Description:

The FTT-01 washer is a customizable fiber-optic-based force and moment sensor designed for precision load monitoring in bolted joints and structural interfaces. Based on Fiber Bragg Grating (FBG) technology, it is engineered to function in extreme temperature environments. The washer's geometry, material, and sensing configuration can be adapted to meet various engineering and application requirements.

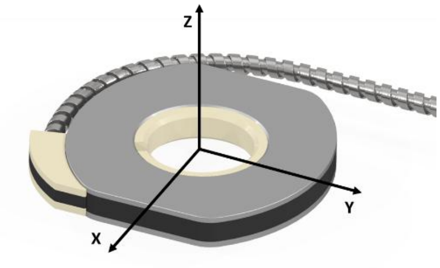
Strain data collected from multiple embedded Fiber Bragg Gratings (FBGs) are processed using a calibration-derived transformation matrix to reconstruct the full set of applied forces and moments. The mathematical model accounts for multi-axis sensitivity and incorporates decoupling and compensation algorithms to ensure reliable and repeatable measurements.

In order to assist users in interpreting the data from FBGs, a dedicated computational framework is provided. This includes the transformation matrices and processing routines required to convert wavelength shifts into physical quantities—namely, axial and lateral forces (Fx, Fy, Fz) and bending and torsional moments (Mx, My, Mz)—tailored to the specific geometry and configuration of each sensorized washer.

Finally, in order to adopt the FTT-01 washer technology, a preliminar technical discussion with INFIBRA TECHNOLOGIES is mandatory.

Typical applications:

- **Structural load monitoring**
- **Aerospace and automotive testing**
- **Industrial machinery diagnostics**
- **Smart bolted connections**
- **Harsh environment force sensing**



Physical specifications:

Form Factor	Customizable (Inner hole, shape)
Minimum Outer Diameter	25 mm (<25 mm R&D)
Minimum Thickness	4 mm (<4 mm R&D)
Material	Application customizabled (e.g. aluminum. stainless steel, titanium)
IP Grade	Up to IP68
Operating Temperature	-80 °C to +250 °C

Measurement specifications:

The FTT-01 washer is available in three distinct measurement configurations, each optimized for specific types of force and moment analysis. Despite the differences in measured components, all configurations share a common technological foundation based on FBG sensing.

- **Tension Measurement (Fz):** designed for monitoring axial preload or tensile force in bolted joints, ideal for structural integrity and stress analysis.
- **Tension & In-Plane Moments Measurement (Fz, Mx, My):** suitable for detecting torques and bending moments in the washer plane, common in fatigue and dynamic load analysis.
- **Full 6-Axis Measurement (Fx, Fy, Fz, Mx, My, Mz):** enables comprehensive force and torque tracking in all spatial directions, ideal for high-performance and multi-axis applications.

Measurement Capacities	> 30 kN
Sensor Technology	Multiple Fiber Bragg Gratings (FBGs)
Resolution	Up to 0.05% of full scale (application dependent)
Sampling Rate	Depending on used FBG interrogator
FBG Central Wavelength	Within the range 1460 ÷ 1620 nm
FBG Bandwidth	1 nm (typical)
Temperature Compensation	Reference Temperature FBGs (optional)

Note: Depending on the FBG sensors reading unit and calibration equipment

Note: All the above specifications may be changed without notice

Rev. 20250619