1. INTRODUCTION
The TS Series In-Line Torque Sensor is a generation of high-precision torque sensors with integrated electronic processing circuitry, developed by Magtrol. This sensor uses a non-contact measurement technology, integrates a conditioning electronic module providing a 0 to ±10 VDC torque output and 3 TTL signals (Tach A, Tach B and Index), for speed and angle measurement.

2. WARNINGS & CAUTIONS
- **WARNING**: Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
  - Make sure that all rotating parts are equipped with appropriate safety guards.
  - Always wear protective glasses when working close to rotating elements.
  - Never work too close or bend over the rotating drive chain.
  - Periodically check all connections and attachments.
- **CAUTION**: Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
  - Never stand or bend close to rotating elements.
  - Make sure that all Magtrol electronic products are earth-grounded, to guarantee personal safety and proper operation.
  - Check the power supply voltage from 12 to 32 VDC (24 VDC recommended) before operating the torque sensor.

3. DESCRIPTION & CONNECTIVITY
3.1 PARTS DESIGNATION
- 1. Rotating shaft
- 2. Rotating shaft
- 3. LED overview of device status
- 4. Analog connector
- 5. Analog cable
- 6. USB mini-B connector
- 7. USB cable
- 8. Housing

3.2 ATTACHED ANALOG CABLE
- 1 White: tach tr
- 2 Brown: Tach A
- 3 Green: Index (1 pulse / rev)
- 4 Yellow: BITE / TARE
- 5 Grey: Torque Ground 0V
- 6 Pink: Torque Signal ±5 (±10) VDC
- 7 Blue: Ground GND
- 8 Red: Power supply 12-32 VDC

4. BITE SEQUENCE DESCRIPTION
The BITE (Built-In Test Equipment) takes place at either «System Power Up» or BITE. 8-pole (external line when pulled low for at least 1 s) or BITE. USB. Its sequence is as follows:

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>LED Behavior</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1.0 s</td>
<td>Red ON, Yellow OFF</td>
<td>-</td>
</tr>
<tr>
<td>1.0-3.0 s</td>
<td>Yellow ON, Green ON, Red OFF</td>
<td>-</td>
</tr>
<tr>
<td>3.0-6.0 s</td>
<td>Red ON</td>
<td>Value stored in NVM</td>
</tr>
</tbody>
</table>

The stator will turn ON power to the rotor. The first 5.5 s of information will be used for rotor voltage measurement. Note during this time, the «analog output» and USB are set to zero. After 5.5 s, the signal from the rotor is available to the analog output and USB.

5. TARE SEQUENCE DESCRIPTION
5.1 TARE - STATUS DESCRIPTION
TARE (external line) is pulled up to +24 V line
1. Activate and hold TARE < 1.0 s then ignore
2. Activate and hold TARE > 1.0 s - 3.0 s then the value is stored in RAM memory which will be reset to factory offset the next time the power is turned on
3. Activate and hold TARE > 3.0 s - 6.0 s then the value is stored in the NVM (Non-volatile Memory), then it will be saved when the power is turned off
4. Activate and hold TARE > 6.0 s then the value in NVM is RESET

5.2 TARE - DESCRIPTION OF LED BEHAVIOR
When TARE is pressed, all three LEDs turn OFF.
- After 1 s, YELLOW turns ON.
- After 4 s, YELLOW and GREEN turn ON.
- After 6 s, YELLOW, GREEN and RED turn ON.

6. USB FEATURES & COMMUNICATION
6.1 HARDWARE & SOFTWARE
A galvanic isolated USB interface is implemented. The maximum «common mode voltage» allowed between the sensor case and the computer GND is 33 V.

TS Series Torque Sensor is delivered with software allowing communication between the sensor and a computer running Windows™ OS.

6.2 POWER SUPPLY
- The device is not powered by the USB. The sensor has to be powered through the 8-pole connector.

6.3 COMMAND SET
A set of commands are used for Configuration, Communication and System Function purposes.
For instance:
- **Configuration commands** allow selection of:
  - the FILTER cutoff frequency (2/5/10/20/50/100/1000 Hz), the output power unit (hp, W, kW), the SPEED measurement algorithm (ΔT; Gated; Index)
- **Communication commands** allow selection of measured values:
  - TORQUE, SPEED, ANGLE, POWER
- **System function commands** allow activation of a sensor function:
  - TARE, SAVE TARE, RESET TARE, BITE

Refer to the User Manual to get the complete “command set” list.
8. INSTALLATION

Magtrol’s TS Series In-Line Torque Sensors should be considered primarily as precision measuring instruments and not as torque transmission components. The model of the sensor and the accuracy of its drive train alignment strongly influence the measurement accuracy and lifetime of the sensor, especially of the bearings.

**WARNING**

IT IS CRUCIAL TO USE A COUPLING DESIGNED FOR YOUR ASSEMBLY (e.g. FLEXIBLE COUPLINGS), NEVER MAKE A RIGID ASSEMBLY!

Magtrol provides a wide range of couplings suitable for torque measurement applications and can assist you in choosing the right coupling for your transducer. Please contact our technical service.

There are two main ways to mount the TS torque sensor: supported or suspended (for low speed applications only).

### 8.1 SUPPORTED INSTALLATION

**SUPPORTED INSTALLATION** mandatory for standard and high speed applications

The measuring shaft is supported by the torque sensor housing, which itself is fixed to the test bench frame by means of a support unit. Couplings with two degrees of freedom must be used in order to avoid hyperstatic mountings.

### 8.2 SUSPENDED INSTALLATION

**SUSPENDED INSTALLATION** for low speed applications only

Both the measuring shaft and torque transducer housing are supported by the drive and measuring unit shafts via couplings. In this configuration, couplings that offer only one degree of freedom are adequate to avoid a hyperstatic mounting.

**CAUTION**

TS 100-102 CANNOT BE USED IN SUSPENDED INSTALLATION AS THE WEIGHT OF THE SENSOR WILL DEGRADE THE ACCURACY OF THE MEASUREMENTS DUE TO RADIAL FORCES.

### 8.3 INSTALLATION PRECAUTIONS

**ALIGNMENT**: Be careful to install with an accuracy equal to or less than the following permissible installation errors.

- **Off-centering**: 0.03 mm or less
- **Angular**:
  - max. 0.2° or less (1/10 of the value recommended by the coupling manufacturer)
- **Eccentricity**: 0.03 mm or less

**WARNING**

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