TF Series
Torque Flange Sensor

FEATURES
- Complete Torque Measuring System consisting of:
  - Measuring Flange with Signal Amplifier
  - Antenna (Pickup)
  - Receiver
- Contactless Signal Transmission: via telemetry
- Torque Range: 50 N·m to 150,000 N·m
- High Accuracy: 0.1% to 0.25%
- Overload Capacity: 200%
- Overload Limit: 400%
- Compact, Easy-to-Mount Design
- High Torsional Stiffness
- Bearingless: maintenance and wear-free
- Excellent Noise Immunity and Shock Resistance
- Protection Class: IP 42 (IP 54 optional)
- 24 V DC Standard Power Supply
- Integrated Speed Pickup (option): for rotational speed measurement
- High Temperature Capability: up to 125 °C (optional)

DESCRIPTION
With its compact, bearingless, maintenance-free design, the new TF Torque Flange Sensor from Magtrol brings many appealing advantages to torque measurement applications. The TF’s high torsional rigidity supports direct mounting on the machine shaft or flange, avoiding the use of couplings on one side. This allows easy integration into a test system, shortens the overall length of the test bench and reduces costs.

Based on strain-gauge technology, the TF Sensor’s precise telemetry system enables highly accurate signal transmission. A signal amplifier mounted in the measuring flange amplifies the measuring signal, modulates it to high frequency and transmits it inductively (via the stationary antenna) to the receiver. In the receiver, the digitized torque signal is transformed into an analog output signal of ±10 VDC or 4–20 mA (option). Rotational speed can be measured and converted to a TTL output signal with the optional speed pickup.

The contactless design of the Torque Flange Sensor permits a gap of up to 5 mm (typically 1 to 3 mm) between the rotor antenna and stator antenna, which makes the signal acquisition insensitive to any axial or radial misalignment. Another advantage of this torque measurement system is its insusceptibility to signal interference—due to the fact that, unlike other designs, the antenna does not need to be looped around the sensor. Additionally, a protective cover can be mounted close to the sensor with no effect on the signal.

APPLICATIONS
TF Torque Flange Sensors measure both static and dynamic torque on rotating and stationary shafts. They are used in general combustion engine, electric motor and gearbox test benches; and can also be mounted inline for active torque monitoring of transmissions, powertrains, wind generators, gas turbines, boat engines, etc.
**BLOCK DIAGRAM**

- **STATIONARY ANTENNA (PICKUP)**
  - Switch
  - Cable (4 m) RG58
- **MEASURING FLANGE**
  - **Signal Amplifier**
  - **Strain Gauge Bridge** for torque measurement
  - **Shunt Calibration Resistor**
  - **2 pulses/rev.** Speed Pickup (optional)
- **RECEIVER**
  - **Torque**
  - **Rotational Speed**
  - Rotational Speed TTL
  - Torque ±10 V or 4–20 mA (option)
  - Power Supply 24 VDC ±10% 350 mA

**SYSTEM CONFIGURATION**

- **TF Measuring Flange**
- **TF Stator Antenna (Pickup)**
- **Motor Under Test (DRIVE)**
- **Dynamometer or Electric Motor (LOAD)**
- **TF Receiver**
- **3410 Torque Display**
## Specifications

### Model Ratings

<table>
<thead>
<tr>
<th>Model</th>
<th>Rated Torque</th>
<th>Accuracy Class *</th>
<th>Maximum Speed</th>
<th>Number of Teeth **</th>
<th>Torsional Stiffness</th>
<th>Deformation Angle</th>
<th>Sensor Weight ***</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF 210</td>
<td>50 N·m</td>
<td>0.1%</td>
<td>14,000 rpm</td>
<td>70 N·m/rad</td>
<td>7.16 × 10^4 N·m</td>
<td>0.040 °</td>
<td>2.0 kg</td>
</tr>
<tr>
<td>TF 211</td>
<td>100 N·m</td>
<td>0.1%</td>
<td>14,000 rpm</td>
<td>70 N·m/rad</td>
<td>1.25 × 10^5 N·m</td>
<td>0.046 °</td>
<td>2.1 kg</td>
</tr>
<tr>
<td>TF 212</td>
<td>200 N·m</td>
<td>0.1%</td>
<td>14,000 rpm</td>
<td>70 N·m/rad</td>
<td>2.05 × 10^5 N·m</td>
<td>0.056 °</td>
<td>2.1 kg</td>
</tr>
<tr>
<td>TF 213</td>
<td>500 N·m</td>
<td>0.1%</td>
<td>8,000 rpm</td>
<td>91 N·m/rad</td>
<td>7.16 × 10^5 N·m</td>
<td>0.040 °</td>
<td>3.2 kg</td>
</tr>
<tr>
<td>TF 214</td>
<td>1,000 N·m</td>
<td>0.1%</td>
<td>8,000 rpm</td>
<td>91 N·m/rad</td>
<td>9.55 × 10^5 N·m</td>
<td>0.060 °</td>
<td>3.2 kg</td>
</tr>
<tr>
<td>TF 215</td>
<td>2,000 N·m</td>
<td>0.1%</td>
<td>8,000 rpm</td>
<td>113 N·m/rad</td>
<td>2.86 × 10^6 N·m</td>
<td>0.040 °</td>
<td>5.5 kg</td>
</tr>
<tr>
<td>TF 216</td>
<td>5,000 N·m</td>
<td>0.1%</td>
<td>4,000 rpm</td>
<td>133 N·m/rad</td>
<td>7.16 × 10^6 N·m</td>
<td>0.040 °</td>
<td>9.3 kg</td>
</tr>
<tr>
<td>TF 217</td>
<td>10,000 N·m</td>
<td>0.1%</td>
<td>4,000 rpm</td>
<td>133 N·m/rad</td>
<td>1.25 × 10^7 N·m</td>
<td>0.046 °</td>
<td>9.2 kg</td>
</tr>
<tr>
<td>TF 218</td>
<td>20,000 N·m</td>
<td>0.2% to 0.25%</td>
<td>1,500 rpm</td>
<td>283 N·m/rad</td>
<td>2.86 × 10^7 N·m</td>
<td>0.040 °</td>
<td>40.5 kg</td>
</tr>
<tr>
<td>TF 219</td>
<td>50,000 N·m</td>
<td>0.2% to 0.25%</td>
<td>1,500 rpm</td>
<td>283 N·m/rad</td>
<td>6.82 × 10^7 N·m</td>
<td>0.042 °</td>
<td>41.1 kg</td>
</tr>
</tbody>
</table>

