SENSOR TECHNOLOGY

TORQSENSE®

Torque Measuring Equipment Product Overview

SENSOR TECHNOLOGY

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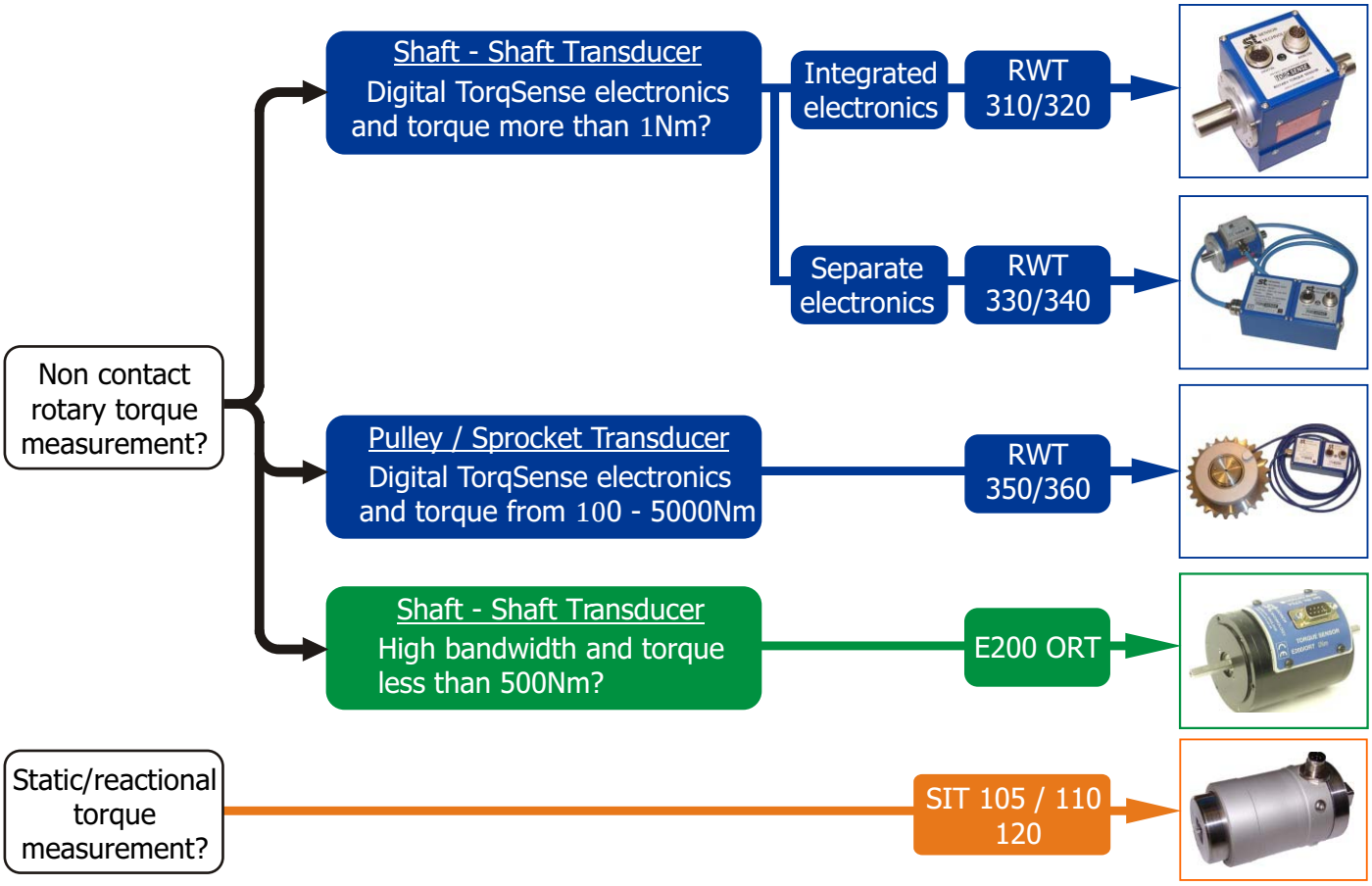
TORQSENSE®

SENSOR TECHNOLOGY

Sensor Technology Ltd has been specialising in providing customers with rotary torque measurement solutions for over 30 years, developing its own technology for the instrumentation and OEM markets.

Torque Transducers

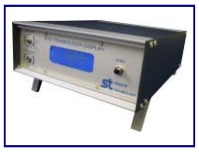
Our torque products include the latest integrated digital non-contact TorqSense technology rotary torque transducers. We also offer Optical rotary torque transducers and Strain Gauge technology torque transducers. Customers can specify any full scale torque range within the standard ranges to optomise accuracy.



Transducer Display Interfaces

Only the E200 ORT Series Transducers require a Transducer Display interface to operate the sensor. Depending upon your requirements Sensor Technology offer:

- E201 and E202 Transducer Display Interfaces for use with E200 ORT Transducers



- For the RWT and SIT range of sensors , the Electronic Transducer Display interface (ETD) is available for applications where a local display is required.

TORQVIEW Advanced Monitoring Display Software

TorqView, an easy to use advanced torque monitoring software, offers real time plotting and data recording. It operates on a PC in conjunction with the RWT320/340/360 series, the SIT 120 and E202 Transducer Display Interfaces.

System Rental

We offer a unique system rental service for short or long term rent of our standard range of transducers. Please see Rental Terms and Conditions.

Calibration

Sensor Technology Ltd recommend that transducers are calibrated every year to ensure their accuracy and performance. The first year's calibration is free of charge. Discounts apply for regular recalibrations.

EMC

Each Transducer and Display Interface complies with EMC Regulation BS EN 55011 (10v/Metre immunity)

WEEE

Sensor Technology's products are subject to Waste Electrical and Electronic Equipment (WEEE) Regulations (2006). Please contact us should you wish to dispose of any equipment that we have produced.

Obsolete Torque Equipment

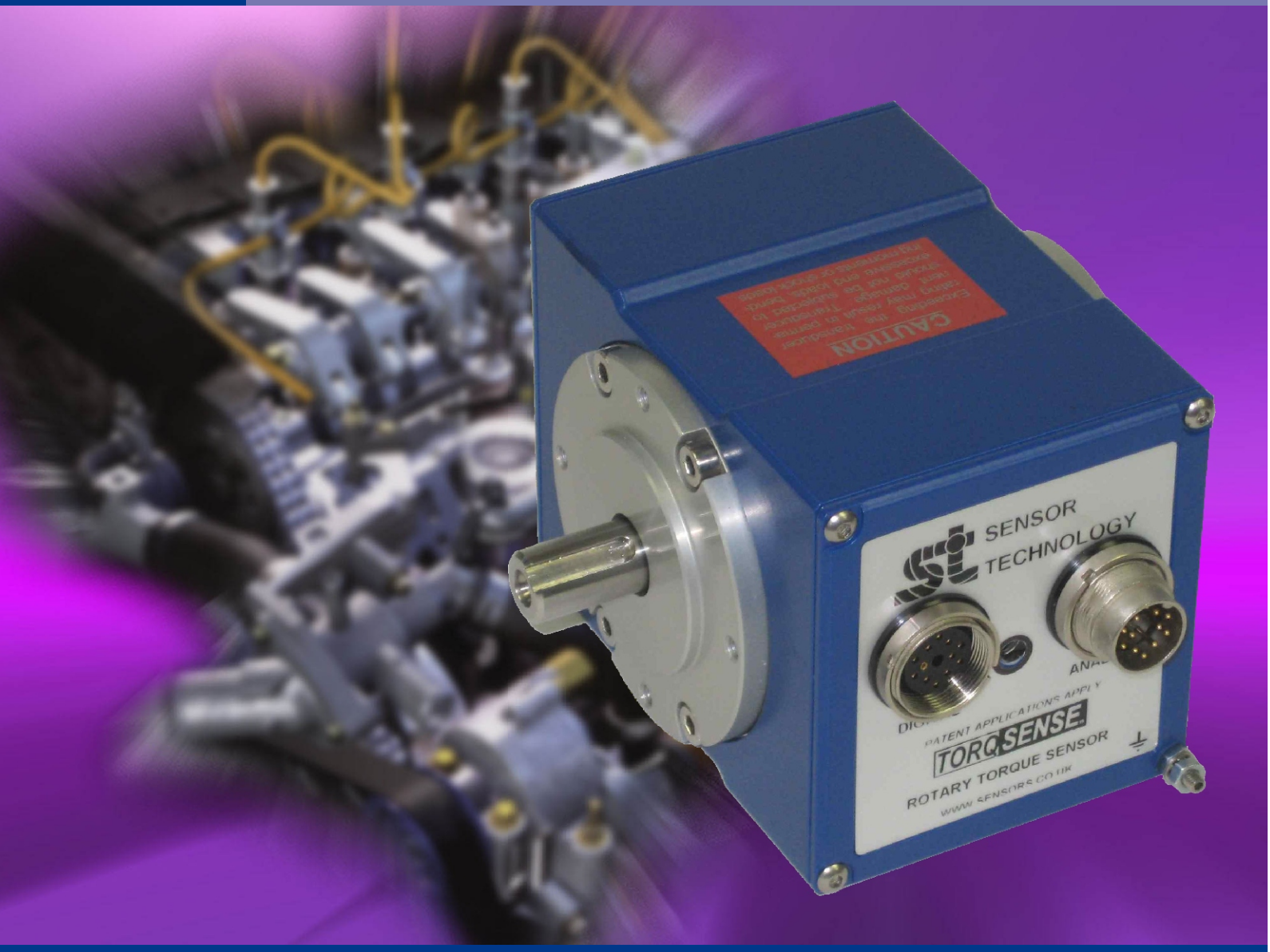
Sensor Technology will be pleased to service and calibrate any of their older products which, although technically obsolete, are still functional. Please consult factory.

Warranty

Sensor Technology Ltd's standard range of torque measuring products are warranted against manufacturing defects and component failure for two years from date of purchase, subject to fair wear and tear and return for the first year's free of charge annual re-calibration. This warranty is extended indefinitely if the equipment is returned to Sensor Technology, or its distributor for annual re-calibration, when software and hardware updates, if required, will be carried out free of charge. Standard range means those products described in the company's product data sheets.

TORQSENSE®

RWT310/320 series
Torque Transducer



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Digital RWT310/320 series Torque Transducer

TorqSense Digital RWT310 & 320 series transducers with integral electronics now offer cost effective, non-contact digital rotary torque measurement, using Surface Acoustic Wave technology, suitable for torque monitoring, testing or controlling drive mechanisms. TorqSense RWT310 & 320 series transducers and their technology are particularly appropriate for OEM applications.

Benefits

- Minimal shaft length - High shaft stiffness
- Low inertia – High Speed capability because electronics are not fixed on to shaft
- Non contact measurement
- High bandwidth 200% safe mechanical overload
- High accuracy and resolution
- Excellent noise immunity
- Integral digital electronics
- Operates both statically and dynamically - Clockwise/anti-clockwise
- Any full scale torque can be specified within Standard range: 1Nm through to 10,000Nm
- Lifetime warranty

Consult factory for ranges greater than 10KNm

High speeds available on request

Technology

TorqSense patented technology is the measurement of the resonant frequency change in 'frequency dependent' surface acoustic wave devices, caused when strain is applied. The signal is coupled via a non-contact RF rotating couple from the shaft to a fixed pick-up.

Integral electronics enables the resonant frequencies to be measured and offer user selectable features, digital outputs and diagnostics. SAW devices are not affected by magnetic fields.

US Patents: US5585571, US6478584.
RWT3243R

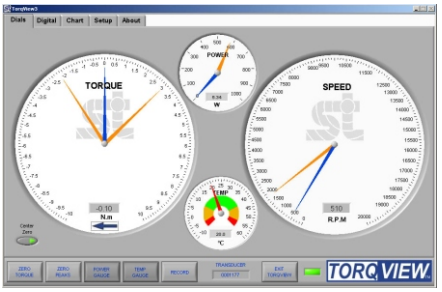
Software

TorqView is an easy to use advanced torque monitoring software, available to assist data recording and instrumentation displays that interface with Windows based PCs. See TorqView datasheet.

Features: 3 types of display. Text files compatible with Matlab and Excel. Real time chart plotting.

LabView VIs are available for users to design their own process control applications.

DLLs are also available for users to write their own custom software.



TorqSense RWT310 series transducers offer:

- Fixed voltage or current analog outputs (one for torque and the other for speed or power) for interfacing with legacy 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 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

Whereas, TorqSense RWT320 series transducers offer:

- 2 x user selectable voltage or current analog outputs (one for torque and the other for speed, power or peak torque) for interfacing with legacy analog instrumentation
- Digital outputs, such as RS232 and USB, for interfacing with modern instrumentation and laptops
- Digital input for configuring transducer via PC
- 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
- Transducer configuration software to allow user to changes transducer variables
- Ability to connect up to 10 transducers using USB
- Simple 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

RWT310/320 Series Torque Transducers - Data Specification

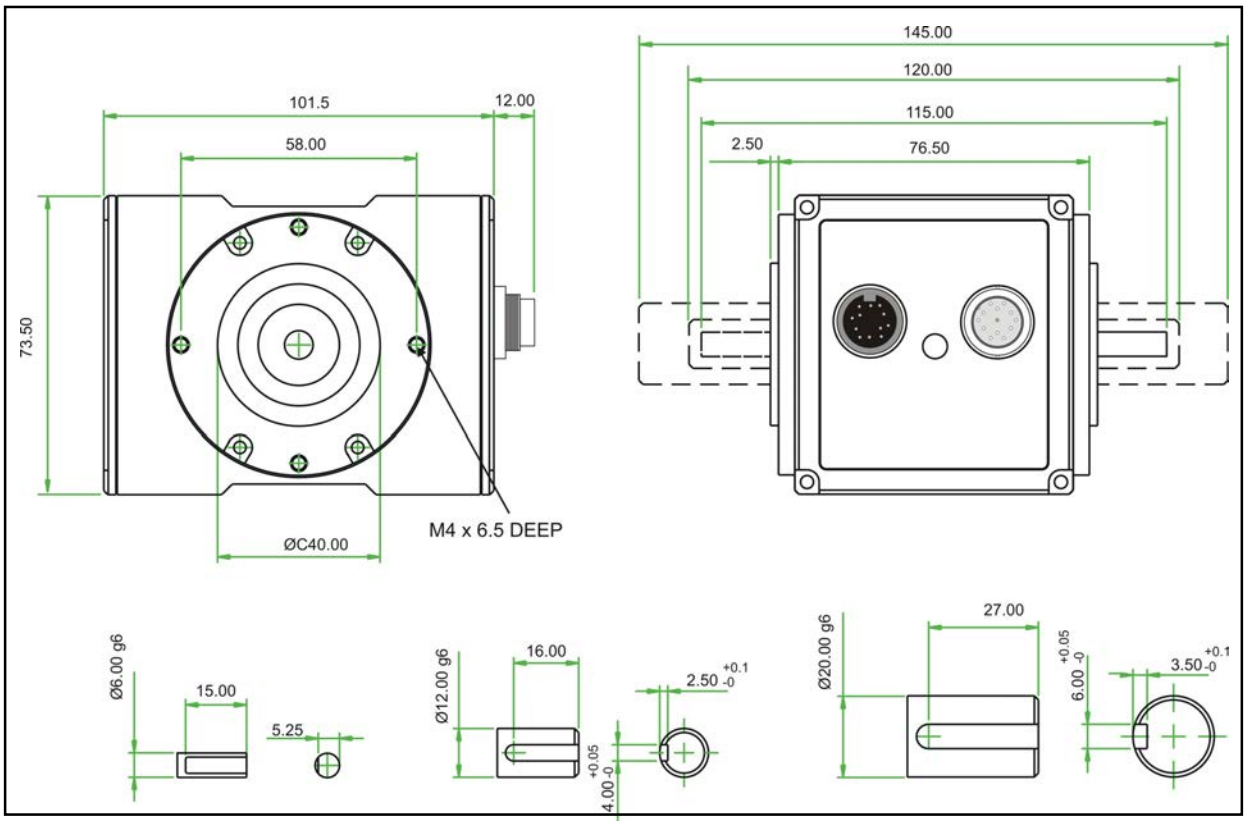
Parameter	Condition	Data								Units
RWT310/320 Torque measurement system										
Measurement method	Strain Dependent Surface Acoustic Wave Resonators (interrogated by an incremental electronic scanning method)									
Torque range	*(See Notes 1 & 2 below)*	0 – 1	0 – 1.1 to 0 - 20	0 – 21 to 0 - 100	0 – 101 to 0 - 500	0 - 501 to 0 - 2000	0 – 2001 to 0 - 10000			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 - 100000]*			*[lbf in]*
Shaft size (diameter)		6	12	20	30	50	75			mm
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), output is independent of any analog or digital processing.									
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 – 2000 RPM 2000 – 4000 RPM 4000 – 8000 RPM 8000 – 16000 RPM 16000 – 32000 RPM				RPM / 2 ((RPM – 2000) x 0.3227) + 650 ((RPM – 4000) x 0.196) + 800 ((RPM – 8000) x 0.1117) + 850 ((RPM – 16000) x 0.058) + 900				Hz
Rotational speed (max)	*(See Note 3)*	30,000	20,000	15,000	12,000	9,000	6,000			RPM
Temperature										
Measurement method	IR temperature sensor monitoring actual shaft temperature									
Temperature accuracy		±1								^{0}C
Reference temperature, T_{RT}		20								^{0}C
Operating range, ΔT_O		-10 to +50								^{0}C
Storage range, ΔT_S		-20 to +70								^{0}C
Temperature drift (FS)	Max	0.05								%FS/^{0}C
Specifications										
Linearity		±0.25								%FS
Hysteresis		<0.1								%FS
Resolution		0.1								%FS
Repeatability		0.1								%FS
RWT310 Series Transducers ONLY										
Frequency response		101								Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±0.25 (±0.5 for 2Nm and below)								%FS
RWT320 Series Transducers ONLY										
Frequency response		1620	810	405	202	101	50	25	12	Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±1	±0.7	±0.5	±0.4	±0.25	±0.25	±0.25	±0.25	%FS
Digital averaging	*(See Note 5)*	1	2	4	8	16	32	64	128	N
Analog output										
Output voltages (Torque/Speed/Power)		Options available: ±1 / ±5 / ±10 / Unipolar (RWT310 Series default setting is ±5Vdc) (RWT320 Series output voltages are user selectable)								Vdc
Load impedance		Maximum 1								KΩ
Output currents (Torque/Speed/Power)		Options available: 4-20mA, 0-20mA and 12±8mA (RWT320 Series output currents are user selectable)								mA
4-20mA Loop resistance		Should not exceed 400								Ω
Digital output (RWT320 Series Transducers ONLY)										
Output type	RS232 (Standard), USB 2.0 full speed 12 Mbps (optional), CANbus (optional)									
Sampling rate		1.62								ksps
Power supply										
Nominal voltage, V_S		12 to 32 (max)								V
Current consumption, I_S		500 (max)								mA
Power consumption, W_S		6								W
Allowed residual ripple of excitation voltage, V_{ripple}		500 (above nominal supply voltage)								mVp-p
Electromagnetic compatibility										
EMC compatibility		EN 61326:2006								

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.

