

# TORQSENSE®

## RWT330/340 series Torque Transducer



## Digital RWT330/340 series Torque Transducer

TorqSense Digital RWT330 & 340 series transducers with separate 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 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
- Separate digital electronics
- Operates both statically and dynamically
  - Clockwise/anti-clockwise
- Any full scale torque can be specified within Standard range: 500mNm 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.

US Patents: US5585571, US6478584.  
RWT3243R

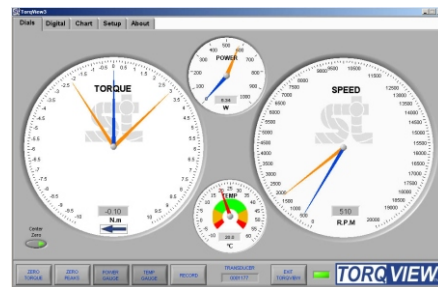
### Software

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 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, USB and CANbus 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		
<b>RWT330/340 Torque measurement system</b>												
Measurement method	Strain Dependent Surface Acoustic Wave Resonators (interrogated by an incremental electronic scanning method)											
Torque range	<i>(See Notes 1 &amp; 2 below)</i>	0 – 0.5 to 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	
		<i>[0 – 5 to 0 – 10]</i>	<i>[0 – 11 to 0 – 200]</i>	<i>[0 – 201 to 0 – 1000]</i>	<i>[0 – 1001 to 0 – 5000]</i>	<i>[0 – 5001 to 0 – 20000]</i>	<i>[0 – 2001 to 0 – 100000]</i>				<i>[lbf·in]</i>	
Shaft size (diameter)		6	12	20	30	50	75				mm	
<b>Rotation speed/angle of rotation measurement system</b>												
Measurement method	IR optical transceiver through slotted disc											
Output signal	Digital, TTL level (5V, square wave signal) and Analogue (Channel 2)											
Update rate (frequency mode above 80 rpm)	Fixed output	1										sec
Update time (period mode below 80 rpm)	Variable output	0-2000 RPM update rate Hz = RPM/3. Over 2000 RPM update rate = 2KHz										Hz
Rotational speed (max)	<i>(See Note 3)</i>	30,000	20,000	15,000	12,000	9,000	6,000				RPM	
<b>Temperature</b>												
Measurement method	IR temperature sensor monitoring actual shaft temperature											
Temperature accuracy		±1										°C
Reference temperature, T <sub>RT</sub>		20										°C
Operating range, ΔT <sub>O</sub>		-10 to +50										°C
Storage range, ΔT <sub>S</sub>		-20 to +70										°C
Temperature drift (FS)	Max	0.05										%FS/°C
<b>Specifications</b>												
Linearity		±0.25										%FS
Hysteresis		<0.1										%FS
Resolution		0.1										%FS
Repeatability		0.1										%FS
<b>RWT330 Series Transducers ONLY</b>												
Frequency response		101										Hz
Accuracy	20°C, SM <i>(See Note 4)</i>	±0.25 (±0.5 for 2Nm and below)										%FS
<b>RWT340 Series Transducers ONLY</b>												
Frequency response		1620	810	405	202	101	50	25	12		Hz	
Accuracy	20°C, SM <i>(See Note 4)</i>	±1	±0.7	±0.5	±0.4	±0.25	±0.25	±0.25	±0.25		%FS	
Digital averaging	<i>(See Note 5)</i>	1	2	4	8	16	32	64	128		N	
<b>Analog output</b>												
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
Output currents (Torque/Speed/Power)		Options available: 4-20mA, 0-20mA and 12±8mA (RWT340 Series output currents are user selectable)										mA
Load impedance		1										KΩ
<b>Digital output (RWT340 Series Transducers ONLY)</b>												
Output type		RS-232 (Standard), USB 2.0 full speed 12 Mbps (optional), CANbus (optional)										
Sampling rate		1.62										ksps
<b>Power supply</b>												
Nominal voltage, V <sub>S</sub>		12 to 32 (max)										V
Current consumption, I <sub>S</sub>		500 (max)										mA
Power consumption, W <sub>S</sub>		6										W
Allowed residual ripple of excitation voltage, V <sub>ripple</sub>		500 (above nominal supply voltage)										mVp-p
<b>Electromagnetic compatibility</b>												
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.

Note 4. SM – Static Mode. Dynamic values will depend upon user application and has to be adjusted accordingly.

