Torque Transducer Selection Guide

datum electronics

Choosing The Right Transducer Can Give You Better Measurements And Save Overall Costs

The selection of a torque transducer usually depends on the following factors:

1. The **mechanical space available** to mount the torque transducer and the **type of driveline** it will be mounted in. Thes can be determined by selecting from the list below which offers a choice of parallel shafts with keyway and splines.

2. The **torque to be measured** and the **maximum torque** that the transducer will be subjected to during start-up, braking and other transient events. This will determine the overall size of the transducer.

3. The **accuracy** and performance you need from your torque transducer. The Datum range can offer you both high accuracy and high resolution. The majority of the Datum Torque Transducer range have an accuracy of better than 0.1% of full scale. Some transducers even have a 0.05% option. The resolution of all of the 425 Series is 24bit, so at low sampling rates you will see a noise-free resolution of better than 1:250,000, at high sample rate up to 4000 samples per second this will reduce to 1:10,000.

4. The **output** you require. All the Datum Torque transducers output serial data that is converted to a choice of Ethernet, USB, Serial 485/232 or analogues 4-20mA, +/-10Vdc, 0-10Vdc, +/-5Vdc.
The use of serial data directly from the transducer makes the system very robust in terms of electrical noise and allows the shaft electronics to be of a higher more stable specialisation. The interface can then be mounted in a control panel or with the user up to 500 metres away to provide accurate analogue data.

5. The **environment** the torque transducer to be used in. This may vary from a clean laboratory to a test cell with oil and water, and engine room or even underwater. We also need to be aware of the electrical environment in terms of large motors, magnets and other items that may add noise to any data acquisition system.

6. The **type of torque** to be measured. All of Datum Electronics 425 Series Torque Transducers are continuous inductively powered allowing both static and rotary torque reading at all times.

Type or Style of a Torque Transducer

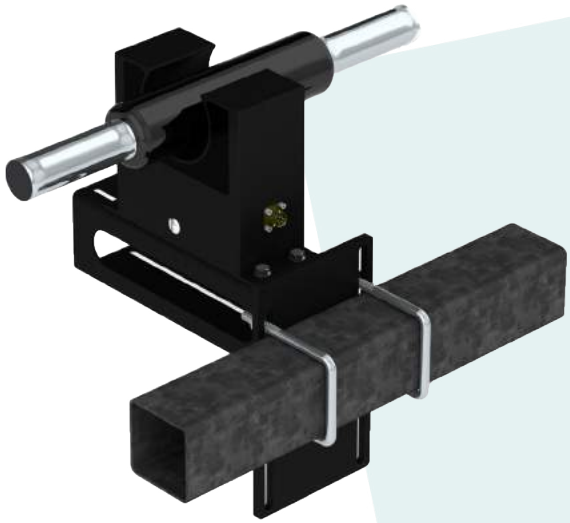
If you are choosing a torque transducer to fit a test rig or a machine, you have the choice of:

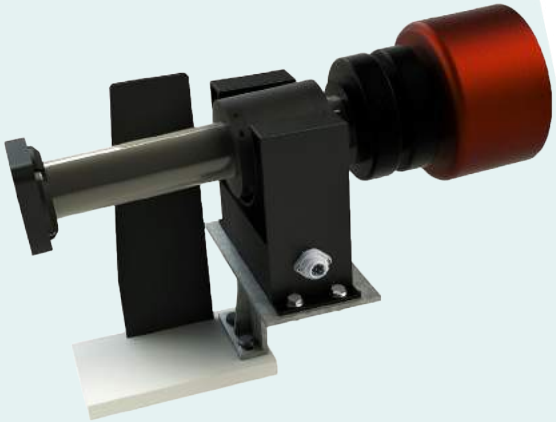
1. Conventional In-Line Transducer

2. Flanged In-Line Transducer

3. Fully Non-Contact In-Line Shaft Torque Transducer

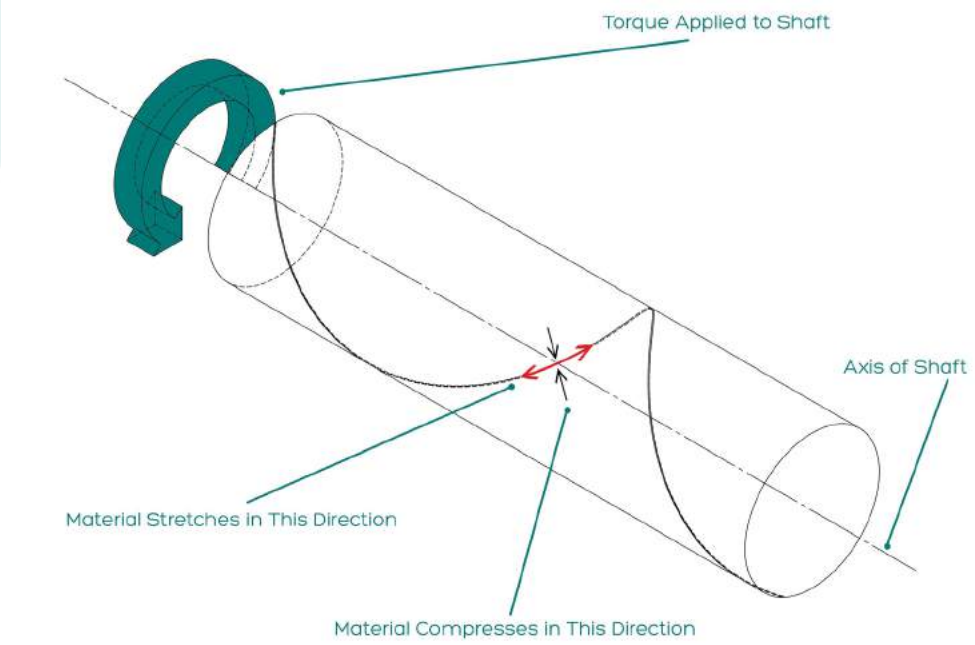
4. **Custom Torque Transducers** (that are designed to replace an existing shaft sector or a shaft spacer)



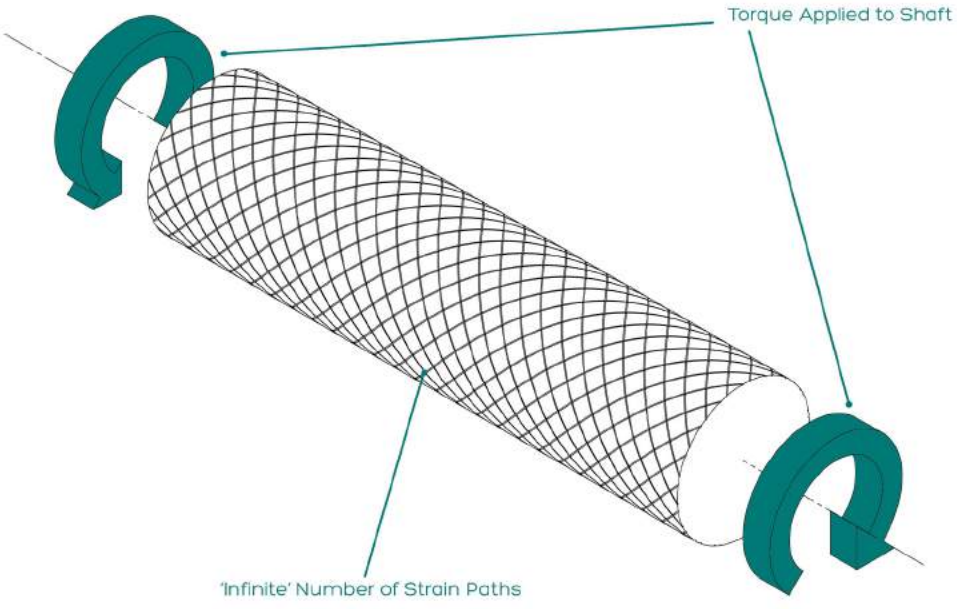


WHAT IS A TORQUE TRANSDUCER?