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

RWT310/320 Series Torque Transducers

Dimensions (1Nm to 100Nm)



Parameter	Data												Units
Mechanical Properties													
Torque (Max)	1	2.5	3.9	6	8.5	13	17.5	20	30	55	85	100	Nm
Shaft Code	CF	DA	DF	DB	DC	DG	DD	DE	EB	EC	ED	EE	
Shaft Size (Diameter)	6	12							20				mm
Torsional Stiffness	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	5.96	6.00	6.04	6.13	6.18	6.24	6.42	22.9	23.9	25.4	27.2	$^{x}10^{-6}$ kg·m^2
Max measurable load limit	120 (of rated torque)												%
Static safe load breaking	200 (of rated torque)												%
Shaft weight, approx	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	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.1	1.1	kg

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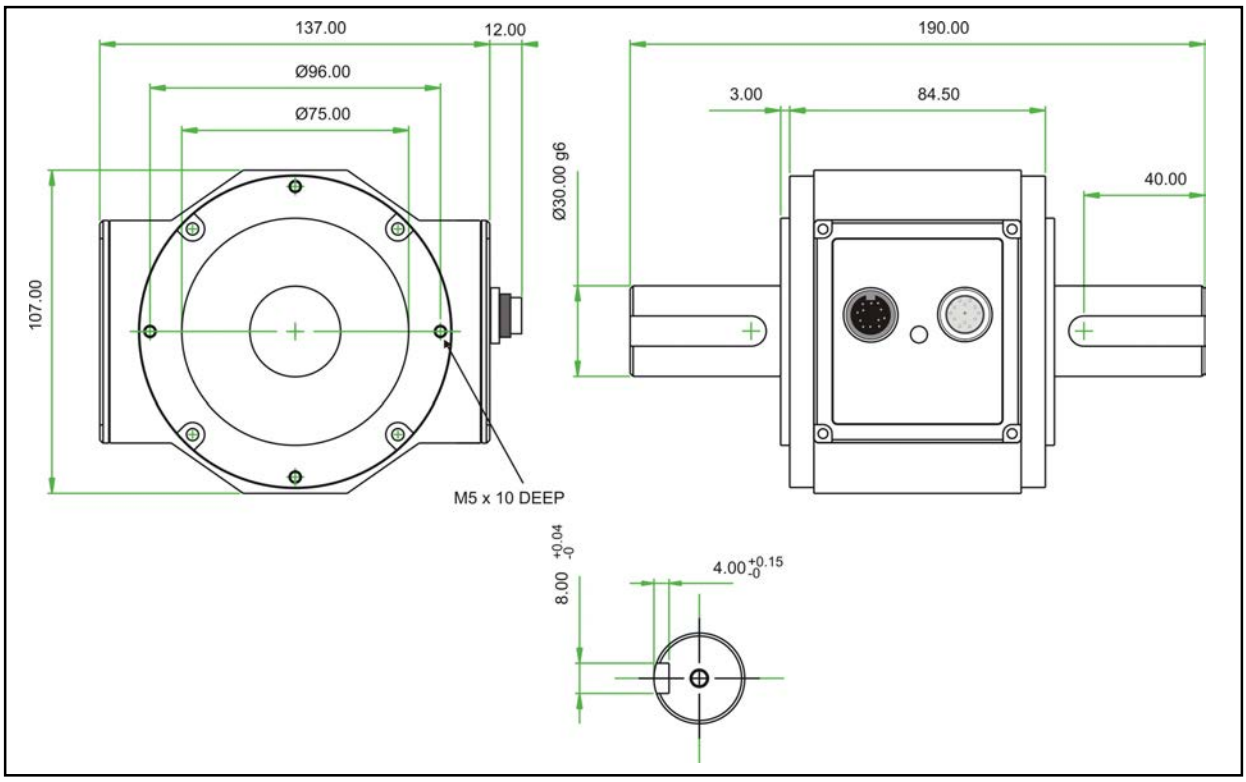
RWT310/320 Series Torque Transducers

Dimensions (101Nm to 500Nm)



Parameter	Data					Units
Mechanical Properties						
Torque (Max)	175	225	265	350	500	Nm
Shaft Code	FA	FB	FC	FD	FE	
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	$^{x}10^{-6}$ kg·m^2
Max measurable load limit	120 (of rated torque)					%
Static safe load breaking	200 (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

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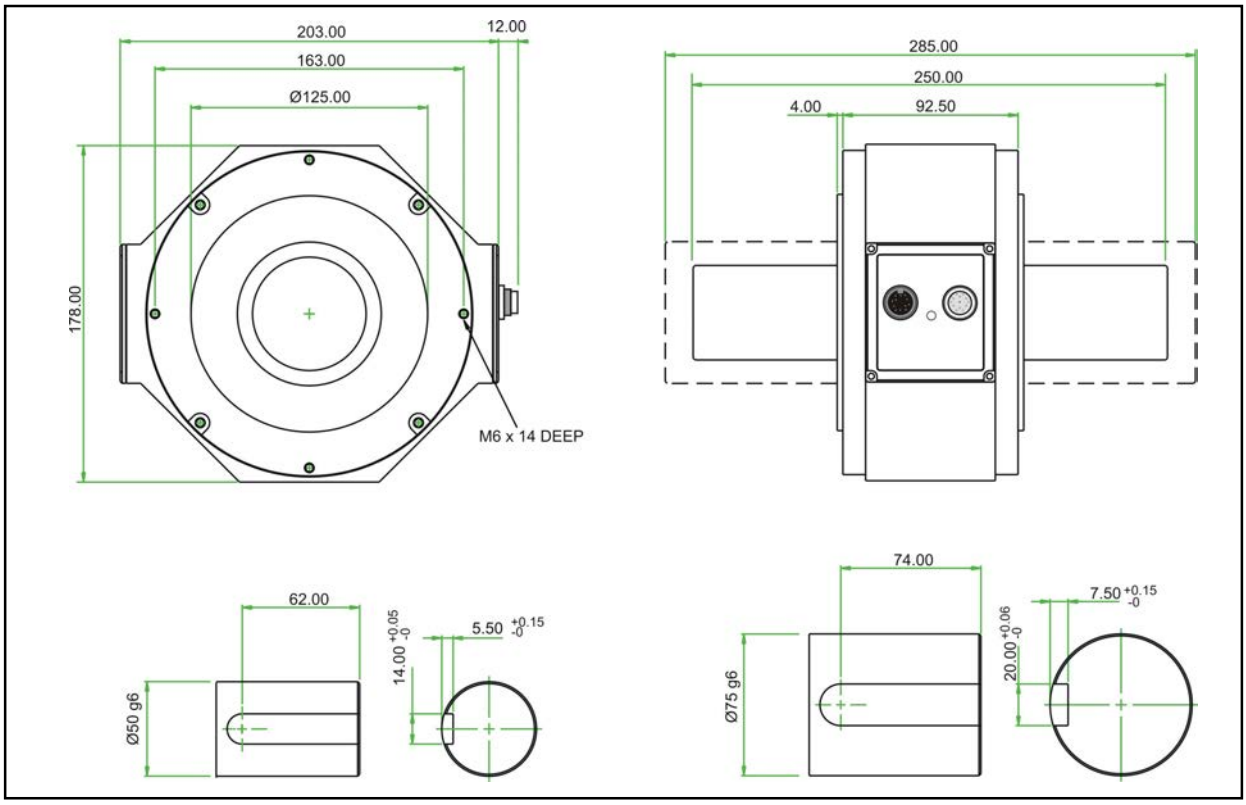
RWT310/320 Series Torque Transducers

Dimensions (501Nm to 10000Nm)



Parameter	Data									Units
Mechanical Properties										
Torque (Max)	650	850	1100	1350	2000	3000	4000	6000	10000	Nm
Shaft Code	GE	GA	GB	GC	GD	HA	HB	HC	HF	
Shaft Size (Diameter)	50					75				mm
Torsional Stiffness	TBC	TBC	199.2	TBC	214.1	TBC	TBC	914.4	945.5	kNm/rad
Mass moment of inertia	TBC	TBC	1330	TBC	1497	TBC	TBC	7932.7	9407.1	$^{x}10^{-6}$ $kg{\cdot}m^2$
Max measurable load limit	120 (of rated torque)									%
Static safe load breaking	200 (of rated torque)									%
Shaft weight, approx	TBC	TBC	3.9	TBC	4.1	TBC	TBC	10.2	10.6	kg
Transducer with shaft weight, approx	TBC	TBC	7.1	TBC	7.3	TBC	TBC	13.4	13.8	kg

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RWT310/320 Series Torque Transducers - Standard Range

● – Standard feature ◇ – Optional feature

	RWT310/320 Series		Option Code	Remarks
Torque, Speed, Power Outputs	**RWT310**	**RWT320**		
Torque only	310	320		
Torque & Speed *(60 pulses/rev)*	311			*User to specify RPM/FSD when ordering*
Torque & Speed *(360 pulses/rev)*	312			*Not yet available*
Torque & Power *(60 pulses/rev)*	313			*User to specify Power/FSD when ordering*
Torque & Speed *(60 pulses/rev)* or Power		321		*Outputs are user selectable*
Torque & Speed *(360 pulses/rev)* or Power		322		*Not yet available*
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*
RS232 output		●		
Torque Averaging and Torque Peak		●		
Self Diagnostics	●	●		
Internal temperature measurement	●	●		*Value available on RWT320 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*
Voltage output ±1v FSD (Fixed)	◇		A	*In place of Option B*
Voltage output ±10v FSD (Fixed)	◇		C	*In place of Option B*
Unipolar voltages (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 6)*
USB 2.0 full speed 12 Mbps Digital output		◇	G	
CANbus output		◇	H	*In place of RS232 ouput*
High Speed Bearings *(See Note 7 below)*	◇	◇	J	*Consult factory for maximum speed allowance.*
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 *(See Note 8 below)*	◇	◇	L	

Note 6. 2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque. Channel 2 (voltage/current) – speed or power, if ordered.
Note 7. At very high speeds, for better balance the factory recommend plain or splined shafts.
Note 8. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

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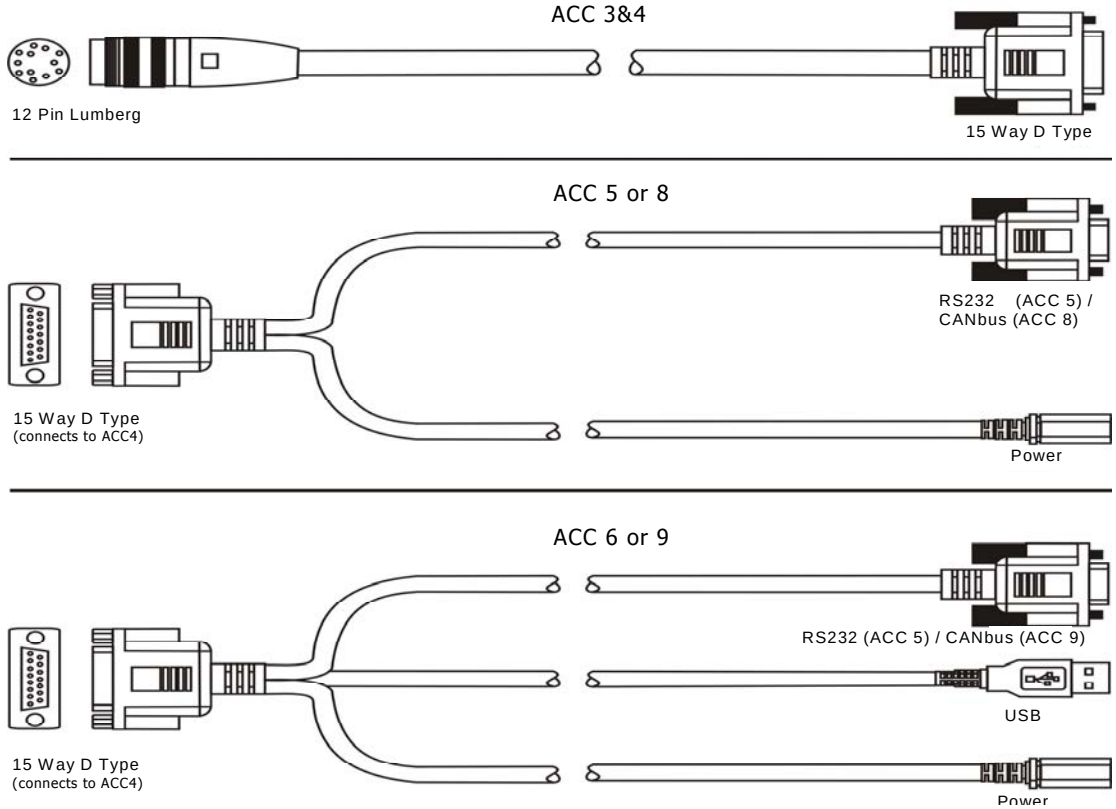
RWT310/320 Series Torque Transducers – Connector and Lead Options

	RWT310/320 Series		Option Code	Remarks/Purpose
Connectors & Leads	**RWT310**	**RWT320**		
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 RWT 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 RWT 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 RWT to PC via RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to RS232, USB and Power Connectors*		◇	ACC 6	*For connecting RWT to PC via USB (Option G) or RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus and Power Connectors*		◇	ACC 8	*For connecting RWT to PC via CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus, USB and Power Connectors*		◇	ACC 9	*For connecting RWT to PC via USB (Option G) or CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*

RWT310/320 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*



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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: ***RWT***	***311 - 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: ***RWT***			
Max speed (if applicable)		RPM	
Connector & Lead options		(if applicable) *See over*	
Additional related products		(if applicable) *See over*	

Glossary of terms and definitions used in this datasheet

- ***Surface Acoustic Wave (SAW)*** - An acoustic wave travelling along the surface of a material having some elasticity, with amplitude that typically decays exponentially with the depth of the substrate.
- ***Strain dependent SAW resonators*** – A type of elastic SAW device, which changes its resonant properties when it is subjected to axial strain/compression. TorqSense uses this principle, which is protected by a number of patents.
- ***Incremental Electronic Scan (IES)*** – The most successful and precise method for interrogating strain dependent SAW resonators. The IES interrogation method uses a processor controlled frequency synthesiser to excite the SAW resonators over a defined range of frequencies and measure the reflected signal. TorqSense uses this patented method.
- ***Resolution of the IES method*** - The minimum measurable number corresponding to the stress/strain sensitive resonance point of the SAW resonator. The value is limited by following the factors:
  - frequency resolution of the synthesiser, which is 1000 times greater then overall resolution of the system.
  - relationship between frequency response and resolution. Increments of the resolution will proportionally decrease the system's frequency response. TorqSense systems are optimised for the best performance that suits most applications. However, on the RWT320 series models customers do have the capability to adjust the system performance.
- ***Frequency response of the IES method*** – The measure of the TorqSense system's response at the output to a signal of varying frequency at its input. The frequency response is typically characterised by the magnitude of the system's response, measured in dB. There are two ways of characterising the system's frequency response:
  - 0.1dB frequency range, where the output magnitude of the signal is different to the input magnitude of the signal by not more then 0.1dB (practically absolutely identical).
  - 3dB frequency range, where the output magnitude of the signal is 0.707 of the input signal. This is a common standard for most applications, unless it specifically says otherwise. This standard is also used to characterise the TorqSense system's frequency response.
- ***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.

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TORQSENSE®

RWT330/340 series
Torque Transducer

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Benefits

- Minimal shaft length - High shaft stiffness
- Low inertia – High Speed capability because electronics are not fixed on to shaft
- Non contact measurement
- High bandwidth 200% safe mechanical overload
- High accuracy and resolution
- Excellent noise immunity
- Separate digital electronics
- Operates both statically and dynamically - Clockwise/anti-clockwise
- Any full scale torque can be specified within Standard range: 1Nm through to 10,000Nm
- Lifetime warranty

Consult factory for ranges greater than 10KNm

High speeds available on request

Technology

TorqSense patented technology is the measurement of the resonant frequency change in 'frequency dependent' surface acoustic wave devices, caused when strain is applied. The signal is coupled via a non-contact RF rotating couple from the shaft to a fixed pick-up.

A separate electronics module enables the resonant frequencies to be measured and offer user selectable features, digital outputs and diagnostics. SAW devices are not affected by magnetic fields.

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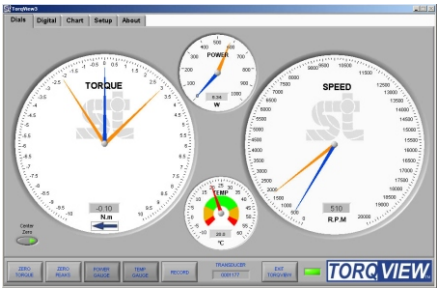


TorqSense RWT330 series transducers offer:

- Fixed voltage or current analog outputs (one for torque and the other for speed or power) for interfacing with legacy 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 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

Whereas, TorqSense RWT340 series transducers offer:

- 2 x user selectable voltage or current analog outputs (one for torque and the other for speed, power or peak torque) for interfacing with legacy analog instrumentation
- Digital outputs, such as RS232 and USB, for interfacing with modern instrumentation and laptops
- Digital input for configuring transducer via PC
- 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
- Transducer configuration software to allow user to changes transducer variables
- Ability to connect up to 10 transducers using USB
- Simple 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

