TORQSENSE®

SGR510/520 SERIES TRANSDUCER

USER MANUAL

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Getting Started

Introduction

The **TORQSENSE** SGR Torque Transducer provides a method of precisely measuring bi-directional rotary or static torque. It can also be fitted with a speed sensor for monitoring in dynamic applications, enabling direct measurements of transmitted power.

The SGR series transducers require no external instrumentation and has its own built in test capability. Its compact size makes it ideal for use in applications where there is little space for any extra equipment. Analog voltage outputs are standard, with current outputs available as an option. The SGR520/540 series can also be connected to a PC via USB (optional) or RS232 so that its configuration can be changed, or by using TorqView to display torque, speed and power.

Hardware Revisions

The SGR series transducers use two different hardware revisions. The two hardware revisions are very similar in functionality, but one major difference is a third analog channel (MK4). The two revisions can be identified by the Firmware Version, which is shown on the product label, affixed to the transducer.

Firmware Revision	Hardware Designation
5 or lower	MK3
6 or greater	MK4

Unpacking the transducer

The following standard components are included:

- 1 x SGR Series Transducer
- 1 x SGR Electronics Module (Only if SGR530/540 ordered).
- 1 x User Manual.
- 1 x Calibration Certificate.

Additional components for SGR520/540 series:

- 1 x TorqView program installation USB flash drive, SGR Configuration Software, Manuals & Appendices in PDF format, USB driver.

The following items may also be included:

- 12pin Lumberg (female) and/or 12pin Lumberg (male).
- 1 x 2.5m Analog Lead - 15 way 'D' type connector (female) to 12pin Lumberg (female).
- 1 x 2.5m Digital Lead - 15 way 'D' type connector (male) to 12pin Lumberg (male). (SGR520/540 series transducer ONLY).
- 1 x Digital Adaptor Lead (DC Jack with USB and/or RS232 connections, depending on options requested) (SGR520/540 series transducer ONLY).
- 1 x Transducer Display ETD
- 1 x AC Mains Adaptor Power Supply.
- 1 x Transducer Signal Breakout Unit.
- 1 x Analog Dongle.

> **CAUTION**
> The SGR series transducers should be installed using correct couplings rated for the maximum torque and speed for the operation.

> **CAUTION**
> The SGR series transducers should not be operated at any torque load greater or speed faster than that specified in the Product data sheet and on the Transducer.

> **CAUTION**
> The SGR series transducers should not be operated in an environment where that operation could be life threatening or a danger to personnel.

> **CAUTION**
> In electrically noisy environments, the SGR series transducers should be earthed using the earthing post located on the transducer.

Mechanical Installation

To obtain the best measurements from your torque transducer, it is essential that it is correctly installed.

To avoid damaging the transducer during the installation process, it is highly recommended that it is electrically connected and working, so that any torque overloads applied due to handling can be monitored.

For Transducers above 1Nm or 10lbf.in. it is recommended that the body of the transducer be restrained from rotation by using a strap or straps connected to the tapped holes in the end plates and that it is not rigidly mounted. Couplings should be used to allow for angular misalignment while the transducer shaft takes up any parallel misalignment. Care should be taken not to induce any end loads or bending moments to the shaft, see below, as these may induce inaccuracies to the torque measurement and in extreme cases damage the transducer.
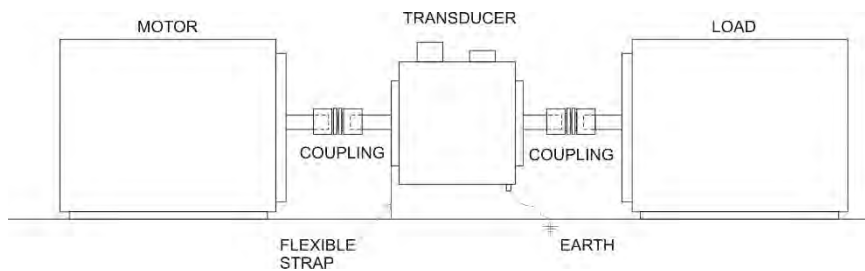
Should rapid variations in torque need to be measured in detail e.g. torque fluctuations in gearboxes or multi vane pumps then it is recommended using torsionally rigid couplings be fitted at both ends of the transducer shaft such as single membrane couplings and that these are *correctly selected for the transducer rating and speed*. An undersized coupling will not transmit the torque while the high inertia of an oversized coupling can result in instantaneous peak torques far in excess of the measured torque. Alternatively, for lower bandwidth applications where it is more important to measure the 'average' torque rather than fast torque fluctuations then couplings with a degree of compliance would be more appropriate.

Single membrane coupling
(Flexible mounting)

Never use a solid coupling to connect a SGR series transducers Torque Transducer

For Transducers below 1Nm or 10lbf.in or if the application requires the body to be **rigidly mounted** then it is recommended that double couplings should be used at each end to compensate for any misalignment of the input/output shafts and the system designed to eliminate any end loads on the transducer shaft. For applications where **end loads cannot be avoided** please consult the sales department for advice *prior to ordering.*

When using a pulley or pulleys it is recommended a bearing block or blocks should be used to ensure bending loads are not transmitted to the transducer.
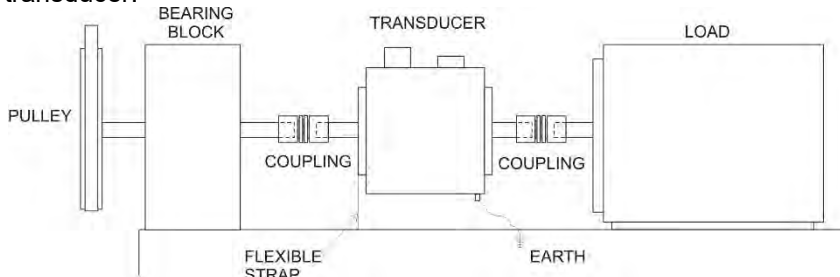
Double membrane coupling
(Rigid mounting)

Lastly, consider using a guard over the transducer and couplings

Whilst the transducer is resistant to EMC interference to BS EN 61326-1:2006, the sensible routing of cables is important to avoid possible EMC interference. Avoid running the transducer cables close, and/or parallel, to high voltage cables, solenoid valves, generators or inverters etc. If the cables must follow the same route as interfering cables then additional screening such as metal conduit should be used to provide isolation.

To avoid damaging the transducer during installation, it is highly recommended that it is electrically connected and working during this process, so that any torque overloads due to handling can be monitored.

Operating Principles

SGR510/520 series transducers operate using a four-element strain gauge wheatstone bridge, which is connected to a miniature shaft mounted analog to digital converter and microcontroller. The microcontroller conditions and measures the strain gauge bridge output as close to the gauges as possible, eliminating any possible external noise pick up in the gauge wiring.

The shaft mounted electronic module is wirelessly powered by a radio frequency source which drives a stator coil, the output of which is received by a rotor coil on the shaft thus making the system completely contactless. This eliminates the need for slip rings and their associated wear and noise problems.

The shaft microcontroller outputs a digital serial stream that is transferred back from rotor to stator by modulating the impedance of the rotor coil and detecting the impedance changes at the stator coil. A secondary high-performance microcontroller receives the serial stream from the shaft microcontroller, which then performs calibration and temperature compensation before outputting the results digitally via RS232, CAN bus or USB. A 16-bit digital to analog converter also outputs the sensors data as a fully calibrated and compensated analog voltage or current.

Pre-load, note:

All SGR510/520 transducers with a LED in the centre of the front label (connector side) have a bearing pre-load spring fitted internally at the <u>left hand</u> side (pre-load end) when viewing the front label of the transducer and with the earth stud bottom ride hand corner.

All SGR530/540 transducers with a LED on the separate electronics module have a bearing pre-load spring fitted internally at the <u>left hand</u> side (pre-load end) of the transducer head when viewing the label of the transducer head and the connector and gland facing towards you.

If there is a possibility of an end load being applied to the transducer, the transducer should be orientated during installation such that the load is applied at the pre-load end (side with the internally fitted spring). Excessive end loads must be avoided and it is recommended that appropriate couplings be used to compensate for axial and radial misalignment.

Operation

Powering the transducer

To power the transducer a supply voltage of 12-32VDC is required with a minimum current of 1 amp (to supply peak start-up current). If a Transducer Display ETD is used, the ETD will provide power to the transducer. If a Transducer Signal Breakout Unit is used, the power supply should be plugged into the DC jack on the Breakout Unit. If a Digital Adaptor Lead is used, the power supply should be plugged into the DC jack on the lead.

If a Transducer Display ETD, Transducer Signal Breakout Unit or a Digital Adaptor Lead are not used, then power can be provided via the 15 way 'D' type connector on either the 2.5m Analog or Digital Lead. A supply voltage of 12-32VDC should be connected on Pin 1, with Ground on Pin 2.

Note: It is imperative that the voltage does not drop below 12V at any stage.

CAUTION
Only provide power through either the Analog or Digital lead.
Do NOT provide power through both leads simultaneously.

Using the transducer

1. Switch on the SGR series transducer by ensuring power is supplied.

2. Allow the transducer to carry out its Built In Test (BIT) procedure. Refer to the Built In Test section for further details.

3. Allow five minutes for the equipment to reach thermal equilibrium before making any measurements.

4. Zero the transducer, refer to the Zeroing the transducer section.

5. The transducer is ready for use, examples of different ways to extract data can be found in the Examples of reading/collecting data section.

Built In Test (BIT)

When the SGR series transducer is switched on it will carry out its Built In Test (BIT) procedure. While the BIT procedure is taking place there will be a series of green flashes from the LED, this is followed by a steady green or an intermittent green flash depending upon the mode of operation.

If the transducer fails its BIT procedure the transducer will display an error sequence identifying the results of each system test. The sequence will repeat until the transducer is powered off.

The error sequence is prefixed with quick succession of red flashes, identifying the LED sequence as an error condition

| ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ½ sec |

After a pause a sequence of green and red flashes will indicate the results of each system test. The following table lists the tests and there test order, for each test the transducer will output either a GREEN for PASS or RED for FAIL.

Test/Sequence Number	System Checks
1	Electronics Check
2	Shaft Electronics
3	Temperature Sensor Check
4	Internal Voltage Check
5	Data Configuration Check
6	Calibration Check
7	SAW Parameters Check
8	ORT Parameters Check
9	SGR Parameters Check

If a failure condition exists, try power cycling the transducer. Contact the factory if the problem continues.

If an error occurs during operation (solid RED LED), but is not present on power on, the BIT procedure may not identify the fault. If the Zero Input has been wired, it is possible to display the Built In Test output during a solid red, to do this, switch the Zero Input ON until the transducer starts flashing RED.
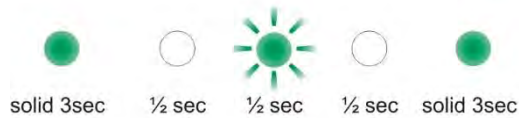
Normal Operation

A solid green LED indicates normal mode and the transducer is working correctly.

An intermittent green flash indicates a special mode of operation; the led sequences below show the different modes.
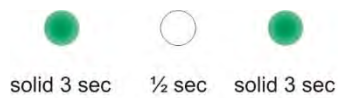
Peak Mode

Analog Scaling
[*SGR 520/540 Series ONLY*]

Peak Mode and Analog Scaling
[*SGR 520/540 Series ONLY*]

Peak Mode
Peak Mode is active, if configured to do so the analog output will output a peak value. Please refer to the Peak Input section for further details.

Analog Scaling
The Analog Scaling status message is shown when a user defined data or voltage scale has been applied to either analog channel. This message is only relevant on SGR520/540 series transducers.

Warning Signals

A warning signal is indicated when the transducer detects a condition which impedes normal operation or the transducer is operating outside of normal operating parameters.

Different hardware revisions indicate warnings in different ways, refer to the appropriate section below for correct identification.

Firmware Version 5 or lower

A warning LED sequence is prefixed with a quick succession of alternating red/green flashes, identifying the LED sequence as a warning condition. A warning sequence will override the normal operation mode LED.

| ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ¼ sec | ½ sec |
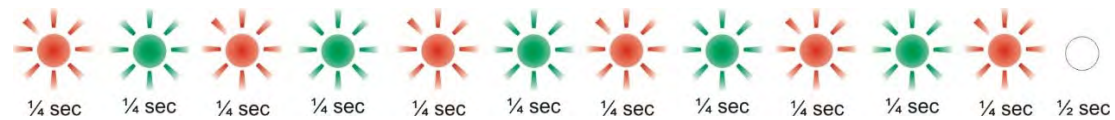
After a pause a sequence of green or red flashes will indicate which warning conditions are flagged. The LED sequence will iterate through each of the flags in the table below, flashing the LED for each. A RED flash indicates that a condition has been flagged; a GREEN flash indicates that a condition is clear.

Firmware Version 6 or greater

A warning LED sequence is prefixed with a quick succession of flashing yellow lights. A warning sequence will override the normal operation mode LED.

| ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec | ¼ Sec |

After a pause a sequence of green or yellow flashes will indicate which warning conditions are flagged. The LED sequence will iterate through each of the flags in the sequence table, shown on the next page, flashing the LED for each. A YELLOW flash indicates that a condition has been flagged; a GREEN flash indicates that a condition is clear.

Once the LED sequence is complete, the sequence will restart, this will continue until the warning has cleared.

Sequence Number	Warning Flag	Reason and Action required
1	Analog Fault CH0	In voltage output mode the analog pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring for Analog CH0.
2	Analog Fault CH1	In voltage output mode the analog pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring for Analog CH1.
3	Zero Offset High	A torque offset greater than 10% of FSD has been applied to the measured torque value. The offset is set when the transducer is zeroed, either by the zero input on the analog connector or via a digital command or setting.
4	Exceeded Temp	Shaft temperature has exceeded normal operating conditions. Temperature compensation may no longer be effective or calibration valid.
5	Over Torque	Torque greater than 201% of FSD has been applied.
6	Critical Over Torque	Torque greater than 300% of FSD has been applied. Contact the factory if the warning continues.
7	Head Disconnect	The transducer head has been disconnected. Power off the transducer electronics and check the cabling. This warning is only relevant for transducers with separate heads.
8	Analog Fault CH2 (Firmware >= 6)	In voltage output mode the analog pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring for Analog CH2.

For example, the following sequence would indicate warnings for 'Analog Fault CH0' and 'Zero Offset High':

Firmware Version 5 or lower

| ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec | ½ sec |

Firmware Version 6 or greater

| ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec | ½ Sec |

Error Signals

An error or fault signal is indicated when the transducer detects a condition which effects its fundamental operation. An error or fault condition will be indicated by a solid red LED. Any error that occurs will latch the LED on and it will remain on until the transducer is reset. An error condition will override a warning and normal mode LED sequence.

If the error persists across multiple power cycles, a fault may have developed with the transducer and you will need to contact the factory.

Peak Input

The peak input is a control signal that has two main purposes. It can control what data gets applied to the torque analog output, and it can be used to reset the torque peak values.

The peak input is activated by grounding pin 8 of the Analog 15 Way 'D' Socket. The best way to control the peak input is to use a toggle switch.
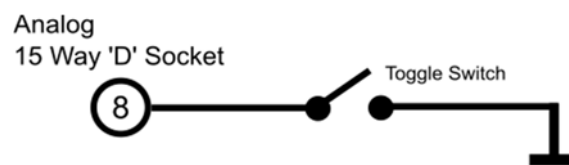
Analog Output

When activated any analog output channel configured as "Torque – Auto Assign" will switch from being the current torque value, to the highest measured torque value since reset, if the analog output is not unipolar then the torque direction will be output.

Peak Reset

When the peak input is toggled, i.e. off-on-off or on-off-on, all torque peak values on both analog and digital interfaces will be reset to defaults. A peak input toggle will also clear any latched fault condition or limit trigger.

Analog Outputs

The transducer has multiple analog outputs which can be configured to different data values, voltages, currents and scales. Transducers with Firmware Version 5 or lower, have 2 analog channels, and transducers with Firmware Version 6 or greater, have 3 analog channels.

Basic models are preconfigured based on the model and options selected, advanced models hand the configuration to the user. The configuration of the analog outputs for advanced models is done using Transducer Control; please refer to the Transducer Control manual for further details.

The following tables show the default assignments for each model and analog option.

Data Assignments

Firmware Version 5 or lower

Model	Analog CH0	Analog CH1
SGR510	Torque – Auto Assign[1] Scale: 0 – FSD	Torque – Peak Scale: 0 – FSD
SGR530		
SGR511	Torque – Auto Assign[1] Scale: 0 – FSD	Speed Fast (RPM) Scale: 0 – Max Speed
SGR512		
SGR531		
SGR532		
SGR513	Torque – Auto Assign[1] Scale: 0 – FSD	Power (Watts) Scale: 0 – Max Watts ((FSD in Nm x Max Speed) / 9.551)
SGR533		
SGR520	Advanced Model - User Selectable Factory Default: Torque – Auto Assign[1] Scale: 0 – FSD	Advanced Model - User Selectable Factory Default: Torque – Peak Scale: 0 – FSD
SGR540		
SGR521	Advanced Model - User Selectable Factory Default: Torque – Auto Assign[1] Scale: 0 – FSD	Advanced Model - User Selectable Factory Default: Speed Fast (RPM) Scale: 0 – Max Speed
SGR522		
SGR541		
SGR542		

[1] The value output by channels assigned with "Torque – Auto Assign" is dependent on the peak switch. If unconnected, or Peak is OFF, the channel is assigned with Torque, if Peak is ON, the channel is assigned with Torque – Peak. Refer to the Peak Input section for more details.

Firmware Version 6 or greater

Model	Analog CH0	Analog CH1	Analog CH2
SGR510	Torque – Actual Scale: 0 – FSD	Torque – Peak Scale: 0 – FSD	Torque – Auto Reset Scale: 0 – FSD
SGR530			
SGR511	Torque – Auto Assign[1] Scale: 0 – FSD	Speed Fast (RPM) Scale: 0 – Max Speed	Power (Watts) Scale: 0 – Max Watts ((FSD in Nm x Max Speed) / 9.551)
SGR512			
SGR531			
SGR532			
SGR513	No longer available		
SGR533			
SGR520	Advanced Model - User Selectable Factory Default: Torque – Actual Scale: 0 – FSD	Advanced Model - User Selectable Factory Default: Torque – Peak Scale: 0 – FSD	Advanced Model - User Selectable Factory Default: Torque – Auto Reset Scale: 0 – FSD
SGR540			
SGR521	Advanced Model - User Selectable Factory Default: Torque – Auto Assign[1] Scale: 0 – FSD	Advanced Model - User Selectable Factory Default: Speed Fast (RPM) Scale: 0 – Max Speed	Advanced Model - User Selectable Factory Default: Power (Watts) Scale: 0 – Max Watts ((FSD in Nm x Max Speed) / 9.551)
SGR522			
SGR541			
SGR542			

[1] The value output by channels assigned with "Torque – Auto Assign" is dependent on the peak switch. If unconnected, or Peak is OFF, the channel is assigned with Torque, if Peak is ON, the channel is assigned with Torque – Peak. Refer to the Peak Input section for more details.

Voltage/Current Assignments

Assignments apply to all channels.

| Option	Analog Output Type	Analog Output
OPTN-A SGR51x/SGR53x	Voltage	Bipolar ±1V, 0V Zero
OPTN-B SGR51x/SGR53x	Voltage	Bipolar ±5V, 0V Zero
OPTN-C SGR51x/SGR53x	Voltage	Bipolar ±10V, 0V Zero
OPTN-D SGR51x/SGR53x	Current	0 - 20mA
OPTN-E SGR51x/SGR53x	Current	4 - 20mA
OPTN-U SGR51x/SGR53x	Voltage	User specified when ordered check transducer label
OPTN-V SGR51x/SGR53x	Current	±8mA, 12mA Zero
Advanced Model SGR52x/SGR54x	Voltage	User Selectable Factory Default: Bipolar ±10V, 0V Zero
Advanced Model (OPTN-F) SGR52x/SGR54x	User Selectable Voltage/Current	User Selectable Factory Default: Bipolar ±10V, 0V Zero

Fail Output

The fail output signals when an error or fault condition occurs within the transducer. The fail output is linked to the internal transducer error flag. Any error condition detected will switch the output on, and will remain on until the error clears. This behaviour is different from the LED which latches.

The fail signal is an open collector output. The output should be pulled up with an appropriate value resistor to the required signal level, using an external supply voltage. The external supply can be anything from 1V to 60V. The fail output transistor will be switched on, grounding the output, when a fail signal is active, when inactive, the output will be pulled up to the external supply voltage.

The fail output is available on both the analog and digital connectors. The following diagrams show two possible setups with the internal circuit:

Example 1 – Analog Connector
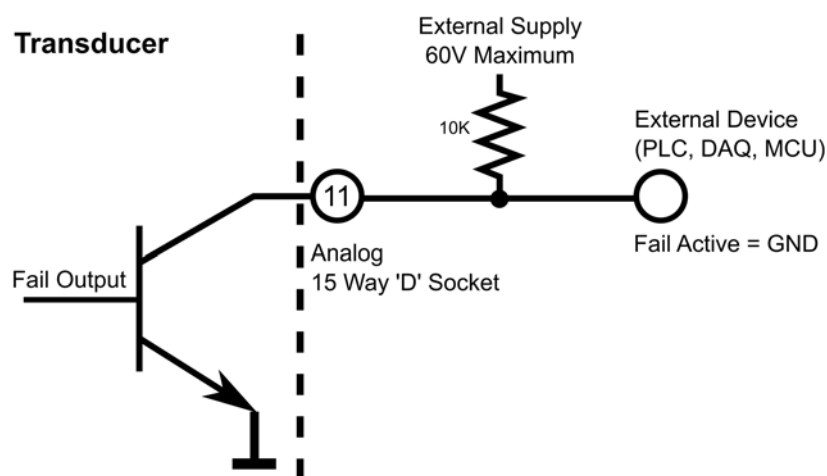
Example 2 – Digital Connector
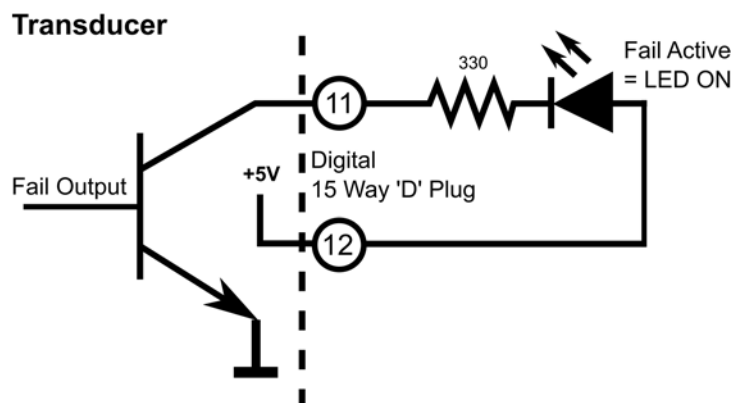
The best use of the fail output is as a safety shutdown signal.