* 0.05% available on request.
** Inductive speed detection available on request.
*** Weight of electronic devices linked to the sensor (pickup, receiver, speed conditioner) is an additional 0.8 kg to 2.8 kg depending on configuration.

### Moment of Inertia (X axis)

<table>
<thead>
<tr>
<th>Model</th>
<th>Moment of Inertia</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF 210</td>
<td>1.846 × 10^{-3} kg·m²</td>
</tr>
<tr>
<td>TF 211</td>
<td>1.923 × 10^{-3} kg·m²</td>
</tr>
<tr>
<td>TF 212</td>
<td>1.923 × 10^{-3} kg·m²</td>
</tr>
<tr>
<td>TF 213</td>
<td>4.918 × 10^{-3} kg·m²</td>
</tr>
<tr>
<td>TF 214</td>
<td>4.918 × 10^{-3} kg·m²</td>
</tr>
<tr>
<td>TF 215</td>
<td>1.026 × 10^{-2} kg·m²</td>
</tr>
<tr>
<td>TF 216</td>
<td>2.503 × 10^{-2} kg·m²</td>
</tr>
<tr>
<td>TF 217</td>
<td>2.503 × 10^{-2} kg·m²</td>
</tr>
<tr>
<td>TF 218</td>
<td>4.672 × 10^{-1} kg·m²</td>
</tr>
<tr>
<td>TF 219</td>
<td>4.672 × 10^{-1} kg·m²</td>
</tr>
</tbody>
</table>

### Ratings Common to All TF Sensors

**Torque Measurement**
- Maximum Dynamic Torque Peak Value (Overload Capacity): 200% of Rated Torque
- Maximum Dynamic Torque Without Damage (Overload Limit): 400% of Rated Torque

**Speed Measurement**
- Resolution: 14-bit

**Environment**
- Rated Temperature Range: +10 °C to +85 °C
- Storage Temperature Range: -25 °C to +85 °C
- Extended Temperature Range (option): -30 °C to +125 °C
- Temperature Influence on Zero: 0.005% / °C
- Protection Class: IP 42 (optional IP 54)

**Input and Output Signals**
- Power Supply: 24 VDC ±10%, max 350 mA
- Torque Output Signal (rated / max): ±5 VDC / ±10 VDC (option: 4–20 mA)
- Speed Output (option): TTL (pulses per revolution corresponds with number of teeth)
- Passband Frequency: 0 to 1 kHz (-3 dB)
TF 210 (50 N·m), TF 211 (100 N·m) and TF 212 (200 N·m)

TF 213 (500 N·m) and TF 214 (1000 N·m)
TF 215 (2 kN-m)

Dimensions

TF 216 (5 kN-m)

Pick-up (torque)

Rotor antenna

Air gap 0.5mm

8 x M12

8 x M8 (TF216)

8 x M8 (TF215)

Air gap 1-3mm

Pick-up (speed)

Pick-up (torque)

Rotor antenna

Air gap 0.5mm

Pick-up (speed)
TF 217 (10 kN-m)

TF 218 (20 kN-m) and TF 219 (50 kN-m)
Model 3410 Torque Transducer Display

Magtrol offers the new Model 3410 Display which supplies power to any TF Sensor and displays torque, speed and mechanical power. Features include:

- Adjustable English, metric and SI torque units
- Large, easy-to-read vacuum fluorescent display
- Built-in self-diagnostic tests
- Overload indication
- Tare function
- RS-232 interface
- Torque and speed outputs
- Closed-box calibration
- Includes Magtrol TM Software

Torque 1.0 Software

Magtrol’s Torque 1.0 Software is an easy-to-use Windows® executable program, used to automatically collect torque, speed and mechanical power data. The data can be printed, displayed graphically or quickly saved as a Microsoft® Excel spreadsheet. Standard features of Magtrol’s Torque 1.0 Software include: peak torque capture, direction of rotation, multi-axes graphing, measured parameter vs. time, adjustable sampling rates and polynomial curve fitting.

Due to the continual development of our products, we reserve the right to modify specifications without forewarning.