RWT330/340 Series Torque Transducers - Data Specification

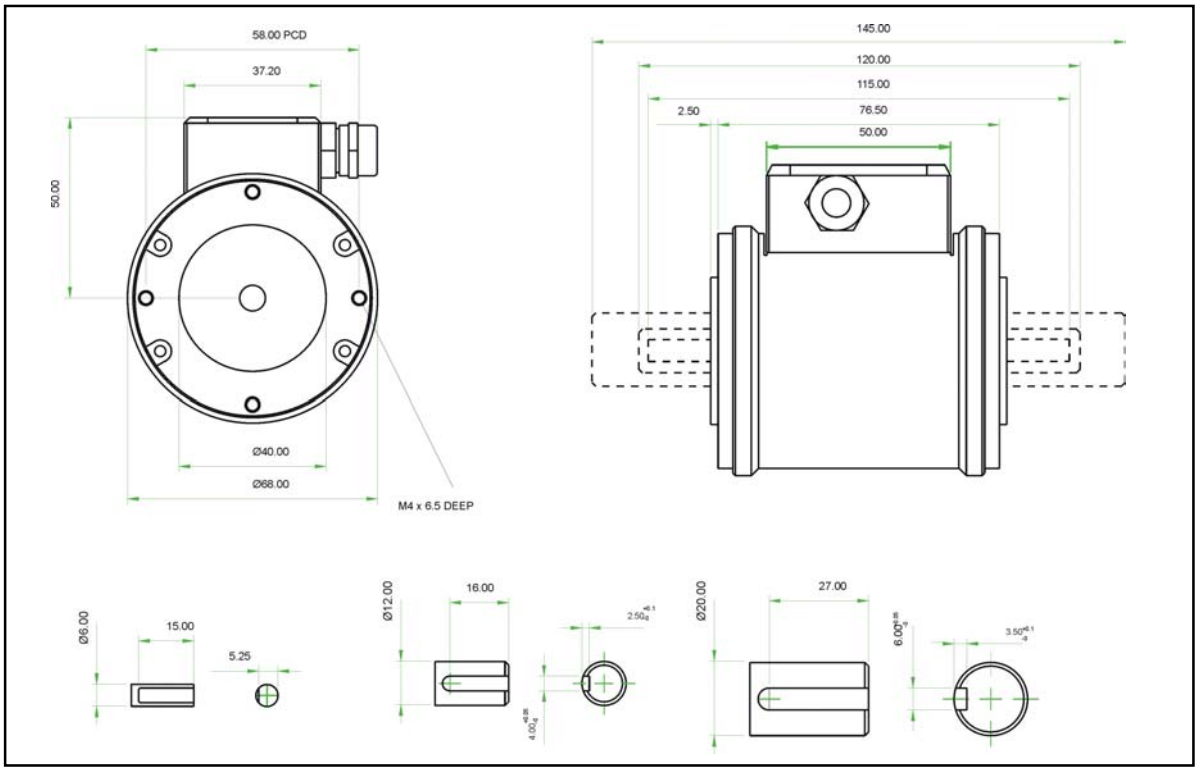
Parameter	Condition	Data								Units
RWT330/340 Torque measurement system										
Measurement method	Strain Dependent Surface Acoustic Wave Resonators (interrogated by an incremental electronic scanning method)									
Torque range	*(See Notes 1 & 2 below)*	0 – 1	0 – 1.1 to 0 - 20	0 – 21 to 0 - 100	0 – 101 to 0 - 500	0 - 501 to 0 - 2000	0 – 2001 to 0 - 10000			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 - 100000]*			*[lbf in]*
Shaft size (diameter)		6	12	20	30	50	75			mm
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), output is independent of any analog or digital processing.									
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 – 2000 RPM 2000 – 4000 RPM 4000 – 8000 RPM 8000 – 16000 RPM 16000 – 32000 RPM			RPM / 2 ((RPM – 2000) x 0.3227) + 650 ((RPM – 4000) x 0.196) + 800 ((RPM – 8000) x 0.1117) + 850 ((RPM – 16000) x 0.058) + 900					Hz
Rotational speed (max)	*(See Note 3)*	30,000	20,000	15,000	12,000	9,000	6,000			RPM
Temperature										
Measurement method	IR temperature sensor monitoring actual shaft temperature									
Temperature accuracy		±1								^{0}C
Reference temperature, T_{RT}		20								^{0}C
Operating range, ΔT_O		-10 to +50								^{0}C
Storage range, ΔT_S		-20 to +70								^{0}C
Temperature drift (FS)	Max	0.05								%FS/^{0}C
Specifications										
Linearity		±0.25								%FS
Hysteresis		<0.1								%FS
Resolution		0.1								%FS
Repeatability		0.1								%FS
RWT330 Series Transducers ONLY										
Frequency response		101								Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±0.25 (±0.5 for 2Nm and below)								%FS
RWT340 Series Transducers ONLY										
Frequency response		1620	810	405	202	101	50	25	12	Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±1	±0.7	±0.5	±0.4	±0.25	±0.25	±0.25	±0.25	%FS
Digital averaging	*(See Note 5)*	1	2	4	8	16	32	64	128	N
Analog output										
Output voltages (Torque/Speed/Power)		Options available: ±1 / ±5 / ±10 / Unipolar (RWT330 Series default setting is ±5Vdc) (RWT340 Series output voltages are user selectable)								Vdc
Load impedance		Maximum 1								KΩ
Output currents (Torque/Speed/Power)		Options available: 4-20mA, 0-20mA and 12±8mA (RWT340 Series output currents are user selectable)								mA
4-20mA Loop resistance		Should not exceed 400								Ω
Digital output (RWT340 Series Transducers ONLY)										
Output type	RS232 (Standard), USB 2.0 full speed 12 Mbps (optional), CANbus (optional)									
Sampling rate		1.62								ksps
Power supply										
Nominal voltage, V_S		12 to 32 (max)								V
Current consumption, I_S		500 (max)								mA
Power consumption, W_S		6								W
Allowed residual ripple of excitation voltage, V_{ripple}		500 (above nominal supply voltage)								mVp-p
Electromagnetic compatibility										
EMC compatibility		EN 61326:2006								

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.

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

RWT330/340 Series Torque Transducers

Dimensions (1Nm to 100Nm)

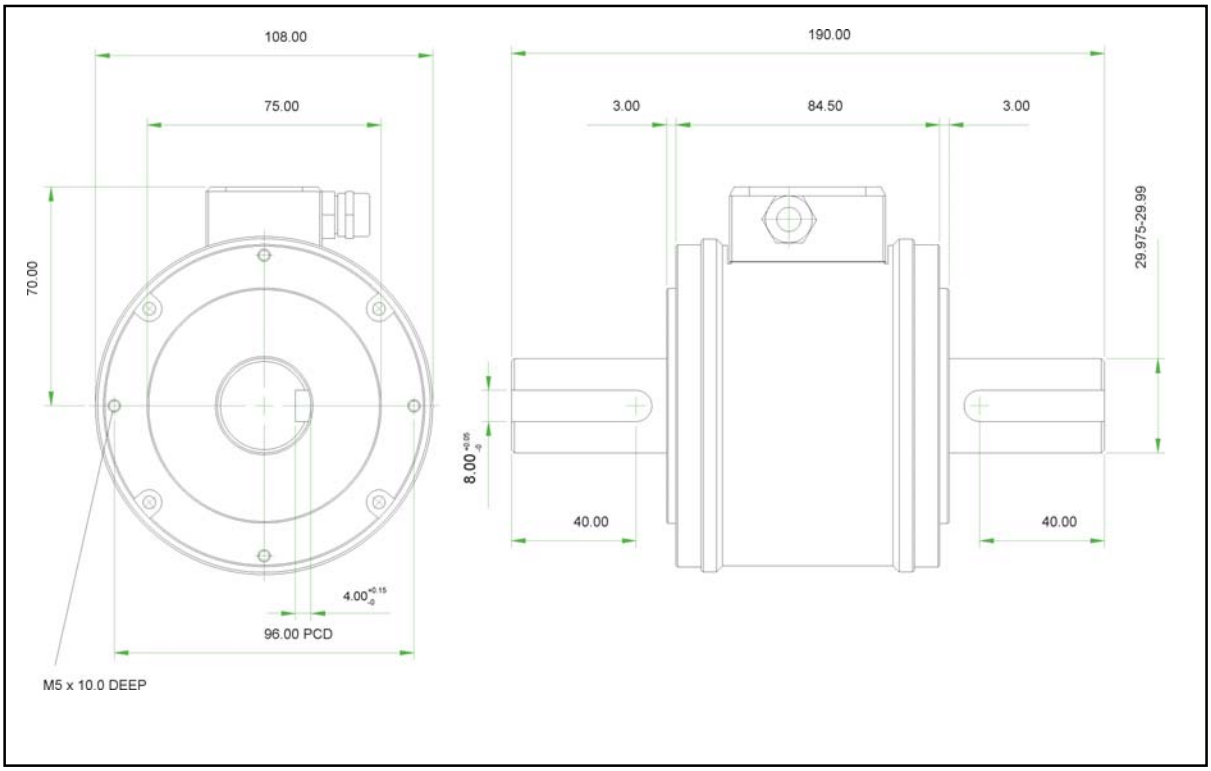


Parameter	Data												Units
Torque (Max)	1	2.5	3.9	6	8.5	13	17.5	20	30	55	85	100	Nm
Shaft Code	CF	DA	DF	DB	DC	DG	DD	DE	EB	EC	ED	EE	
Shaft Size (Diameter)	6	12							20				mm
Torsional Stiffness	0.23	1.28	1.3	1.32	1.6	1.7	1.8	1.9	4.1	6.4	8.1	9.2	KNm/rad
Mass moment of inertia, L_V	0.45	5.96	6.00	6.04	6.13	6.18	6.24	6.42	22.9	23.9	25.4	27.2	$^{x}10^{-6}$ $kg{\cdot}m^2$
Max measurable load limit	120 (of rated torque)												%
Static safe load breaking	200 (of rated torque)												%
Shaft weight, approx	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 (1 dp)	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.9	0.9	0.9	0.9	kg

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

RWT330/340 Series Torque Transducers

Dimensions (101Nm to 500Nm)

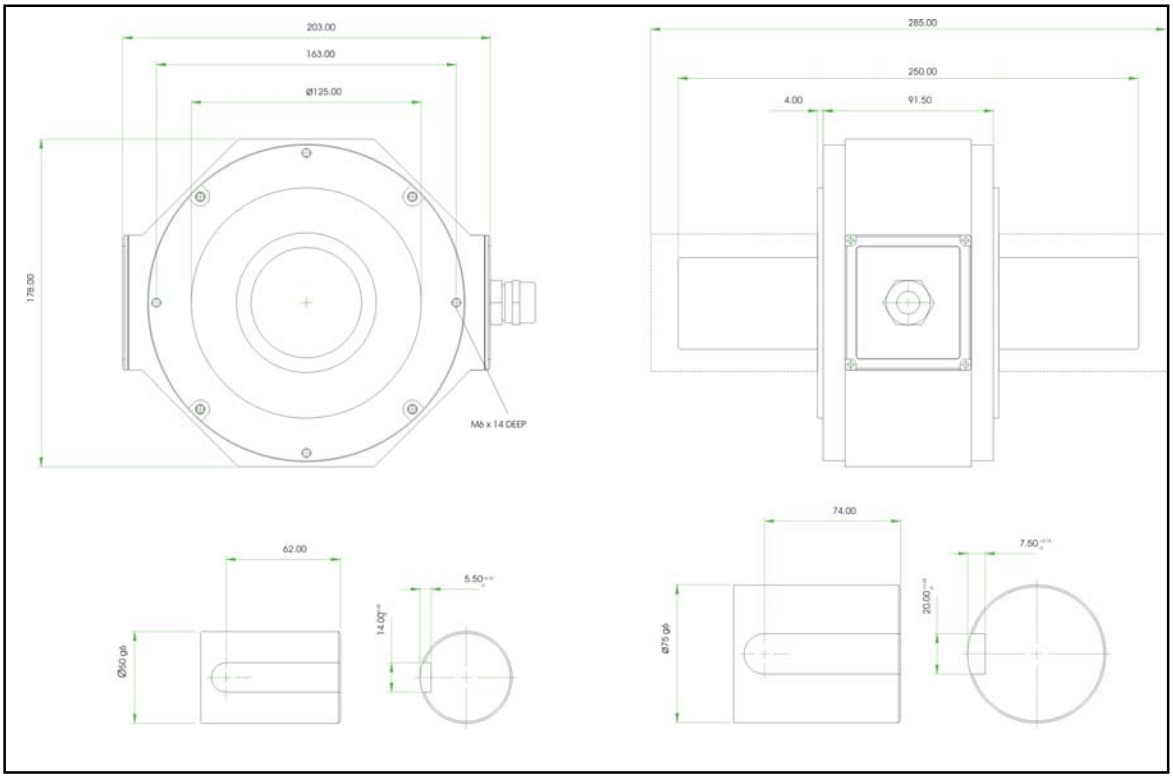


Parameter	Data					Units
Mechanical Properties						
Torque (Max)	175	225	265	350	500	Nm
Shaft Code	FA	FB	FC	FD	FE	
Shaft Size (Diameter)	30					mm
Torsional stiffness	32.9	35.6	37.2	37.9	39.8	kNm/rad
Mass moment of inertia	138.9	143.1	147.7	151.9	174.2	$^{x}10^{-6}$ kg·m^2
Max measurable load limit	120 (of rated torque)					%
Static safe load breaking	200 (of rated torque)					%
Shaft weight, approx	1.1	1.1	1.1	1.2	1.2	kg
Transducer with shaft weight, approx (1 dp)	2.3	2.3	2.3	2.4	2.4	kg

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

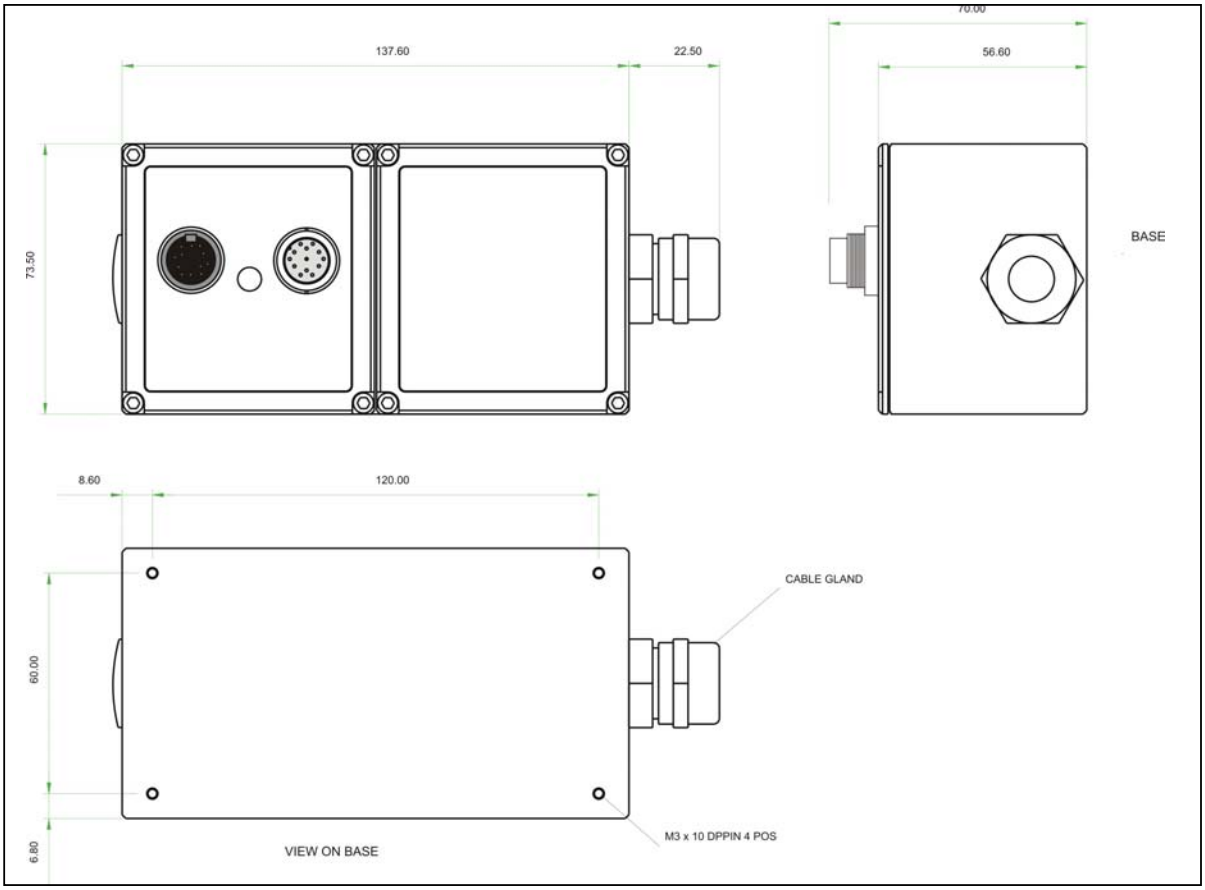
RWT330/340 Series Torque Transducers

Dimensions (501Nm to 10000Nm)



Parameter	Data									Units
Mechanical Properties										
Torque (Max)	650	850	1100	1350	2000	3000	4000	6000	10000	Nm
Shaft Code	GE	GA	GB	GC	GD	HA	HB	HC	HF	
Shaft Size (Diameter)	50					75				mm
Torsional Stiffness	TBC	TBC	199.2	TBC	214.1	TBC	TBC	914.4	945.5	kNm/rad
Mass moment of inertia	TBC	TBC	1330	TBC	1497	TBC	TBC	7932.7	9407.1	$^{x}10^{-6}$ $kg{\cdot}m^2$
Max measurable load limit	120 (of rated torque)									%
Static safe load breaking	200 (of rated torque)									%
Shaft weight, approx	TBC	TBC	3.9	TBC	4.1	TBC	TBC	10.2	10.6	kg
Transducer with shaft weight, approx	TBC	TBC	7.1	TBC	7.3	TBC	TBC	13.4	13.8	kg

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



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

RWT330/340 Series Torque Transducers - Standard Range

● – Standard feature ◇ – Optional feature

	RWT330/340 Series		Option Code	Remarks
Torque, Speed, Power Outputs	**RWT330**	**RWT340**		
Torque only	330	340		
Torque & Speed *(60 pulses/rev)*	331			*User to specify RPM/FSD when ordering*
Torque & Power *(60 pulses/rev)*	333			*User to specify Power/FSD when ordering*
Torque & Speed *(60 pulses/rev)* or Power		341		*Outputs are user selectable*
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*
RS232 output		●		
Torque Averaging & Torque Peak		●		
Self Diagnostics	●	●		
Internal temperature measurement	●	●		*Value available on RWT340 series only*
Deep grooved shielded bearings with oil lubrication	●	●		
Ingress Protection (IP) 54	●	●		
Link Cable (1.5m)	●	●		*From sensor head to electronics module*
Optional features				
Plain Shaft Ends	◇	◇	P	*Shaft length will be longer than keyed end shafts – consult factory for length*
Voltage output ±1v FSD (Fixed)	◇		A	*In place of Option B*
Voltage output ±10v FSD (Fixed)	◇		C	*In place of Option B*
Unipolar voltages (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 6)*
USB2.0 full speed 12 Mbps Digital output		◇	G	
CANbus output		◇	H	*In place of RS232*
High Speed Bearings *(See Note 7 below)*	◇	◇	J	*Consult factory for maximum speed allowance*
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 –for sensor and electronics *(See Note 8 below)*	◇	◇	L	
Ingress Protection (IP) 65 – Cavity 'D' connectors in lead b/w sensor & electronics	◇	◇	M	
Cavity 'D' connectors in lead b/w sensor & electronics	◇	◇	N	
Link Cable (>1.5m)	◇	◇	R	*Consult factory for length*

Note 6. 2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque. Channel 2 (voltage/current) – speed or power, if ordered.
Note 7. At very high speeds, for better balance the factory recommend plain or splined shafts.
Note 8. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

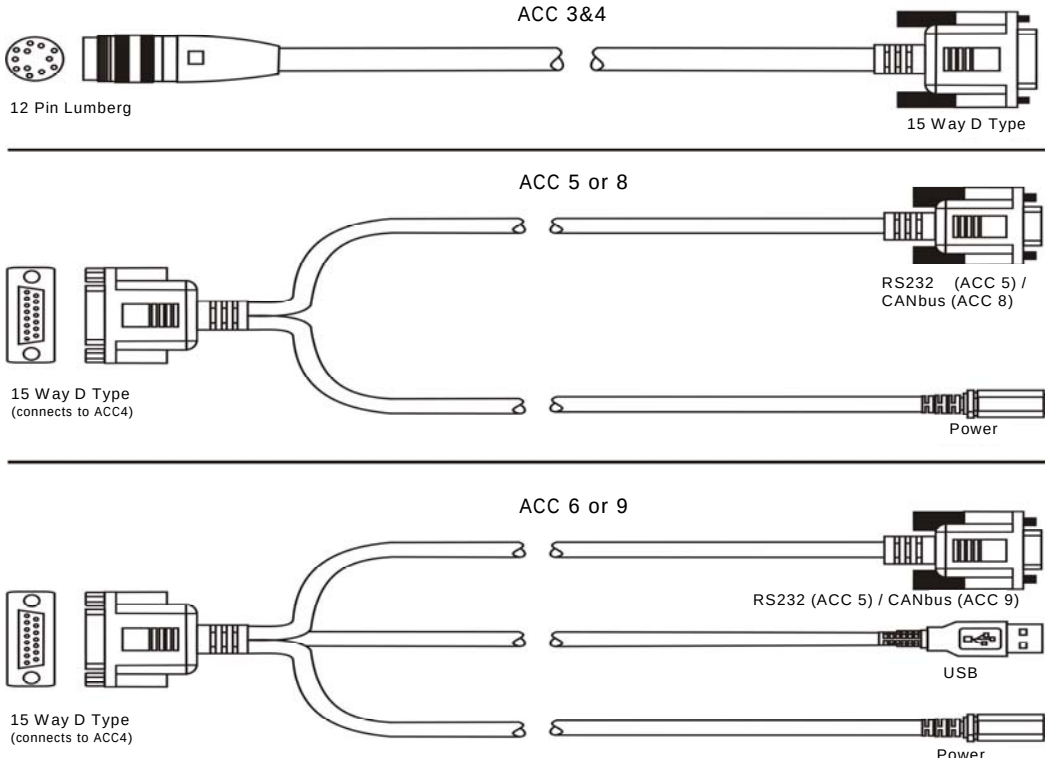
Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