Note 5. Digital averaging can be configured by user to optimise accuracy/frequency response for specific user applications. Digital averaging default setting is N=16. For details see User Manual.

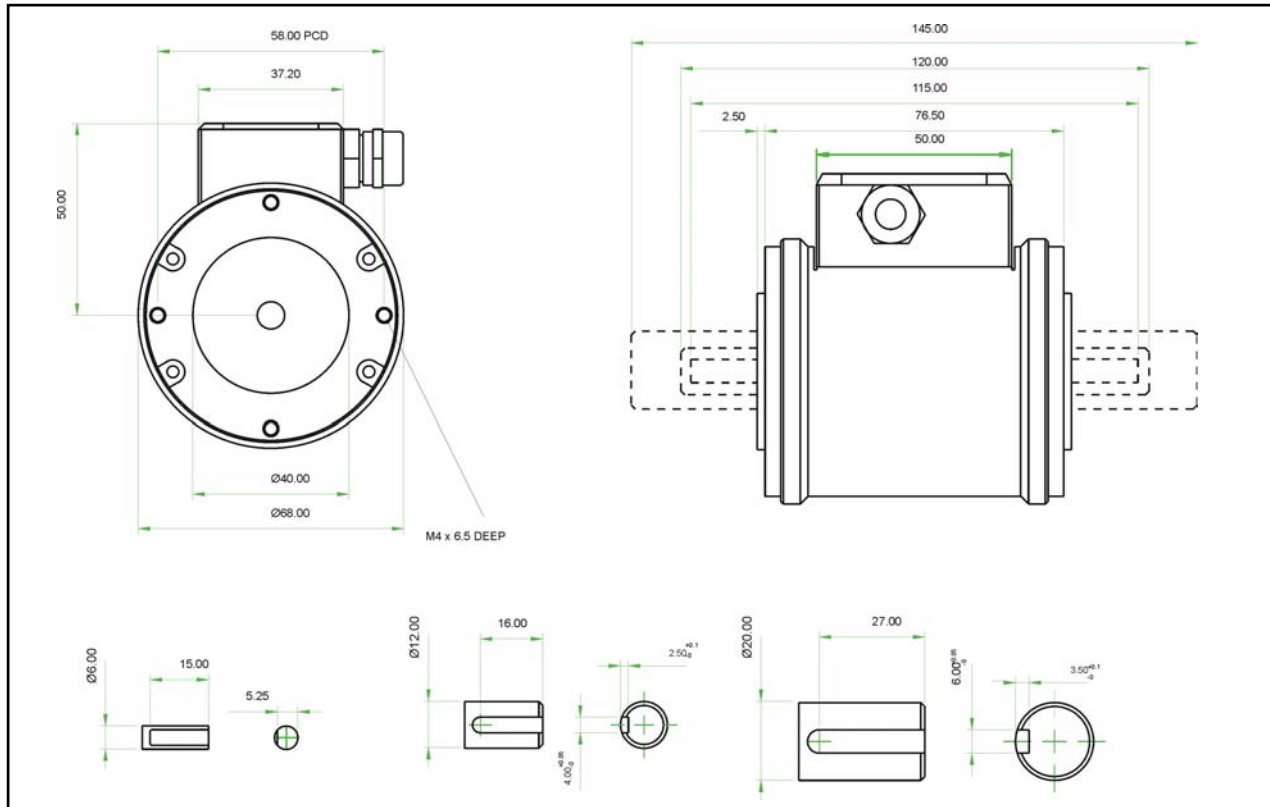
Note 6. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