In firmware prior to version 5, the fail output is shared with the limits module. If the limits module is active the fail output is overridden.
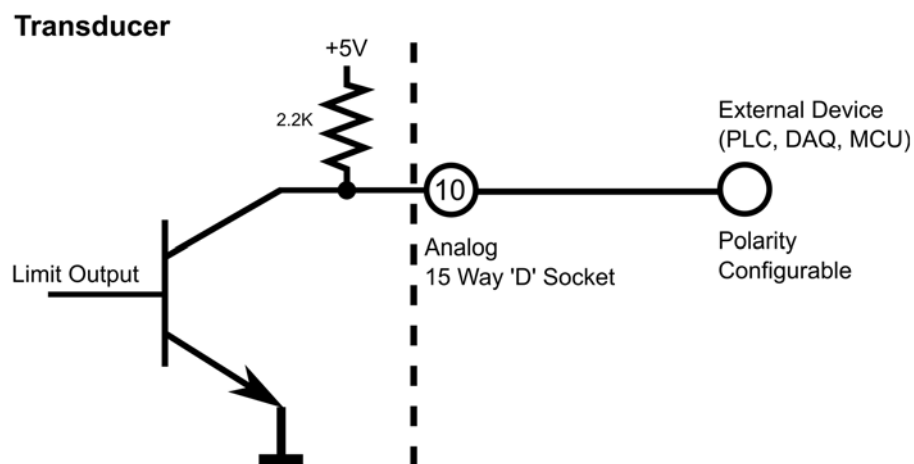
Limit Output

The limit output is driven by the limits module. The limits module is a configurable set of parameters, which switch the limit output on or off when certain conditions are met. These conditions include triggering when torque or speed goes above or below a set level. It also includes more advanced functionality, like auto reset or triggering after a delay

The limits module is configured using Transducer Control; please refer to the Transducer Control manual for further details.

The limit signal is an open collector output, with an internal 5V pullup, no external voltage should be applied to this output. The output polarity is controlled by the configuration parameters.

The diagram below shows a setup example with the internal circuit. The limit output is available on pin 10 of the Analog D connector.

Transducer

+5V

2.2K

(10)

Limit Output

Analog
15 Way 'D' Socket

External Device
(PLC, DAQ, MCU)

Polarity
Configurable

In firmware prior to version 5, the limits module does not have a dedicated output pin, instead the limit output is routed to the fail output pin (pin 11 on both Analog and Digital D connectors). When the limits module is active the fail out signal is overridden.

Zeroing the transducer

Zeroing the transducer has the effect of introducing an offset to the torque reading. The zero can be used to remove any offset that may have been introduced from its mechanical installation, or from idle torque present. It must be stressed that the zero offset is no substitute for correct installation.

When using high zero offsets, care must be taken not to overstrain the transducer. A zero offset will not extend the full scale rating of the transducer, e.g. if a transducer was zeroed at 50% then a further 50% was applied, the transducer will have reached full scale, even though the transducer would be reading 50%. A zero offset of 10% or greater will trigger a warning condition and will be indicated by a warning LED sequence.

The transducer can be zeroed by using either a digital command or an electrical signal.

There are 3 zero modes that can be used:

- Normal Zero: Sets the zero offset to the current torque reading.
- Average Zero: Sets the zero offset to the average of 8 consecutive torque readings.
- Fixed Zero: A fixed value can be input and saved. Fixed Zero is only available in Transducer Control.

Unless the zero is saved, any zero offset applied will be lost after a power cycle.

Electrical Signal

Zeroing the transducer electrically can be achieved by grounding the Zero Input on pin 7 of the Analog 15 Way 'D' Socket. The best way of zeroing a transducer is to use a push button. A simple circuit diagram using a push button is shown below.
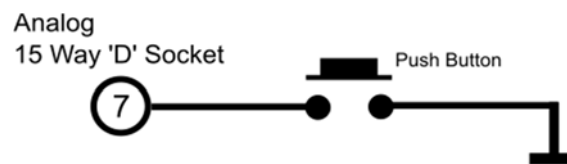
The zero action is only carried out once the input has been ungrounded. Grounding the zero input momentarily (less than 2 seconds) will initiate a normal zero, grounding the input for longer will initiate other modes. When the zero input is grounded for more than 2 seconds the LED will start flashing to indicate that a new mode has been selected, subsequent mode changes are shown by an increase in flash frequency. The LED will not flash if an error condition is present.

The table below shows the various modes and timings.

Ground Hold Time	LED Flash	Zero Mode / Action
0 - 2 Seconds	None	Normal Zero
4 - 6 Seconds	1 Hz Green Flash	Average Zero
Greater than 6 Seconds	2 Hz Green Flash	Transducer will save the current zero offset so that it is retained across power cycles.

Digital Command

There are multiple digital commands to select the different zero modes, refer to the transducer communication protocol manual.

Our Torqview and Transducer Control software programs implement these commands providing a simple way of zeroing the transducer.
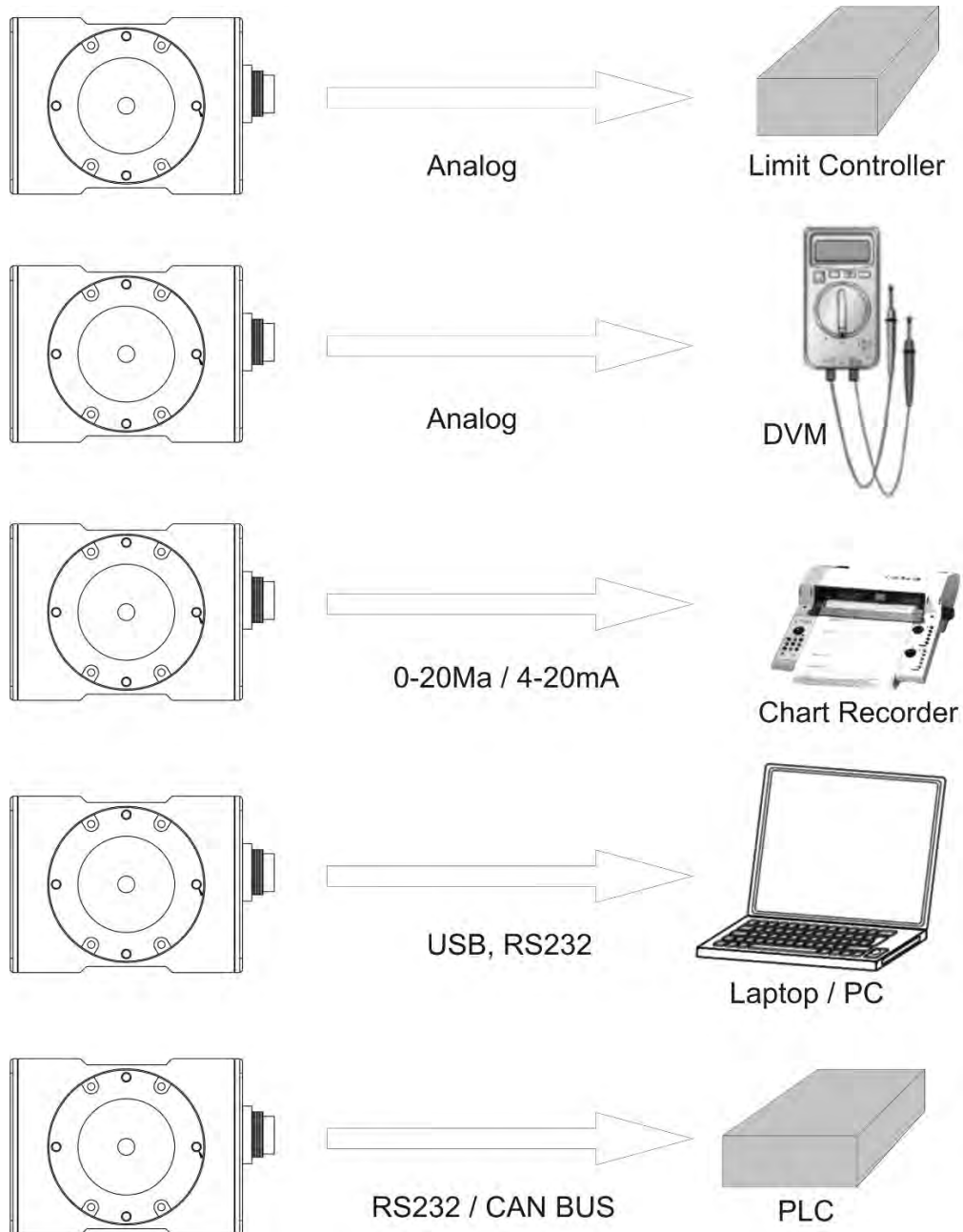
Resetting transducer to factory default

To reset the transducer to the factory default settings (i.e. the functions set by the factory on purchase) follow the steps below:

1. Turn off transducer.
2. While holding in the zero button, power the transducer. The LED will stay solid green until the zero button is released.
3. Allow the transducer to carry out its BIT procedure.
4. When the LED is solid green again, all user-adjusted parameters will have been reset to the factory defaults.

Examples of reading/collecting data

For diagrammatic purposes only the SGR510/520 model is shown.

Analog → Limit Controller

Analog → DVM

0-20Ma / 4-20mA → Chart Recorder

USB, RS232 → Laptop / PC

RS232 / CAN BUS → PLC

Optional Accessories
Analog Lead
The Analog Lead is a 2.5m length - 15 way 'D' type connector (female) to 12 pin Lumberg (female). It can be used for any SGR series transducers.

Digital Lead (SGR520/540 series ONLY)
The Digital Lead is a 2.5m length - 15 way 'D' type connector (male) to 12 pin Lumberg (male). It is used to configure the SGR520/540 series.

Digital Adaptor Lead (SGR520/540 series ONLY)
The Digital Adaptor Lead is an optional accessory and plugs into the 15 way 'D' type connector on the 2.5m Digital Lead. It provides a DC jack for power and RS232 and/or a USB connection, depending upon the options requested. *Note: USB specification limits the length of a cable between host and full speed device to 5 meters. A USB Extender is required for distances greater than 5m; please consult the factory for USB Extenders.*

AC Mains Adaptor Power Supply (PSU)
The AC Mains Adaptor Power supply is a 12V 2A unit, which provides power for an SGR series Transducer and Transducer Signal Breakout Unit.

Additional Related Products and Transducer Resources
Transducer Display ETD
The Transducer Display ETD is a readout suitable for all SGR transducers. The ETD displays Torque and Peak Torque, and if fitted, Speed and Power. The ETD doubles as a breakout for analog and digital connections, so it can be connected to external devices. The ETD is mains powered, and provides power to the transducer without the need for an additional supply.

Transducer Signal Breakout Unit (SBU)
The Transducer Signal Breakout Unit connects to a transducer, and provides a breakout for the analog and digital connections. Standard 4mm sockets are provided for the analog connections, in addition to a USB port and 9-way 'D' for RS232. Switches connect to the control lines to allow for zero and peak control, LED's are provided for status. The SBU is powered, and provides power to the transducer, using a 12-32VDC 1 Amp power supply.

Ethernet Module (ENET-01)
The Ethernet Module is an add-on which adds network connectivity to our transducers. This makes our transducers accessible from any location within a premises where a network connection is available. This capability allows monitoring by multiple concurrent users in different geographical locations.

TorqView (SGR520/540 series ONLY)
TorqView is an easy to use advanced torque monitoring and recording software package, for use with the SGR520/540 series transducers. It allows the Torque, Speed, Power and Temperature values to be displayed in charts, dials and digital bars.

Transducer Control Program (SGR520/540 series ONLY)
Transducer Control is an all-round application to unlock the advanced functionality of the SGR520/540 Series Transducers. Transducer Control enables the user to exploit the flexibility of the advanced transducer series, by configuring the run time parameters of the transducer to best suit their application.

Transducer Communication Protocol (SGR520/540 series ONLY)
The Transducer Communication Protocol describes the protocol required to communicate with a transducer on either RS232 or USB. The Transducer uses a simple request and send protocol, which defines the commands for requesting data and configuring functionality. Further information on the Transducer Communication Protocol is available from the factory or as a download from our website: www.sensors.co.uk/documents.

Transducer DLL Programmers Guide (SGR520/540 series ONLY)
The Transducer DLL Programmers Guide provides information on how a transducer can be integrated into a third-party software program. The DLL simplifies access to transducers connected on USB, RS232 or Ethernet, by providing a unified interface. It takes care of the low-level driver access, protocol negotiation and data manipulation. Further information on the Transducer DLL Programmers Guide is available from the factory or as a download from our website: www.sensors.co.uk/documents.
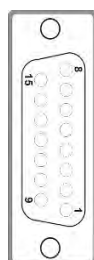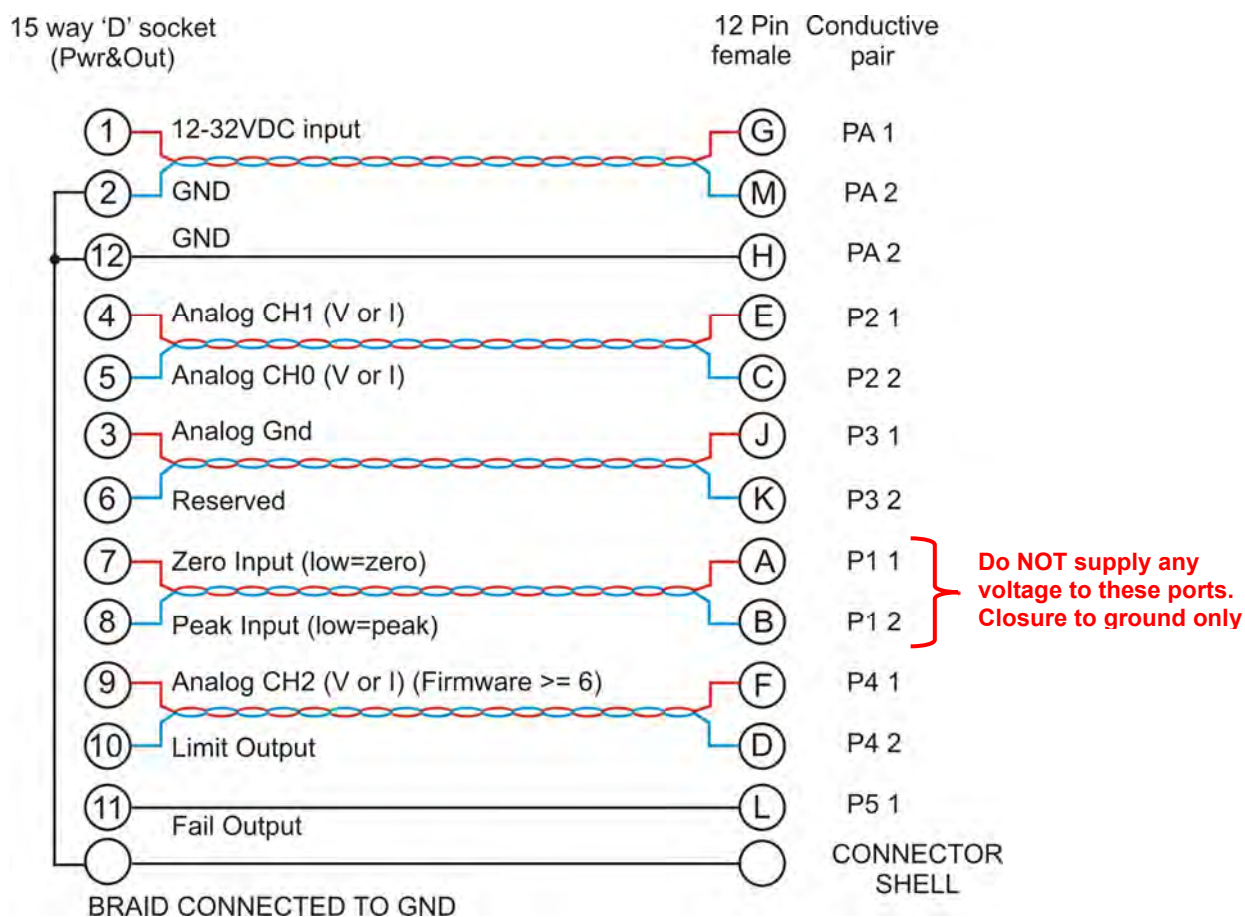
Leads

Analog Lead - Pin Out

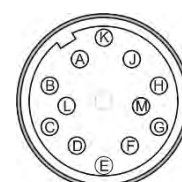2.5m length - 15 way 'D' type connector (female) to 12 pin Lumberg (female)

15way 'D' type connector (Pwr&Out)		12 Pin male on transducer
Pin	Description	Pin
1	12-32VDC input	G
2	GND	M
3	Analog GND	J
4	Analog CH1 (V or I)[1]	E
5	Analog CH0 (V or I)[1]	C
6	Reserved	K
7	Zero Input (low = zero)	A
8	Peak Input (low = peak)	B
9	Analog CH2 (V or I)[1,2]	F
10	Limit Output	D
11	Fail Output	L
12	GND	H

[1] For Analog channel assignments refer to the **Analog Outputs** section.
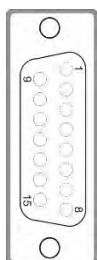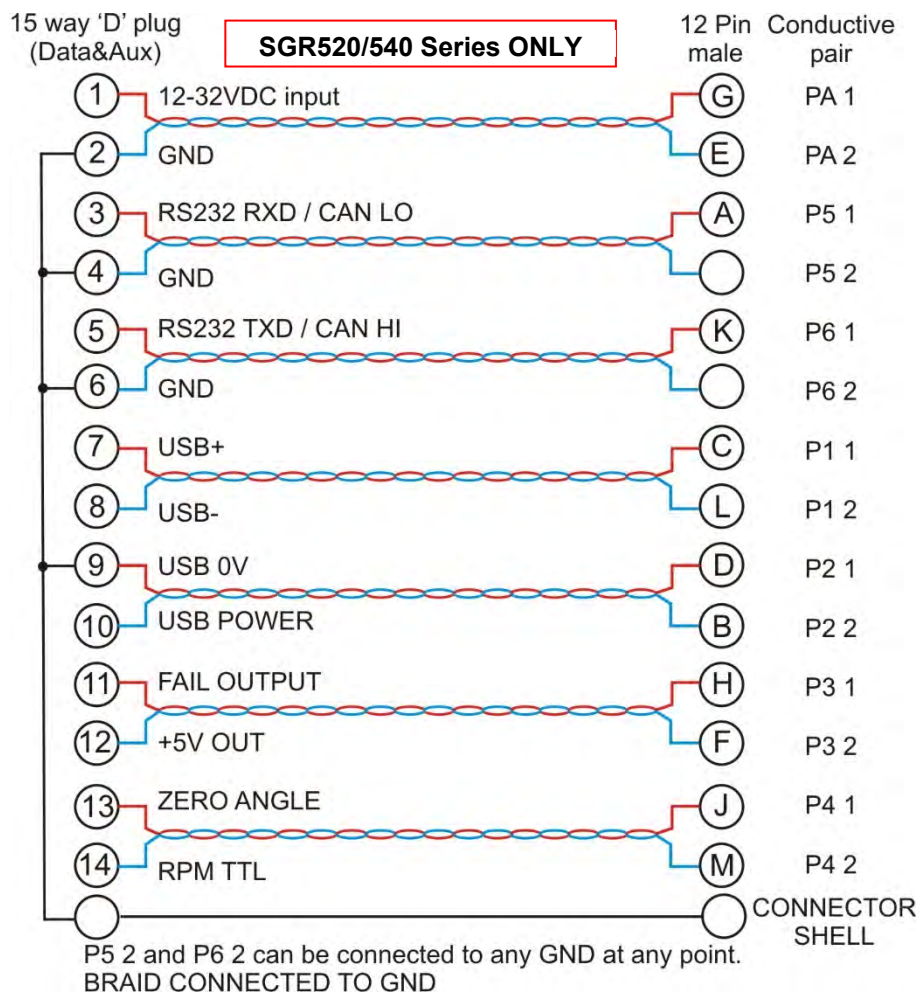[2] CH2 only available with Firmware Version 6 or greater.

Female 15 way 'D'
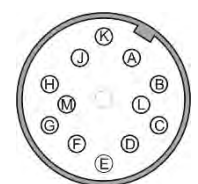
Female 12 way Lumberg

Digital Lead - Pin Out (SGR520/540 Series ONLY)
2.5m length - 15 way 'D' type connector (male) to 12 pin Lumberg (male)

15 way 'D' type connector (Pwr&Out)		12 Pin female on transducer
Pin	Description	Pin
1	12-32 VDC Input	G
2	GND	E
3	RS232 RXD / CAN LO	A
4	GND	
5	RS232 TXD / CAN HI	K
6	GND	
7	USB +	C
8	USB -	L
9	USB 0V	D
10	USB Power	B
11	Fail Output	H
12	+5V OUT	F
13	Zero Angle	J
14	RPM	M

15 way 'D' plug (Data&Aux) — **SGR520/540 Series ONLY** — 12 Pin male / Conductive pair

15 way 'D' plug	12 Pin male	Conductive pair
1 12-32VDC input	G	PA 1
2 GND	E	PA 2
3 RS232 RXD / CAN LO	A	P5 1
4 GND		P5 2
5 RS232 TXD / CAN HI	K	P6 1
6 GND		P6 2
7 USB+	C	P1 1
8 USB-	L	P1 2
9 USB 0V	D	P2 1
10 USB POWER	B	P2 2
11 FAIL OUTPUT	H	P3 1
12 +5V OUT	F	P3 2
13 ZERO ANGLE	J	P4 1
14 RPM TTL	M	P4 2
	CONNECTOR SHELL	

P5 2 and P6 2 can be connected to any GND at any point.
BRAID CONNECTED TO GND

Male 15 way 'D'

Male 12 way Lumberg DIN45321 0332 12

Transducer Connections

Analog

15 way 'D' socket
(Pwr&Out)

Pin	Signal
1	12-32VDC input
2	GND
12	GND
4	Analog CH1 (V or I)
5	Analog CH0 (V or I)
9	Analog CH2 (V or I) (Firmware >= 6)
3	Analog GND
7	Zero Input (low=zero) — Push Button
8	Peak Input (low=peak) — Toggle Switch
10	Limit Output — PLC
11	Fail Output — 330 / LED / +5V (Ext supply)

Do NOT supply any voltage to these ports. Closure to ground only

BRAID CONNECTED TO GND
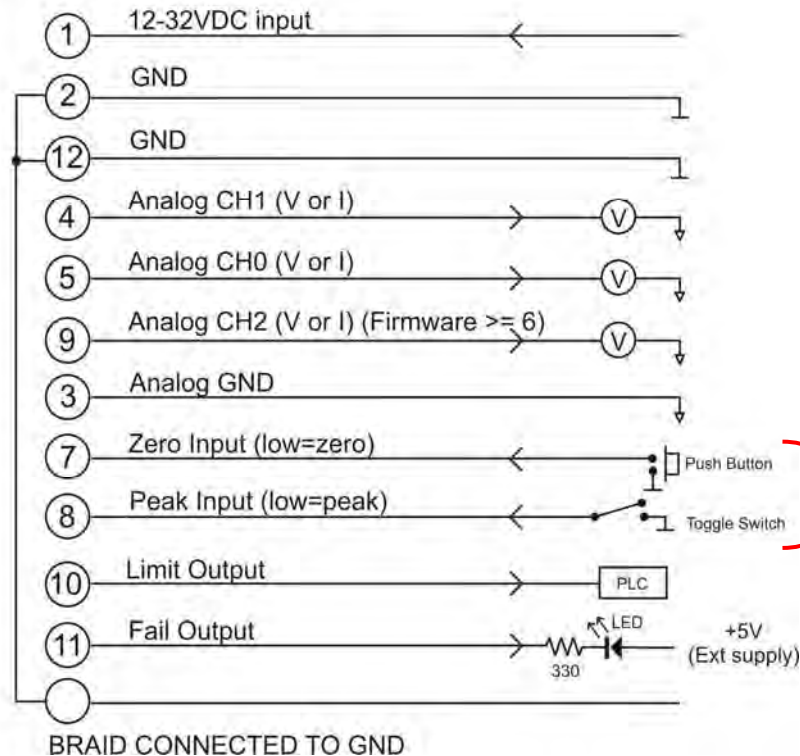
Digital

15 way 'D' plug
(Data&Aux)