RWT330/340 Series Torque Transducers – Connector and Lead Options

	RWT330/340 Series		Option Code	Remarks/Purpose
Connectors & Leads	**RWT330**	**RWT340**		
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 RWT 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 RWT 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 RWT to PC via RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to RS232, USB and Power Connectors*		◇	ACC 6	*For connecting RWT to PC via USB (Option G) or RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus and Power Connectors*		◇	ACC 8	*For connecting RWT to PC via CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus, USB and Power Connectors*		◇	ACC 9	*For connecting RWT to PC via USB (Option G) or CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*

RWT330/340 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 2	
TorqView	TV	*Torque Monitoring Software*



Data parameters measured at +20°C

Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

When you order 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: ***RWT***	***331 - 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: ***RWT***			
Max speed (if applicable)		RPM	
Connector & Lead options		(if applicable) *See over*	
Additional related products		(if applicable) *See over*	

Glossary of terms and definitions used in this datasheet

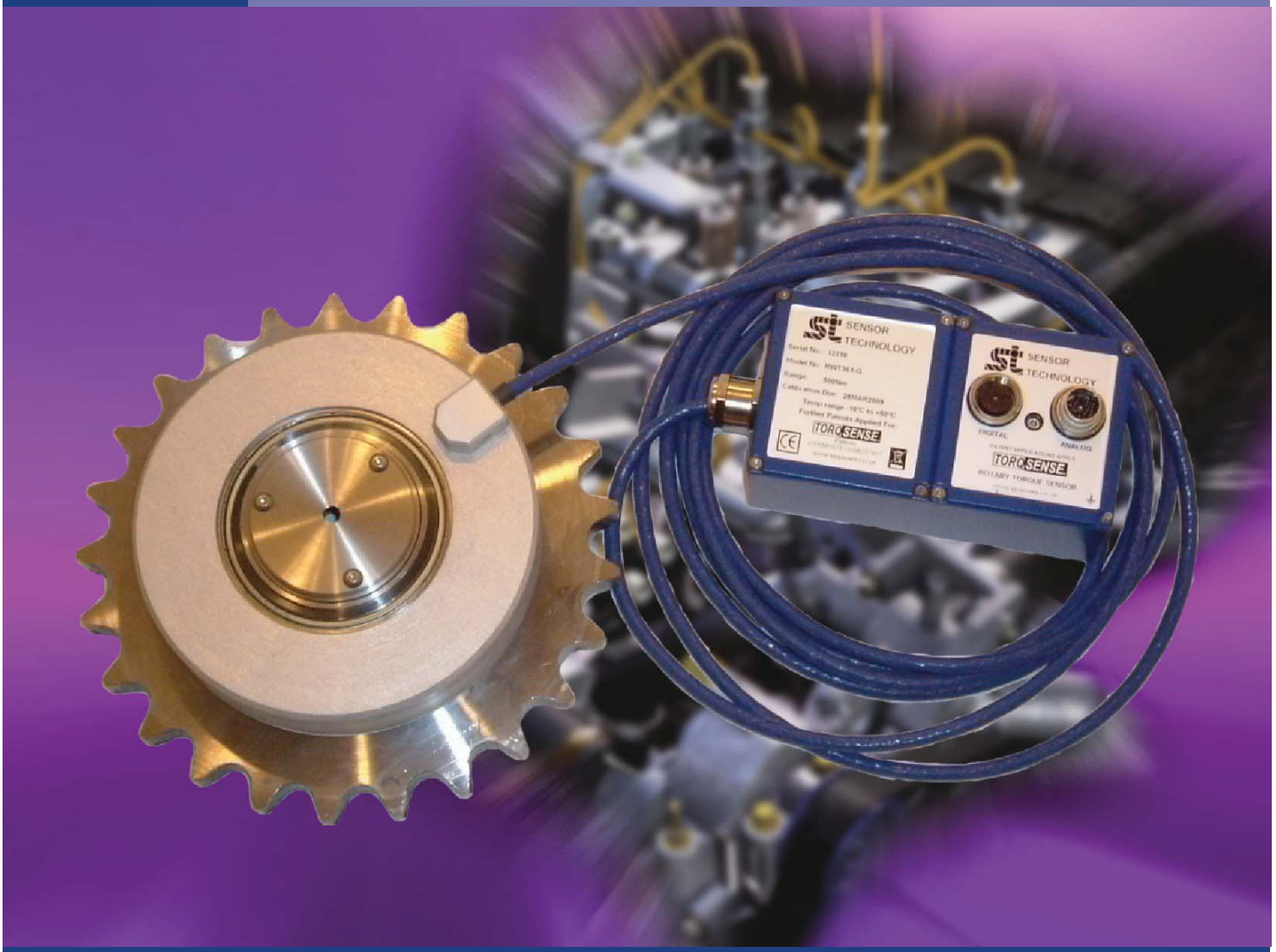
- ***Surface Acoustic Wave (SAW)*** - An acoustic wave travelling along the surface of a material having some elasticity, with amplitude that typically decays exponentially with the depth of the substrate.
- ***Strain dependent SAW resonators*** – A type of elastic SAW device, which changes its resonant properties when it is subjected to axial strain/compression. TorqSense uses this principle, which is protected by a number of patents.
- ***Incremental Electronic Scan (IES)*** – The most successful and precise method for interrogating strain dependent SAW resonators. The IES interrogation method uses a processor controlled frequency synthesiser to excite the SAW resonators over a defined range of frequencies and measure the reflected signal. TorqSense uses this patented method.
- ***Resolution of the IES method*** - The minimum measurable number corresponding to the stress/strain sensitive resonance point of the SAW resonator. The value is limited by following the factors:
  - frequency resolution of the synthesiser, which is 1000 times greater then overall resolution of the system.
  - relationship between frequency response and resolution. Increments of the resolution will proportionally decrease the system's frequency response. TorqSense systems are optimised for the best performance that suits most applications. However, on the RWT340 series models customers do have the capability to adjust the system performance.
- ***Frequency response of the IES method*** – The measure of the TorqSense system's response at the output to a signal of varying frequency at its input. The frequency response is typically characterised by the magnitude of the system's response, measured in dB. There are two ways of characterising the system's frequency response:
  - 0.1dB frequency range, where the output magnitude of the signal is different to the input magnitude of the signal by not more then 0.1dB (practically absolutely identical).
  - 3dB frequency range, where the output magnitude of the signal is 0.707 of the input signal. This is a common standard for most applications, unless it specifically says otherwise. This standard is also used to characterise the TorqSense system's frequency response.
- ***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.

TORQSENSE®

RWT350/360 series

Pulley / Sprocket

Torque Transducer



SENSOR TECHNOLOGY

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Digital RWT350/360 series Pulley / Spocket Torque Transducer

TorqSense Digital RWT350 & 360 series pulley / sprocket transducers with integral electronics now offer cost effective, non-contact digital rotary torque measurement, using Surface Acoustic Wave technology, suitable for torque monitoring and process control on any belt / chain driven machinery. TorqSense transducers and their technology are particularly appropriate for OEM applications.

Benefits

- Direct replacement for standard pulley / spocket
- Low inertia – High Speed capability because electronics are not fixed on to shaft
- Non contact measurement
- High bandwidth 200% safe mechanical overload

- High accuracy and resolution
- Excellent noise immunity
- Integral digital electronics
- Operates both statically and dynamically - Clockwise/anti-clockwise
- Any full scale torque can be specified within Standard range: 100Nm through to 10,000Nm
- Lifetime warranty

Consult factory for ranges greater than 10KNm

High speeds available on request

Technology

TorqSense patented technology is the measurement of the resonant frequency change in 'frequency dependent' surface acoustic wave devices, caused when strain is applied. The signal is coupled via a non-contact RF rotating couple from the shaft to a fixed pick-up.

Integral electronics enables the resonant frequencies to be measured and offer user selectable features, digital outputs and diagnostics. SAW devices are not affected by magnetic fields.

US Patents: US5585571, US6478584.
RWT3243R

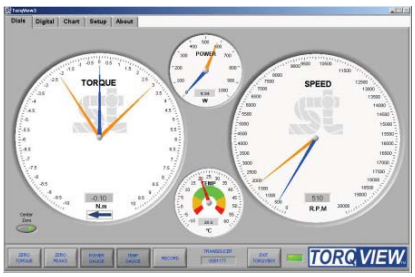
Software

TorqView is an easy to use advanced torque monitoring software, available to assist data recording and instrumentation displays that interface with Windows based PCs. See TorqView datasheet.

Features: 3 types of display. Text files compatible with Matlab and Excel. Real time chart plotting.

LabView VIs are available for users to design their own process control applications.

DLLs are also available for users to write their own custom software.



TorqSense RWT350 series transducers offer:

- Fixed voltage or current analog outputs (one for torque and the other for speed or power) for interfacing with legacy 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 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

Whereas, TorqSense RWT360 series transducers offer:

- 2 x user selectable voltage or current analog outputs (one for torque and the other for speed, power or peak torque) for interfacing with legacy analog instrumentation
- Digital outputs, such as RS232, CANbus and USB, for interfacing with modern instrumentation and laptops
- Digital input for configuring transducer via PC
- 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
- Transducer configuration software to allow user to changes transducer variables
- Ability to connect up to 10 transducers using USB
- Simple 'Fail' output pin
- Sensors to monitor shaft temperature for better compensation and accuracy

RWT350/360 Series Torque Transducers - Data Specification

PRELIMINARY

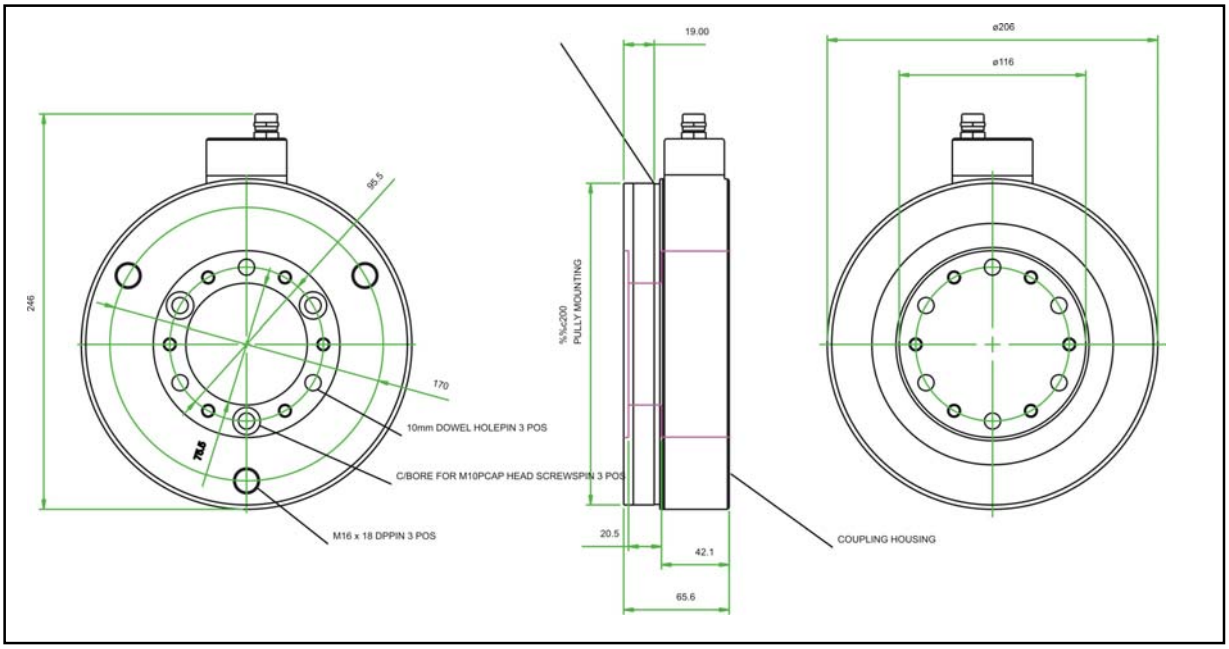
Parameter	Condition	Data								Units
RWT350/360 Torque measurement system										
Measurement method	Strain Dependent Surface Acoustic Wave Resonators (interrogated by an incremental electronic scanning method)									
Torque range	*(See Notes 1 & 2 below)*	From 100 – 10,000								Nm
		[From 1000 – 100,000]								*[lbf in]*
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), output is independent of any analog or digital processing.									
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 – 2000 RPM 2000 – 4000 RPM 4000 – 8000 RPM 8000 – 16000 RPM 16000 – 32000 RPM	RPM / 2 ((RPM – 2000) x 0.3227) + 650 ((RPM – 4000) x 0.196) + 800 ((RPM – 8000) x 0.1117) + 850 ((RPM – 16000) x 0.058) + 900							Hz
Rotational speed (max)	*(See Note 3)*	Consult factory								RPM
Temperature										
Measurement method	IR temperature sensor monitoring actual shaft temperature									
Temperature accuracy		±1								^{0}C
Reference temperature, T_{RT}		20								^{0}C
Operating range, ΔT_O		-10 to +50								^{0}C
Storage range, ΔT_S		-20 to +70								^{0}C
Temperature drift (FS)	Max	0.05								%FS/^{0}C
Specifications										
Linearity		±0.25								%FS
Hysteresis		<0.1								%FS
Resolution		0.1								%FS
Repeatability		0.1								%FS
RWT350 Series Transducers ONLY										
Frequency response		101								Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±0.25								%FS
RWT360 Series Transducers ONLY										
Frequency response		1620	810	405	202	101	50	25	12	Hz
Accuracy	20^{0}C, SM *(See Note 4)*	±1	±0.7	±0.5	±0.4	±0.25	±0.25	±0.25	±0.25	%FS
Digital averaging	*(See Note 5)*	1	2	4	8	16	32	64	128	N
Analog output										
Output voltages (Torque/Speed/Power)		Options available: ±1 / ±5 / ±10 / Unipolar (RWT350 Series default setting is ±5Vdc) (RWT360 Series output voltages are user selectable)								Vdc
Load impedance		1								KΩ
Output currents (Torque/Speed/Power)		Options available: 4-20mA, 0-20mA and 12±8mA (RWT360 Series output currents are user selectable)								mA
4-20mA Loop resistance		Should not exceed 400								Ω
Digital output (RWT360 Series Transducers ONLY)										
Output type	RS232 (Standard), USB 2.0 full speed 12 Mbps (optional), CANbus (optional)									
Sampling rate		1.62								ksps
Power supply										
Nominal voltage, V_S		12 to 32 (max)								V
Current consumption, I_S		500 (max)								mA
Power consumption, W_S		6								W
Allowed residual ripple of excitation voltage, V_{ripple}		500 (above nominal supply voltage)								mVp-p
Electromagnetic compatibility										
EMC compatibility		EN 61326:2006								

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.

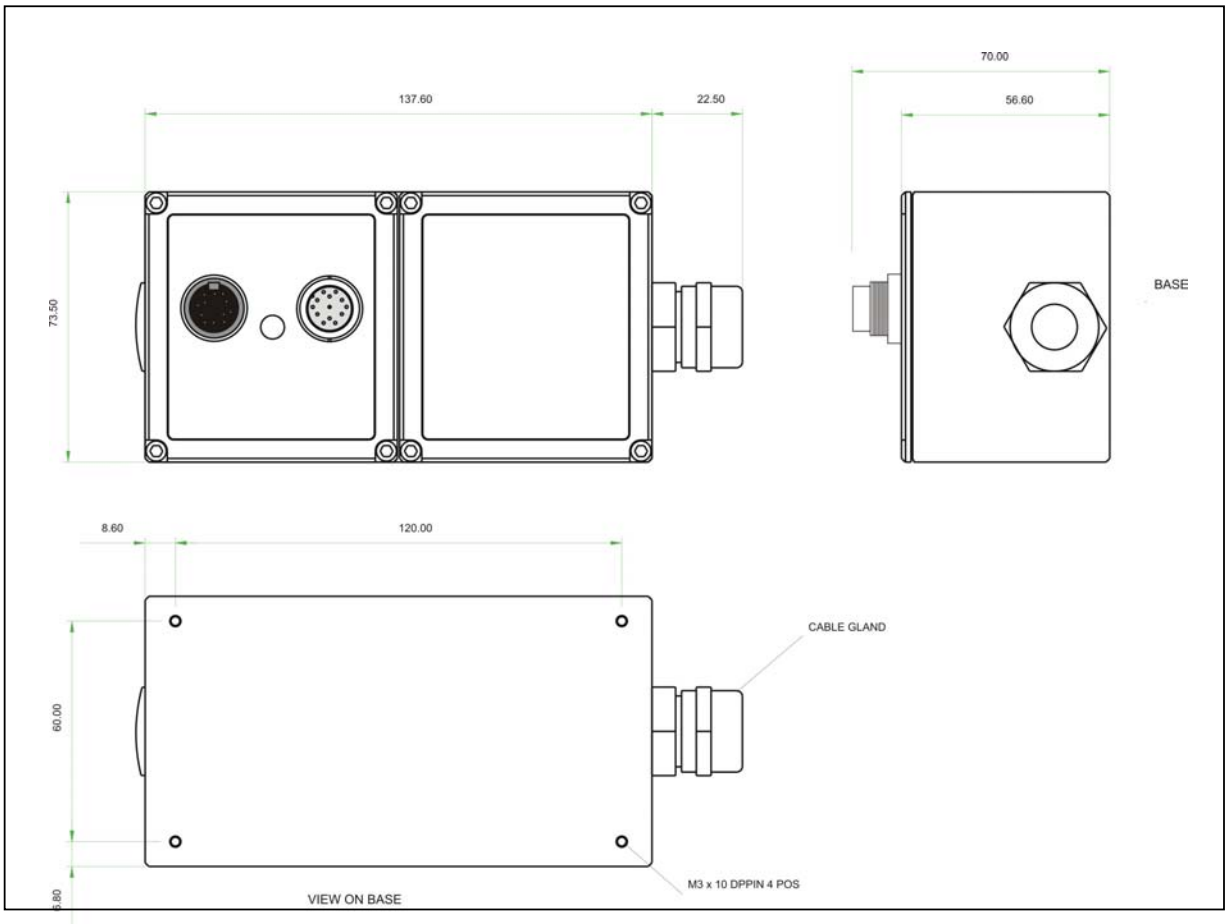
Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

RWT350/360 Series Torque Transducers

Dimensions (5KNm) (Please consult factory for other sizes)