Torque Transducers (or Torque Sensors) measure torque in a variety of methods. The basic principle is, in essence, a very simple mechanical process, it is a measure of the “force” being used (or attempting) to turn an element.



When a force of “torque” is applied to a shaft, the shaft twists (by a very small amount). This twisting produces a “stretch” in the material of the shaft, in a direction at 45 degrees to the axis of the shaft, between points on the shaft that are moved apart by the twisting motion. The material of the shaft also sees a “compression” in the opposite 45-degree direction.

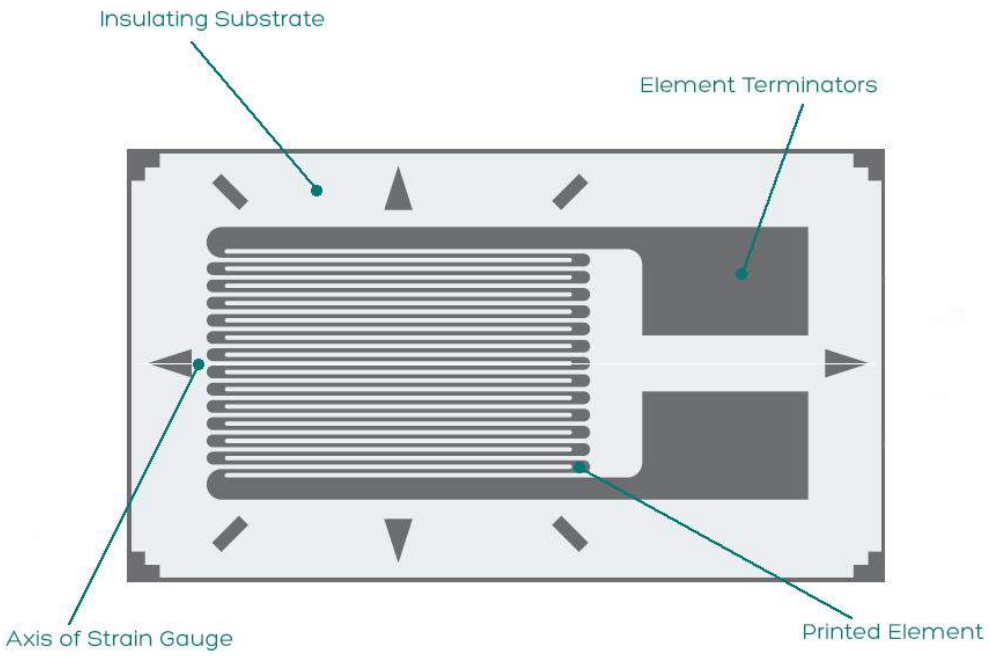


Datum Electronics Torque Transducers utilise this shaft bending and measure the change in order to calculate the torque. This measurement is achieved by the use of strain gauges bonded to the shaft, measuring the strain, induced in the shaft by the applied torque or “force”. There are various methods of measuring this twist through a shaft, but strain gauges are recognised as one of the most reliable methods if you have the expertise to achieve this.

Strain Gauges are incredibly accurate if you have the expertise and experience of using and understanding how they work. They have been traditionally associated with inaccurate and unreliable measurement. However, when used correctly and with right understanding, they are a very reliable, stable, robust and cost-effective method of torque measurement.

