



# TILT SENSOR

## TILT SENSOR SERIES (TS)

-  **±0.25% FSO Uncertainty**
-  **Electrical Isolation**
-  **Transmission Distance**
-  **EMI & Radiation Immune**

Optical tilt sensors offer a method of collecting small variations in angle within a single axis of a structure. The Fibos Tilt Sensor utilizes two FBG sensors for effective temperature compensation and is available in daisy chain or point measurement configuration. If using in series with other FBG sensors, a conventional FBG spectrum can be provided and the desired wavelengths for each FBG can be set. If using a PiMS™ (Pi-FBG Measurement Standard) signal conditioner, please select the PiMS™ FBG configuration. Mounting dimensions and alternative cable lengths can be provided upon request.

The performance specifications presented used a signal conditioner that utilizes the PiMS™ technique. Performance with other interrogators is not guaranteed as the interrogator's measurement performance will impact the overall measurement performance.

### APPLICATIONS

Ideal for measurements on large structures, such as bridges, buildings, and wind turbines. The Tilt Sensor can be used in high voltage and high electromagnetic areas with long transmission distances without signal integrity issues. Typical applications include:

- Structural health monitoring
  - Bridge, tunnel, and other infrastructure monitoring
- Wind turbine health monitoring
  - Onshore and offshore pile monitoring

**Alpha Release:** Device specifications may change as a result of additional testing

### PERFORMANCE

Transducer Operating Range <sup>1</sup>	-20 to 70°C
Measurement Range	-10 to +10 degrees
Tilt Sensitivity <sup>2</sup>	212 pm/deg
Resolution	±0.02 deg
Expected Tilt Uncertainty <sup>3,4,5</sup>	±0.05 deg
Natural Frequency <sup>6</sup>	1.3 Hz
Temperature Absolute Uncertainty <sup>3,4</sup>	±1.0°C
Temperature Relative Uncertainty <sup>3,4</sup>	±0.5°C
Temperature Resolution	0.01°C
Optical Sensor Specifications	PiMS™ Compliant or Standard FBG

<sup>1</sup> As designed. Laboratory tested between 0 to 70°C

<sup>2</sup> As designed. Sensitivity will be provided for each unit

<sup>3</sup> Measurement uncertainty includes error of signal conditioner (PiMS™ compliant)

<sup>4</sup> Uncertainty possible due to interchanging signal conditioners

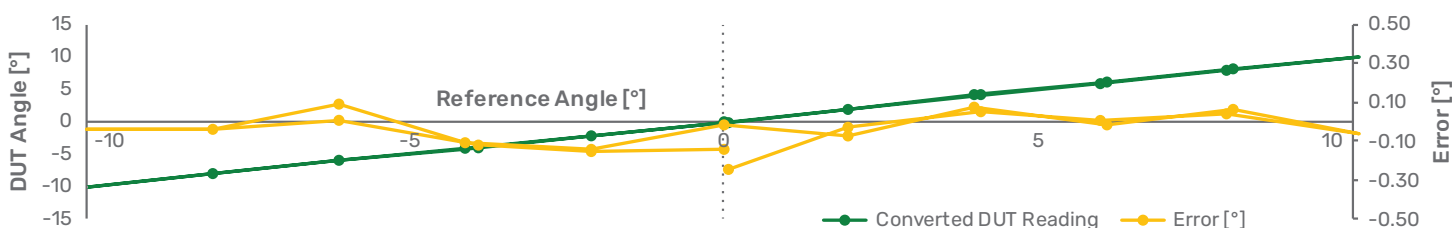
<sup>5</sup> Uncertainty possible during continuous operation with signal condition in stable ambient conditions

<sup>6</sup> As designed. Tilt measurement is not mechanically damped

### ENVIRONMENTAL

Mounting Method	M8 Slots
Dimensions (L x W x H)	246 x 143 x 44 mm
Cable Temperature (OFNP Cable)	-40 to 70°C
Minimum Cable Bend Radius	16 mm
Optical Connector	E2000/APC, FC/APC or No Connector
Fiber Type	SMF28 compatible