RWT350/360 Series Electronics Module



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

RWT350/360 Series Torque Transducers - Standard Range

● – Standard feature ◇ – Optional feature

	RWT350/360 Series		Option Code	Remarks
Torque, Speed, Power Outputs	**RWT350**	**RWT360**		
Torque only	350	360		
Torque & Speed (Low Resolution)	351			*Specify RPM/FSD (60 pulses / rev)*
Torque & Speed (High Resolution)	352			*Not yet available (360 pulses / rev)*
Torque & Power	353			*Specify Power/FSD*
Torque & Speed (Low Resolution) or Power		361		*User self selectable (60 pulses / rev)*
Torque & Speed (High Resolution) or Power		362		*Not yet available (360 pulses / rev)*
Standard features				
Voltage Output ±5v FSD	●		B	
Voltage Output ±1v to ±10v FSD and Unipolar		●		*User self selectable*
RS232 Output		●		
Torque Averaging		●		
Torque Peak		●		
Self Diagnostics		●		
Internal Temperature Reading		●		
Deep grooved shielded bearings with oil lubrication	●	●		
Ingress Protection (IP) 54	●	●		
Link Cable (1.5m)	●	●		From sensor head to electronics module
Optional features				
Voltage Output ±1v FSD	◇		A	*In place of Option B*
Voltage Output ±10v FSD	◇		C	*In place of Option B*
Unipolar voltages	◇		U	*User to specify*
Current Output 0-20mA	◇		D	*In place of Options A,B & C*
Current Output 4-20mA	◇		E	*In place of Options A,B & C*
Current Output 12mA±8mA	◇		V	*In place of Options A,B & C*
Current Output 0-20mA, 4-20mA & 12mA±8mA		◇	F	*Current output is user selectable and in place of Voltage output. However user can reselect a Voltage output, if required. (Note 6)*
USB2.0 full speed 12 Mbps Digital output		◇	G	
CANbus output		◇	H	*In place of RS232*
High Speed Bearings	◇	◇	J	*Consult factory for maximum speed allowances*
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 - for sensor and electronics *(See Note 7 below)*	◇	◇	L	
Ingress Protection (IP) 65 connectors in lead b/w head & electronics	◇	◇	M	
Cavity 'D' connectors in lead b/w head & electronics	◇	◇	N	
Link Cable (>1.5m)	◇	◇	R	*Consult factory for length*
When you order a Torque Transducer please note that any torque/FSD is possible between ranges – please specify rated torque and options using the following format:				

Note 6. 2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque. Channel 2 (voltage/current) – speed or power, if ordered.
Note 7. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

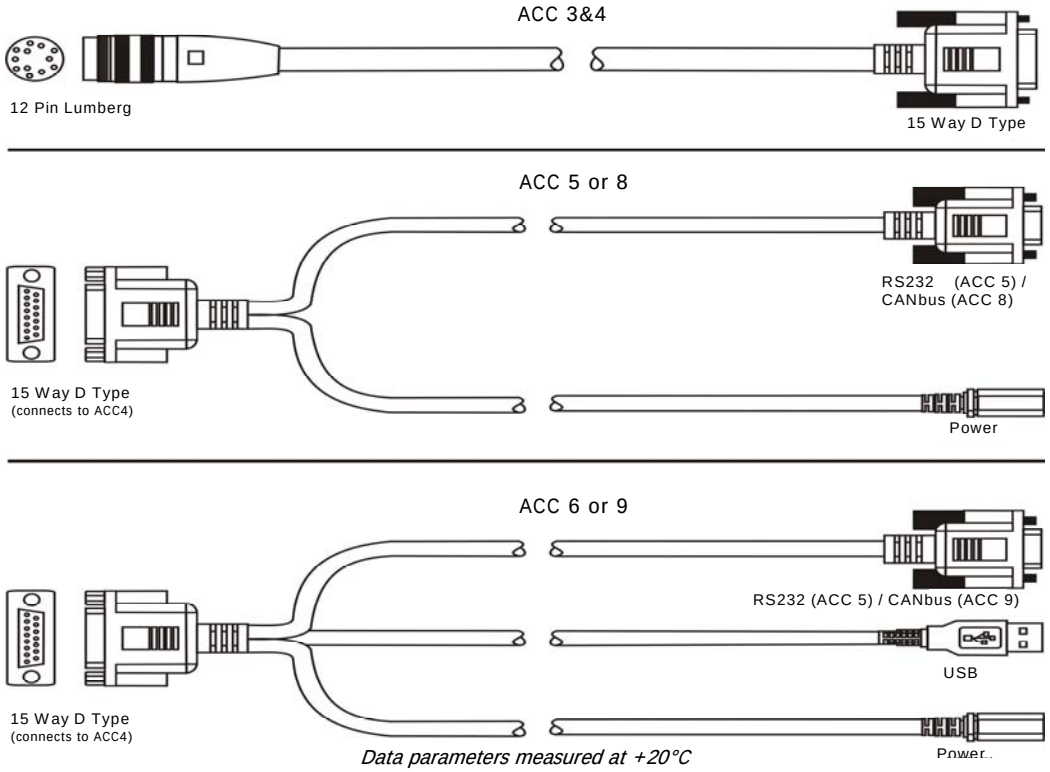
Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

RWT350/360 Series Torque Transducers – Connector and Lead Options

	RWT350/360 Series		Option Code	Remarks/Purpose
Connectors & Leads	**RWT350**	**RWT360**		
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 RWT 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 RWT 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 RWT to PC via RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to RS232, USB and Power Connectors*		◇	ACC 6	*For connecting RWT to PC via USB (Option G) or RS232* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus and Power Connectors*		◇	ACC 8	*For connecting RWT to PC via CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*
Digital Lead Adapter (Length 1m) *15 Way 'D' type (female) to CANbus, USB and Power Connectors*		◇	ACC 9	*For connecting RWT to PC via USB (Option G) or CANbus (Option H)* *[Also needs Digital Lead (ACC4) to connect to RWT]*

RWT350/360 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 2	
TorqView	TV	*Torque Monitoring Software*



Data parameters measured at +20°C

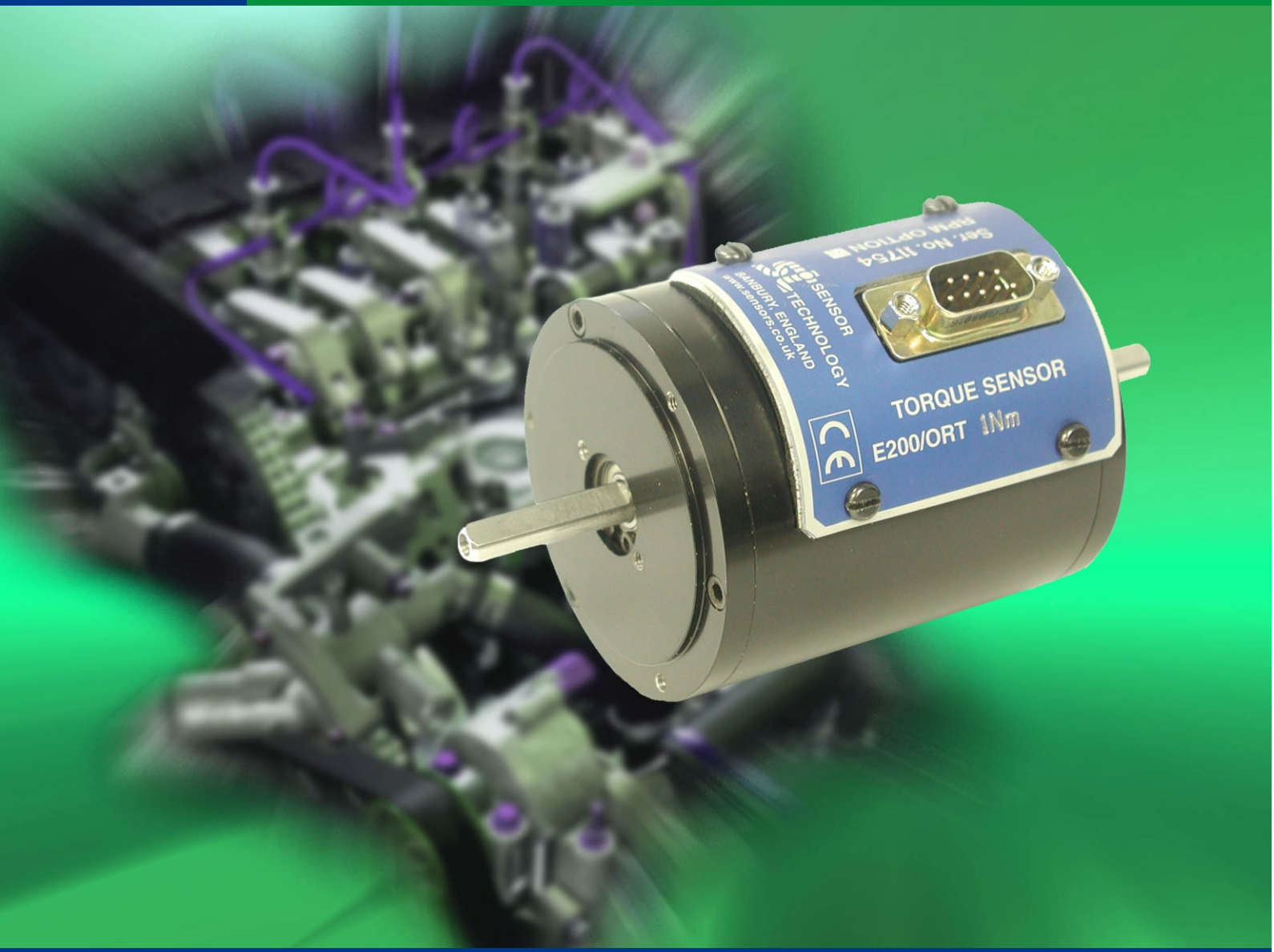
When you order a Torque Transducer please note that any torque/FSD is possible between ranges – please specify rated torque and options using the following format:

For example: ***RWT***	***351 - 100Nm -***	***CL***	A 'basic' transducer with torque and speed outputs, rated and calibrated to 100Nm FSD, ±10v and IP65 protection.
Your transducer requirement: ***RWT***			
Max speed (if applicable)		RPM	
Connector & Lead options		(if applicable) *See over*	
Additional related products		(if applicable) *See over*	

Glossary of terms and definitions used in this datasheet

- ***Surface Acoustic Wave (SAW)*** - An acoustic wave travelling along the surface of a material having some elasticity, with amplitude that typically decays exponentially with the depth of the substrate.
- ***Strain dependent SAW resonators*** – A type of elastic SAW device, which changes its resonant properties when it is subjected to axial strain/compression. TorqSense uses this principle, which is protected by a number of patents.
- ***Incremental Electronic Scan (IES)*** – The most successful and precise method for interrogating strain dependent SAW resonators. The IES interrogation method uses a processor controlled frequency synthesiser to excite the SAW resonators over a defined range of frequencies and measure the reflected signal. TorqSense uses this patented method.
- ***Resolution of the IES method*** - The minimum measurable number corresponding to the stress/strain sensitive resonance point of the SAW resonator. The value is limited by following the factors:
  - frequency resolution of the synthesiser, which is 1000 times greater then overall resolution of the system.
  - relationship between frequency response and resolution. Increments of the resolution will proportionally decrease the system's frequency response. TorqSense systems are optimised for the best performance that suits most applications. However, on the RWT360 series models customers do have the capability to adjust the system performance.
- ***Frequency response of the IES method*** – The measure of the TorqSense system's response at the output to a signal of varying frequency at its input. The frequency response is typically characterised by the magnitude of the system's response, measured in dB. There are two ways of characterising the system's frequency response:
  - 0.1dB frequency range, where the output magnitude of the signal is different to the input magnitude of the signal by not more then 0.1dB (practically absolutely identical).
  - 3dB frequency range, where the output magnitude of the signal is 0.707 of the input signal. This is a common standard for most applications, unless it specifically says otherwise. This standard is also used to characterise the TorqSense system's frequency response.
- ***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.

E200 ORT series
Torque Transducer
10mNm to 500Nm



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SENSOR TECHNOLOGY

E200 ORT Series Optical Rotary Torque Transducer

The E200 ORT Series (Optical Rotary Torque) Transducer offers, in conjunction with an E201/2 Display Interface, an ideal means for precise dynamic measurement of rotary and static torque less than 500Nm and for bandwidths up to 50KHz.

Benefits

- Operates both statically and dynamically clockwise/anticlockwise
- Non contact measurement
- High bandwidth (up to 50KHz)
- 200% safe mechanical overload
- Low intertia High Speed capability
- E200 ORT Transducers are compatible with our older D Series Instrumentation
- Lifetime warrenty

Software

TorqView is an easy to use advanced torque monitoring software available to assist data recording and instrumentation displays that interfaces with Windows based PCs. See TorqView datasheet.

Features: 3 types of display. Text files compatible with Matlab and Excel. Real time chart plotting.

LabView VIs are available for users to design their own process control applications.

DLLs are also available for users to write own custom software.

Technology

An extensively developed measurement principle is used, in which the intensity of light beams is measured by means of photovoltaic detectors, and the electrical output is used to provide precise indication of the applied torque transmitted by the shaft.
The use of this technique results in a transducer being able to sense torque bi-directionally, have a fast mechanical and electrical response, low inertia, and complete freedom from brushes or complex electronics. The absence of brush gear allows high-speed operation with a continuous rating of up to 30,000 RPM standard. Further increases in RPM are available as an option depending upon shaft size. The torque shaft is of low compliance ½° maximum torsion deflection on the smaller transducers, and ¼° maximum on the larger transducers, at full-scale deflection. The lamps providing the light source are selected to ensure long life and high stability with the light intensity automatically controlled within the transducer body by a monitor cell.

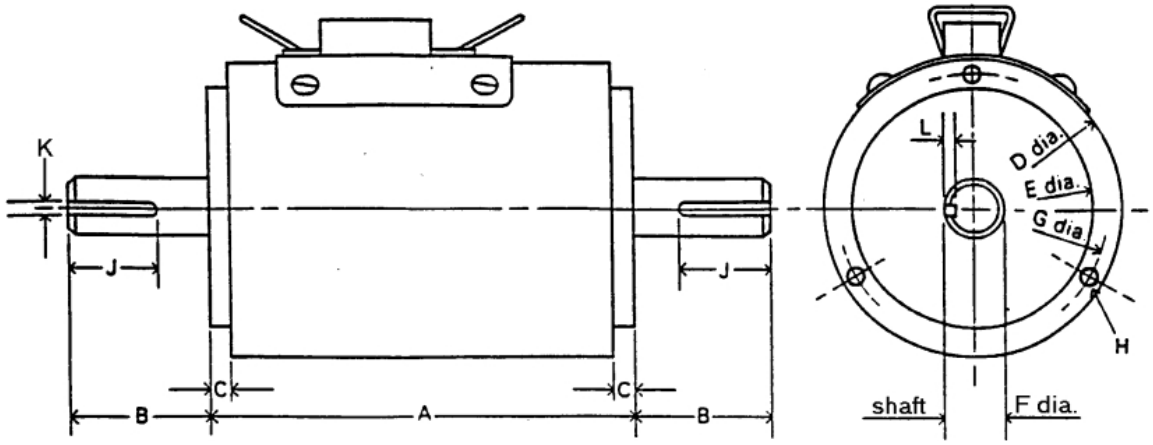
Standard Specifications

Model	Full Scale Deflection (Calibration in any of the units below is possible)							
	S.I		F.P.S		M.K.S		Max Speed (RPM)	Shaft type
E200ORT-1S	0-10	mNm	0-1	ozf.in	0-100	gf.cm	30,000	P
E200ORT-2S	0-20	mNm	0-2	ozf.in	0-200	gf.cm	30,000	P
E200ORT-1	0-50	mNm	0-5	ozf.in	0-500	gf.cm	30,000	P
E200ORT-2	0-100	mNm	0-10	ozf.in	0-1	kgf.cm	30,000	P
E200ORT-3	0-200	mNm	0-20	ozf.in	0-2	kgf.cm	30,000	P
E200ORT-4	0-500	mNm	0-50	ozf.in	0-5	kgf.cm	30,000	F
E200ORT-5			0-100	ozf.in			30,000	F
E200ORT-6	0-1	Nm	0-10	lbf.in	0-10	kgf.cm	30,000	F
E200ORT-7	0-2	Nm	0-20	lbf.in	0-20	kgf.cm	20,000	K
E200ORT-8	0-5	Nm	0-50	lbf.in	0-50	kgf.cm	20,000	K
E200ORT-9	0-10	Nm	0-100	lbf.in	0-100	kgf.cm	20,000	K
E200ORT-10	0-20	Nm	0-200	lbf.in	0-200	kgf.cm	20,000	K
E200ORT-11	0-50	Nm	0-500	lbf.in	0-500	kgf.cm	15,000	K
E200ORT-12	0-100	Nm	0-1000	lbf.in	0-10	kgf.m	15,000	K
E200ORT-13	0-200	Nm	0-100	lbf.ft	0-20	kgf.m	12,000	K
E200ORT-14	0-500	Nm	0-200	lbf.ft	0-50	kgf.m	12,000	K

P = Plain, F = Flat, K = Keyed

Standard

Cable length	2 metres - see options 3&4	Interface readout	E201/2
Outputs	From E201/2 module (±5V)	Safe mechanical overload	200% of rating
Power supply	From E200 interface	Memory	Embedded non-volatile memory chip
Accuracy	±1% FSD; ±0.5% to order	Hysteresis	Better than 0.1%
Bandwidth	50 KHz	Bearings	Deep grooved shielded bearings with oil lubrication- see options 5&6
Temperature range	-10ºC to + 50ºC	Temperature coefficient	Less than 0.05% per ºC



Mechanical Parameters

Model	Dimensions (mm)											
	A	B	C	D	E	F	G	H	depth	J	K	L
E200ORT-1s-E200ORT-3	75	25.4	1.5	62	50	6.35	56	M3	5	19.05	Plain	0.183
E200ORT-4 E200ORT-6	75	25.4	1.5	62	50	6.35	56	M3	5	19.05	Flat	0.183
E200ORT-7-E200ORT-10	105	38	1.5	62	50	12.7	56	M3	6.35	30	3.96	1.98
E200ORT-11-E200ORT-12	130	60	1.5	62	50	20	56	M3	11	53	6	3.5
E200ORT-13-E200ORT-14	135	60	4	88	70	30	80	M4	12.7	54	10	5

Options

Option	Description	Information/remarks
1	Optical RPM Pickoff	External dimensions are not affected
2	Transducer Sealing to IP65	Some external dimensions change. Maximum running speeds will be considerably reduced, and drag torque will increase - Consult factory
3	Extension Cable	Between 2 metres and 10 metres a standard or heavy-duty extension cable may be used. Please specify required length
4	Cable Driver	Between 10 metres and 120 metres, a cable driver is fitted close to the transducer together with an extension lead. Please specify required length
5	High Speed Bearings	At very high speeds, for better balance, we recommend plain or splined shafts – Consult factory See chart below for max speeds
6	Sealed Bearings	See chart below for max speeds

Max speed (Note: quoted in RPM with no radial or side loads)

Option	E200 ORT-1S E200 ORT-6	E200 ORT-7 E200 ORT-10	E200 ORT-11 E200 ORT-12	E200 ORT-13 E200 ORT-14
5	Consult factory	30,000	25,000	20,000
6	15,000	12,000	9,000	7,000
Standard	30,000	20,000	15,000	12,000

Data parameters measured at 20ºC

E200 ORT Torque Transducer Display Interface

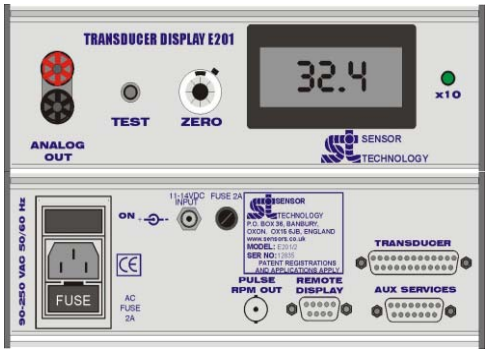
A Transducer Interface is required with the E200 ORT Series (Optical Rotary Torque) Transducers.