DEFINITION OF A STRAIN GAUGE

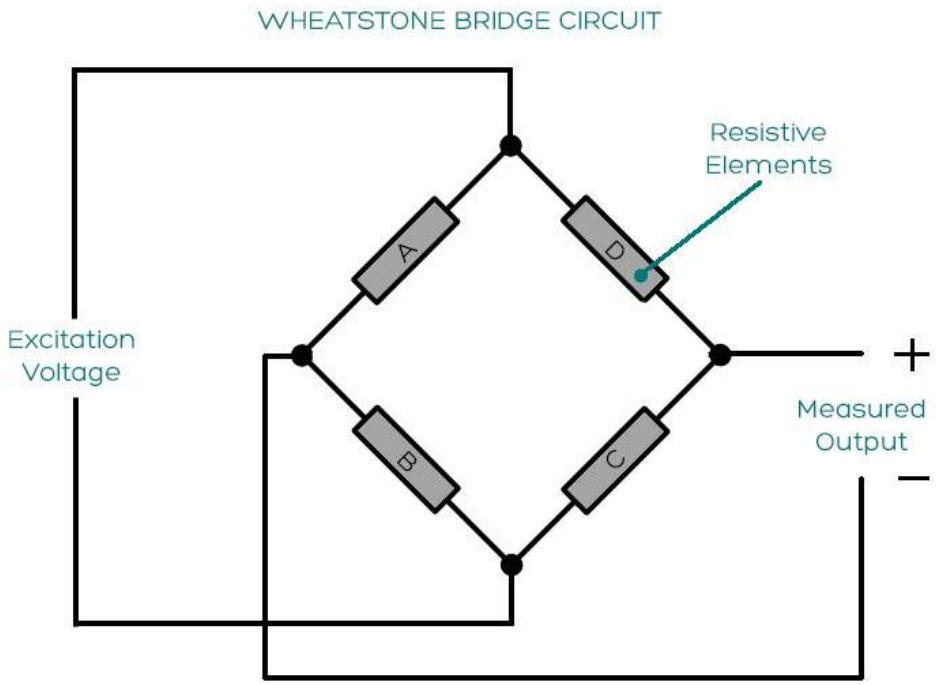
A strain gauge is a small electrical element printed on a non-conductive substrate. The pattern of the element is arranged so that if the gauge is stretched (or compressed) in one direction (along with operating axis of the gauge), the resistance of the element increases (or decreases) in relation to that stretch. A stretch perpendicular to the axis of the strain gauge has little effect on the resistance of the element.



If a gauge is bonded to the shaft, with its axis aligned with the direction in which the shaft material stretches when a torque is applied, the strain gauge will also stretch and therefore the element will increase in resistance.

If a gauge is bonded to the shaft, with its axis aligned with the direction in which the shaft material compresses when a torque is applied, the strain gauge will also compress and therefore the element will decrease in resistance.

In a Torque Transducer, strain gauges, making up four resistive elements, are bonded to the shaft. Two elements are aligned to the direction of tension (stretch). The remaining two are aligned with the direction of compression.



The four resistive elements are electrically connected in a “Wheatstone Bridge” configuration. The Wheatstone Bridge configuration is appropriate for measurement of the small resistance changes, produced in strain gauges. As the combination increases and decreases in resistance, it produces a change in output voltage, which is only proportional to excitation voltage and change of resistance between opposing elements, not to any overall change in resistance such as might be produced by a change in temperature.

TORQUE TRANSDUCERS: MEASUREMENT DEFINED

The Datum Torque Transducers range transmits digital data providing the end user with clean and definitive data. The on-shaft signal, provided by the Wheatstone Bridge, is amplified and converted into a digital value. This signal is transmitted from the shaft and then processed digitally and amplified to provide a measurement of torque. Digital data can be provided with up to 24-bit resolution or up to 96,000 samples per second, providing valuable and accurate data for the end user.

Our rotary transducers provide not only torque measurement, but also speed indication (rpm). Combining both torque and speed data, also allows you to measure power as a calculated figure. The series 425 torque transducers measure speed by counting 1 pulse per revolution and then converts this figure to rpm. Using an in-built hall-effect sensor, our torque range is capable of measuring the speed at up to 20,000 rpm.

In order to determine the best transducer for your application, please call a member of our technical sales team on **+44 (0) 19893 282834** or email an outline of your requirements to **web@datum-electronics.co.uk**

If you are able to include information regarding the mechanical arrangement and the level of torque or power to be measured and any other special conditions, this will assist us in guiding you to the correct product design.