Data parameters measured at +20°C

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

# RWT330/340 Series Torque Transducers

## Dimensions (0.5Nm to 100Nm)

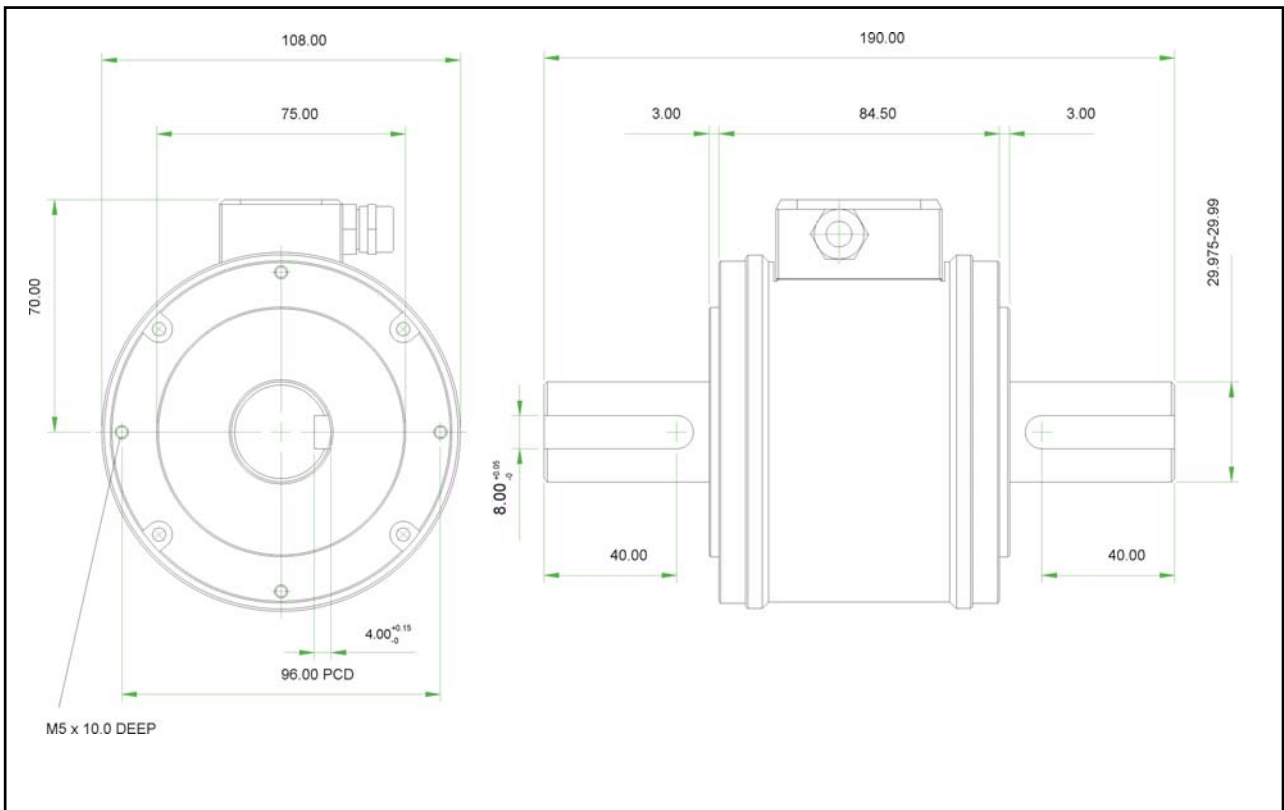


Parameter	Data													Units
<b>Mechanical Properties</b>														
Torque (Max)	0.6	1	2.5	3.9	6	8.5	13	17.5	20	30	55	85	100	Nm
Shaft Code	CE	CF	DA	DF	DB	DC	DG	DD	DE	EB	EC	ED	EE	
Shaft Size (Diameter)	6		12						20				mm	
Torsional Stiffness (Note 5)	0.22	0.23	1.28	1.3	1.32	1.6	1.7	1.8	1.9	4.1	6.4	8.1	9.2	KNm/rad
Mass moment of inertia, $L_v$	0.42	0.45	5.96	6.00	6.04	6.13	6.18	6.24	6.42	22.9	23.9	25.4	27.2	$\times 10^{-6}$ kg m <sup>2</sup>
Max measurable load limit	120 (of rated torque)													%
Static safe load breaking	200 (of rated torque)													%
Shaft weight, approx	0.03	0.03	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.36	0.37	0.40	0.41	kg
Transducer with shaft weight, approx (1 dp)	0.5	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  
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# RWT330/340 Series Torque Transducers