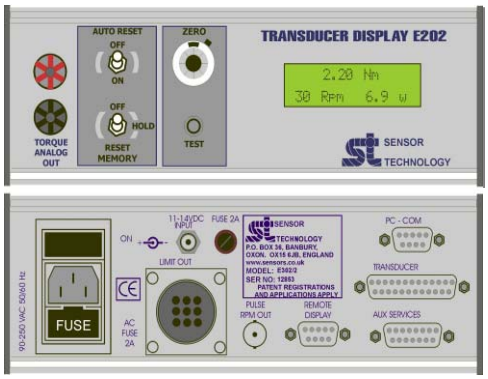
Two models are available, the E201 is a basic transducer display, whereas the E202 is a more advanced unit offering many additional features.

A typical E Series Transducer Display unit. Front panel varies depending on model.

Common Features

- E201/E202 automatically detects and sets the full-scale range of any E200 transducer.
- The display is automatically programmed to read the full scale of the transducer.
- ±5v analog output for Torque FSD.
- 90-250V AC or 12V DC operation.





Additional Features for E202

- Operates independently or under control from remote PC.
- Operates with TorqView to give advanced display modes (see TorqView data sheet).
- 2 external analog input channels. (**Option only**)
- Peak readings can be displayed and reset manually or automatically.
- Options menu to allow user to:
  - Set torque limits.
  - Average torque readings.
  - Set instrument display to feature other options (e.g. analog inputs).
  - Fast record facility.

Additional Features for E202 (if Optical RPM pickoff fitted to E200 transducer)

- Speed and power displayed.
- Options menu also allows user to:
  - Average speed readings.
  - Adjust speed output full scale setting.

Data parameters measured at 20ºC

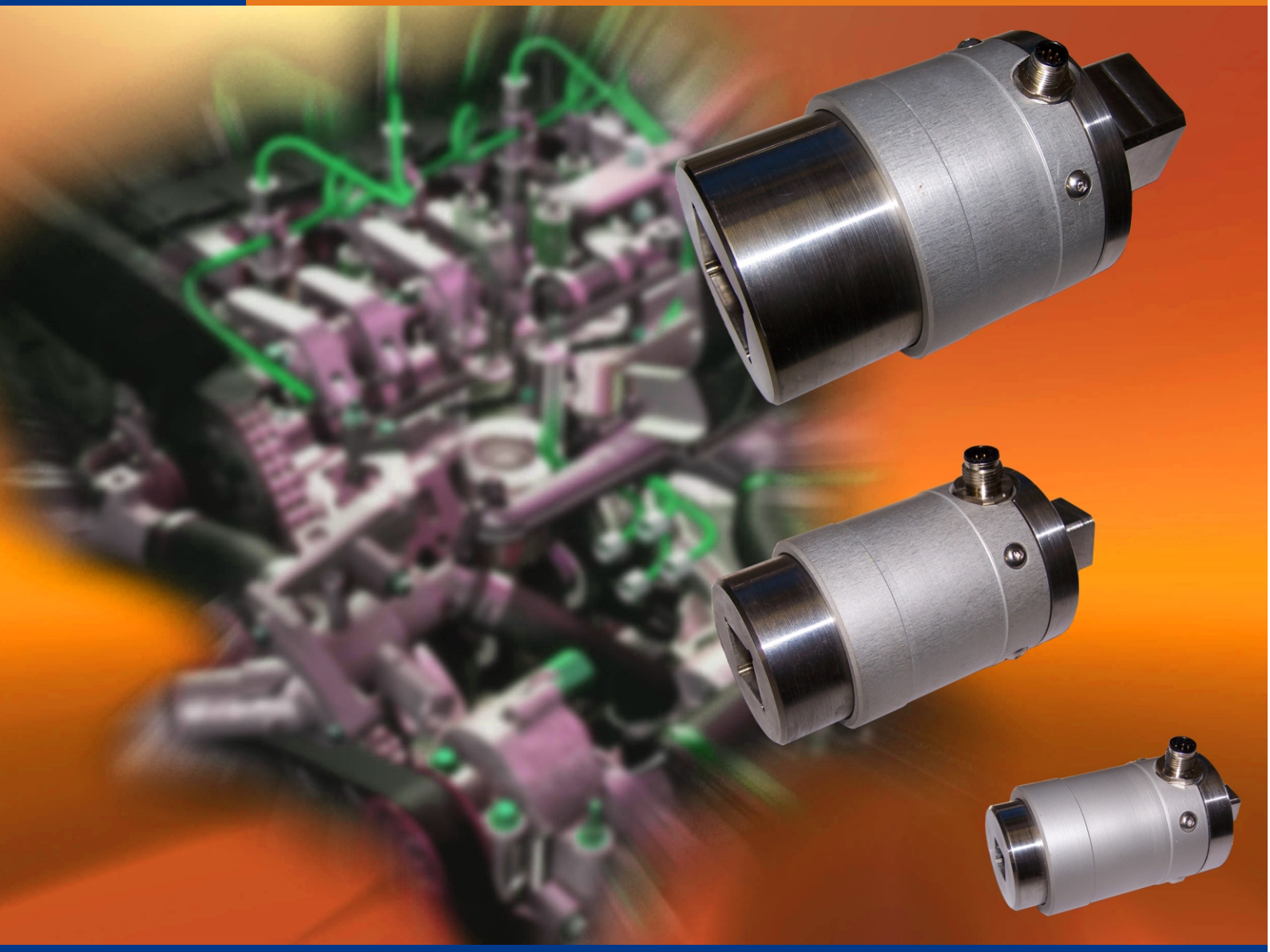
Display Interface Technical Data and Option Sheet

		E201	E202	Option	
Display Interface Accuracy	±0.1% Digital readout	●	●		
Resolution	0.1% Digital readout	●	●		
	0.05% Analog out	●	●		
Display	LCD (max 1999) with x10 LED indicator	●			
	LCD 16 x 2		●		
Analog Bandwith	50KHz @-3dB	●	●		
Local display update rate	10 times/sec		●		
Overall Size (mm)	220w x 290d x 100h (Aluminium enclosure)	●	●		
Fitted Tilt Feet		●	●		
Weight (nominal)	2.5Kg (5lb 10 oz)	●	●		
Temperature Range	-10°C - 50°C	●	●		
Front Panel (Language)	English	●	●		
Power Supply	90-250v AC, 50-400Hz, 20W, IEC connector. 11-14 v DC 1 A 2.1mm jack reverse polarity protected	●	●	1	-
	Power Input - 24v	○	○		a
Torque Analog Output	Analog Output ±5v FSD	●	●	2	-
	Analog Output ±1v FSD	○	○		a
	Analog Output ±10v FSD	○	○		b
	Analog Output +0.5v (fsd ccw) +2.5v(zero) +4.5(fsd cw)	○	○		c
	Analog Output 4-20 mA	○	○		d
Speed Analog Output (Specify RPM FSD required) (Speed pickoff on Transducer reqd)	RPM Analog +1v for FSD		○	3	a
	RPM Analog +5v for FSD		○		b
	RPM Analog + 10v for FSD		○		c
	RPM Analog 4-20 mA for FSD		○		d
Power Analog Output (Specify Power FSD required) (Speed pickoff on Transducer reqd)	Power Analog +1v for FSD		○	4	a
	Power Analog +5v for FSD		○		b
	Power Analog + 10v for FSD		○		c
	Power Analog 4-20 mA for FSD		○		d
Serial Output	TORQVIEW		○	5	a
	RS232		○		b
	Optical Fibre Transmitter for RS232		○		c
	RS 422 Output 4800 baud		○		d
	USB Adaptor		○		e
Auxiliary Inputs	4-20mA		○	6	a
	AC RMS (50-400Hz)		○		b
	Dual Analog inputs + 1v		○		c
	Dual Analog inputs +5v		○		d
	Dual Analog inputs +10v		○		e
External Limit Outputs	Limit output (relay)		○	7	a
	Limit output (opto)		○		b
	Limit output TTL/HC +5v positive logic		○		c
Extended Cable Driver	Over 10 Metres		○	8	a

● – Standard ○ – Option available

Data parameters measured at 20°C

SIT 105/110/120 Series
Torque Transducer
50Nm to 5000Nm



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SIT 105/110/120 Strain Gauge In-Line Torque Transducer

The SIT 105/110/120 strain gauge reaction transducers are designed for operation in any industrial environment.

Models are available in sizes ranging from 50Nm to 5000Nm, offering outputs from mV/V outputs, to ratiometric voltage outputs, to digital data connection via RS232 or USB.

An option of a bench mount housing is available for torque wrench test and calibration.

Technology

The SIT 105/110/120 torque transducers use modern wire foil strain gauge technology with the latest high performance stainless steel shafts

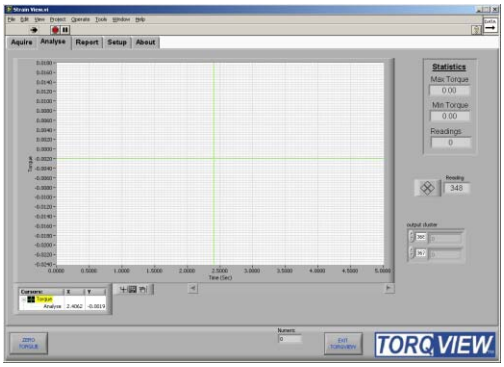
Software

TorqView is an easy to use advanced torque monitoring software, available to assist data recording and instrumentation displays that interface with Windows based PCs. See TorqView datasheet.

Features: 3 types of display. Text files compatible with Matlab and Excel. Real time chart plotting.

LabView VIs are available for users to design their own process control applications.

DLLs are also available for users to write their own custom software.



SIT 105 transducers offers:

- Calibrated 1mV/V output

SIT 110 transducers offers:

- Scaled ratiometric voltage output, 2.5V zero, 4.5V CW FSD 0.5V ACW FSD

SIT 120 Transducers offers:

- Ratiometric voltage output as above
- RS232 output for connection to PC

SIT 120 Extension Module also offers:

- USB digital output
- User scalable voltage or current outputs, ±1V to ± 10V, 4-20mA bipolar and unipolar

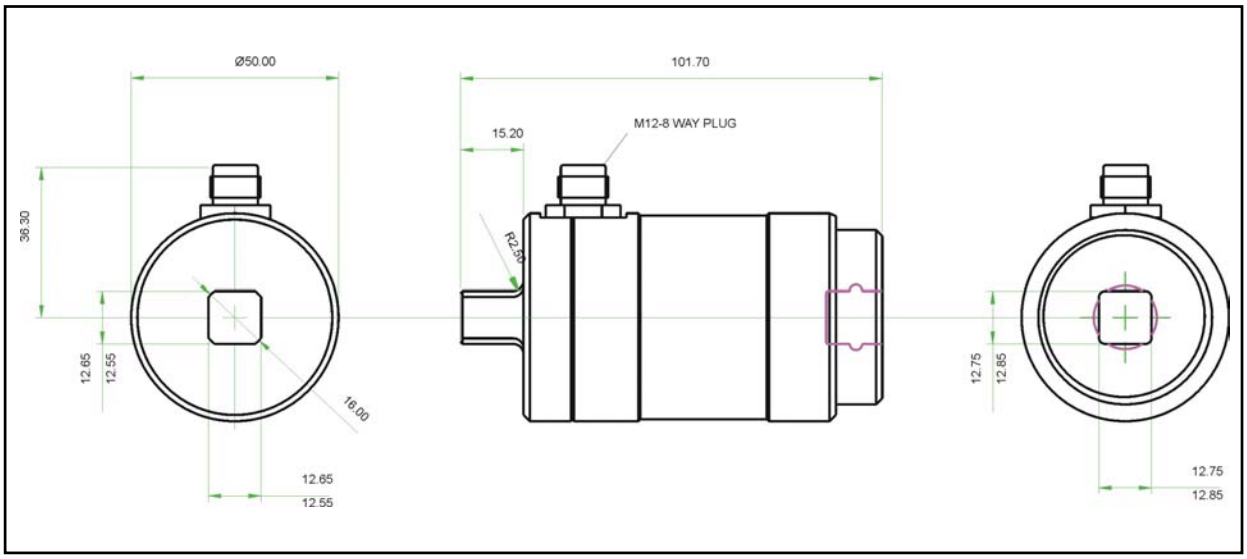
SIT 105/110/120 Series Strain Gauge Torque Transducers - Data Specification

Parameter	Condition	Data				Units
SIT105/110/120 Static torque measurement system						
Measurement method	DC Strain Gauge bridge with calibration and temperature compensation					
Torque range	***Note 1***	50, 100, 200, 500, 1000, 2000, 5000, 10000 50, 100, 200, 500, 1000, 2000, 5000, 10000				Nm lbf.ft
Drive size		1/2 (up to 200Nm)	3/4 (up to 500Nm)	1 (up to 2000Nm)	1 1/2 (Above 2000Nm)	Inch
Temperature						
Measurement method	Static torque measurement system based on Strain Gauge technology					
Temperature accuracy		±0.5				^{0}C
Ref. Temp., T_{RT}		20				^{0}C
Operating range, ΔT_O		-10 to 50				^{0}C
Storage range, ΔT_S		-20 to 60				^{0}C
Temperature drift (FS)	Uncompensated	Consult Factory				%FS/^{0}C
	Compensated	Consult Factory				%FS/^{0}C
SIT105/110/120						
Linearity		0.05				%FS
Hysteresis		0.05				%FS
Resolution		0.005				%FS
Frequency response		Up to 5KHz (digital output), Up to 8KHz (Analog output)				Hz
Accuracy	20^{0}C, SM *(See Note 2)*	±0.6 @ 5KHz ±0.1 @ 310KHz ±0.06 @ 155KHz ±0.025 @ 40Hz				%FS
Averaging	*(See Note 3)*	From 1 to 128				N
Analog output						
Output voltage		SIT105 = mV/V SIT110 = 0.5v (ACW FS) – 2.5v (zero) – 4.5v (CWFS) SIT120 = As Above, (±1v to ±10v & 4-20mA Output available via SIT120 Extension module (OPTN-X))				Vdc
Load impedance		5k				KΩ
Digital output (SIT120 Series Transducers ONLY)						
Output type	RS-232 (standard), USB (via SIT120 Extension Module (OPTN-X)					
Sampling rate	See User Guide for details	4.5Ksps (min) –5.5Ksps (max)				ksps
Power supply						
Nominal voltage, V_S		10 to 18				V
Current consumption, I_S		80 (max)				mA
Power consumption, W_S		1.2 (max)				W
Allowed residual ripple of excitation voltage, V_{rip}		20				mVp-p
Electromagnetic compatibility						
EMC compatibility		EN 55011 & EN 61326-1 (JG)				

Note 1. Other sizes are possible. Consult factory for details.
Note 2. SM – Static Mode. Dynamic values will depend upon user application and has to be adjusted accordingly.
Note 3. Digital averaging can be configured by user to optimise accuracy/frequency response for specific user applications. Digital averaging default setting is N=32. For details see User Manual.

SIT 105/110/120 Series Strain Gauge Torque Transducers

Dimensions (50 – 200Nm)



Parameter	Data			Units
Mechanical Properties				
Torque (Max)	50	100	200	Nm
Shaft Code	CA	CB	CC	
Drive Size	1/2			Inch
Max measurable load limit	120 (of rated torque)			%
Static safe load breaking	200 (of rated torque)			%
Transducer weight, approx	TBC			Kg

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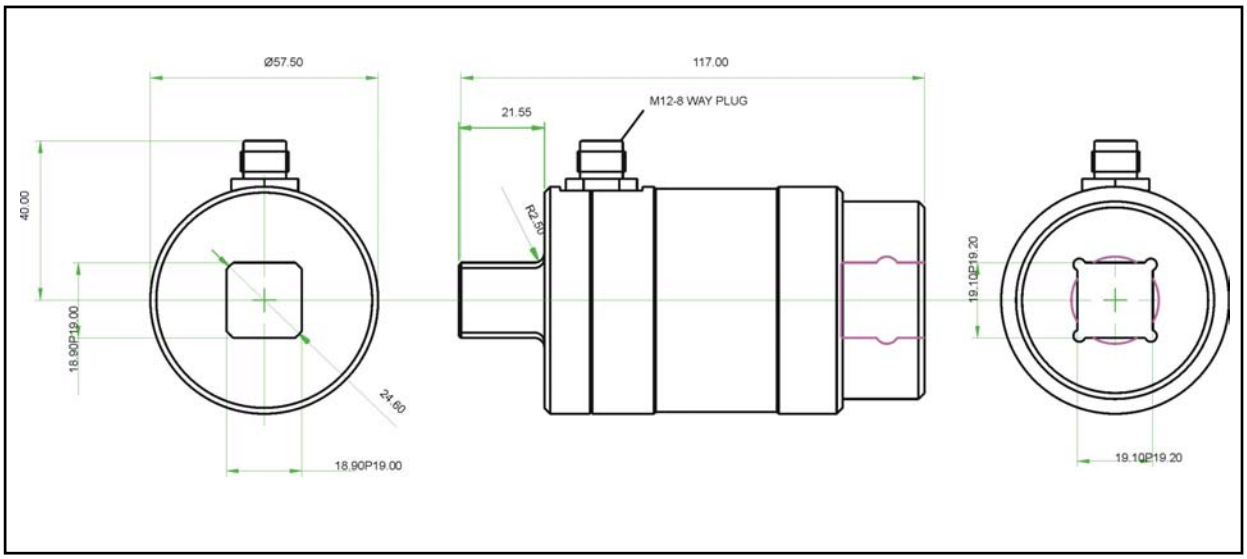
SIT 105/110/120 Series Strain Gauge Torque Transducers

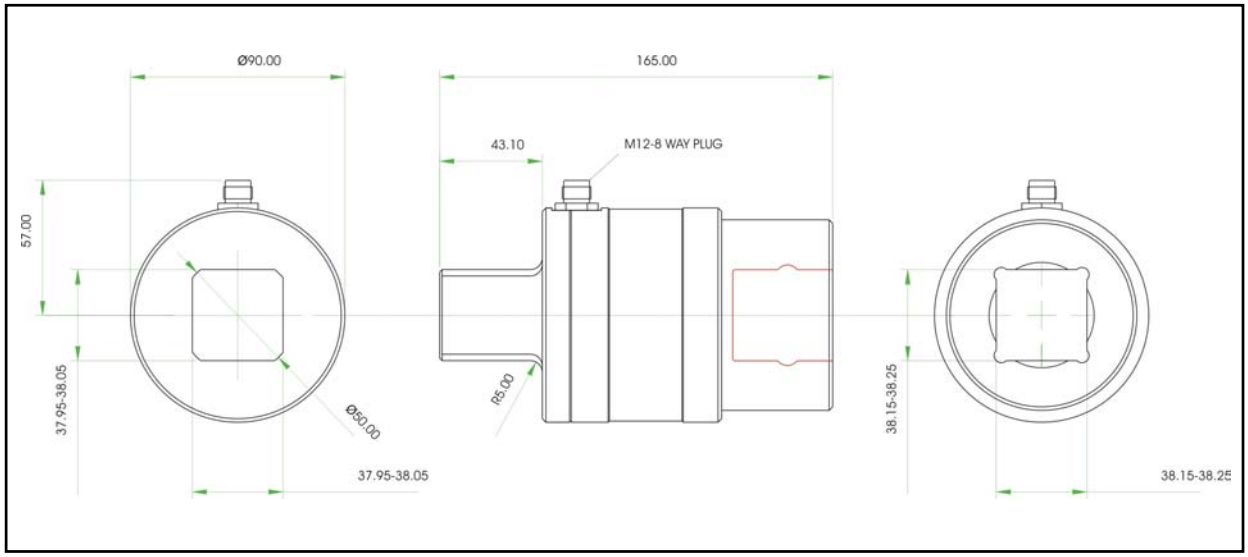
Dimensions (201 – 500Nm)