Pin	Signal
1	12-32VDCc input
2	GND
3	RS232 RXD / CAN LO
4	GND
5	RS232 TXD / CAN HI
6	GND
7	USB+
8	USB-
9	USB 0V
10	USB POWER
11	FAIL OUTPUT — 330 / LED
12	+5V OUT
13	ZERO ANGLE — Push Button
14	RPM TTL OUT — Counter

P5 2 and P6 2 can be connected to any GND at any point.
BRAID CONNECTED TO GND
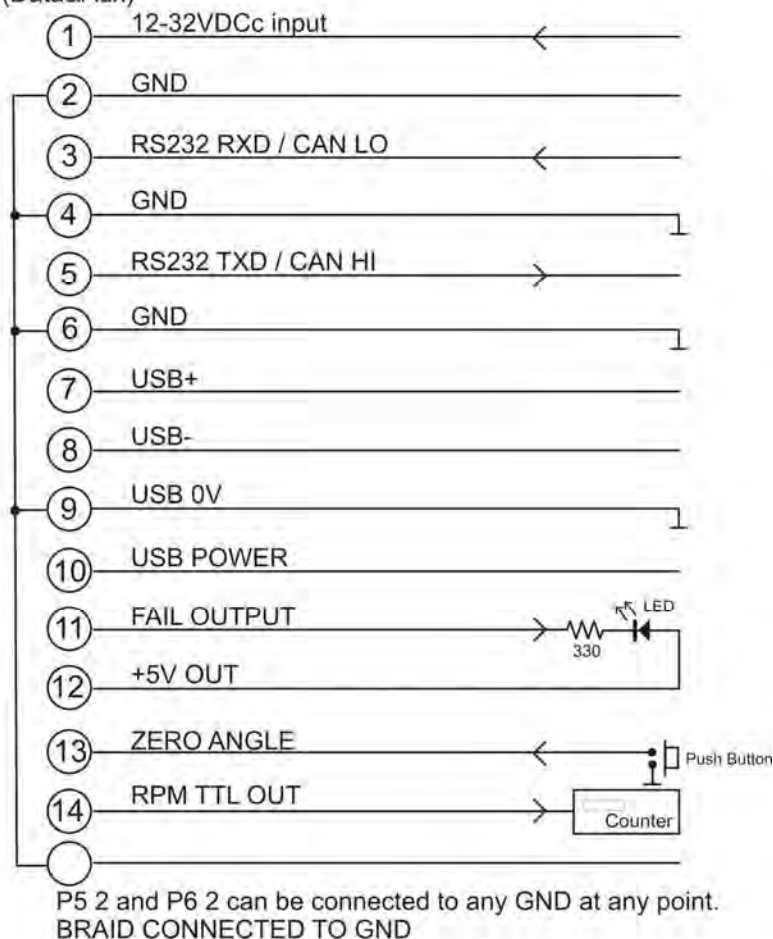
Declaration of Conformity

EC Directives

We, Sensor Technology Ltd, hereby declare that the products named below, to which this Declaration of Conformity relates, is in conformity to the requirements of EC Council Directives and Standards as listed:

- 2004/108/EC (Electromagnetic compatibility).

- BS EN 61326-1:2006, (Electrical equipment for measurement, control and laboratory use).

Type of Product	Rotary Torque Transducer
Product Name(s)	SGR510, SGR511, SGR513. SGR520, SGR521. SGR530, SGR531, SGR533, SGR540, SGR541, SGR542.
Intended use:	Measurement of rotary torque within the rated torque and speed limits as described on the transducer.

UK CA   CE

……………………….......................................
Managing Director
Sensor Technology Ltd

SENSOR
TECHNOLOGY LTD

Digital SGR510/520 series Torque Transducer

Torqsense Digital rotary strain gauge series (SGR) Transducers use non contact technology eliminating the need for noisy slip rings. They are suitable for torque measuring, testing, feedback control of drive mechanisms and process control applications.

The SGR series transducers use modern strain gauge signal conditioning techniques to provide a high bandwidth low cost torque measuring solution with high overrange and overload capabilities.

Benefits & Features

- Transducers from 175mNm to 13000 Nm.

- Large fully functional overrange capability of 250% *(SGR 520)*

- Minimal side and end load errors

- Low linearity deviation of ± 0.05 % FSD

- Low hysteresis error of ± 0.05 % FSD

- Zero variation in torque signal with rotation (cyclic variation)

- Non contact signal transmission, no slip rings to wear out

- High digital sample rate of 4000 samples per second

- Adjustable torque data smoothness, low pass filter (SGR520)

- Speed measurement / Power computation

- Wide power supply range 12-32 VDC

- Compatible with ethernet gateway module

Technology

The SGR series torque transducers use a full four element strain gauge bridge to measure the torsion present on a shaft. The full bridge helps to diminish errors from any off-axis forces that are sometimes unintentionally applied to the transducer in some test setups. The full bridge also increases the sensitivity and the temperature performance of strain measurement.

A rotor mounted ultra-miniature microcontroller measures the strain gauge bridge and transfers the information back to the stator digitally eliminating any noise pickup usually associated with slip ring and other analog methods of transferring torque data from rotor to stator. External noise pickup into the gauge wiring is virtually eliminated due to the short distance between the strain gauge elements and the rotors measuring circuits.

A multipoint calibration method reduces any linearity errors within the sensor. A large functional overrange capability allows the peaks of a torque signal to be captured more faithfully without any clipping when operating the sensor close to its full scale rating.

All this combined with a mechanical overload capability of over 400% make the SGR series torque sensors a very robust and accurate torque measuring solution.

TorqSense SGR510 series transducers offer:
- Fixed voltage or current analog outputs (one for torque and the other for speed or power) for interfacing with analog instrumentation
- BIT Self-diagnostics for letting the manufacturer know that the transducer's torque, speed ratings and calibration due date have not been exceeded.
- Simple 'Sensor status' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

Whereas, TorqSense SGR520 series transducers offer:
- Digital outputs, such as RS232, CANbus and USB, for interfacing with modern instrumentation and laptops
- Digital input for configuring transducer via PC
- 2 x user selectable voltage or current analog outputs (one for torque and the other for speed, power or peak torque) for interfacing with analog instrumentation
- Transducer configuration software to allow user to change transducer variables
- BIT Self-diagnostics for letting users know data is trustworthy, that the transducer's torque, speed ratings and calibration due date have not been exceeded
- Simple 'Sensor status' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy
- Ability to connect up to 10 transducers using USB
- Optional external ethernet gateway module

TORQVIEW™ Software

TorqView is an easy to use advanced torque monitoring software, available to assist data recording and instrumentation displays that interface with Windows based PCs.
Features include: 3 types of display, text files compatible with Matlab and Excel and Real time chart plotting.
See TorqView datasheet for more details.

LabView VI's are available for users to design their own process control applications. DLLs are also available for users to write their own custom software. Get data from across your network using the ethernet module.
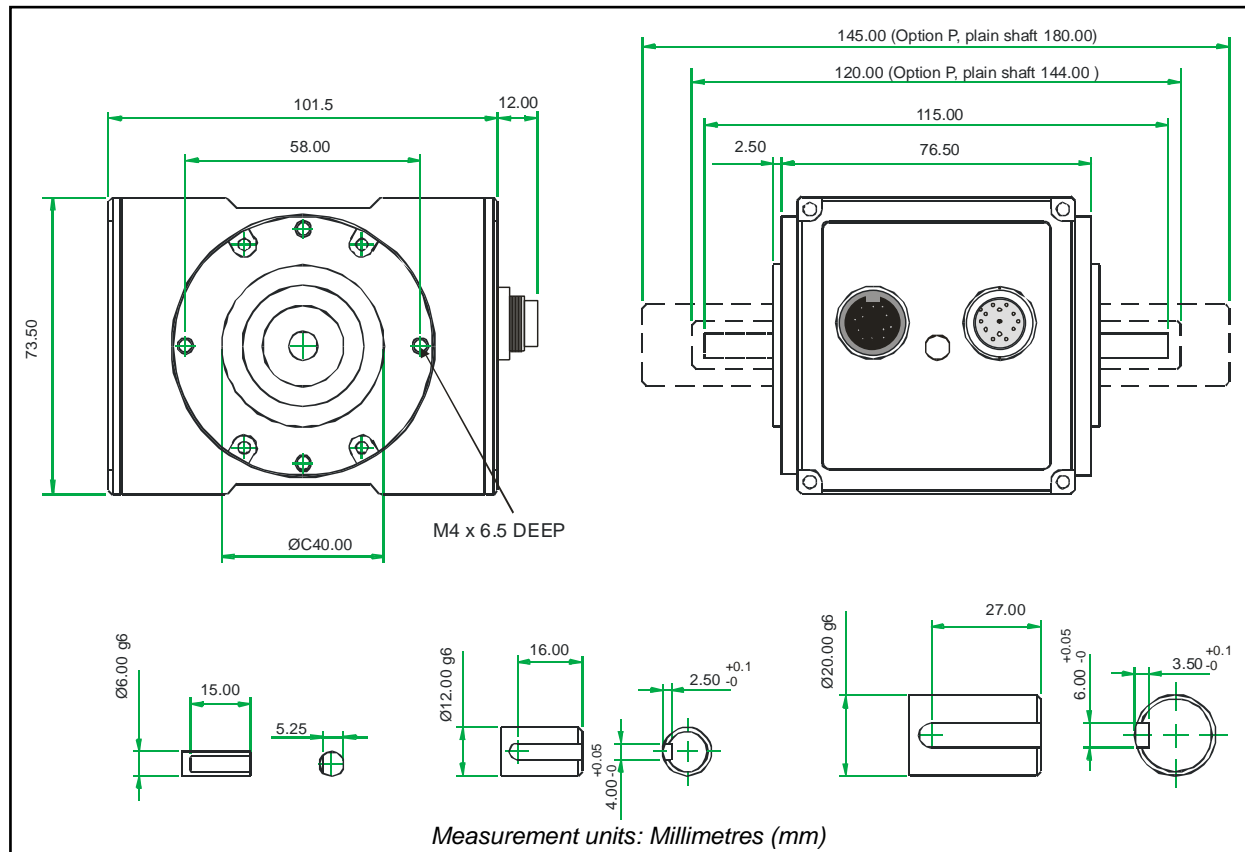
SGR4297R (Rev 7)

SGR510/520 Series Torque Transducers - Data Specification

Parameter	Condition	Data								Units
SGR510/520 Torque measurement system										
Measurement method		Full bridge strain gauge								
Torque range	*(See Notes 1 & 2 below)*	0 − 1	0 − 1.1 to 0 - 20	0 − 21 to 0 - 100	0 − 101 to 0 - 500	0 - 501 to 0 - 2000	0 − 2001 to 0 - 13000			Nm
		[0 - 10]	*[0 − 11 to 0 - 200]*	*[0 − 201 to 0 - 1000]*	*[0 − 1001 to 0 - 5000]*	*[0 − 5001 to 0 - 20000]*	*[0 − 20001 to 0 - 175000]*			*[lbf in]*
Shaft size (diameter)		6	12	20	30	50	75			mm
Specifications										
Combined non-linearity and hysteresis		±0.1								%FS
Resolution		0.01								%FS
Repeatability		0.05								%FS
SGR510 Series Transducers ONLY										
Accuracy	20⁰C, SM *(See Note 4)*	±0.2								%FS
3dB Bandwidth	*(See Notes 5&6)*	250 (default ave. = 16)								Hz
Analog output										
Output voltages (Torque/Speed/Power)		Options available: ±1 / ±5 / ±10 / Unipolar (SGR510 Series default setting is ±5Vdc) (SGR520 Series output voltages are user selectable)								Vdc
Load impedance		Maximum 1								KΩ
Output currents (Torque/Speed/Power)		Options available: 4-20 / 0-20 / 12±8 (SGR520 Series output currents are user selectable)								mA
4-20mA Loop resistance		Should not exceed 400								Ω
SGR520 Series Transducers ONLY										
Accuracy	20⁰C, SM *(See Note 4)*	±0.1								%FS
Digital averaging	*(See Note 5)*	2	4	8	16	32	64	128	256	N
Noise Floor	20⁰C, SM *(See Note 4)*	0.06	0.04	0.03	0.02	0.015	0.01	0.01	0.01	%FS
3dB Bandwidth	*(See Note 6)*	2000	1000	500	250	125	62	31	15	Hz
Digital output (SGR520 Series Transducers ONLY)										
Connections		CAN Bus		RS232		USB				
Configuration		CAN 2.0B, 11bit Message Identifiers		Data Bits: 8, Parity: None, Stop Bits:1		USB 2.0 Full-Speed				
Baud Rate(s)		1 Mbps, 500 Kbps, 250 Kbps, 100 Kbps		115200 bps, 38400 bps, 9600 bps		12 Mbps				
Output Rate *(Note 7)*		Up to 10 KHz		Up to 1.1 KHz		Single Transfer	Up to 500 Hz			
						Bulk Transfer	Up to 10 KHz			
Rotation speed/angle of rotation measurement system										
Measurement method		Opto switch through slotted disc								
Direct output signal		Pulse output direct from opto switch (TTL, 5V square wave)								
Accuracy		±1rpm up to 30,000rpm								
Rotational speed (max)	*(See Note 3)*	30,000	20,000	15,000	12,000	9,000	6,000			RPM
Digital Processing Techniques Processing modes run simultaneously and can be applied to either analog channel or accessed individually via a digital connection.		Processing Method		Update rate for analog and digital outputs						
		Mode 1 (Slow Method)Frequency Count		1						Hz
		Mode 2 (Fast Method)Period Count		0 RPM	1					Hz
				< 2000 RPM	RPM					
				> 2000 RPM	RPM x (1 / (⌊ (RPM - 1) / 2000 ⌋ + 1))					
Temperature										
Measurement method		Shaft mounted platinum temperature sensor								
Temperature accuracy		±1								⁰C
Reference temperature T_{RT}		20								⁰C
Compensated range, ΔT_O		0 to +90								⁰C
Usable range, ΔT_S		-40 to +90								⁰C
Temperature		Coefficient of zero 0.002								%
Temperature		Coefficient of span 0.01								%
Power supply										
Nominal voltage, V_S		12 to 32 (max)								V
Current consumption, I_S		250 (max) @ 12 VDC								mA
Power consumption, W_S		3								W
Allowed residual ripple of supply voltage, V_{ripple}		500 (above nominal supply voltage)								mVp-p
Electromagnetic compatibility										
EMC compatibility		EN 61326:2006								

* For notes, please see glossary page

SGR510/520 Series Torque Transducers
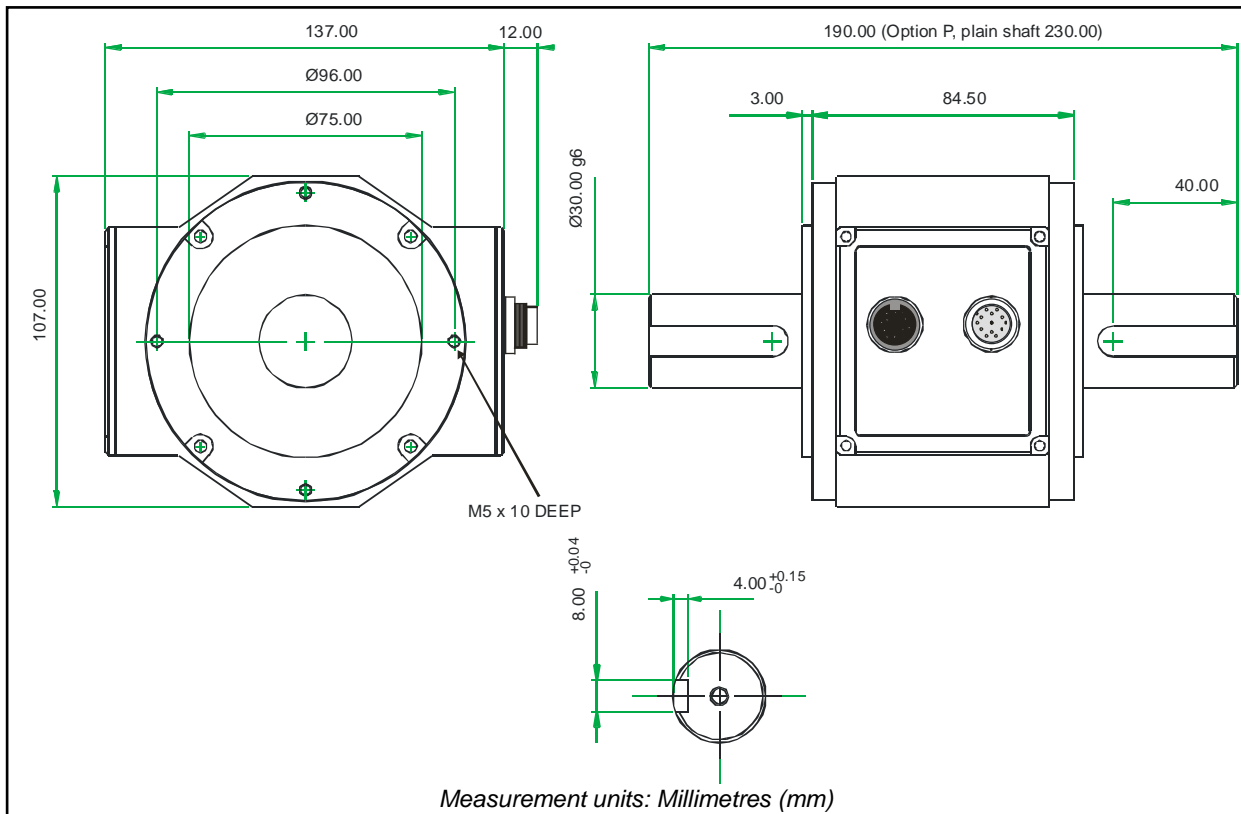
Dimensions (1Nm to 100Nm)

Measurement units: Millimetres (mm)

Parameter	Data														Units
Mechanical Properties															
Torque (Max)	0.225	0.6	1	2.5	3.5	6	8.5	13	17.5	20	30	55	85	100	Nm
Shaft Code	CD	CE	CF	DA	DF	DB	DC	DG	DD	DE	EB	EC	ED	EE	
Standard Shaft Type	Plain	Plain	Flat	Keyed											
Shaft Size (Diameter)	6			12							20				mm
Torsional Stiffness	0.23	0.23	0.23	1.28	1.3	1.32	1.6	1.7	1.8	1.9	4.1	6.4	8.1	9.2	KNm/rad
Mass moment of inertia, L_V	0.45	0.45	0.45	5.96	6.00	6.04	6.13	6.18	6.24	6.42	22.9	23.9	25.4	27.2	$\times 10^{-6}$ kg·m²
Max measurable load limit	250 (of rated torque)														%
Static safe load breaking	400 (of rated torque)														%
Shaft weight, approx	0.03	0.03	0.03	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.36	0.37	0.40	0.41	kg
Transducer with shaft weight, approx	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.1	kg

Dimensions (101Nm to 500Nm)

137.00   12.00   190.00 (Option P, plain shaft 230.00)

Ø96.00

Ø75.00

3.00   84.50

40.00

Ø30.00 g6

107.00

M5 x 10 DEEP

$8.00 \,^{+0.04}_{-0}$ $4.00 \,^{+0.15}_{-0}$

Measurement units: Millimetres (mm)

Parameter	Data					Units
Mechanical Properties						
Torque (Max)	175	225	265	350	500	Nm
Shaft Code	FA	FB	FC	FD	FE	
Standard Shaft Type	Keyed					
Shaft Size (Diameter)	30					mm
Torsional stiffness	32.9	35.6	37.2	37.9	39.8	kNm/rad
Mass moment of inertia	138.9	143.1	147.7	151.9	174.2	$\times 10^{-6}$ kg·m^2
Max measurable load limit	250 (of rated torque)					%
Static safe load breaking	400 (of rated torque)					%
Shaft weight, approx	1.1	1.1	1.1	1.2	1.2	kg
Transducer with shaft weight, approx	2.4	2.4	2.4	2.5	2.5	kg

Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

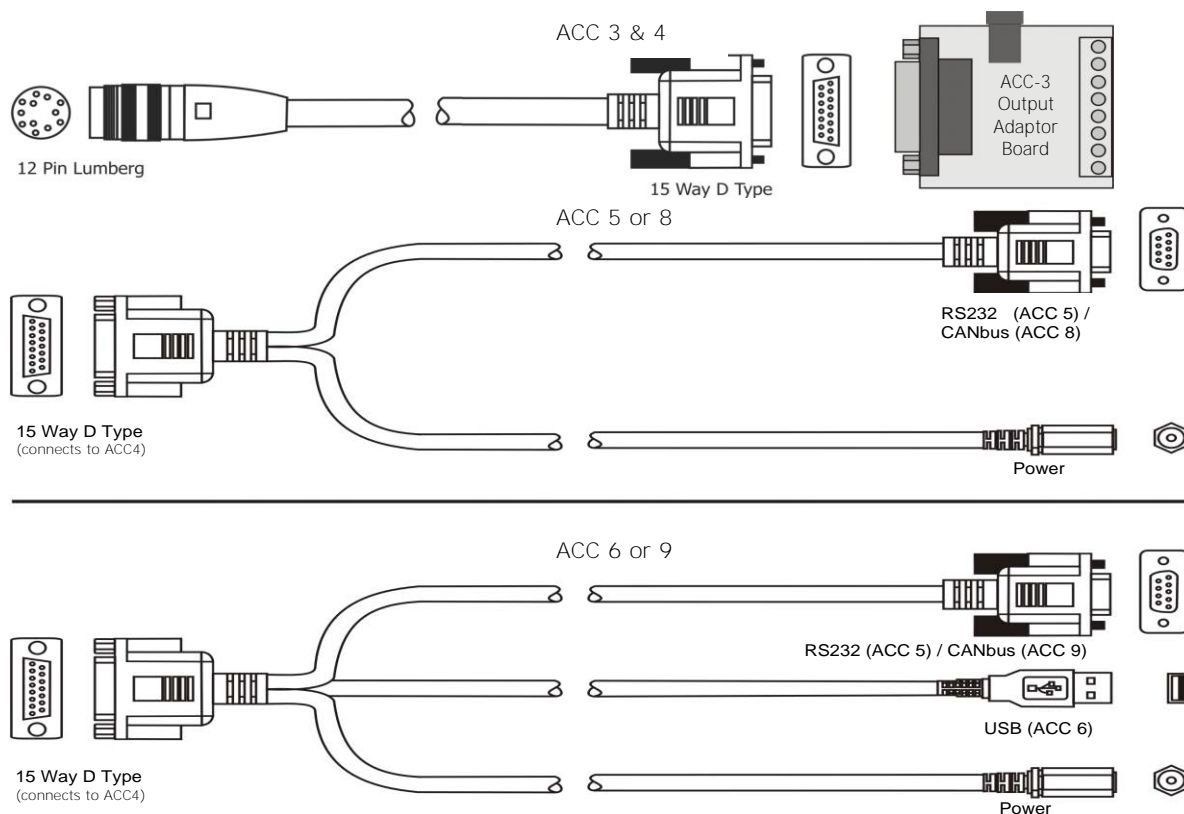# SGR510/520 Series Torque Transducers

Dimensions (501Nm to 13000Nm)