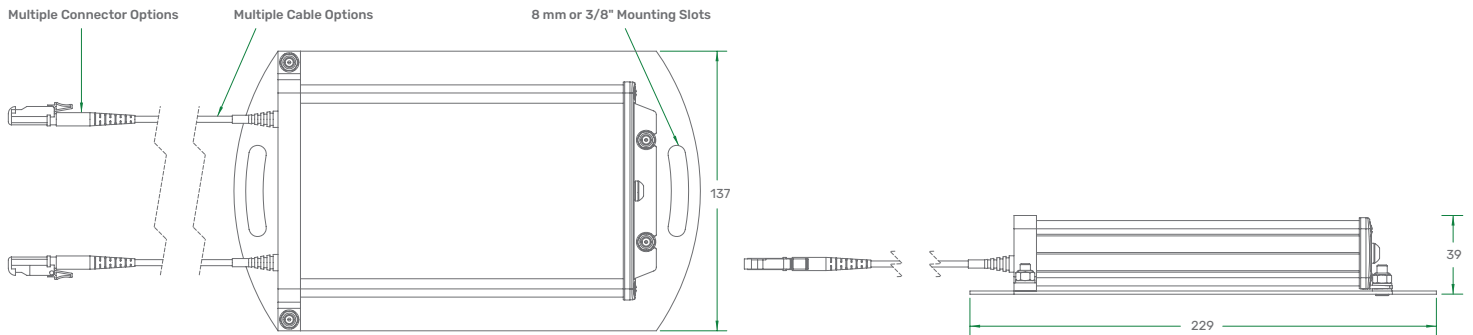
Continued product improvement necessitates that Fibos reserve the right to modify these specifications without notice. With continuous improvement, extensive testing, and conservative specifications, Fibos ensures product reliability expected within the industry.



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Reference drawing provided for model #TS-SPPS-NB1E2



### MODEL PART NUMBER TABLE

TS -							
1	2	3	4	5	6	7	8
<b>1. Temperature Range</b> S – Standard (-20 to 70°C)				<b>5. Cable Jacket</b> N – OFNP Z – No jacket X – Custom			
<b>2. FBG Type</b> P – PiMS™ S – Standard FBG (0.3 nm FWHM, >90% R) X – Custom				<b>6. Cable Outer Diameter</b> A – 0.9 mm B – 2.0 mm X – Custom			
<b>3. FBG Wavelength</b> P – PiMS™ 1 – 1528.5 nm 2 – 1530.1 nm 3 – 1533.3 nm 4 – 1539.7 nm 5 – 1545.8 nm 6 – 1552.1 nm 7 – 1558.5 nm X – Custom				<b>7. Cable Length</b> 1 – 2.5 m 2 – 5.0 m X – Custom			
<b>4. Tilt Range</b> S – -10 to +10 deg X – Custom				<b>8. Connector Type</b> E2 – E2000/APC FC – FC/APC			

### TYPICAL CALIBRATION DATA (TS-SPPS-NB1E2 USED FOR REFERENCE)

Typical Tilt Calibration: Angle = Y (FBG1 – FBG2) + B

Set Temperature [°C]	Calibration Angle [°]	Reference Sensor [°]	FBG1-FBG2 Delta [nm]
21.0	0	0.0	-0.0756
21.0	-2	-2.1	-0.4874
21.0	-4	-3.9	-0.8319
21.0	-6	-6.1	-1.2380
21.0	-8	-8.1	-1.6362
21.0	-10	-10.1	-2.0271
21.0	2	2.0	0.3271
21.0	4	4.0	0.7472
21.0	6	6.1	1.1377
21.0	8	8.1	1.5452
21.0	10	10.1	1.9098

### Typical Temperature Calibration

Calibration Temperature [°C]	Temperature Wavelength [nm]
0	1549.878
25	1550.112
50	1550.361
75	1550.624

#### Notes:

1. Calibration can be performed via comparison between the device under test and a traceable reference sensor. Calibration above was conducted with a tilt sensor mounted onto a vice that could change angular position.
2. Fibos can provide commercial calibration with metrological traceability to the SI. Calibration certificates from accredited calibration laboratories can be provided upon request.
3. Calibration data is provided with every sensor produced. This information can be used with a PiMS™ signal conditioner to achieve the specifications listed on the previous page. Performance with alternative interrogators can be provided upon request.

#### About us

Developers of a unique optical point sensing platform that can be utilized in a variety of industrial applications.

We design, manufacture, and support customers of the optical platform from our headquarters in Toronto, Canada.

V1.0-072220

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