Parameter	Data	Units
Mechanical Properties		
Torque (Max)	500	Nm
Shaft Code	DA	
Drive Size	3/4	Inch
Max measurable load limit	120 (of rated torque)	%
Static safe load breaking	200 (of rated torque)	%
Transducer weight, approx	1.3	Kg

SIT 105/110/120 Series Strain Gauge Torque Transducers

Dimensions (1001 – 5000Nm)



Parameter	Data		Units
Mechanical Properties			
Torque (Max)	2000	5000	Nm
Shaft Code	FA	FB	
Drive Size	1 1/2		Inch
Max measurable load limit	120 (of rated torque)		%
Static safe load breaking	200 (of rated torque)		%
Transducer weight, approx	4.5		Kg

SIT 105/110/120 Series Strain Gauge Torque Transducers - Standard Range

● – Standard feature ◇ – Optional feature

	SIT 105	SIT 110	SIT 120	Option Code	Remarks
Standard features					
M / F Square ends	●	●	●		
mV / V Output	●	●	●		
Ratiometric voltage output 2.5V ± 2.5V FSD		●	●		
Internal temperature reading / correction		●	●		
RS232			●		
Optional Features					
Round Shaft ends (with keyways)	◇	◇	◇	K	
Plain shaft ends (no keyways)	◇	◇	◇	P	
Bench mount housing	◇	◇	◇	Y	
SIT120 extension module			◇	X	*USB output ±1V to ±10V output. 0-20 mA or 4-20mA output. User adjustable (includes lead to transducer)*

SIT 105/110/120 Series Strain Gauge Torque Transducers - Connector and Lead Options

	SIT 105	SIT 110	SIT 120	Remarks
Leads				
ACC – 11	◇	◇	◇	*Open ended for user to self wire*
ACC – 12	◇	◇	◇	*With 15 way 'D' connector for easier system integration*

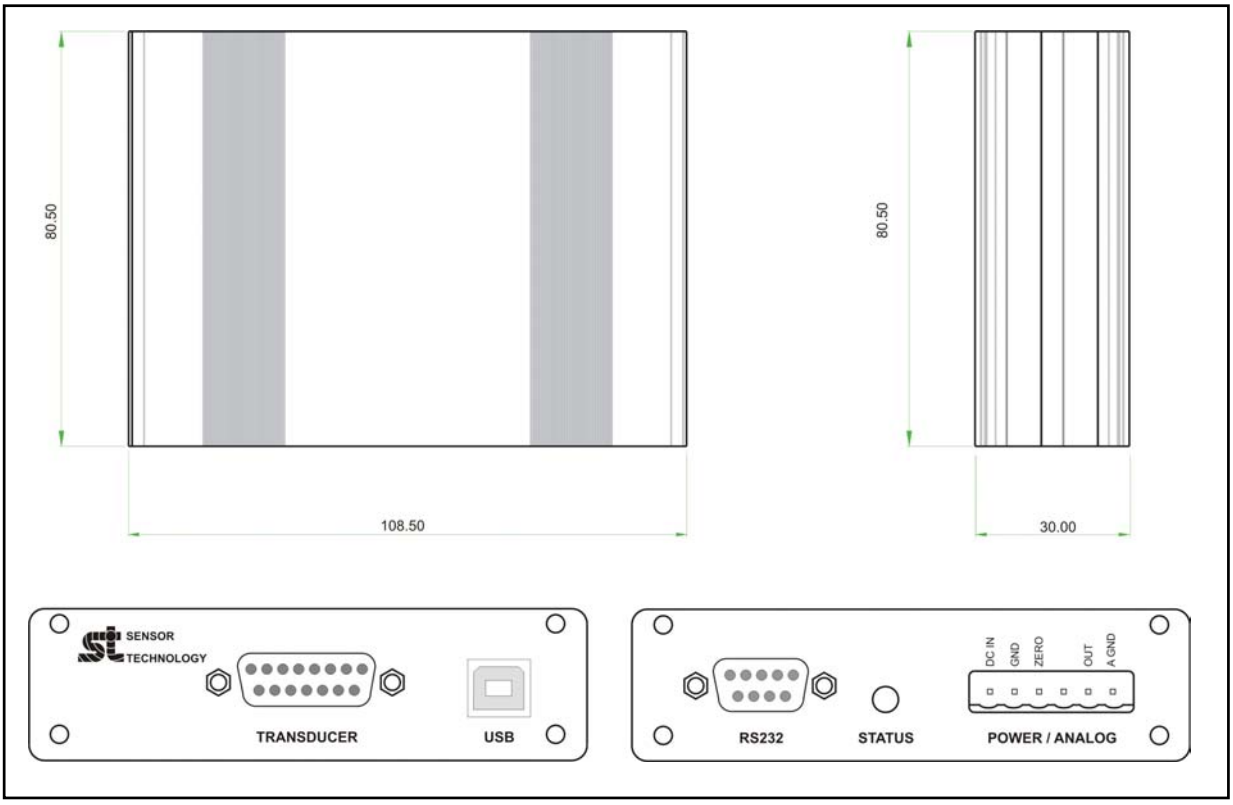
SIT 105/110/120 Series Strain Gauge Torque Transducers – Additional related products

	Code	Remarks/Purpose
Transducer Display ETD	ETD	*Display readout*
AC Mains Adapter Power Supply	PSU 1	*For providing 12Vdc*
Transducer Signal Breakout Unit	SBU 1	
TorqView2	TV2	*Torque Monitoring Software*

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.

SIT 120 Mulit Function Interface box



Features

The SIT Multi Function Interface Box is used as an optional accessory to the SIT 120 and takes the 2.5V zero ± 1.5V analog Voltage from the transducer head and provides additional user configurable analog outputs via Transducer Control software (provided).

Power supply	**Data**	**Unit**
Voltage	9 – 18	VDC
Ripple	< 50	mV
Current	TBC	mA

Physical		
Enclosure	Height 30 x Width 108.5 x Length 80.5	mm
Temperature Range	-10 to +50	°C
Temperature Stability	TBC	%/°C

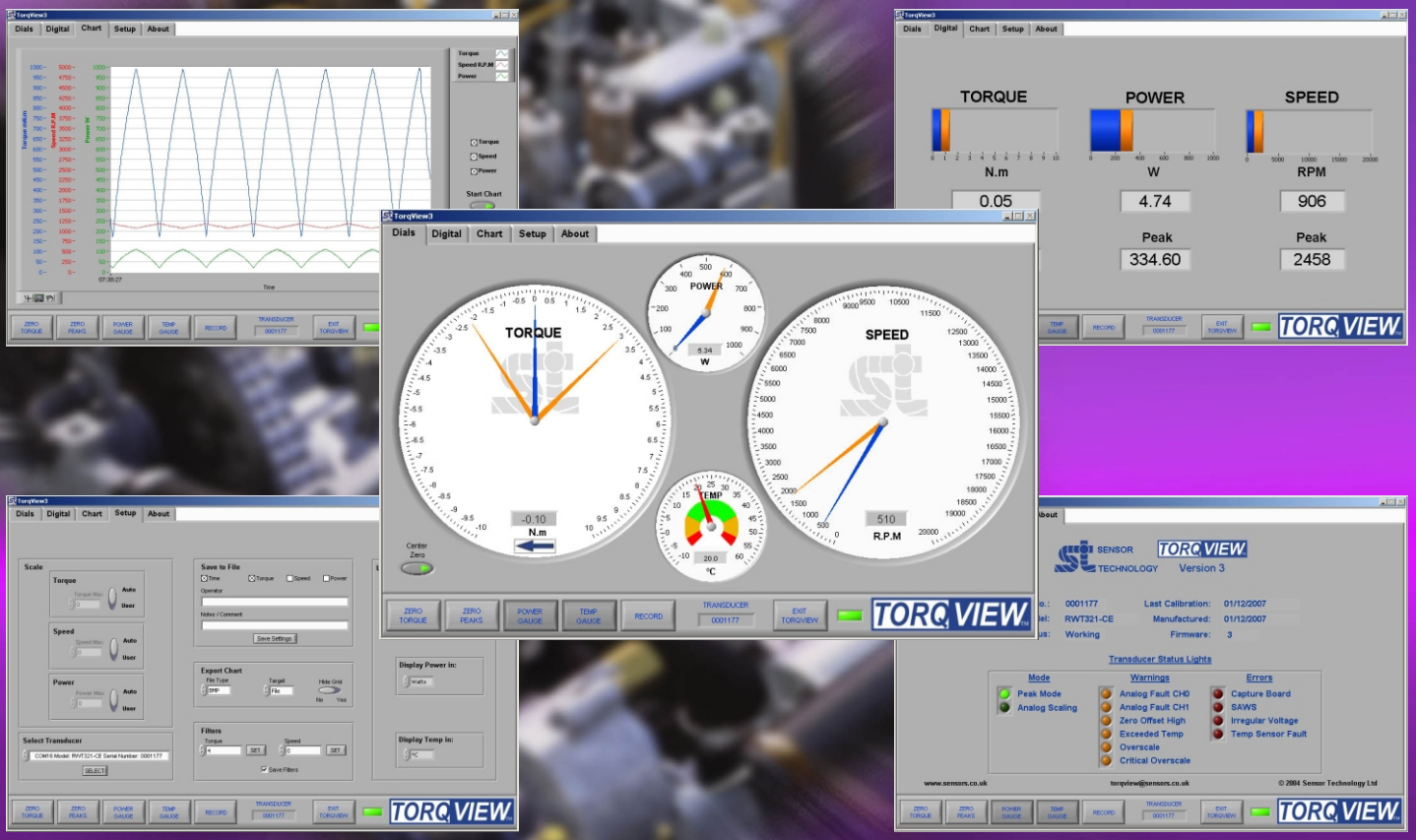
Digital		
RS232	115	kbps
RS232 Sampling Rate	4200	Samples / Sec
USB	USB 2.0 full speed (12Mbps)	Mbps
USB Sampling Rate	Up to 6000	Samples / Sec

Analog Output		
FSD Voltage Output	User configurable ± 10 ± 5 ± 1	VDC
Min Load Impedance	1	KΩ
Current Output	User configurable 0-20 4-20	mA
Max Loop resistance	500	Ω

Electromagnetic Compatibility		
EMC Compatibility	EN 61326:2006	

TORQVIEW

Advanced Torque Monitoring PC Interface Software



SENSOR TECHNOLOGY

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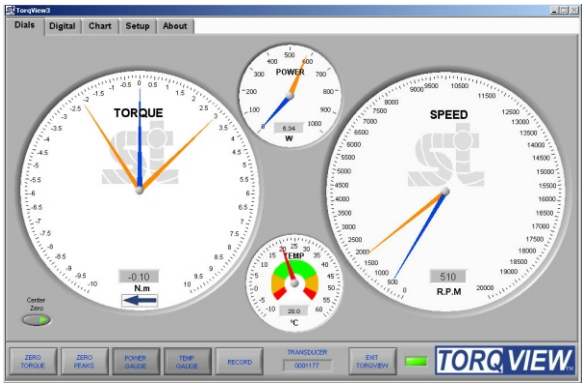
TORQVIEW

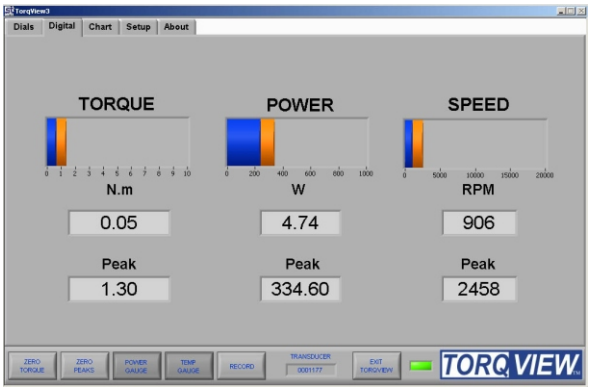
SENSOR TECHNOLOGY

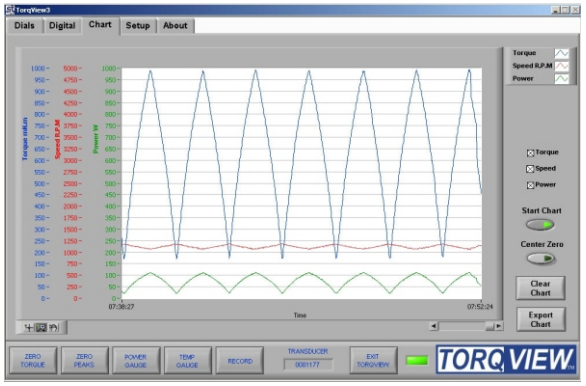
Advanced Torque Monitoring PC Interface Software

TORQVIEW is an easy to use advanced torque monitoring software available to operate in conjunction with the RWT320 and RWT340 Series Transducers to provide a flexible display, real time plotting and data recording facility.



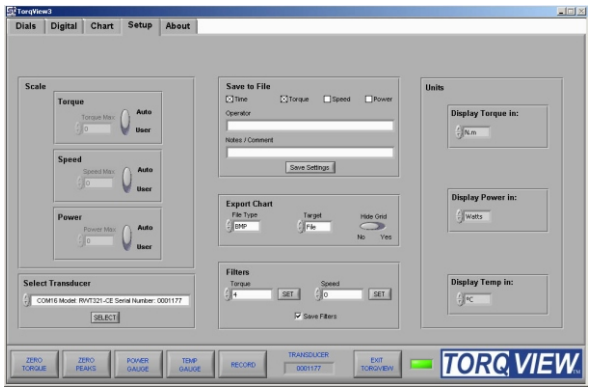
TORQVIEW has been written using National Instruments LabVIEW, and as it is a self running executable file so LabVIEW is not required to run this software.





Hardware requirements (Recommended)

Sensor Technology recommends a PC running Windows 2000, XP or Vista with a minimum of 256 MB of RAM; a minimum screen resolution of 1024 x 768 pixels; a Pentium III, Celeron 600MHz or equivalent processor; and a minimum of 200MB free disk space



Benefits

- Simple installation using serial port or USB.
- Ease of operation (user friendly, a variety of user interface settings such as scales, units, etc.)
- 3 types of display: dials, digital bars and chart graph.
- Wide choice of displayed units (SI, FPS and MKS)
- Displays torque, RPM, power and temperature. Output a text file compatable with Matlab, Excel.
- LabView VIs available for users to design their own Interfaces
- DLLs available for users to write their own custom software process control applications.
- Data recording facility.
- User configurable settings

January 2008. TSE2099R

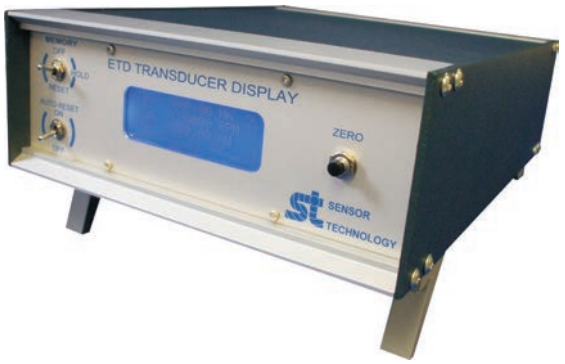
Transducer Display ETD

Introduction

The Transducer Display ETD is a readout suitable for all RWT and SIT transducers. Although it is primarily used to display torque and peak torque, it can also display speed* and power*, provide access to the analog outputs from the transducer and connect the transducer to a PC for use with TorqView and the Transducer Control Program.

Benefits

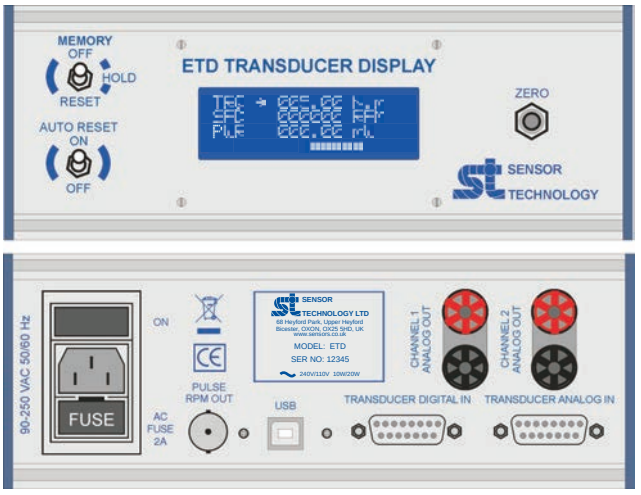
- Displays torque, peak torque, speed* or power* in the units specified within the transducer.
- Automatically detects and displays the model, range, serial no. and calibration due date of the transducer.
- Provides auto reset of peak torque values.
- Provides power to the transducer in place of the standard power supply unit.
- Provides access to analog torque outputs and pulse speed* output.
- Provides USB output if used with RWT320/340 series with USB option fitted.
- Displays warnings and high temperature if appropriate.



* Provided RWT transducer has speed option fitted and enabled

Technical Data

Display	LCD 20 x 4 STN BLUE
Display update rate	4 Hz
Overall size	220w x 290d x 100h (Aluminium enclosure)
Weight	1.76 Kg
Operating temperature range	-10°C - 50°C
Power supply	90-250v AC, 50-60Hz, 10W, IEC connector
Channel 1 analog output	As specified by transducer
Channel 2 analog output	As specified by transducer
Pulse RPM out	TTL compatible
Serial output	USB Type B
Connection to transducer	Cable ACC-04



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

System Rental

“A Unique Service from Sensor Technology”

General

Sensor Technology Ltd offers a unique System Rental Service for all their standard Transducers, Display Interface Readout Systems and Software.

Suitable for:

- Short term Research or Development programmes.
- Cash flow or budgetary reasons.

The equipment or system is offered on short or long term rent, with an option to purchase which may be exercised at any time during the rental term.

An outline of our rental terms is below but please see over for our full Rental Terms and Conditions:

Rental Period

Minimum rental is one month. The hire starts from the time the equipment is delivered to the customer or at an agreed site, and continues until the equipment is returned to our premises. NOTWITHSTANDING THAT A DIFFERENT RENTAL TERM IS SETFORTH ON THE CUSTOMERS PURCHASE ORDER.

Option to Purchase

Allowance if converted to purchase:
75% of rentals paid for first 6 months.
50% of rentals paid thereafter.

Insurance

Equipment is to be insured for retail value by hirer until it is returned to Sensor Technology. Any damage to equipment will be charged to the hirer.

Rental Charges

1st Month	- 14% of purchase price.
2nd Month	- 11% of purchase price.
3rd Month	- 8% of purchase price.
4th Month and subsequent months	- 7% of purchase price.