Measurement units: Millimetres (mm)
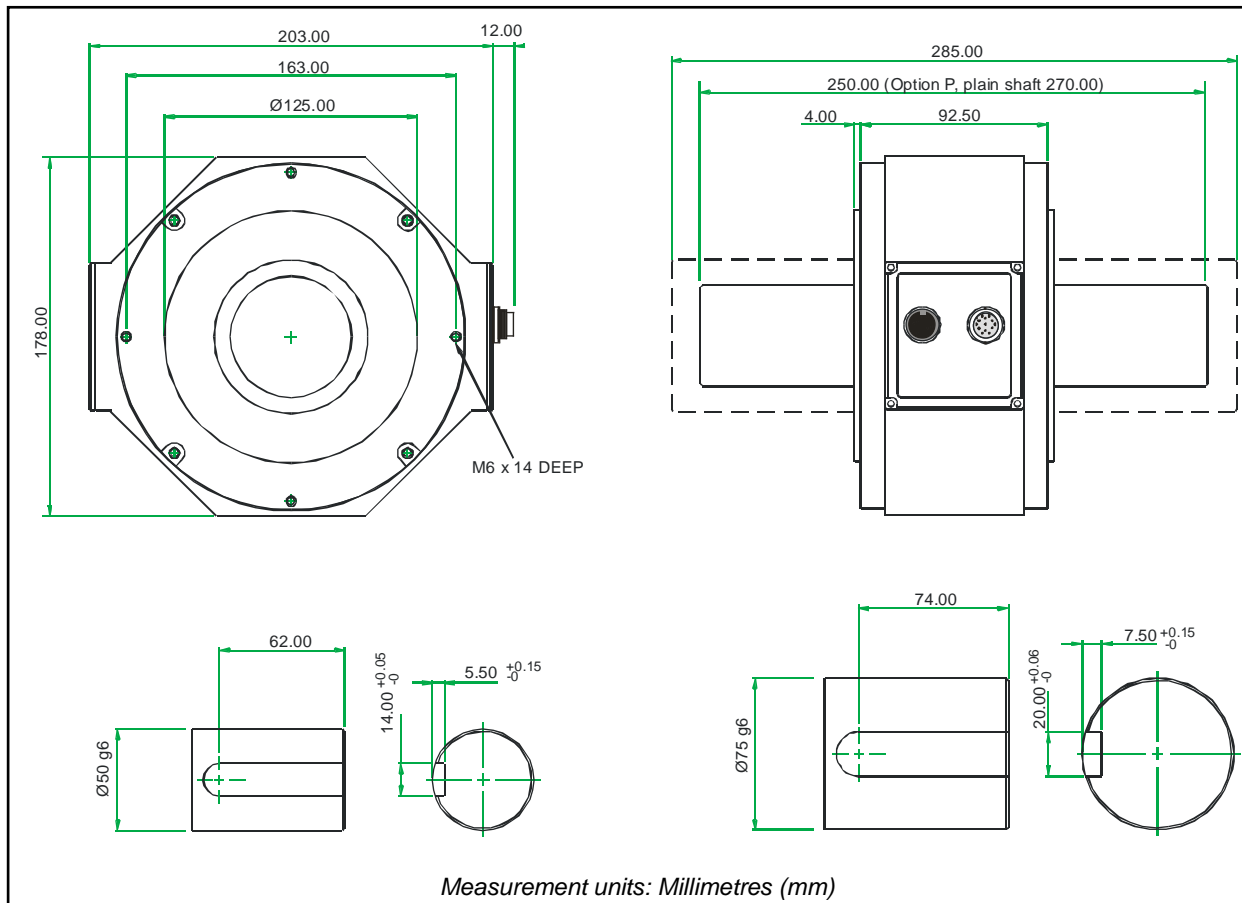
Parameter	Data												Units
	Mechanical Properties												
Torque (Max)	650	850	1100	1350	2000	3000	4000	6000	7000	8000	10000	13500	Nm
Shaft Code	GE	GA	GB	GC	GD	HA	HB	HC	HD	HE	HF	HG	
Standard Shaft Type	Keyed												
Shaft Size (Diameter)	50					75							mm
Torsional Stiffness	TBC	TBC	199.2	TBC	214.1	TBC	TBC	914.4	TBC	TBC	945.5	TBC	kNm/rad
Mass moment of inertia	TBC	TBC	1330	TBC	1497	TBC	TBC	7932.7	TBC	TBC	9407.1	TBC	$\times 10^{-6}$ kg m^2
Max measurable load limit	250 (of rated torque)												%
Static safe load breaking	400 (of rated torque)												%
Shaft weight, approx	TBC	TBC	3.9	TBC	4.1	TBC	TBC	10.2	TBC	TBC	10.6	11.2	kg
Transducer with shaft weight, approx	TBC	TBC	7.1	TBC	7.3	TBC	TBC	13.4	TBC	TBC	13.8	14.4	kg

Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

● – **Standard feature**   ◊ – Optional feature

	SGR510/520 Series		Option Code	Remarks
Torque, Speed, Power Outputs	SGR510	SGR520		
Torque only	510	520		
Torque & Speed *(60 pulses/rev)*	511			*User to specify RPM/FSD when ordering*
Torque & Speed *(360 pulses/rev)*	512			
Torque & Power *(60 pulses/rev)*	513			*User to specify Power/FSD when ordering*
Torque & Speed *(60 pulses/rev)* or Power		521		*Outputs are user selectable*
Torque & Speed *(360 pulses/rev)* or Power		522		
Standard features				
Keyed Shaft Ends	●	●	K	*1Nm will have flats*
Voltage output ±5v FSD (Fixed)	●		B	
Voltage outputs from ±1v to ±10v FSD and unipolar (Variable)		●		*Output is user selectable*
USB 2.0 full speed 12 Mbps Digital output		●		
RS232 output		●		
Torque Averaging and Torque Peak		●		
Self Diagnostics	●	●		
Internal temperature measurement	●	●		*Value available on SGR520 series only*
Deep grooved shielded bearings with oil lubrication	●	●		
Ingress Protection (IP) 54	●	●		
Optional features				
Plain Shaft Ends	◊	◊	P	*Shaft length will be longer than keyed end shafts – consult factory for length*
Splined Shaft Ends	◊	◊	T	*Consult factory for details*
Voltage output ±1v FSD (Fixed)	◊		A	*In place of Option B*
Voltage output ±10v FSD (Fixed)	◊		C	*In place of Option B*
Customer Specified Voltage Output (Fixed)	◊		U	*In place of Option B. User to specify range/scale when ordering*
Current output 0-20mA (Fixed)	◊		D	*In place of Voltage output options*
Current output 4-20mA (Fixed)	◊		E	*In place of Voltage output options*
Current output 12±8mA (Fixed)	◊		V	*In place of Voltage output options*
Current output 0-20mA, 4-20mA & 12±8mA (Variable)		◊	F	*Current output is user selectable and in place of Voltage output. However user can reselect a Voltage output, if required. (Note 8)*
CANbus output		◊	H	*In place of RS232 ouput*
High Speed Bearings *(See Note 9 below)*	◊	◊	J	*Consult factory for maximum speed allowance.*
Sealed Bearings	◊	◊	S	
Ingress Protection (IP) 65 *(See Note 10 below)*	◊	◊	L	

Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

SGR510/520 Series Torque Transducers – Connector and Lead Options

Connectors & Leads	SGR510/520 Series		Option Code	Remarks/Purpose
	SGR510	SGR520		
Analog Connector *12 Pin Lumberg (female)*	◊	◊	ACC 1	*For user to self wire*
Digital Connector *12 Pin Lumberg (male)*		◊	ACC 2	*For user to self wire*
Analog Lead (Length 2.5m) *12 Pin Lumberg (female) to 15 way 'D' type connector (female)*	◊	◊	ACC 3	*For connecting SGR **to user's system via 15 pin 'D' connector***
Digital Lead (Length 2.5m) *12 Pin Lumberg (male) to 15 way 'D' type connector (male)*		◊	ACC 4	*For connecting SGR **to user's system via 15 pin 'D' connector***
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to RS232 and Power Connectors*		◊	ACC 5	*For connecting SGR to PC via RS232* *[Also needs Digital Lead (ACC4) to connect to SGR]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to RS232, USB and Power Connectors*		◊	ACC 6	*For connecting SGR to PC via USB (Option G) or RS232* *[Also needs Digital Lead (ACC4) to connect to SGR]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus and Power Connectors*		◊	ACC 8	*For connecting SGR to PC via CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to SGR]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus, USB and Power Connectors*		◊	ACC 9	*For connecting SGR to PC via USB (Option G) or CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to SGR]*

SGR510/520 Series Torque Transducers – Additional related products

	Code	Remarks/Purpose
Transducer Display ETD	ETD	*Display readout*
AC Mains Adapter Power Supply	PSU 1	*For providing 12-32Vdc*
Transducer Signal Breakout Unit	SBU 1	
TorqView	TV	*Torque Monitoring Software*
Ethernet Module	E-NET-01	*Getting data on to the network*

ACC 3 & 4

12 Pin Lumberg

15 Way D Type

ACC-3 Output Adaptor Board

ACC 5 or 8

15 Way D Type
(connects to ACC4)

RS232 (ACC 5) / CANbus (ACC 8)

Power

ACC 6 or 9

15 Way D Type
(connects to ACC4)

RS232 (ACC 5) / CANbus (ACC 9)

USB (ACC 6)

Power

Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

When ordering a Torque Transducer please note that any torque/FSD is possible between ranges – please specify rated torque and options using the following format:

For example: *SGR*	*511 - 15Nm -*	*K-CL*	**A 'basic' transducer with** torque and speed outputs, rated and calibrated to 15Nm FSD with keyed ends, ±10v and IP65 protection.
Your transducer requirement: *SGR*			
Max speed (if applicable)		RPM	
Connector or Lead options			
Additional related products			

Glossary of terms and definitions used in this datasheet

- *Accuracy* - The degree of conformity of a measured or calculated quantity, which will show the same or similar results. Accuracy of the overall TorqSense system is limited by the combined error of several factors such as linearity, hysteresis, temperature drifts and other parameters affecting measurements. If errors in the system are known or can be estimated, an overall error or uncertainty of measurement can be calculated.

- *Digital averaging* – The application of algorithms to reduce white noise. In any electronic system, electronic white noise is mixed with the signal and this noise usually limits the accuracy. To reduce the influence of white noise and increase the accuracy of the system different averaging algorithms can be applied. In the TorqSense system a flying digital averaging technique is applied to reduce the white noise commensurate with the level of accuracy required. However, as any averaging algorithm works as a low pass filter, the more averaging that is applied the lower the frequency response. Therefore, each Torqsense **system should be optimised to the customer's requirements by choosing the right combination of** accuracy/frequency response. Please see relevant part of the Datasheet and User Manual.

Note 1:	Any torque/FSD is possible between ranges – please specify max rated torque.
Note 2:	Max rated torque should not be exceeded.
Note 3:	Please consult factory for applications requiring rotational speeds that exceed maximum figures given. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.
Note 4:	SM – Static Mode. Dynamic values will depend upon user application and has to be adjusted accordingly.
Note 5:	Digital averaging can be configured by user to optimise accuracy/frequency response for specific user applications. Digital averaging default setting is N=16. For details see User Manual.
Note 6:	>5Khz Sample Rate. Up to 10Khz sample rate possible, please consult factory. Digital averaging also affects the analog output, max analog output 3dB Bandwidth = 5Khz when digital average is 1.
Note 7:	Output rate figures are calculated from the time taken to capture 10000 torque readings. Testing was conducted with each connection method configured at its maximum baud rate. The maximum output rate available for CAN and USB is dependant on the transducers setup. USB - USB is a host based bus architecture, because of this the output rate achievable will be affected by other bus traffic and host activity. USB has two transfer modes, Single Transfer which requests 1 reading at a time and Bulk Transfer which transfers readings in blocks of 50 Torque/Speed pairs. CAN Bus - to achieve a Torque reading output rate of 10KHz, the Speed reading output rate must be reduced to 100Hz.
Note 8:	2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque. Channel 2 (voltage/current) – speed or power, if ordered.
Note 9:	At very high speeds, for better balance the factory recommend plain or splined shafts.
Note 10:	Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

Transducer Control 5
User Manual

Version 5.7

Revision 8 – February 2021

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Introduction

Transducer Control is an all-round application to unlock the advanced functionality of the ORT/RWT/SGR Series Transducers. Transducer Control enables the user to exploit the flexibility of the advanced transducer series by configuring the run time parameters of the transducer to best suit their application.

Transducer Control gives the user complete control of the dual channel analog outputs, by allowing adjustment of the output voltage scaling, zero voltage, data scaling and data assignment. On the digital side, the user can control the digital filtering level, adjust the RS232 baud rate, configure auto reset characteristics and configure the limit controls.

As well as configuring the transducer, Transducer Control can also be used as a readout, providing a simple logger and text display that shows torque, speed and power, along with peak values and zero control.

Compatible Models

Advanced models from the ORT, RWT, and SGR series of Transducers are compatible with Transducer Control 5. Transducers must be running firmware version 3 or higher.

The compatible models are listed below:

Transducer Family	Model Range	Models
Optical (ORT)	ORT240	ORT240/ORT241
Rayleigh Wave (RWT)	RWT320	RWT320/RWT321/RWT322
	RWT340	RWT340/RWT341/RWT342
	RWT420	RWT420/RWT421/RWT422
	RWT440	RWT440/RWT441/RWT442
Strain Gauge Rotary (SGR)	SGR520	SGR520/SGR521/SGR522
	SGR540	SGR540/SGR541/SGR542

Compatible transducers can be identified by the presence of a status LED and serial number greater than 12200.

Ethernet Module

The Ethernet Module is an add-on module which adds network connectivity to our transducers. This allows a network connected PC to connect to a transducer located anywhere in the building, and provides the same features that a directly attached transducer would have.

The Ethernet Module is compatible with the models listed in the previous section, provided that they are running firmware version 4 or higher. A firmware upgrade to 5.2.1 is advised for best operation.

If your using ethernet, your PC must be connected to the same network subnet as the ethernet module, or the subnet must be reachable via a gateway.

By default, the Ethernet Module will attempt to obtain an address via DHCP, if no DHCP server is present, it will fall back to 192.168.1.1/255.255.255.0.

The IP address can be configured via the ethernet connection, or via the transducer using the Ethernet Module USB loop through.

Transducer Requirements
- Advanced ORT/RWT/SGR Series Transducer.
- RS232 or USB connection to a PC, or an Ethernet Module and network connected PC.

PC Requirements
Operating System: Microsoft Windows 7/8/8.1/10 32/64bit.
CPU: Intel or AMD 1GHz.
RAM: 512MB.
Hard Drive Space: 4MB + 2GB for Microsoft .NET Framework 4 Runtime.

Installation
Transducer Control can be installed from a supplied CD, USB Flash Drive or downloaded from our web site.

CD/USB Flash Drive
To install Transducer Control 5 from a CD or USB Flash Drive:

1. Insert the Sensor Technology Installation CD into your CD-ROM drive, or plugin the USB flash drive. If the install loader doesn't run, use Windows Explorer to navigate to the CD-ROM or flash drive, then run autorun.exe. The following screen will be displayed.

2. Click the "Install" button next to "Transducer Control 5".
3. Follow the onscreen instructions.
4. Transducer Control will now be installed, and be ready for use.

The USB drivers are installed as part of the installation.

Web Site Download
To install Transducer Control 5 from our web site:

1. Go to our software downloads page and download Transducer Control:
    https://www.sensors.co.uk/torque-sensors/torqview/software-downloads/
2. Open the downloaded Zip file and run setup.exe.
3. Follow the onscreen instructions.
4. Transducer Control will now be installed, and be ready for use.

The USB drivers are installed as part of the installation.

Running Transducer Control & Connecting To A Transducer

To run Transducer Control and connect to a transducer:

1. Ensure that power is supplied to the transducer.
2. Connect the transducer to the computer using either RS232 or USB. If your using ethernet, ensure your connected and running on the same network subnet, or the subnet can be reached via a gateway.
3. Run the Transducer Control program by clicking on the "Start"/"Windows" button, then "Sensor Technology" > "Transducer Control 5".

When Transducer Control starts the "Search for connected transducers" dialog box will be displayed. The purpose of the dialog box is to find transducers that are attached to the computer.
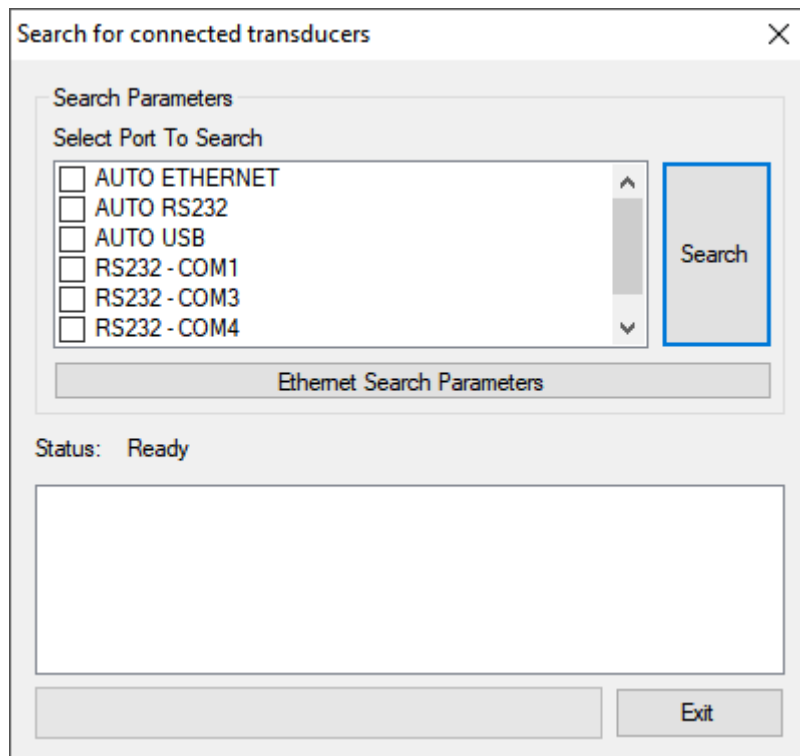
Before pressing the "Search" button, select the search interfaces to use from the "Select Port To Search" list box. The items in the list correspond to the default search options, custom network entries, and ports discovered on the user's computer. The filter reduces the time taken to search for transducers, by only looking in the selected areas.

The options prefixed with "AUTO" will search for multiple transducers, whereas the other options will search for a single transducer on a specific port.

AUTO ETHERNET
AUTO ETHERNET looks for network connected transducers. It does this by sending a broadcast packet on the configured port for all connected network interfaces.

AUTO RS232
AUTO RS232 will search for connected transducers on all the systems detected RS232 ports.

AUTO USB
AUTO USB will search for connected transducers on the hosts USB ports.

NET – HOST:PORT
Any options prefixed with NET, are custom hostnames/IP addresses added by the user. These hosts identify individual ethernet modules. See the "Ethernet Search Parameters" option.

RS232 - COMx
RS232 - COMx will search for a connected transducer on the selected COM port.

Select the filters required by clicking on the relevant options. To search, click on the "Search" button. Transducer Control will then search for compatible transducers using the filters supplied. During this process the window will update to indicate the progress of the search, transducers will be added to the list box as they are found.

If a single transducer is detected the program will automatically initialise the transducer and load the main window. If multiple transducers are detected, the dialog box will require the user to make a transducer selection. To select a transducer, click on the transducer from the list. The transducer will then be initialised and used by the program.
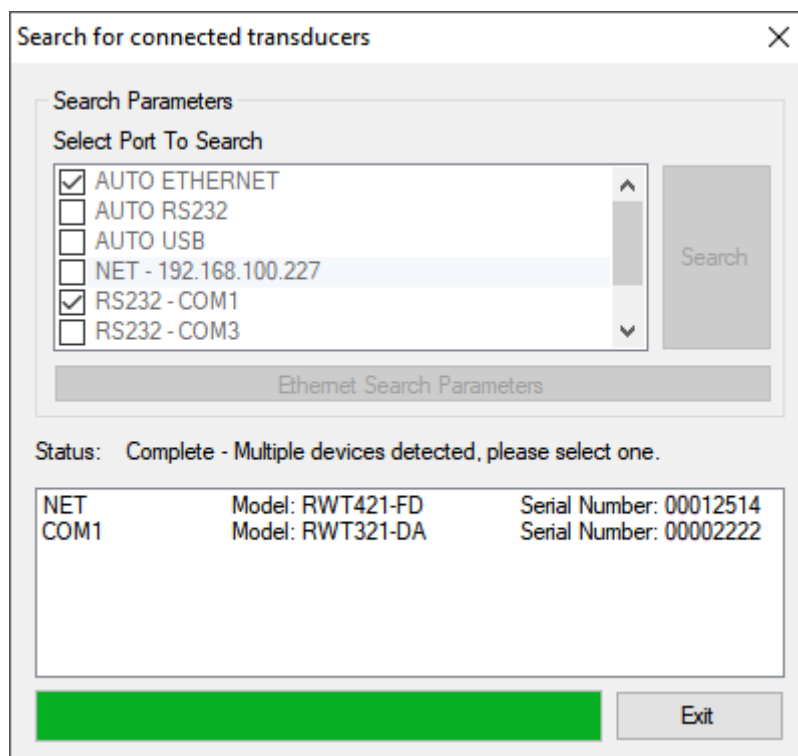
Ethernet Search Parameters
The "Ethernet Search Parameters" dialog adds known hosts to the search list, as well as configure the broadcast port.

Network Broadcast – UDP Port
The UDP port configures the port on which broadcasts are sent, as well as the default port used with hosts specified without a port

IP/HOST
The IP/HOST list is a custom list of hosts added by the user.

Add hosts by typing into the IP/Host text box and click add. The port number is optional, if not specified the broadcast port is used.

Accepted formats:

0.0.0.0 (IPV4 Address)
0.0.0.0:PORT (IPV4 Address)
HOSTNAME
HOSTNAME:PORT

Delete hosts by selecting it and clicking "Delete Selected".

Click "OK" to finish.

Firmware Upgrade
If a firmware upgrade is available, Transducer Control may show an upgrade notification. The Ethernet Module may run in legacy mode if an old version of firmware is used.

Firmware Upgrade ✕

? A firmware upgrade to 5.2.1 is available.

Do you want to upgrade?

Yes

Ethernet Module ✕

? Ethernet Module is currently operating in legacy mode, a firmware upgrade to 5.2.1 is advised.

Do you want to upgrade?