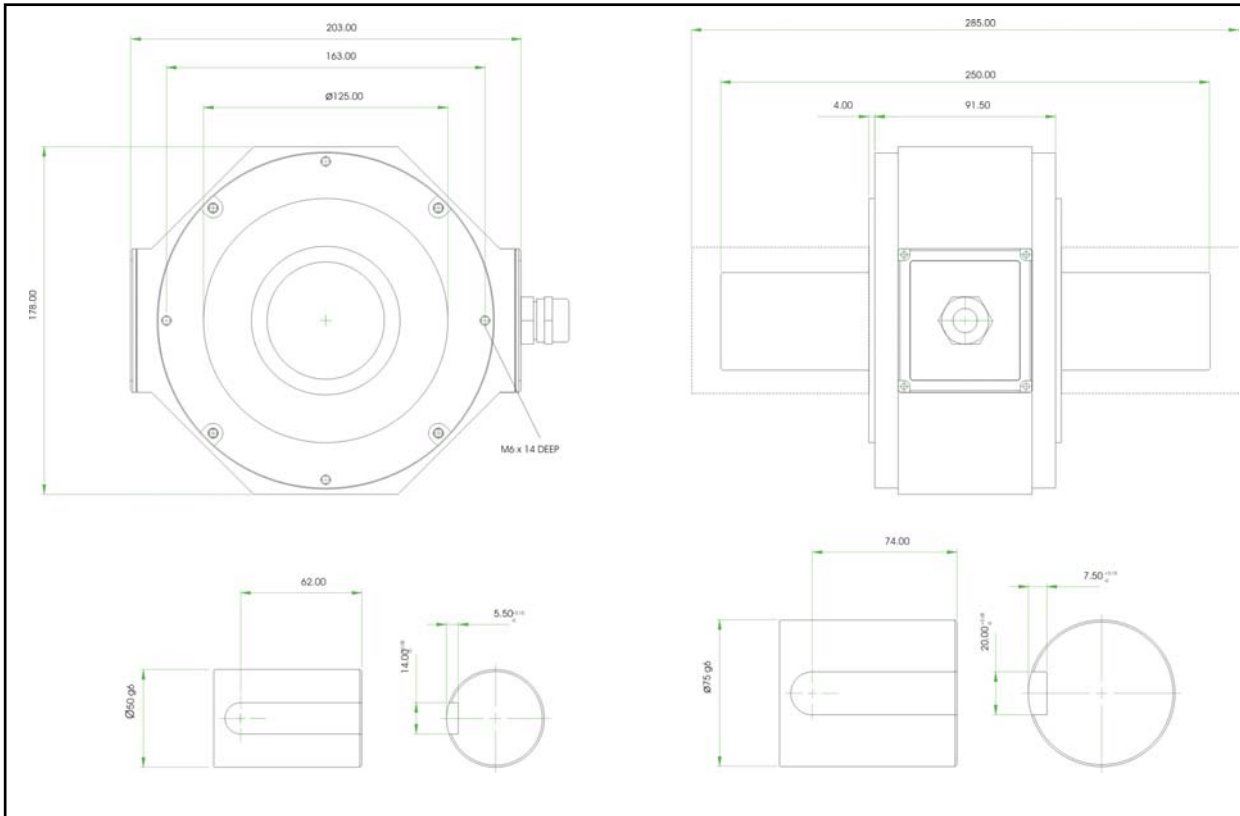
## Dimensions (101Nm to 500Nm)



Parameter	Data					Units
<b>Mechanical Properties</b>						
Torque (Max)	175	225	265	350	500	Nm
Shaft Code	FA	FB	FC	FD	FE	
Shaft Size (Diameter)	30					mm
Torsional stiffness (Note 5)	32.9	35.6	37.2	37.9	39.8	kNm/rad
Mass moment of inertia	138.9	143.1	147.7	151.9	174.2	$\times 10^{-6} \text{ kg m}^2$
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