Part months will be charged on a daily pro-rata basis. One month = 30 days.

Invoiced on dispatch-1st months payment on delivery.

Subsequent months - Net 30 days from invoice for approved accounts.

Carriage and Packing will be charged at cost.

Please see over for full Rental Terms and Conditions.
We will be pleased to quote price and delivery for your exact requirements.

Rental Terms & Conditions

BY ACCEPTANCE AND USE OF THIS EQUIPMENT, THE CUSTOMER IS BOUND BY THE TERMS AND CONDITIONS OF THIS AGREEMENT:
THE CUSTOMER'S SIGNATURE IS NOT REQUIRED. No modification of the terms of this Agreement shall be allowed unless agreed in writing and signed by us.

1. Period of Hire
The period of hire shall be for a minimum of one month and thereafter extendible monthly or part thereof. The hire starts from the time the equipment is delivered to the customer or an agreed site, and continues until the equipment is returned to Sensor Technology Ltd's premises **NOTWITHSTANDING THAT A DIFFERENT RENTAL TERM IS SETFORTH ON THE CUSTOMERS PURCHASE ORDER.**

2. Hire Charge
All prices quoted are net ex-works and exclusive of VAT, which will be charged at the prevailing rate at tax, point date. Sensor Technology Ltd reserves the right to alter the rental charge for equipment already on hire and will give reasonable notice to that effect. An option to purchase is available.

3. Delivery
Shipments will be made by an approved carrier and at the customers' expense. Sensor Technology Ltd will use all reasonable endeavours to meet quoted delivery dates but will not be liable for delay in delivery arising from whatever cause.

4. Acceptance of Equipment
Unless Sensor Technology Ltd is notified within 48 hours of receipt of equipment by the customer, the equipment will be held to have been delivered in good operating condition and to be in complete accordance with the customers order.

5. Repair & Replacement of Equipment
Sensor Technology Ltd shall at its expense endeavour to repair any item of equipment that becomes defective during the rental period through no fault of the customer or his staff. In the event that any item does not operate properly, the customer shall notify Sensor Technology Ltd and request instructions before taking remedial action or returning same to Sensor Technology Ltd. In the event that equipment cannot be repaired, Sensor Technology Ltd will endeavour to provide a suitable replacement. In the event that any item of equipment requires repair or calibration as a result of negligence, misuse or abuse of such item by the customer or his employees, the customer will bear the entire cost of any such repair or calibration, including transportation costs. Sensor Technology Ltd does not warrant the merchantability of the equipment or its fitness for any particular purpose or use.

6. Customers Obligations
The customer shall during the continuance of the hire period:

   A Keep the said equipment at the delivery address and in the customers own possession and not remove the same from such address without first notifying Sensor Technology Ltd in writing of its destination and in any event, not allowing said equipment to be transferred to any country prohibited by the Department of Trade and Industry or the US Department of Commerce.
   B Repay Sensor Technology Ltd on demand all costs, charges and expenses incurred in any way by reason of any breach of these terms and conditions by the customer including but not by way of limitation, all costs, charges and expenses incurred in ascertaining the equipments whereabouts.
   C Keep the equipment in good condition and not subject to any misuse - normal wear and tear accepted - while the said equipment is in the customers possession.
   D Permit Sensor Technology Ltd or their authorised representative at all reasonable times to enter upon premises or vessel where the said equipment may be inspected, repaired or tested.
   E Preserve Sensor Technology Ltd's identification marks or any nameplate that should be upon the said equipment.
   F Notify Sensor Technology Ltd in writing immediately, of any loss or damage to the said equipment and, on demand, reimburse Sensor Technology in respect thereof within 30 days of the occurrence the full cost of repair or replacement. Where the equipment is damaged the hire charges will continue until the equipment is delivered to our Laboratory.
   G Arrange at the customers expense, adequate insurance coverage for the loss or damage of the equipment from the moment it is received with the customer (or delivered to a designated site) until the said equipment is received at our Laboratory. Alternatively the customer may request and Sensor Technology Ltd may agree to arrange insurance cover for the equipment and Sensor Technology will charge and the customer will pay for such insurance.
   H Take all reasonable and practical steps to ensure that the equipment use conforms with all Government statutes (particularly the Health and Safety at Work Act 1974 section 2(2)(b) and 2(2)(c)). Further to be responsible for and indemnify Sensor Technology Ltd against any loss, damage, injury, death to person or property for whatever reason.
   I Not sell, assign, sub-rent or transfer the benefit of the contract in part or in whole or to part with possession of the said equipment or any part of it at any time during the rental.
   J Not make any alterations, modifications, or technical adjustments or do or attempt to do any repairs to the said equipment without the written consent of Sensor Technology Ltd.
   K Any items or non-expendable material not returned to Sensor Technology Ltd will be charged to the customer at the full replacement cost or £25-00 which ever is the greater.

7. Payment Terms
Payments shall be due within 30 days of date of invoice. In addition, if any such rental fee or other amount remains unpaid more than 30 days after the date it is due, Sensor Technology Ltd shall have the right to charge interest at the rate of 2% per month on sums unpaid calculated from the date due until payment. In the event that payment is not received 30 days after the due date, Sensor Technology Ltd has the right to terminate the agreement and recover the equipment at the customers expense without prior notice.

8. Cancellation
If the customer cancels part or all of the agreement prior to commencement of the rental, such cancellation can only be accepted with Sensor Technology Ltd's consent and on terms that indemnify against loss.

9. Rental Rates and Discounts
Rental rates and discounts may be subject to change without prior notice. At present they are: 1st Month - 14% of purchase price; 2nd Month - 11% of purchase price;3rd Month - 8% of purchase price; 4th Month and subsequent months - 7% of purchase price. Part months will be charged on a daily pro-rata basis. One month = 30 days. Carriage and Packing will be charged at cost. Should the customer wish to subsequently purchase the equipment, 75% of rental paid for the first 6 months will be allowed and 50% of the rental paid for subsequent months will be allowed.

10. Termination of Hire
The hire is terminated when the equipment is returned to Sensor Technology Ltd's premises or when the customer has arranged for collection with Sensor Technology Ltd.

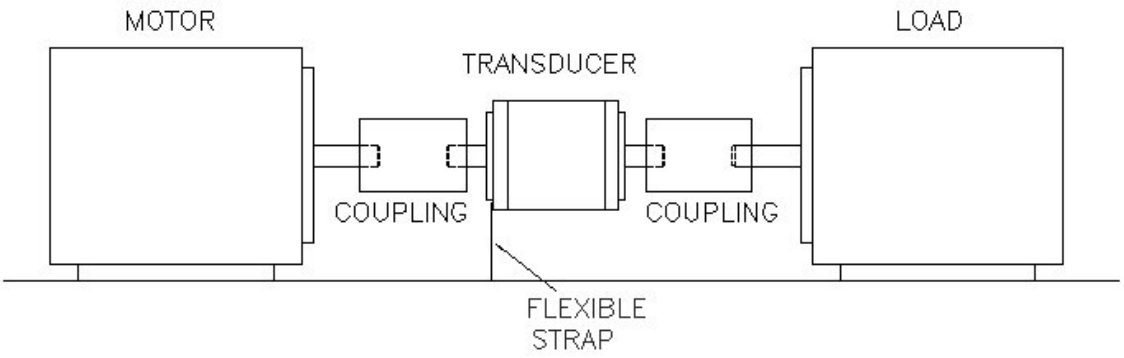
11. Return of Equipment
It is the customer's responsibility to return the equipment at the expiry termination by his own transport or an approved carrier OR to make the equipment available for collection by Sensor Technology Ltd's nominated transport. In either case the customer retains the responsibility to ensure the safety and securit of the equipment until the equipment is received at Sensor Technology Ltd's premises. Sensor Technology Ltd packing materials are chargeable in full if not returned upon termination of the hire.

Rotary Torque Transducer Installation Guide

To get the best from your RWT Series or E200 Series Rotary Torque Transducer it is essential that it is correctly installed.

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.

For rotary torque transducers **with torque ranges more than 1Nm (10lbf.in.)** it is recommended that the body of the transducer is not rigidly mounted but restrained from rotation using a strap or straps connected to the tapped holes in the end plates. 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, 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 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.

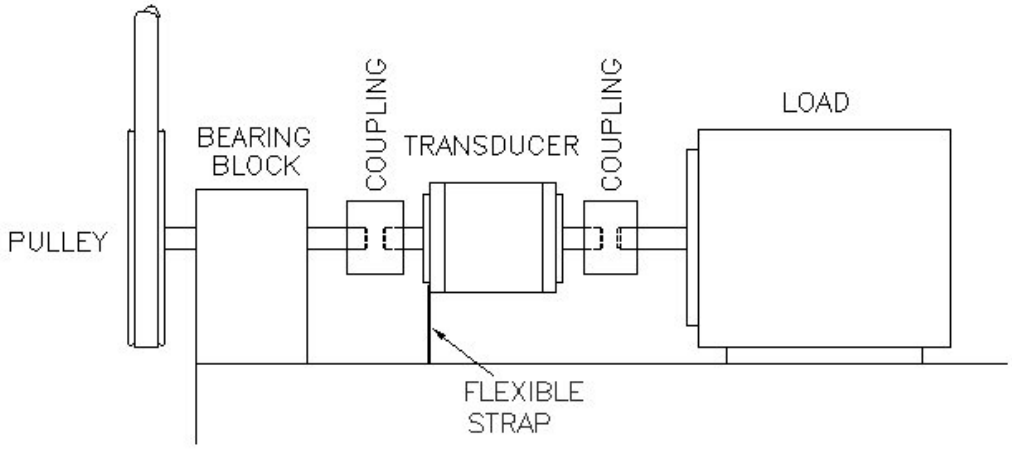
Single membrane coupling (Flexible mounting)

Double membrane coupling (Rigid mounting)

Never use a solid coupling to connect a RWT Series or E200 Series Rotary Torque Transducer.

For rotary torque transducers with **torque ranges less than 1Nm (10lbf.in.),** or rigidly mounted torque transducers, it is recommended that double couplings should be used at each end to compensate for any misalignment of the input/output shafts. The system should be designed to eliminate any end loads on the transducer shaft. For applications where end loads cannot be avoided please consult our 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.



Whilst the transducer is resistant to EMC interference (BS EN 61326:2006), 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. If using an E200 Series or E300 Series rotary transducer with an E Series Display Interface do not attempt to lengthen, shorten or modify the cable between the transducer and the Display Interface. Contact our Sales Department if a longer cable is required.

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.

If in doubt, please ask for advice on the installation of your Rotary Torque Transducer via our Sales Department.

Tel: +44(0)1869 238400
Email: info@sensors.co.uk

Application Notes - Viscosity Measurement

Most laboratory viscometers employ the well-known principle of rotational viscometers to measure viscosity by sensing the torque required to rotate a spindle at a constant speed while it is immersed in the sample fluid. This is because the torque, generally measured using the reaction torque on the motor, is proportional to the viscous drag on the immersed spindle and thus the viscosity of the fluid.

AEA Technology wished to measure the consistency of cement mixes for pressure injection into containers full of radioactive waste because it is vital that the mixture is injected at the correct consistency to ensure it fills all the air spaces but yet still sets correctly.

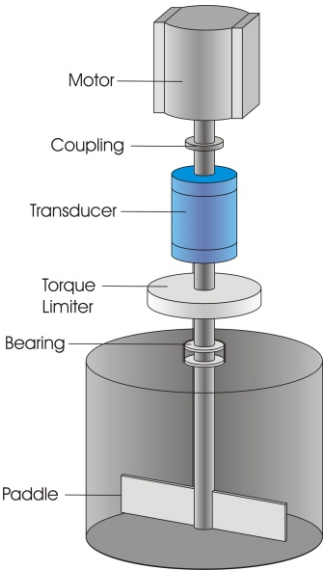
AEA found that this could only be achieved by using Sensor Technology's Rotary Torque equipment and accurately measuring the drive torque required to turn the mixer paddle during mixing. Many other applications mixing fluids with solids in suspension have been similarly measured since this work, such as plaster mixes, coal slurry, and magnetic particles in fluid as it is very difficult to measure the viscosity of these by normal methods and in most cases online monitoring is required.

There are many other applications where it is necessary to monitor the viscosity of the fluid during mixing, for example during the manufacture of shampoos and pharmaceutical solutions. Again, it is important in such applications that the relative viscosity is known during mixing, in order to ascertain when the process is completed and the viscosity or consistency is at optimum.

Operation

Provided that the motor speed is constant, the torque will vary with changes in viscosity during mixing, and thus enable the operator to measure the relative viscosity of the mix. The relationship between the torque and the absolute viscosity is controlled by the paddle type and size, which will be designed for optimum mixing. Classic viscosity measuring systems use a cylinder rather than a paddle but of course a cylinder is not effective for mixing, and thus absolute viscosity cannot usually be measured during the mixing process.

Installation

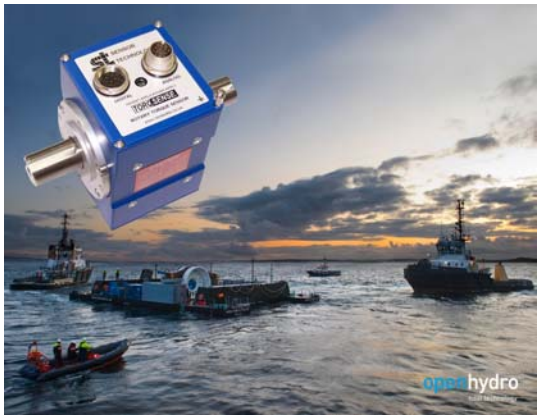


The Rotary Torque Transducer is mounted between the motor and the paddle. As the rotary transducers can be sensitive to side loads, it is essential that the paddle is not directly connected to the transducer but that double bearings are used to eliminate any side loads. See Transducer Installation Guide.

Many mixers are driven by motors which are many times more powerful than they need to be, and so a stoppage of the paddle mechanism can lead to the inline torque transducer being severely overstrained or broken. Consideration should be given to protecting the transducer with a torque-limiting couplings.

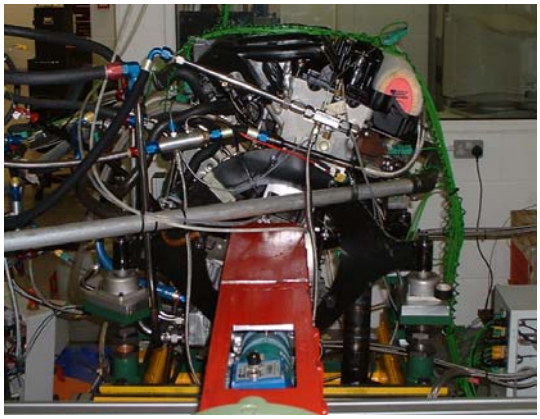
The relative reading can be related to the absolute viscosity by measuring a known relative sample in a laboratory viscometer to obtain its absolute reading and thus find the optimum relative torque figure, which represents the required viscosity.

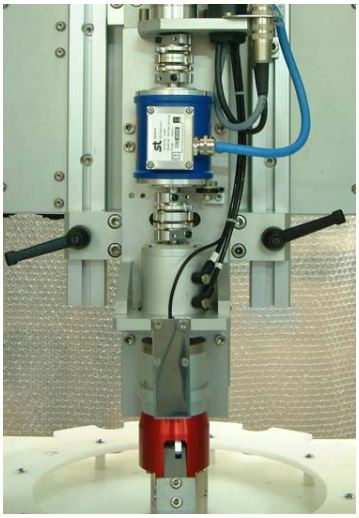
Recent Applications



TorqSense transducers from Sensor Technology are playing a key role in the development of commercial-scale in-stream tidal turbines produced by Irish company, OpenHydro. They are being used to test the bearings, and this involves the use of a simulator that allows the company's engineers to determine how frictional forces in the bearings vary with different loads and rotational speeds. Central to the operation of this simulator is the measurement of torque in a shaft from the motor that drives the bearing under test. OpenHydro uses the RWT321 sensor in conjunction with Sensor Technology's TorqView software. This offers a choice of dial, digital bar and chart graph format display for torque, RPM, temperature and power. It also provides facilities for realtime plotting and for data recording, and can output stored results as files that are compatible with Matlab and Excel.

A TorqSense torque sensor is helping Powertrain Technologies reduce engine emissions and improve economy as part of a project to develop an intelligent lubrication system. The engine being tested was a current production Diesel and the test bed was configured for motored friction tests with a 6,000rpm 32kW electric motor driving the engine. The engine lubrication system was re-designed with a bank of five computer controlled oil pumps, each capable of supplying individual parts of the engine with oil under conditions unique to that part of the engine and sensitive to the engine operating conditions. The torque sensor is critical to the project since the object of the exercise is to measure the effect on friction of a range of different oil supply strategies and oil types. Thus the changes in friction are represented by a change in the motored drive torque of the engine.





In the world of pharmaceuticals product integrity is paramount and packaging has a key role to play. CapCoder of Oxford use TorqSense transducers at the core of its specialist bottle sealing machines. These capping machines not only tighten bottle caps within precisely defined tolerance but also log every detail of every bottle that is capped. A batch size is typically 10,000 bottles, which are capped at a rate of one per second. Every cap has to be done up to the same torque, and proof of this performance is required. The machine had to run the torque up to 10kgf.cm within tolerances of 10% recording the actual value achieved. This secures the cap at a level of tightness that will ensure security and sterility, yet can be opened relatively easily by an adult. The logged values are saved using TorqView software to provide a permanent record for traceability.

Recent Applications

The new wireless LoadSense load cell provides all the information needed to optimise efficiency and increase profitability of a wide range of industrial operations. The new development allows weighing processes to be fully integrated with handling operations. All live data is captured in real time and can be transferred to a database, stored, totalised and analysed. The load sensor can be integrated with a crane hook, fork lift or other handling device. It has an on-board single-chip computer for recording, analysing and archiving readings, and wireless communications (operating on a harmonized global 2.4 GHz waveband) that can transfer data in real time to a host computer. Internal batteries make LoadSense's operation completely autonomous. As such it can be deployed with minimal disruption to operations, and will automatically begin transmitting data. No special training is required to install or operate the unit. Multi channel operation is standard.

Highway engineers and horticulturalists are using LoadSense wireless load cells to solve a critical safety problem, tree viability. Trees can transform a roadside verge, townscape or recreation space with their beauty and their ability to capture carbon dioxide. But they also present a potential hazard: if they fall, they could block a vital highway or even kill someone. As a result, professionals responsible for trees like to test the strength of their roots, usually by fixing a sling around the trunk and giving it a good tug with a tractor! A LoadSense transducer is put in line with the sling, and a wireless transmitter sends the live data to a nearby ruggedised PC or custom built handheld readout. The procedure is to pull the tree until the first suggestions of movement, with the load force being automatically displayed as a pass/fail signal.

LoadSense is helping theatres create breath-taking spectacles and leave the audience gasping for more, and ensure safety when excited performers and heavy machinery share the same space. This is achieved using real-time load signals from each winch. The data is monitored by a computer in the control room so that instant action can be taken if any loads move out of tolerance. For instance, if a load starts running too fast it can be slowed down immediately. If a prop is heavier than expected this could suggest someone was standing on it so shouldn't be whizzed 50 feet into the air at high speed. In fact, in this case, the computer 'jiggles' the load for a second or two as a warning to encourage the person to step away: If the load then returns to normal it can rise; if it doesn't, the floor manager is alerted by an alarm to check the situation.

TORQSENSE®

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