Yes   No
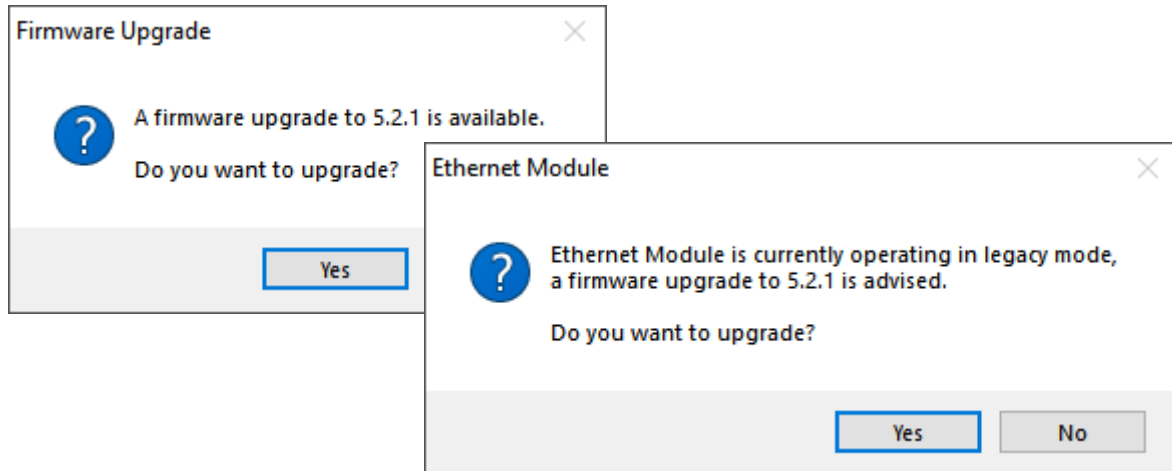
The transducer is in a vulnerable state while flashing the firmware, please ensure all the cables and power supply are trusted and properly connected. Failure to do so may leave the transducer in an unusable state.

Transducer Firmware Update ✕

⚠ WARNING: This process must not be interrupted. Any interruption may leave the transducer in an unusable state.

Please ensure all cables are properly connected and a stable power supply is used.

Do you want to continue?

Yes   No
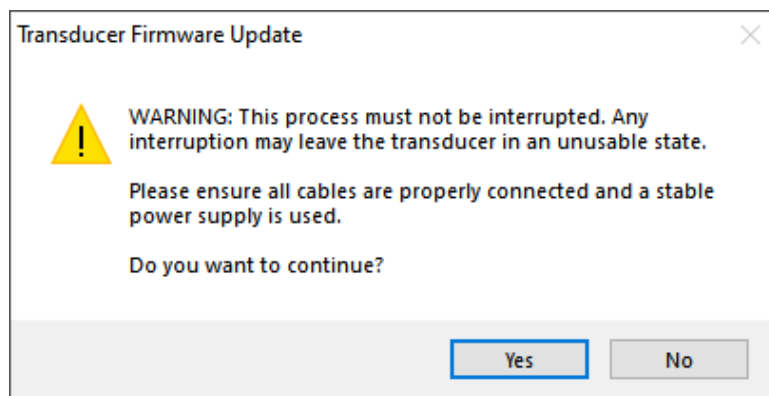
The firmware update may take a few minutes, Transducer Control will feedback progress while the update runs, do not close the program. On completion a dialog box message will be shown. Transducer Control will work following an update, but to ensure correct operation, close Transducer Control and power cycle the transducer.

Transducer Firmware Update

Transducer Firmware Update

Update Progress

Erasing
Program
Verifying
Rebootir
Validatin
Update

Transducer Firmware Update ✕

ℹ Firmware Update Success.

To ensure correct operation, a transducer power cycle as advised.

OK

Stage
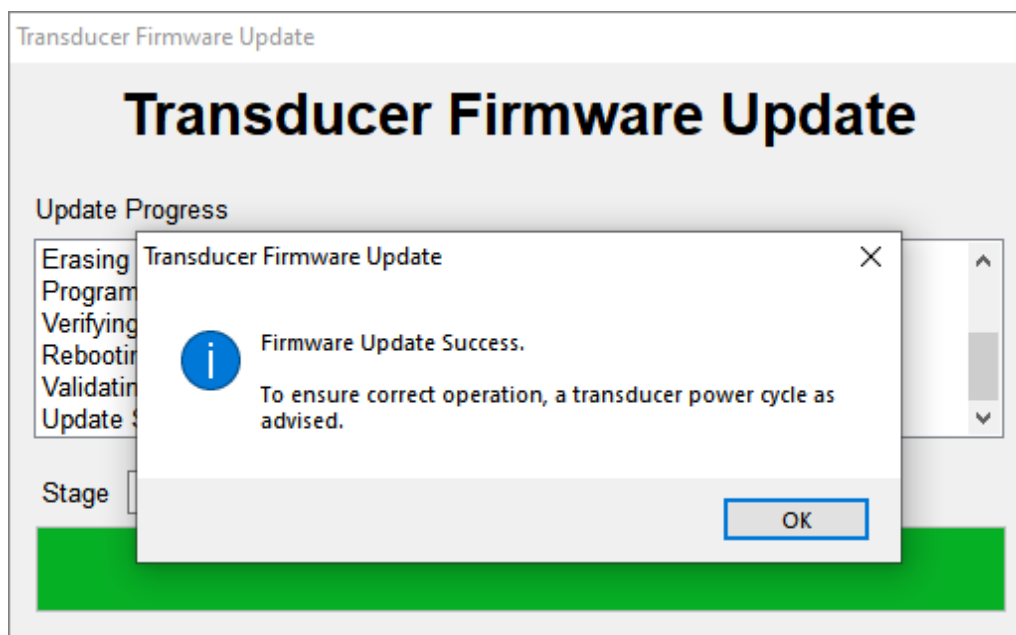
Using Transducer Control
The main screen will be displayed once a transducer has been selected, use the menu at the top of the screen to select an option.
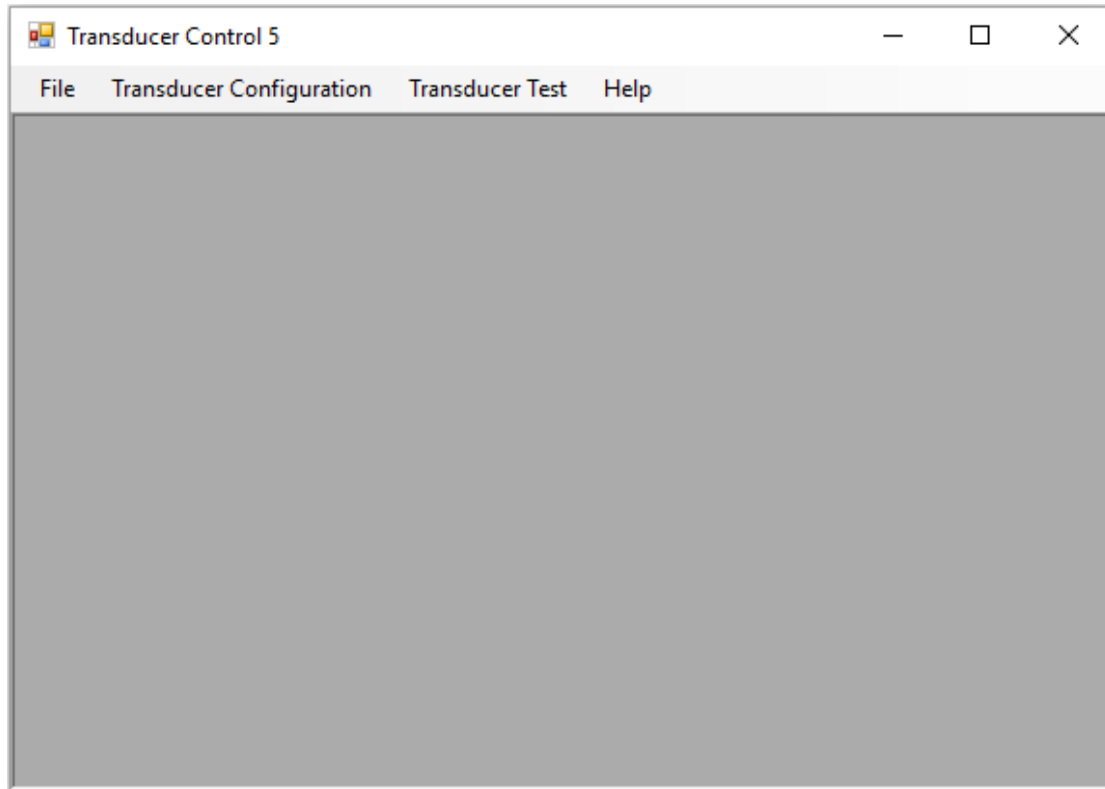
Menu Tree
The menu structure below outlines the functionality of the different menu options.

> *File*
> - *Exit* – Closes Transducer Control.
>
> *Transducer Configuration*
> - *Ethernet Configuration* – Configure Ethernet Module parameters.
> - *User Configuration* – Configures the operational parameters of the transducer.
> - *Zero Offset* – Sets a torque offset.
>
> *Transducer Test*
> - *Data Capture* – Simple interval data capture.
> - *Output Monitor* – Displays capture data generated by the transducer.
> - *Transducer Status* – Displays the transducer's status.
>
> *Help*
> - *About Transducer Control* – Displays version information.

Transducer Configuration

Ethernet Configuration
The Ethernet Configuration settings are only available when the Ethernet Module is detected. The settings can be accessed via an ethernet connection or USB loop through.

Ethernet Module
The Ethernet Module section lists the build information for the connected Ethernet Module.

IPV4
The IPV4 section configures the Ethernet Module IP address.

> *DHCP*
> DHCP mode configures the Ethernet Module to request an IP address from your networks DHCP server. If no DHCP server is present, the Ethernet Module will fall back to 192.168.1.1/255.255.255.0. If an address is assigned, the IP address will be shown in the "IP Address" text box.
> *Static IP*
> In Static IP mode the user must specify the IP address settings. Fill in the "IP Address" and "Subnet Mask". The "Gateway" and "DNS" settings are optional, and only required if using the Ethernet Module from a different subnet or remote location. IP addresses use the IPV4 notation, e.g. 192.168.1.1.
> *Port*
> The "Port" setting is the port that the Ethernet Module will listen on, valid numbers are 1024-49151. The default is 4200, if a different value is used, the Ethernet Module will listen on 4200 and the custom value.

Save

Click the "Save" button to update the Ethernet Module. The update may take a few seconds to complete, especially if updating via USB.

If Transducer Control is connected via Ethernet, the new settings won't take effect until the Ethernet Module is power cycled.
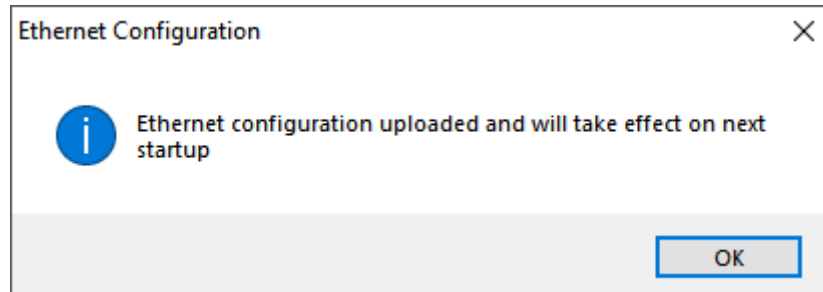
User Configuration

Analog Setup
The "Analog Setup" tab of the user configuration allows the user to configure the transducers analog outputs.

All transducers have dual analog outputs with equal capability on both.
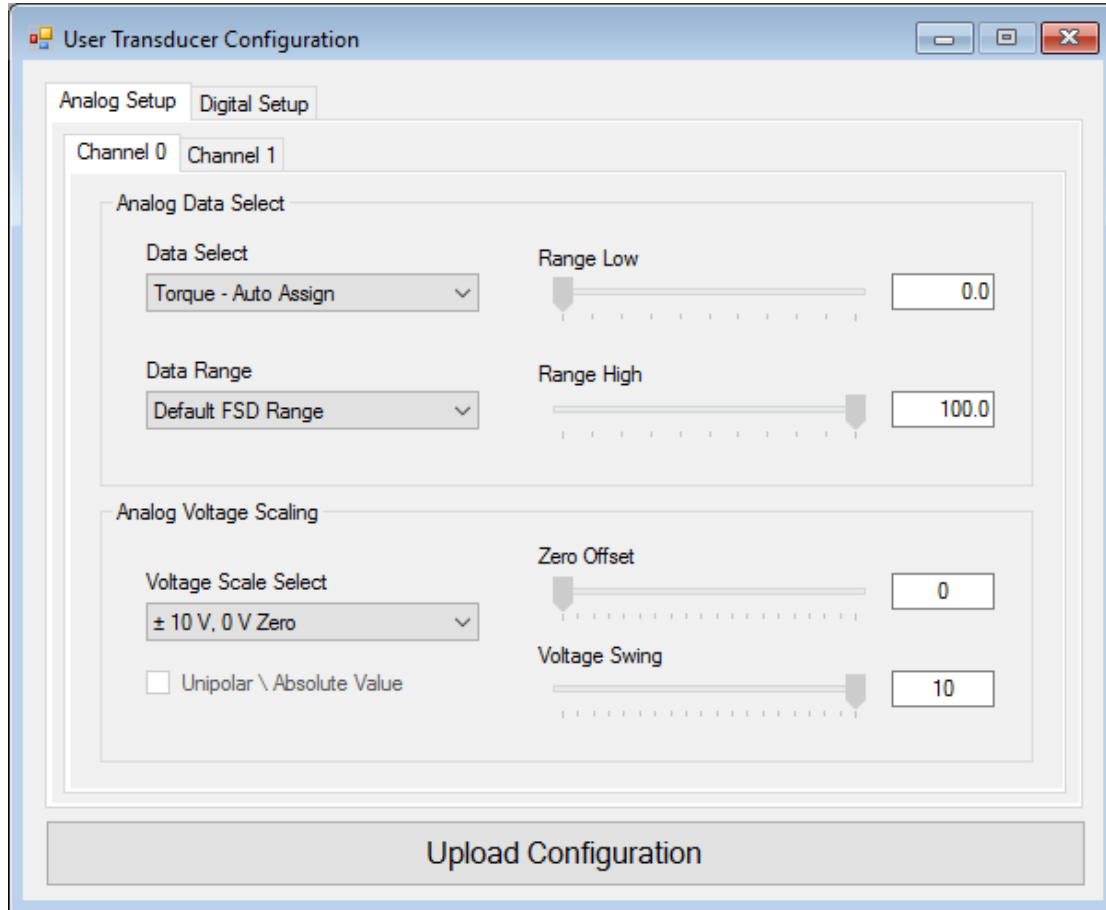
Analog Data Select
The Analog Data Select section allows the user to assign an internal data variable to the output, and select a data range to be applied to the Analog Voltage Scaling.

Data Select
The following list details the available internal data variables that can be assigned to the output. Speed and Power items are dependent on the relevant options being fitted:

Torque – Auto Assign
The "Torque – Auto Assign" data option will switch between Torque – Actual and Torque – Peak based on the state of the external peak switch input (see the Transducer Manual for pin out and control information). If the Peak input is switched ON, Torque – Peak is selected, otherwise Torque – Actual is selected.

Torque – Actual
Current torque value.

Torque – Peak
Peak torque value captured since the last reboot or reset.

Torque – Auto Reset
Peak torque value captured since the last reboot or reset. Auto Reset mode automatically resets the peak torque when the current torque drops below a percentage of the peak value.

Torque – Peak CW
Peak torque value captured in the CW direction.

Torque – Peak CCW
Peak torque value captured in the CCW direction.

Torque – Min
Lowest numerical torque value captured.

Torque – Max
Highest numerical torque value captured.

Speed (Fast) / Speed (Slow)
Current speed value. The slow/fast descriptor refers to the method used to capture speed.

Speed (Fast) – Peak / Speed (Slow) – Peak
Highest speed value captured since the last reboot or reset.

Speed – Rotations
Number of shaft rotations recorded from the fitted angle device or speed pickoff.

Power (Fast) / Power (Slow)
Power is computed from the current torque and speed values. The slow/fast descriptor refers to the method used to capture speed.

Power (Fast) – Peak / Power (Slow) – Peak
Highest power value captured since the last reboot or reset. Power is calculated from every torque/speed pair captured; the highest value is stored.

Temperature – Shaft
Temperature captured from the shaft sensor.

Temperature – Internal
Temperature captured from the internal body sensor.

Data Ranges

The data range parameters control how data from the selected internal variable is taken and scaled. This feature is useful when the user is working in a specific measurement area and requires a greater change in analog output.

The low and high range values effectively rescale to the Zero and FSD voltages set in the Analog Voltage Scaling section. Values that fall below or above the range are masked off; the range selection applies to both negative and positive sides.

Data Range

The user can select a default scale or opt for a custom scale, by selecting from the "Data Range" combo box.

Default FSD Range

The "Default FSD Range" option scales the selected internal variable based on the FSD rating programmed into the transducer, i.e. 0 to FSD.

User Defined

The "User Defined" option allows the user to adjust the "Range Low" and "Range High" sliders to select a custom scale.

Range Low / Range High

The "Range Low" and "Range High" slider bars control the low and high scale values. The "Range Low" parameter can be set between 0 and 80% of FSD, and the "Range High" parameter can be set between 20% and 100% of FSD. The parameter value is displayed in a text box to the right of each range slider. The value is displayed in an appropriate unit for the selected data variable, i.e. Torque = Nm or the configured unit, Speed = RPM, Power = Watts.

To change the high or low range values adjust the slider bar to the left or right until the number in the text box equals the required value. The difference between the "Range Low" and "Range High" must be greater than 10% of FSD and "Range High" must be a higher value than "Range Low".

The following graphs illustrate some examples of how the range selection works.

- Torque (100Nm FSD), Standard Range (0 Nm - 100 Nm), ±10v Scale.
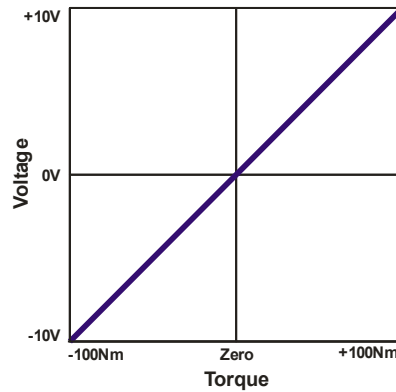
- Torque (100Nm FSD), User Defined Range (50 Nm - 100 Nm), ±10v Scale.
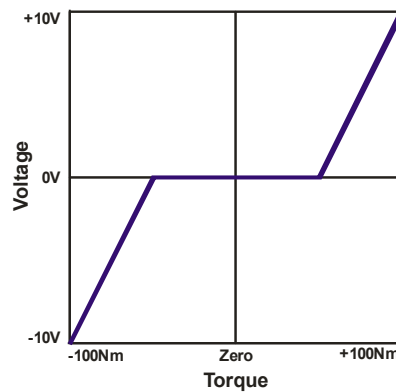
- Torque (100Nm FSD), User Defined Range (0 Nm - 50 Nm), ±10v Scale.
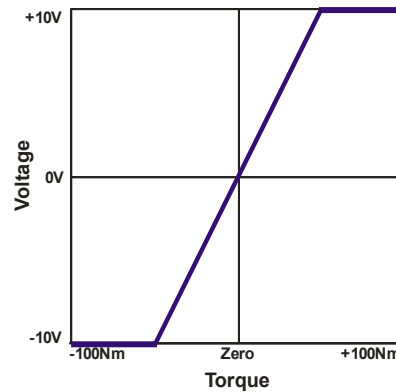
Range effects on resolution

The range selection will in no way effect or increase the resolution of the transducer. The value expansion is artificial and aids only to give the user a greater change in analog output value.

Analog Voltage Scaling

The Analog Voltage Scaling section configures the zero and output range of the analog output channels. The data and range values selected in the Analog Data Select section are scaled to values configured here.

Users can either select from a list of common predefined scales or select a custom scale using the slider bar adjustments.

Voltage Scale Select

The "Voltage Scale Select" combo box lists the available predefined scales and user select modes. When a selection is made the slider bars will adjust to reflect the selection and illustrate the scaling.
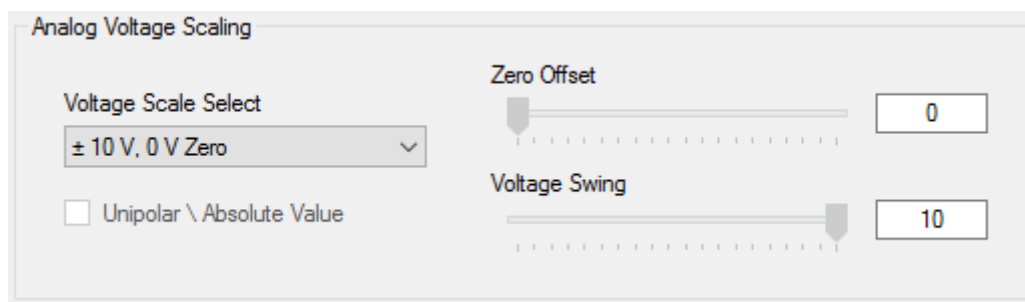
The following graphs illustrate the predefined scales that are available. The graphs are scaled against Torque with a standard 0 – FSD Range.

Predefined Voltage Scales

0V - 10V Unipolar

0V - 5V Unipolar

0V - 1V Unipolar
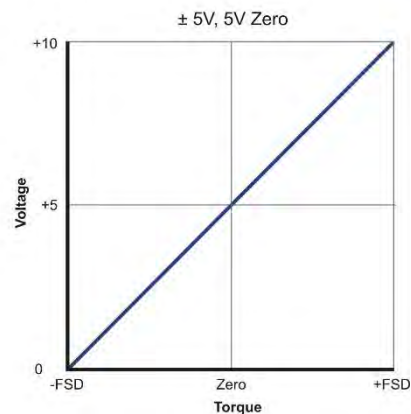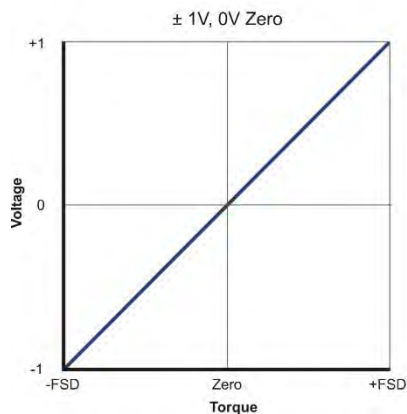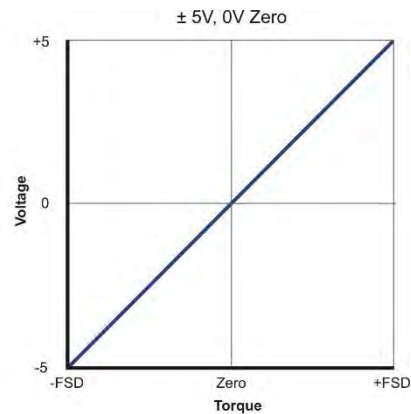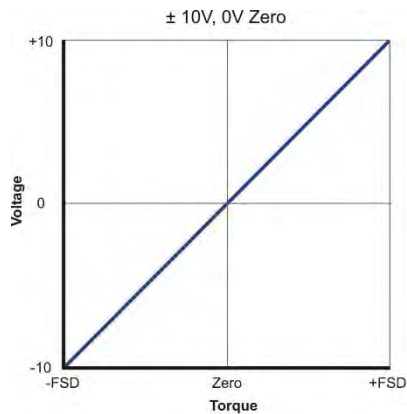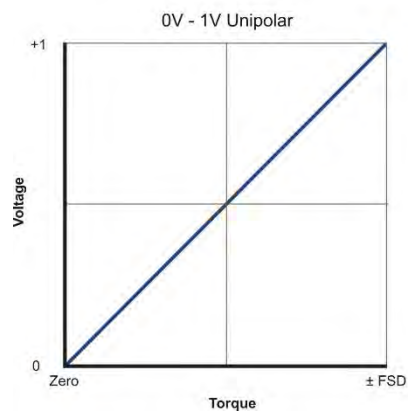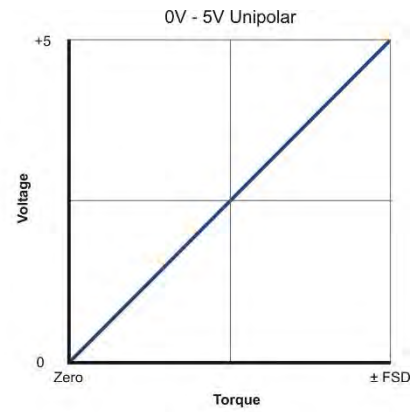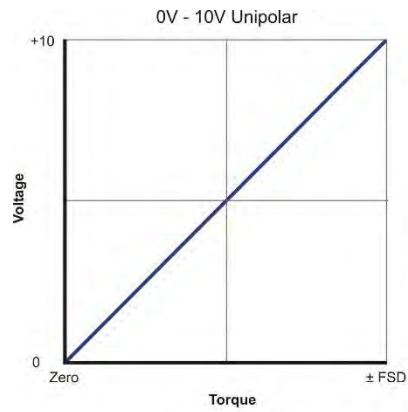
Predefined Current Scales (Option 'F' - Current Output)

0mA -> 20mA Unipolar

4mA -> 20mA Unipolar

±10mA, 10mA Zero

±8mA, 12mA Zero
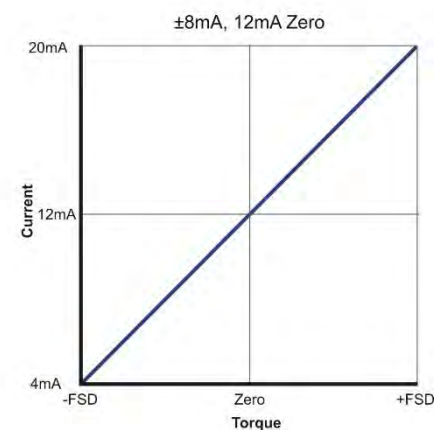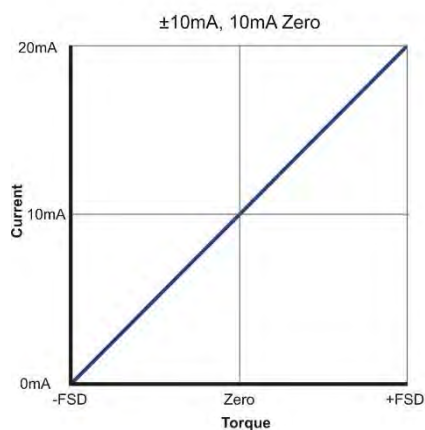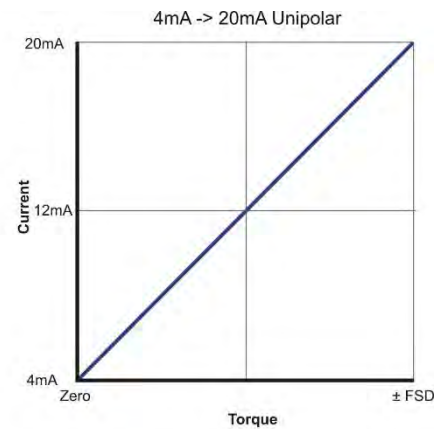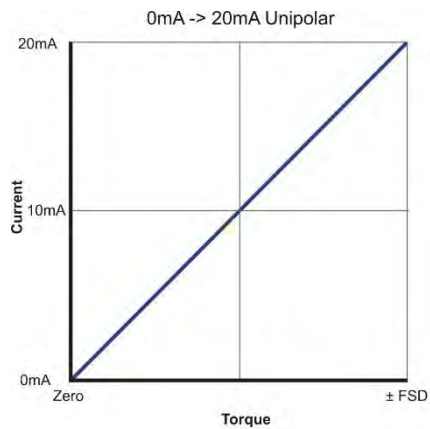
User Defined Voltage

If a custom analog output scaling is required select the "User Defined Voltage" option from the "Voltage Scale Select" combo box, then use the "Zero Offset" and "Voltage Swing" slider bars to configure the required scaling. The text boxes to the right of the respective slider bars will display the configured voltage.

Zero Offset

The "Zero Offset" allows the user to change the zero point voltage between 0 and 9.5V. If the "Zero Offset" is increased, the maximum 10V "Voltage Swing" voltage will be reduced.

This feature is useful if the user has an analog capture device that does not support negative voltages (unipolar only), but requires the direction of torque.

Voltage Swing

The "Voltage Swing" sets the voltage span of the analog output. The voltage can be stepped in 0.1V increments and can be scaled between 0.5V and 10V. The maximum voltage will be reduced if the "Zero Offset" is not 0V.

Unipolar / Absolute Value

The "Unipolar / Absolute Value" checkbox option switches the analog output into a positive only voltage. All input values will be made absolute, making all negative values positive, i.e. -5Nm value will become +5Nm. This has the effect of removing the torque direction from the voltage output.

Digital Setup

The "Digital Setup" tab of the User Configuration allows the user to control some of the operational parameters that effect the processing and output of data.

For CAN Bus settings and setup, please refer to the CAN Bus Interface guide (RWT3536IM).

Auto Reset

The Auto Reset settings control the Peak Torque Auto Reset value. Auto reset is a method of storing a peak value until a reset condition is met. This is especially useful in machines that cycle, e.g. bottle top tightener.

The reset parameters control the reset point, hold time and when to apply the reset.

Depending on your transducer firmware version, some of these settings may not be available. The Auto Reset capabilities were upgraded in version 5.2.0 of the firmware.
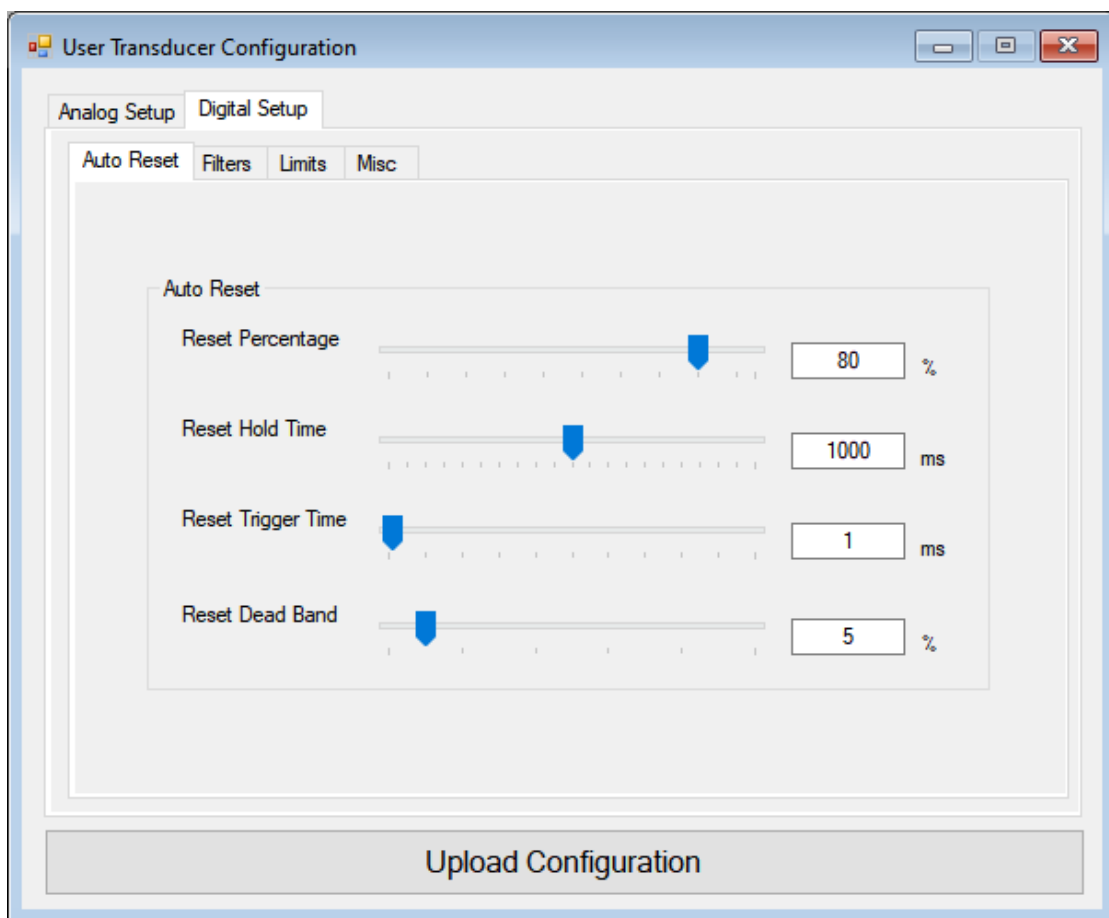
With each of the settings, move the slider to the value required. The settings are described below.

Reset Percentage

The reset percentage controls the point at which the Peak Torque Auto Reset value will hit its reset trigger. The reset point is a percentage of the stored Peak Torque Auto Reset value, compared against the current torque value.

Reset Hold Time

The reset hold time is the amount of time in milliseconds (ms), which the Peak Torque Auto Reset value will hold at its peak value for, before it is reset.

Reset Trigger Time

The Reset Trigger Time is the length of time the torque value needs to be below the reset trigger level, for a reset to be triggered.

Reset Dead Band

The Reset Dead Band is a ± band around zero, and is specified as a percentage of FSD. The dead band is a band where the "Reset Hold Time" will not be applied. The band relates to the Auto Reset value, and not the reset point. The purpose of the band is to avoid applying the hold time for irrelevant misfires, caused by residual torque or value jitter around zero.

Examples

The following waveforms illustrate the Auto Reset capability.

Example 1

A ±10Nm sign wave torque signal is applied to the transducer (yellow line). The "Reset Percentage", "Reset Hold time", "Reset Trigger Time" and "Reset Dead Band" are all zero. The Peak Torque Auto Reset value (blue line) tracks the peak and resets when it crosses zero.
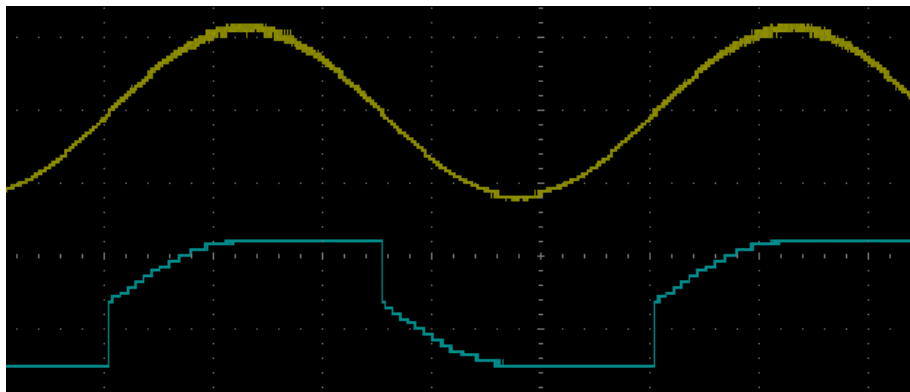
Example 2

A synthesized torque signal (yellow line) is applied to transducer, scaling from 0 to 10Nm. This example is more complex and uses all of the parameters. The "Reset Percentage" = 80%, "Reset Hold time" = 750ms, "Reset Trigger Time" = 40ms and "Reset Dead Band" = 20%. The initial jitter is tracked, but because it falls within the dead band, the hold time is not used. As torque is increased, the Peak Torque Auto Reset value (blue line) tracks. The two glitches, while below 80%, do not satisfy the 40ms reset period. The Peak Torque Auto Reset value is held until the third larger dip drops below 80%, and stays below 80% for more than 40ms. At this point the hold time is triggered, and holds the Peak Torque Auto Reset value for 750ms, at which point it resets.
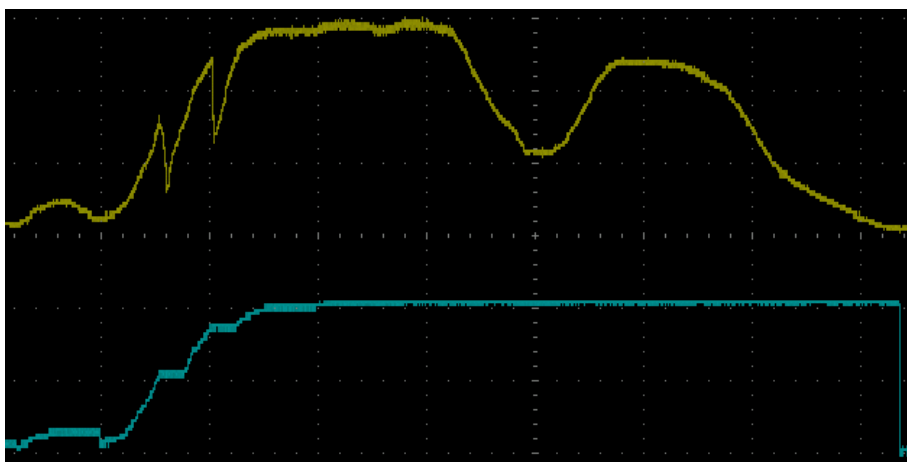
Filters

The torque and speed filters provide data smoothing for conditions where there may be erratic torque and speed readings. The filters apply to the base data captured and will affect both the digital and analog outputs.
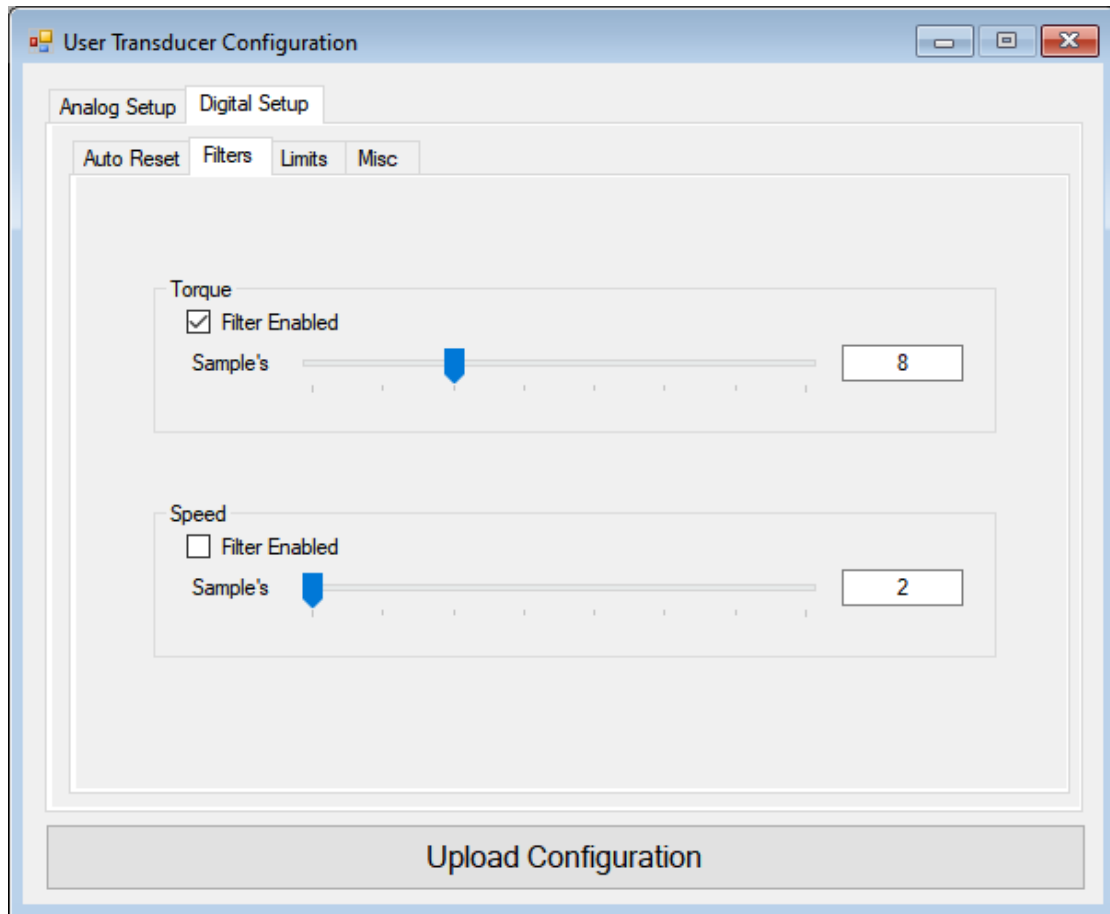
Enable or disable the filter for torque or speed by clicking on the appropriate "Filter Enabled" checkbox. If enabled, use the appropriate slider bar to select a filter value. Valid values are 2, 4, 8, 16, 32, 64, 128 and 256.

The filtering algorithms can also be enabled, disabled and adjusted on the fly by sending digital commands via the RS232, USB and Ethernet interfaces.

Limits

The limits feature allows the user to configure the transducer to control external processes based on predefined operational parameters. Control is accomplished via an output on the transducers analog connector. There are numerous ways this feature could be utilised, some examples include, system shutdown on overload or triggering a conveyor belt when a nut/bolt has been tightened to the correct torque.

At present there is a single control line, but the limits feature is very flexible, allowing the user to control the output polarity, high and low limit threshold, samples before trigger, and an auto reset function which resets the limit out if the control value falls back between threshold values.

When Limits are enabled the transducer will monitor the selected control channel, when the value falls below the low limit (if enabled) or exceeds the high limit (if enabled), an internal counter is started and is incremented every time a new value meeting the condition is met. The counter will be stopped and reset if the control value falls back between the low and high limits. When the counter exceeds the "Samples Required Before Trigger" parameter, the limit output will be set to the active state (level configured using the output polarity). If auto reset has not been configured, the limit output will remain latched irrespective of the control channel value. The limit output can only be reset via a system reset or peak switch input toggle.

If auto reset is enabled, the limit function will enter a reset state when the control channel value falls back between the low and high limits. If the reset timeout is enabled, the limit output will remain latched until the timeout expires, at which point the limit output will return to its inactive state. The reset stage is cancelled if the control channel value exceeds the high or low limits during the timeout period, if this occurs the timeout is disabled and the limit output will remain in an active state. If the reset timeout is disabled, and the control channel value falls back between the low and high limits, the limit output will instantly be set to its inactive state.

> On transducers with firmware version 3 or 4 the limit output is shared with the Fail Output pin. When limits are enabled the fail output signal is overridden.
>
> On transducers with firmware version 5 the limit output has been moved to a dedicated I/O pin, allowing access to both limit and fail signals.
>
> Refer to the Transducer User Manual for more details.
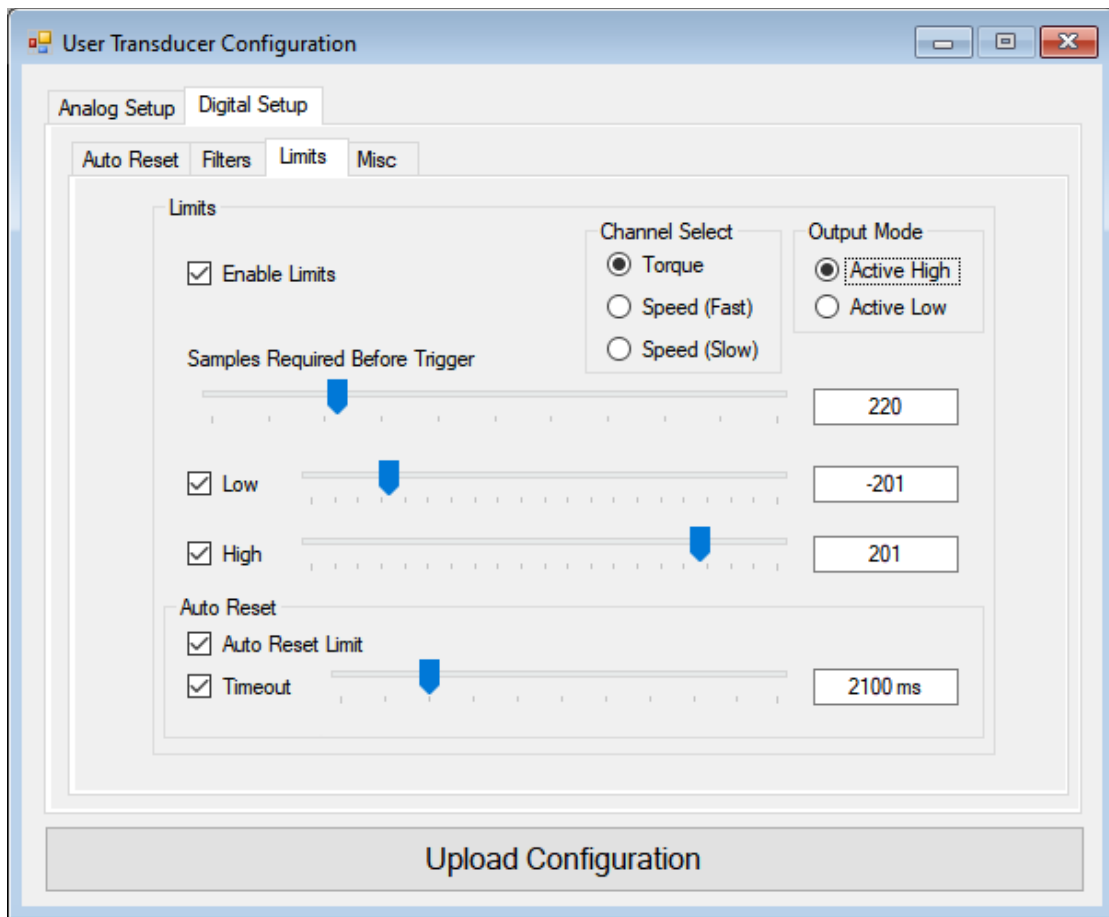
To enable Limits, click the "Enable Limits" checkbox.

Channel Select
The "Channel Select" option selects the control channel to be used with the limits feature. The user can select between torque and speed.

Output Mode
The "Output Mode" option selects the polarity of the active / triggered state.

Active High
Active / triggered state is high, inactive is low.

Active Low
Active / triggered state is low, inactive is high.

Samples Required Before Trigger
The "Samples Required Before Trigger" parameter sets the number of continuous samples that must exceed the high/low limits, before the limit output is set to the active / triggered state.

Use the "Samples Required Before Trigger" slider bar to select a value, the slider is scaled from 0 to 1000 in increments of 10.

Low / High Limits
The "Low" and "High" limits set the trigger thresholds that control the limit output. Low, High or both limits must be selected to use the Limits feature. The High value must not be lower than the Low value and vice versa.

Enable the High/Low limit by clicking the High/Low checkbox, then use the High/Low slider bar to select the trigger level.

If torque is selected as a control channel, then the slider will be scaled from –FSD (counter clockwise full-scale) to +FSD (clockwise full-scale) in increments of 1% of FSD.

If speed is selected as a control channel, then the slider bar will be scaled from 0 to Max Speed, in increments of 1% of FSD.

Auto-Reset Limit

The "Auto-Reset Limit" option, when enabled, will automatically reset a triggered limit output to its inactive state, when the control channel value no longer exceeds the low or high limit threshold.

Timeout

The "Timeout" option is an extension of the "Auto-Reset Limit" option and can only be enabled when "Auto-Reset Limit" is enabled. When Timeout is enabled, a reset limit event is delayed by the time specified by the Timeout parameter. During the timeout period the limit output will remain latched. The reset limit event is cancelled, if the control channel value drops between the low or high limit thresholds during timeout.

To enable the Timeout option, click on the "Timeout" checkbox (Auto-Reset Limit must be enabled), then use the slider bar to select the timeout duration. The slider bar is scaled from 100ms to 1000ms in 100ms increments.

Misc
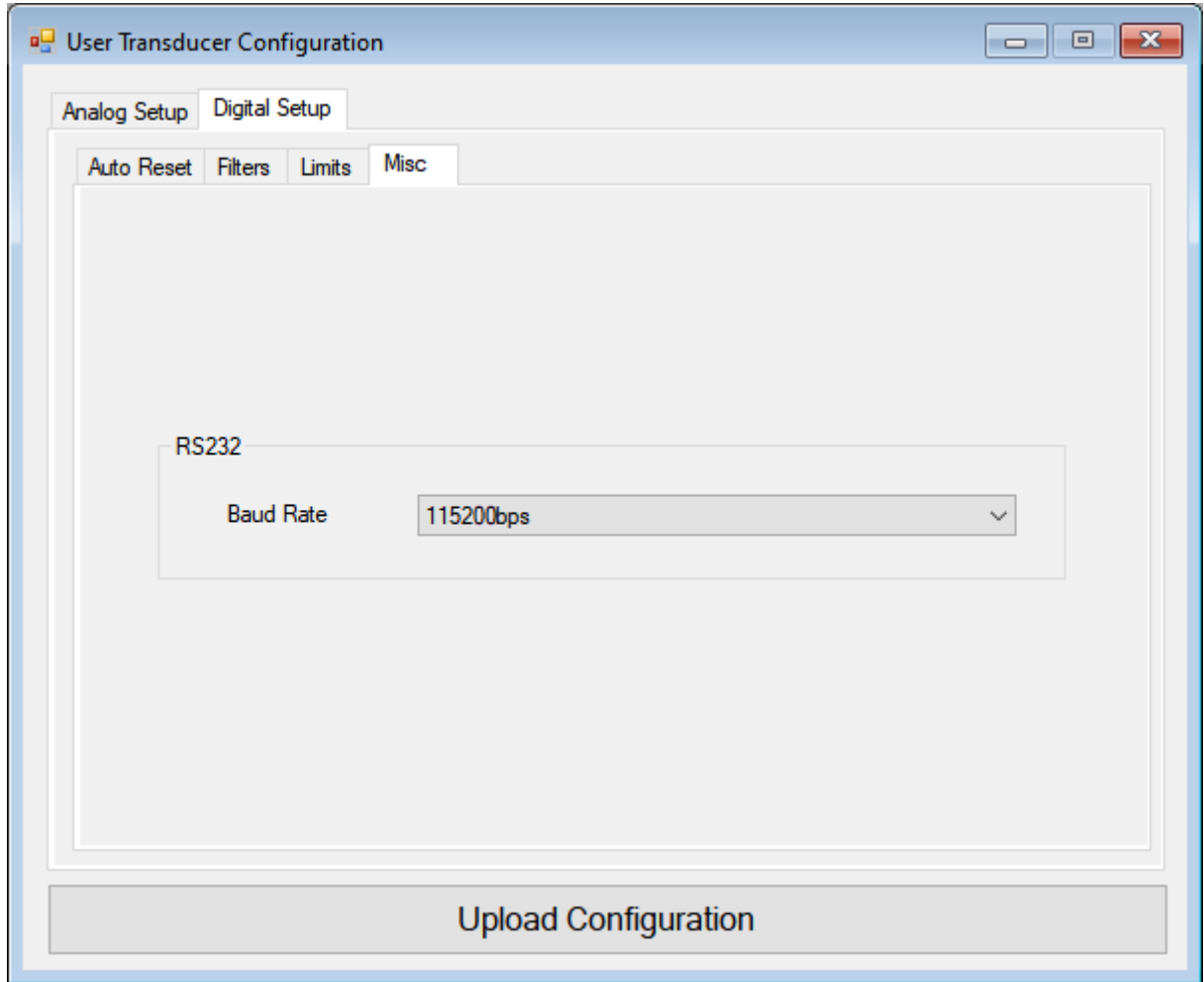
RS232
The RS232 settings control the RS232 functionality of the connected transducer.

Baud Rate
The baud rate option selects the RS232 transmit and receive rate for the connected transducer. It is recommended that the user select the fastest mode possible (115200bps), as lowering the speed will reduce the throughput and add latency to the programs interrogating the transducer.

In some circumstances it may not be possible to run at very high baud rates as some systems, especially embedded devices, may not be able to generate such high baud rates. Long cable lengths may also hinder the use of higher baud rates. To accommodate all users, we have provided a selection of three baud rates:

- 9600bps
- 38400bps
- 115200bps

To change the baud rate, select the desired option from the "Baud Rate" combo box. Please note that a baud rate change will only take effect after a transducer reset.

Upload Configuration

The "Upload Configuration" button will upload the settings to the Transducer. Transducer Control will validate the settings before transmission, to ensure that there are no errors. If an error is detected, an onscreen prompt will notify the user and direct them to a resolution.

If all tests pass the validation check, a progress bar will be displayed to indicate the progress of the settings upload.

Zero Offset
The Zero Offset feature sets a fixed torque offset value. The Zero Offset can be used to remove any offset that may have been introduced from its mechanical installation, or from idle torque present. It must be stressed that the zero offset is no substitute for correct installation.

Any torque value up to FSD is permitted; values over 25% of FSD are allowed but are not advisable. Using an offset of over 25% will flag the High Zero Offset warning. When using high zero offsets, care must be taken not to overstrain the transducer. A zero offset will not extend the full-scale rating of the transducer, e.g. if a transducer was zeroed at 50% then a further 50% was applied, the transducer will have reached full scale, even though the transducer would be reading 50%.

The zero offset can be temporarily overridden by the digital zero commands, or the Normal/Average Zero Input. When the transducer is power cycled the saved zero offset will be restored.

The offset can be entered manually or set from one of 3 options.
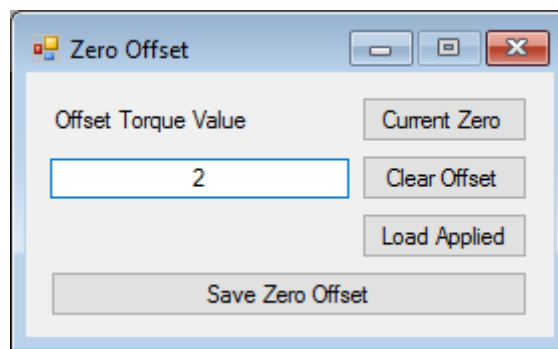
Offset Torque Value
The "Offset Torque Value" text box is the torque offset value in the transducer's native unit. The offset is subtracted from the captured torque readings. Manually type in the required offset, or select from the 3 options.

> ***Current Zero***
> The "Current Zero" button sets the "Offset Torque Value" to the current zero offset value of the transducer.

> ***Clear Offset***
> The "Clear Offset" button sets the "Offset Torque Value" to zero.

> ***Load Applied***
> The "Load Applied" button sets the "Offset Torque Value" to the current un-zeroed torque value.

Save Zero Offset
The "Save Zero Offset" button saves the "Offset Torque Value" into the transducer's memory. The offset will be retained across power cycles, until it is cleared by this setting, by the zero input on the transducer, or a factory reset.

Transducer Test

The Transducer Test menu houses functions which allow the transducers digital output to be monitored, or its internal status viewed

Data Capture
The Data Capture function is a simple interval data capture, which records torque data to a CSV file.

To capture data, use the "Capture Rate" slider bar to select a capture rate, i.e. how many data points per second. Next, press the browse button and use the "Save As" dialog box to select an output file. Press the "Start" button to initiate a capture. The records captured count will be shown in the "Record Count" box. To stop, press the "Stop" button shown on screen. A stopped capture cannot be restarted, you must either select a new file or overwrite the current one.

The following descriptions describe the different fields.

Mode
The "Mode" text box describes the capture method used by the program and transducer. The method used depends on the connection method and firmware version. The "USB Optimised" mode buffers data in the transducer, and transfers the data in bulk packets, making use of the USB bandwidth available. "Poll Mode", polls the transducer at the requested frequency.

Capture Rate Max (Hz)
The "Capture Rate Max (Hz)" text box, is the maximum capture rate available for the combination of connection method and transducer firmware. This value is the actual internal capture rate for "USB Optimised", or a theoretical value based on bandwidth for "Poll Mode".

Capture Control

Capture Rate (Hz)

The "Capture Rate (Hz)" slider sets the requested data capture rate. The capture rate is not guaranteed, and is highly dependent on PC and transducer load.

File Name

The "File Name" text box displays the selected path and filename, where output data will be written. Use the "Browse" button to select an output file.

Start/Stop

The Start/Stop button starts and stops the data capture process.

Record Count

The "Record Count" text box displays the number of records captured and written to the output file.

File Format

The data capture function generates a comma separated (CSV) output file, which can be easily imported into a Spreadsheet program like Microsoft Excel or LibreOffice Calc.

The CSV output has 3 fields, Elapsed Time in us, Torque in the transducer's native torque unit, and Speed in RPM (if fitted). The first line will always include column headers.

The following is a sample data set. The capture is configured at 50Hz, and is using Poll Mode.

Elapsed(us),Torque,Speed
0,3.99,821
19998,3.93,839
39948,4.14,857
59891,3.6,876
79832,3.87,893
99762,2.79,911
119738,3,929

Output Monitor
The Output Monitor displays the capture data generated by the transducer.

The peak, min and max values are generated by the transducer based on the torque, speed and power readings captured.

Zero
The "Zero" button instructs the transducer to zero the torque readings. The transducer zeros the torque readings by recording the current torque value as an offset, the offset is then subtracted from all future torque readings.

AV Zero
The "AV Zero" button works in the same way as the "Zero" button, but will base the offset value on an average of eight torque readings rather than one.

Reset Peaks (Torque)
The "Reset Peaks" button instructs the transducer to reset all peak torque values.

Reset Peaks (Power)
The "Reset Peaks" button instructs the transducer to reset all peak power values.

R
The "R" buttons instruct the transducer to reset the appropriate peak values.

Transducer Status

The Transducer Status section displays the current transducer status. The status code is extracted from the transducer and displayed on screen. The transducer LED status sequence is derived from this status code.

System Status

The System Status represents the overall status of the transducer. There are three possible system states:

System OK

Transducer is operating normally.

System Warning

Transducer has detected an error which requires user intervention.

System Error

Transducer has detected a system fault.

Status Code

The Status Code is the value that has been extracted from the transducer and represents the current status. The Status Code is a collection of binary flags that are combined together and shown in numeric form.

The status code is split into 3 categories, Information, Warning and Error. Each category is composed of a number of flags which identify the status of each test item. When the status code is retrieved from the transducer it is decoded and the status of each item is displayed onscreen.

The meaning of each category and flag is described in the following sections.

Information
Information flags inform the user of operational conditions.

Peak ON
Peak switch is ON.

Custom Analog Scaling
A non-standard analog output setup is being used.

Limits Triggered
The limits feature is in an active/triggered state.

Warning
Warning flags inform the user of conditions that need user intervention or conditions that the user should be aware of.

Analog Channel 0 / Analog Channel 1
Analog output load fault detected. The actual problem depends on whether the output is voltage or current, in either case there is a wiring fault.
> **Voltage** - Fault caused by a short or low load resistance.
> **Current** - Fault caused by a high load resistance or open load.

High Zero Offset
A torque zero offset greater than 25% of FSD is in use. Any offset value is allowed, but the warning is asserted because it is potentially a very dangerous circumstance, as a user may not realise that an offset is present, then overscale the transducer and damage connected equipment.

Exceeded Temperature
The transducer is operating outside of its temperature range. The transducer may not operate correctly.

Overscale
A torque of over 101% of FSD for RWT/ORT, or 201% of FSD for SGR, has been applied to the transducer, measurement accuracy cannot be trusted.

Critical Overscale
A torque of over 120% of FSD for RWT/ORT, or 300% of FSD for SGR, has been applied to the transducer, at this level measurements will have a low accuracy, and there is a danger of permanent damage to the transducer. Reduce the torque level.

Head Disconnect
The torque measurement head for transducers with external electronics has been disconnected. Power off the electronics, reconnect the torque head and power on.

Error

Error flags indicate that a system fault has been detected. System faults cannot be corrected by the user. If a fault condition does occur, try power cycling the transducer. If the fault does not clear, the transducer may have to be returned for service, contact the factory.

Electronics Fault (Firmware Version 5)

An electronics fault has been detected.

Head Disconnect (Firmware Version 3/4)

Please refer to the previous section for a description of this error. In firmware version 5, this error was reclassified as a warning, as it is a condition that is correctable by the user.

SAW Error

A SAW error indicates that the shaft attached SAW devices are not operating within normal parameters.

Failed Temperature Sensor

A failed temperature sensor error indicates that the transducers internal shaft temperature sensor has malfunctioned. When the temperature sensor fails, the transducer will no longer compensate torque readings for changes in temperature, causing a loss in accuracy.

Irregular Internal Voltage

An irregular internal voltage error indicates that the processor has detected that one of the internal voltage rails is operating outside of normal parameters.

Data Configuration Invalid

A data configuration invalid error indicates that main build configuration has been corrupted.

Calibration Invalid

A calibration invalid error indicates that the calibration data has become corrupted.

SAW Parameters Invalid (RWT Transducers)

A SAW parameters invalid error indicates that an internal configuration structure has become corrupted.

ORT Parameters Invalid (ORT Transducers)

An ORT parameters invalid error indicates that an internal configuration structure has become corrupted.

RSG Parameters Invalid (RSG Transducers)

An RSG parameters invalid error indicates that an internal configuration structure has become corrupted.

Maximum Operating Conditions Exceeded

The maximum operating conditions exceeded section reports on conditions that the transducer has been subjected to, which are beyond normal operating parameters.

Torque

Exceeded Count

Count of the number of times the torque level has gone over FSD.

Maximum Recorded

Maximum recorded torque value over FSD.

Temperature

Exceeded Count

Count of the number of times the temperature has exceeded the normal operating parameters of the transducer.

Maximum Recorded

Maximum recorded temperature. If a negative and a positive temperature value has been recorded, the value shown is the one with the biggest change from 25°C.

USER MANUAL
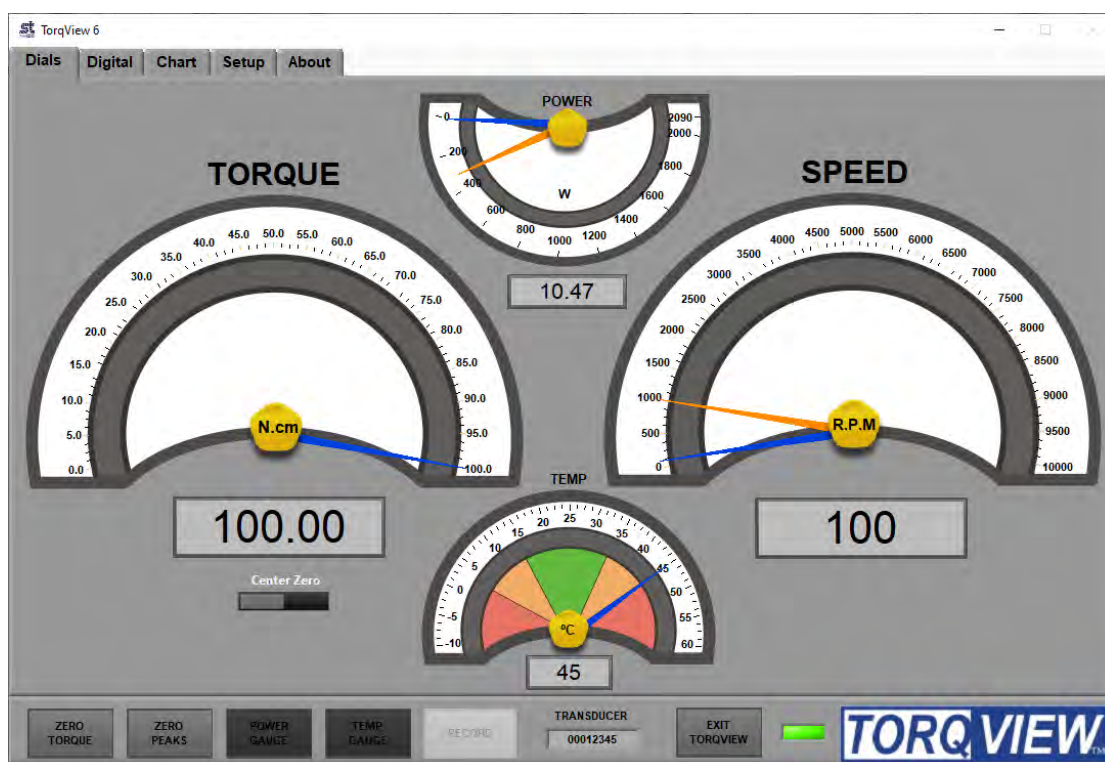
TorqView6 Software

TorqView, version 6, can be installed as a Demo (if a full program has not yet been purchased) and as a Full purchased program. The demo program allows for 10 hours use and all functions are available except the save to file function.

If TorqView was purchased with the transducer, the transducer will be enabled to run TorqView. If TorqView was purchased at a later date then an activation key is required to convert the program from Demo to Full. The factory will send the activation key and details of how to convert are on the About Screen towards the end of this manual.

<div style="border:1px solid black;padding:10px;">

<u>**CAUTION**</u>
If planning to use a USB connection please either install Transducer Control 6 or run the driver installer program before running TorqView 6.

</div>

Installing TorqView
Step 1: Insert the TorqView USB flash drive into an available USB port.
Step 2: Navigate to Computer and select the TORQVIEW USB device:
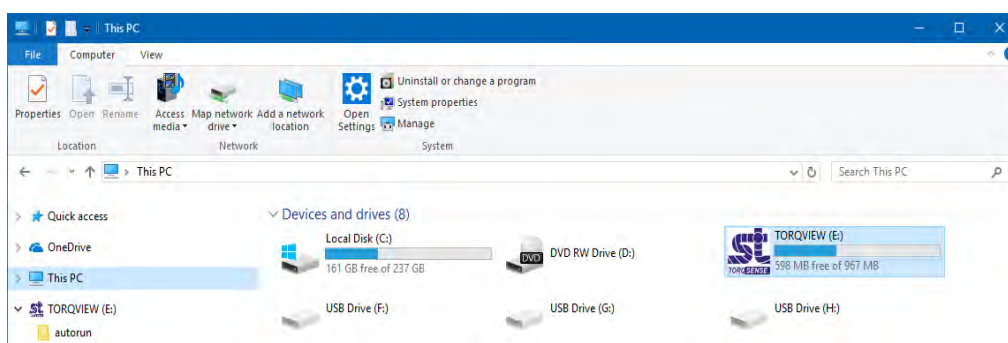
Step 3: Double click on AutoRun.exe
Step 4: Click on the 'Install' button opposite TorqView.

Step 5: Follow the guidance.
Step 6: On completion TorqView is ready to run.

The default install directory is: C:\Program Files(x86)\Sensor Technology\Torqview 6\Torqview6.exe

Running TorqView
To avoid any communication errors it is advised that all torque transducer cables and leads are correctly plugged in and the instrument is turned on before running TorqView.

TorqView can be run from:- "Start"/"Windows" button, then "Programs"/"All apps" > "Sensor Technology" > "TorqView 6".

When TorqView starts a screen will be displayed to enable users to select which port the transducer is connected to.

Click on the left hand side drop down menu to show all available ports found on the computer.
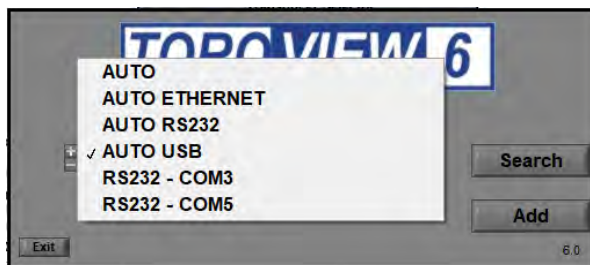
AUTO will search for transducers connected on all ports. Use AUTO if more than one transducer is connected.
AUTO RS232 will search for transducers connected only on RS232 ports.
AUTO USB will search for transducers connected only on USB ports.
COM1 etc.. will search for transducers connected only on COM1 etc ports.
If it is known which port the transducer is connected, then select it from the list and click it.

Next, click on the 'Search' button. TorqView will now search for transducers connected on the selected port.

A 'Searching' text will flash blue and an indicator will show the progress. This may take a few minutes depending on the number of ports. When the transducer connected to its port has been found, it will be displayed in a drop down menu. If more than one transducer has been found it will display all of them in a drop down menu. Select which transducer to use.
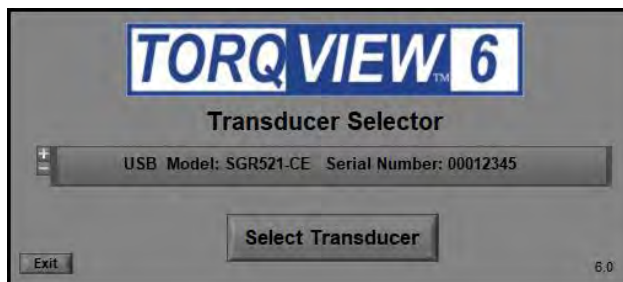
The selected transducer will now be connected and the 'Search For Transducers' screen will disappear and be replaced by the Dials Screen.

See the Setup Screen for more information on how to change between transducers when using TorqView. For ease of use, the next time TorqView is run it will default to the previously selected port a transducer was connected to.

TorqView Function Bar

The TorqView Function Bar, located at the bottom of all the screens, shows all the relevant TorqView buttons. The LED, illuminates green when connected to show that the transducer is working correctly. If any warnings or errors occur with the transducer while running TorqView, the LED will change its colour from Green to Yellow (Warning) or to Red (Error). To diagnose the warning or error see the About Screen to diagnose.
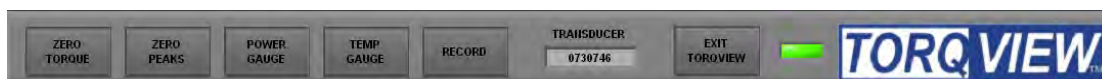
The Function Bar also shows the serial number of the currently active transducer. If two transducers are connected they can be changed using the Setup Screen.

Click "EXIT TORQVIEW" to exit the program. Choose, "Shutdown" to close the program or "Standby" to disconnect the transducer and leave the screen showing so the program can be run again.

To run the program from "Standby", click on the white arrow button at the top left hand corner of the screen.
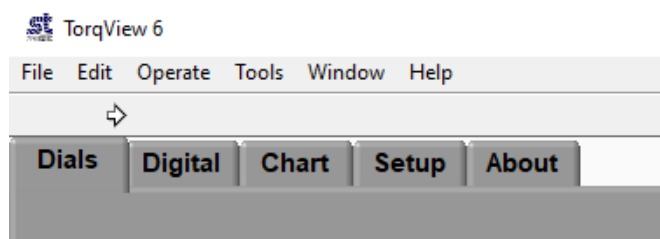
Click "ZERO TORQUE" to zero the torque value. Care should be taken when using the "ZERO TORQUE" function because an offset could be created if there is any torque already applied.

Click "ZERO PEAKS" to zero the peaks of the Torque, Speed and Power values.

Click "POWER GAUGE" and "TEMP GAUGE" to select power and shaft temperature dials.

Click "RECORD" to start recording data. (See Setup Screen for details on how to set parameters and record/save a file). Record button will be disabled until a file has been configured.

Function buttons will change to a darker grey when switched on.

Dials Screen
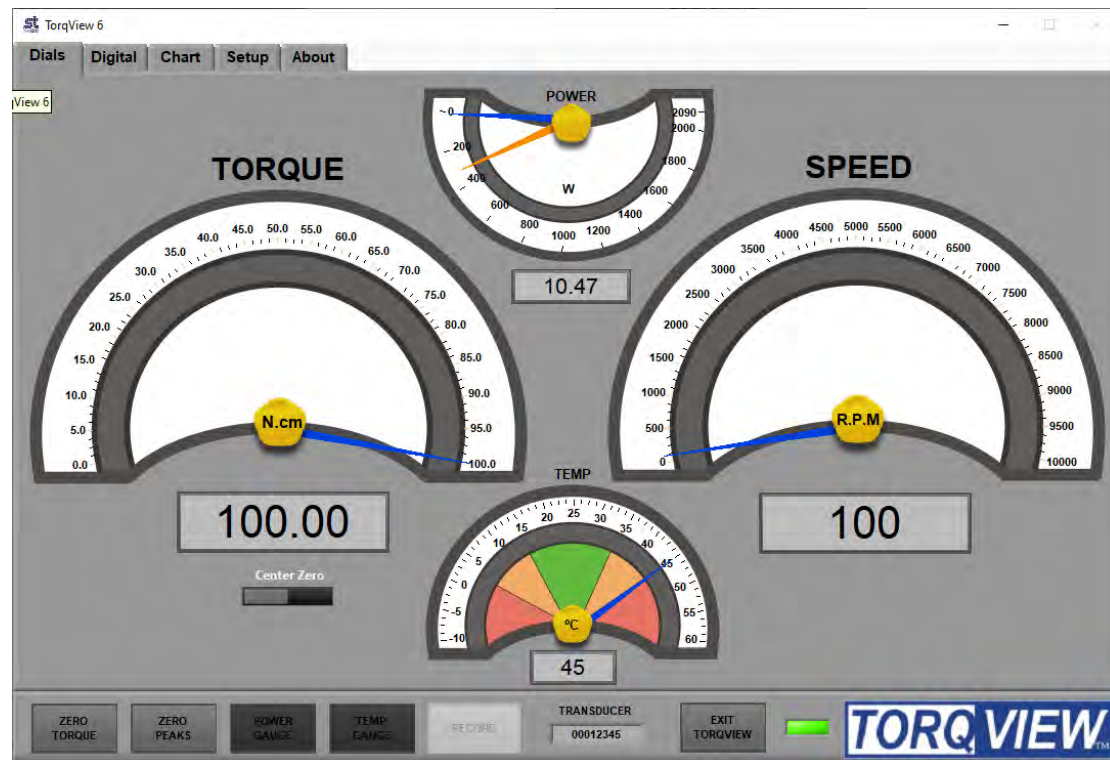
The Dials Screen is the main TorqView screen and displays torque, speed, power and temperature.

The torque dial is automatically scaled to the FSD of the connected transducer. Units and full scale are displayed on the dial and can be user configured via the Setup Screen.

The torque dial can be set to display Center Zero (zero at the top centre) or Normal (zero at bottom). The blue needle displays the torque applied value.

Peak Torque is displayed in two ways. If the dial is in Center Zero mode, orange needles will display the peak value for both the CC and CCW directions. If the dial is in Normal mode one orange needle will display the highest peak from either the CC or CCW direction.

The Speed dial scale is automatically adjusted depending on the value, e.g. if the speed rises above 1000 rpm, the scale will auto adjust to 5000 rpm. The blue needle displays actual speed values whereas the orange needle displays the peak speed value.

The Temp dial displays the temperature inside the transducer. See the Data sheet for limitations.

The Power dial displays the power as a function of the torque and speed applied.

Digital Screen
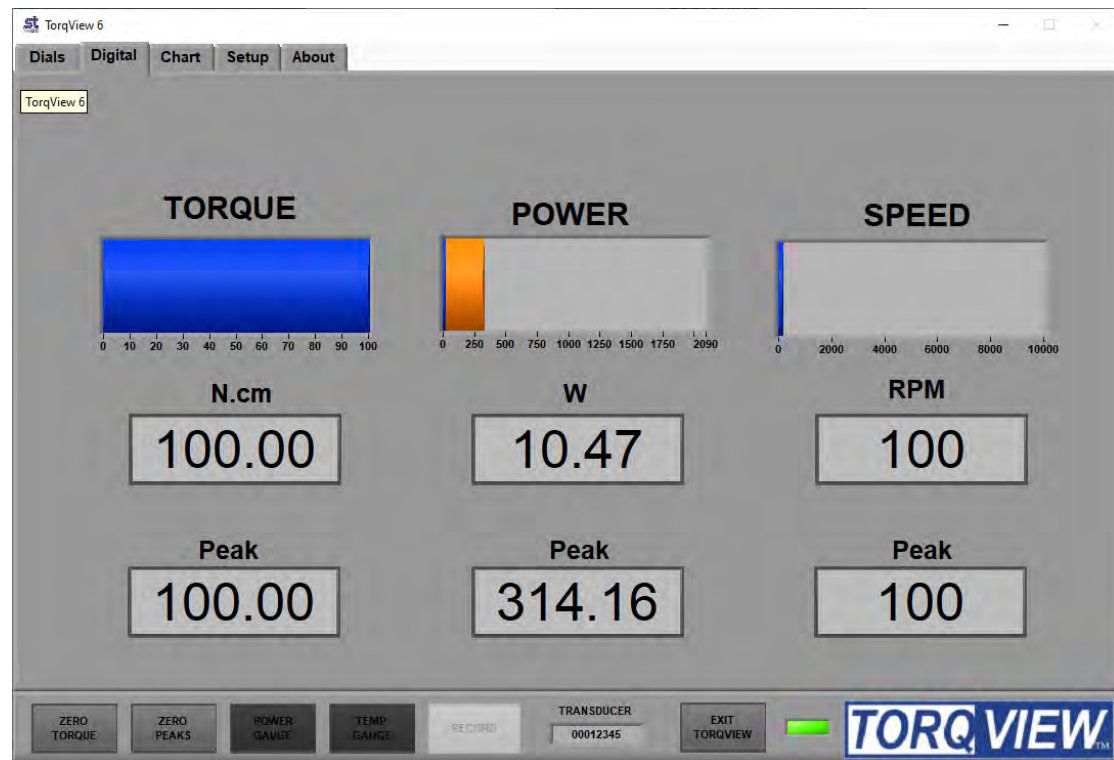
The Digital Screen displays the same data, less temperature, as the Dials Screen but as digital bars. The blue coloured bar displays the actual data, whereas the orange coloured bar, as an underlay of the blue coloured bar, displays peak value. Actual and Peak values are also displayed as numeric values under the coloured display bars.

Chart Screen
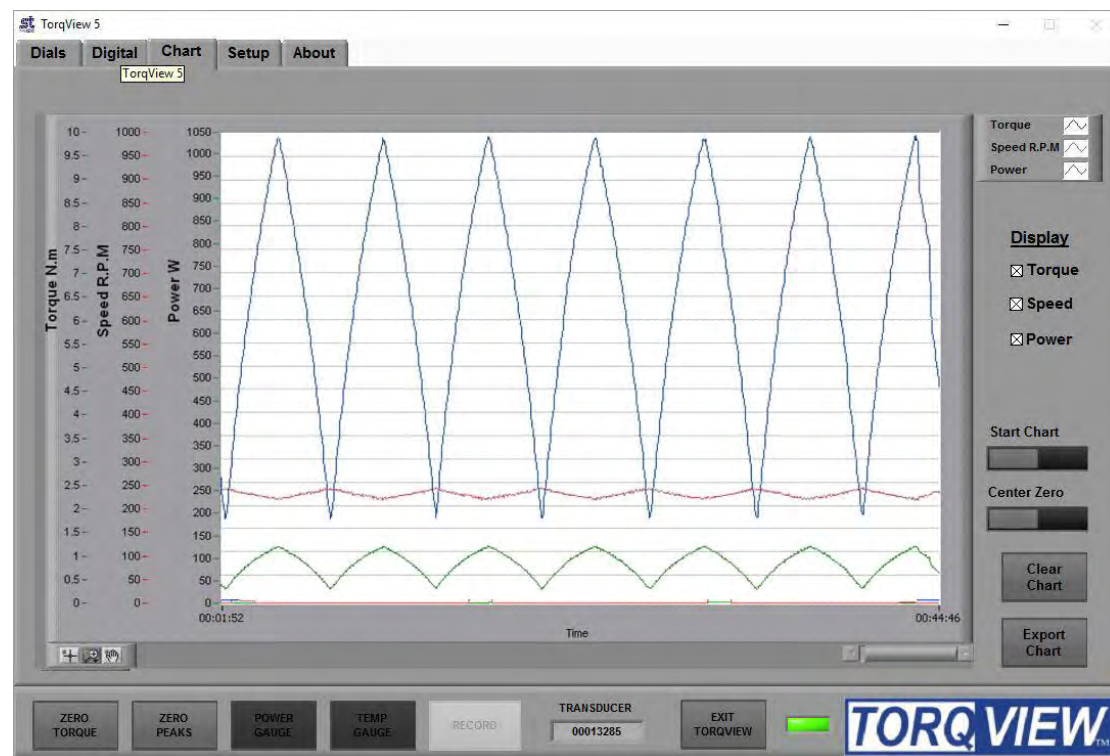
The Chart Screen displays the data onto a chart. Scales are automatically set at initialisation or user set via the Setup Screen.

Check the Torque, Speed, Power boxes to select which channels to display. Any combination is possible. Only the selected channel scales will be visible.

The "Start Chart" button starts and stops the chart with the green light illuminated to indicate that the chart has started and no light illuminated to indicate that the chart has stopped. With the chart is stopped, the horizontal slider can be used to analyse the data.

The "Clear Chart" button deletes data from the chart.

The "Center Zero" button allows the torque chart go through zero to show bi-polar torque.

Zoom tools are available at the bottom left of the chart.

The "Export Chart" button allows the chart's current data to be exported as several picture formats or to the clipboard. These settings are adjustable on the Setup Screen. Use the Zoom tools to export a specific section of the chart.

Setup Screen
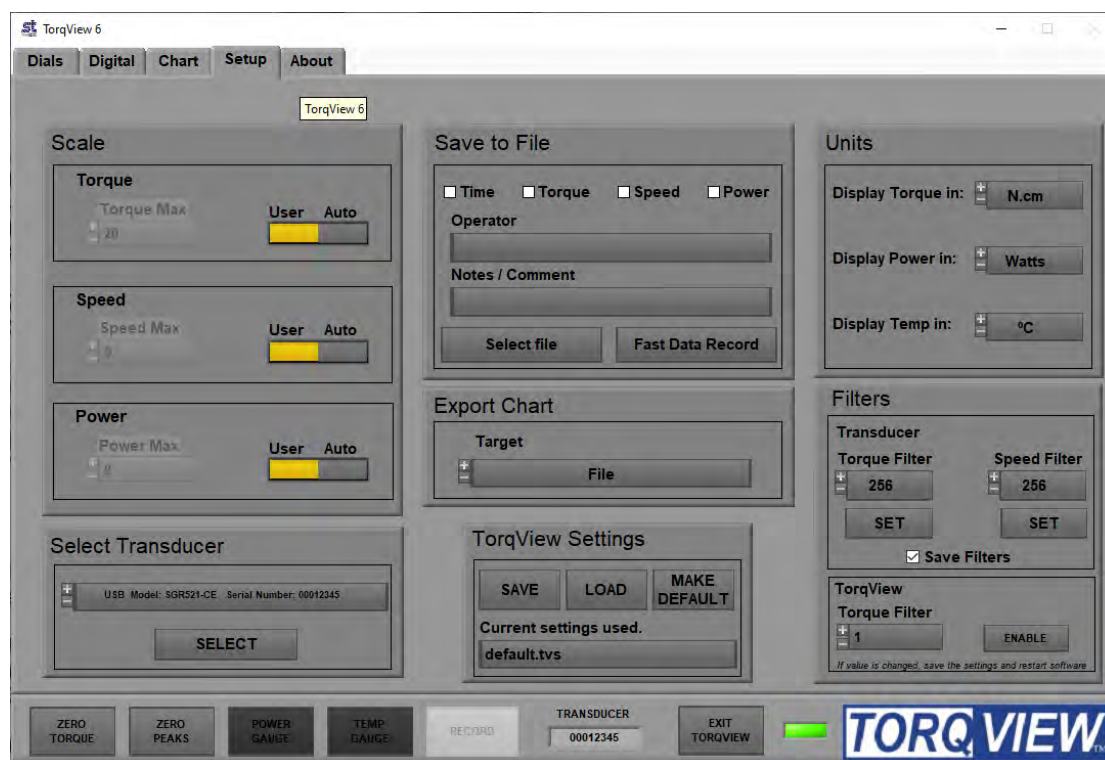
The Setup Screen is used to select the scales and units displayed on other screens as well as to select other options.

Scale: The Scale section has functions to override the default Torque, Speed and Power scales. To change the scale, toggle the Auto/User button to User and enter the scale by typing or toggling the "Torque", "Speed" and Power.

Units: The Units section has functions to select the units displayed on other screens by clicking the drop downs. Changes between different units of Torque, Power and Temperature Eg: Nm to lbf.in are possible.

Save to file: (not available on the Demo program) Record the selected data into a text file. The channels to be recorded are selected by using the check boxes. Name, notes or comments can be added. These details will form the header of the text file containing the date, serial number of the active transducer and any comments. Once these details are entered, click 'Select file'. Chose the destination of the file. Click "RECORD" on the TorqView Function Bar to start recording. To view saved files, double click file at saved destination. The file will open in 'Notepad' or a related text viewer. Data will be displayed in columns in the order of the boxes checked. E.g. if Torque and Power are checked then Torque will be column 1.

Fast data record
This is used to record data at up to 50000 samples per second with start and stop criteria. Please see below for more details

Export Chart: The Export Chart section has functions to setup which file type to export the picture of the chart, whether to save it as a file or copy it to the clipboard. It also enables grid lines to be selected.

Filters: The Filters section has functions to smooth any erratic data. The frequency response will reduce depending on the filter factor. Check 'Save Filters' to store the filter value in the transducer so that it can be remembered after a power cycle. If 'Save Filters' is unchecked when 'SET' button is pressed then the value will return to the last saved value after a power cycle.

Select Transducer: If more than one transducer is connected, select one from the drop down menu and click on 'Select' for it to be active and connected.

Fast data record

When you click on 'Fast Data Record, it will warn you that it will close TorqView and run the Fast Data Record Program.

You will now be presented with the Setup Wizard. This will take you through the steps of setting up how you wish the record to be setup. Simply select your options and click next to continue.
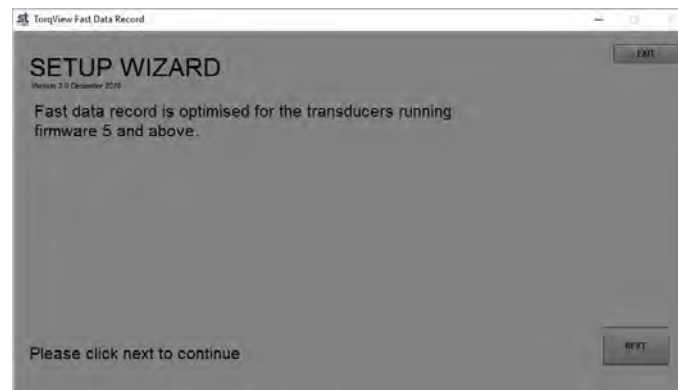
The first screen is where you select what data you would like to record, and any comments you would like to add. Once you have finished, click Next. You will then be asked where you want to save the file and the file name. Click Save when done.

You can now set the sample rate at which you want to record. TorqView will tell you the maximum rate your transducer is capable of. Type in the box the samples you require and it will give you an approximate file size that will be created. Once done click Next.
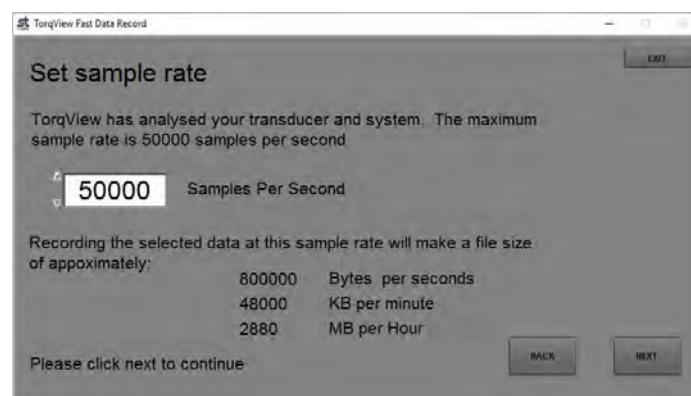
The start condition can now be set. Select your option from the drop down, fill in any additional information and click Next


Set the stop condition. Choose your option from the drop down fill in any additional information and click next.

The next screen will show you a summary of how the record has been set up. If you are happy with details, click the ARM button. The program will now wait until the start trigger has been met and will then start to record.
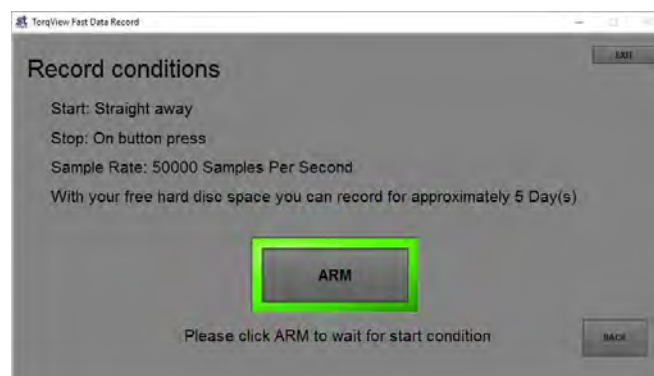
The software will keep recording until the stop condition is met. If this was stop with button, click the button to stop the record.
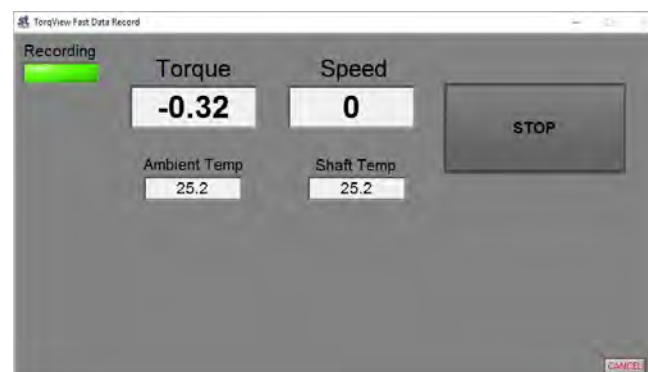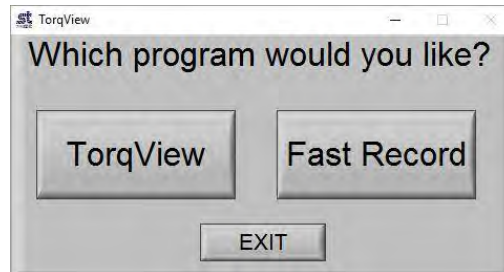
When it has stopped recording, the data will save to file, and you will be asked if you would like to repeat the test.

If you select yes, the record wizard will start again, if you select no you will be given the option of running TorqView or exiting the program.

If you select TorqView, the program will close and TorqView will start.

About Screen

The About Screen displays the TorqView version and whether it is a Demo or Full program. The Demo program will display how many minutes remain. Both programs will also display the Serial No. of the active transducer, the date of its last calibration, its manufactured date the firmware version and the Transducer Status Lights diagnostic box.

Convert to Full program: To convert the program from Demo to Full, enter an Activation key (supplied at a later date only on purchase of a full program) in the box and the press the 'Activate' button. Next exit TorqView and restart the program.

Factory default reset: If a factory default reset (details in User Manual) has been carried out and TorqView was purchased with the transducer then TorqView reactivation is not required. However, if a factory default reset has been carried out and TorqView was purchased at a later date then reactivation is required.

Transducer Status Lights: The rectangular transducer status lights box illuminates appropriate lights to enable diagnostics.
An appropriate 'Warnings' light will illuminate if the TorqView Function Bar LED changes colour from Green to Yellow. Likewise, an appropriate 'Errors' light will illuminate if the TorqView Function Bar LED changes colour from Green to Red.

If, while using TorqView on the other screens, the TorqView Function Bar LED changes colour from Green to Yellow or from Green to Red, then always refer to the About Screen and, in particular, the Transducer Status Lights for more information. See the table below for an interpretation and possible actions.

Transducer Status Lights - Interpretation and actions:

Mode	Warnings	Errors
Peak mode One of the peak options has been selected in either the transducer control software or by using the analog lead contact closure on pin 8. **Analog Scaling** The full scale of the analog out has been changed to a user-selected scale in the transducer control program. **Limits** Limits output has been triggered	**Analog Fault CH0** In voltage output mode the analog output pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring on Channel 0. **Analog Fault CH1** In voltage output mode the analog output pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring on Channel 1. **Analog Fault CH2** In voltage output mode the analog output pin is short circuit, in current output mode the analog output pin is open circuit. Check the analog connector wiring on Channel 1 **Zero Offset High** There may be an offset applied to the current torque applied value because the 'Zero Peaks' has been pressed while torque, greater than 10% of the fsd, has been applied. **Exceeded temp** Shaft temperature has exceeded normal operating conditions. Temperature compensation may no longer effective or calibration valid. **Overscale** Torque has been applied greater than the specified FSD. **Critical overscale** Torque has been applied greater than 120% of the FSD. Contact factory if warning continues. **Head Disconnect** Lead has been disconnected from the transducer.	**Electronics** Electronics fault has been detected. **Shaft electronics** Shaft electronics either not transmitting or reporting an error. **Temp sensor fault** The infrared temperature sensor has failed. Temperature compensation is ineffective. Contact factory if error continues. **Irregular Voltage** One or more of the internal voltages is not within specification. Check the input power supply is within specification of the data sheet. Contact factory if error continues.

Additional Information

There is no requirement to install LabVIEW because TorqView is a self-running executable file.

However, if LabVIEW is installed and there is a requirement to make unique programs or allow TorqView to communicate with other LabVIEW programmes, VI's are available from Sensor Technology on the website www.sensors.co.uk at:
http://sensors.co.uk/products/pages/labvi.html