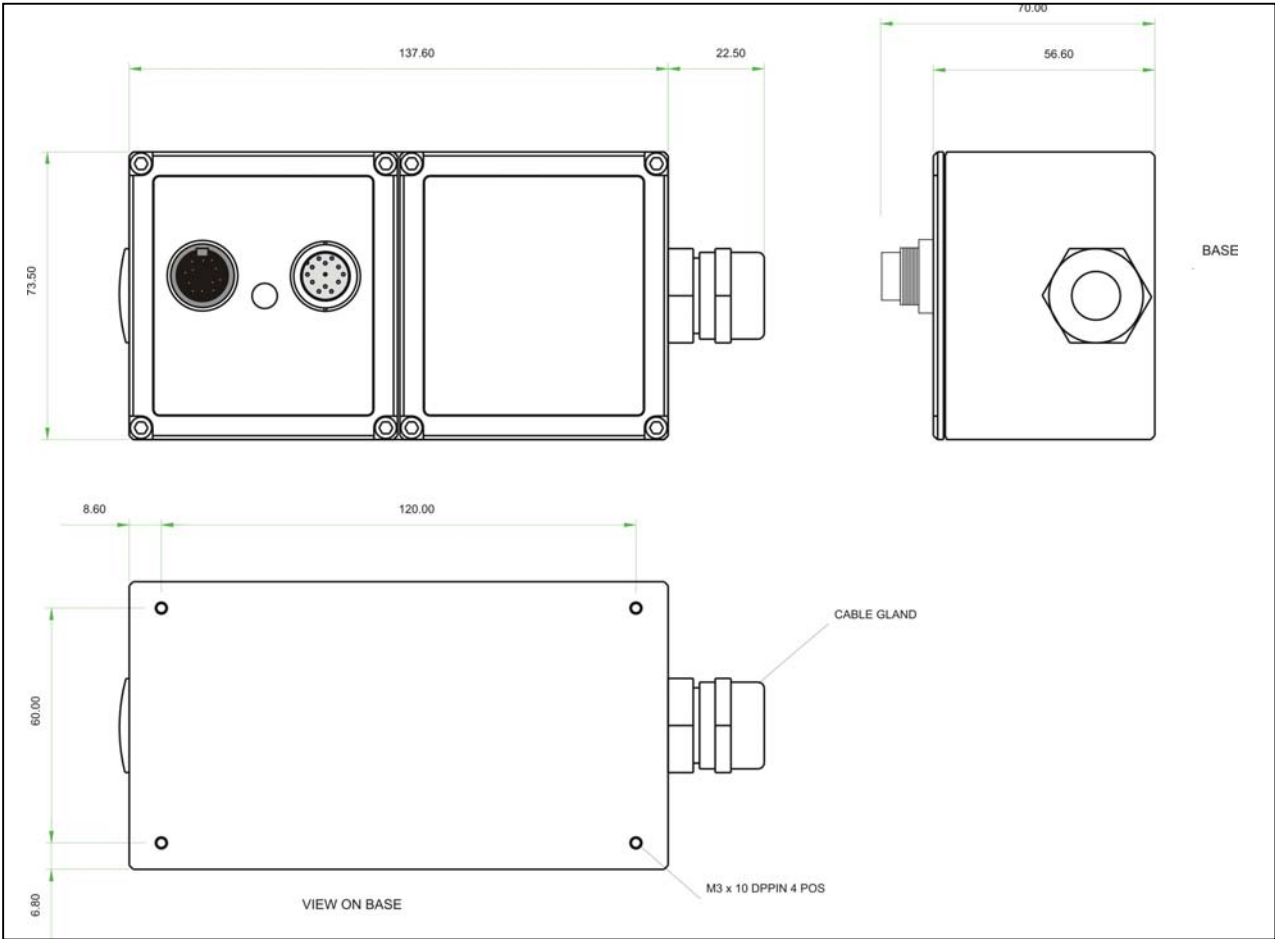
# RWT330/340 Series Torque Transducers

## Dimensions (501Nm to 10000Nm)



Parameter	Data				Units
<b>Mechanical Properties</b>					
Torque (Max)	1100	2000	6000	10000	Nm
Shaft Code	GB	GD	HC	HF	
Shaft Size (Diameter)	50		75		mm
Torsional Stiffness (Note 5)	199.2	214.1	914.4	945.5	kNm/rad
Mass moment of inertia	1330	1497	7932.7	9407.1	$\times 10^{-6}$ kg m <sup>2</sup>
Max measurable load limit	120 (of rated torque)				%
Static safe load breaking	200 (of rated torque)				%
Shaft weight, approx	3.9	4.1	10.2	10.6	kg
Transducer with shaft weight, approx	7.1	7.3	13.4	13.8	kg

RWT330/340 Series Electronics Module



## RWT330/340 Series Torque Transducers - Standard Range

● – Standard feature    ◇ – Optional feature

	RWT330/340 Series		Option Code	Remarks
	RWT330	RWT340		
<b>Torque, Speed, Power Outputs</b>				
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
<b>Standard features</b>				
Keyed Shaft Ends	●	●	K	Torque ranges below 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 (2m)	●	●		(sensor head to electronics module)
<b>Optional features</b>				
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 5)
USB2.0 full speed 12 Mbps Digital output		◇	G	
CANbus output		◇	H	In place of RS232
High Speed Bearings (See Note 3 below)	◇	◇	J	Consult factory for maximum speed
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 –for sensor and electronics (See Note 4 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 (>2m)	◇	◇	R	Consult factory for length

Note 1. Any torque/FSD is possible between ranges – please specify rated torque.

Note 2. Max rated torque specified should not be exceeded.

Note 3. At very high speeds, for better balance the factory recommend plain or splined shafts.

Note 4. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

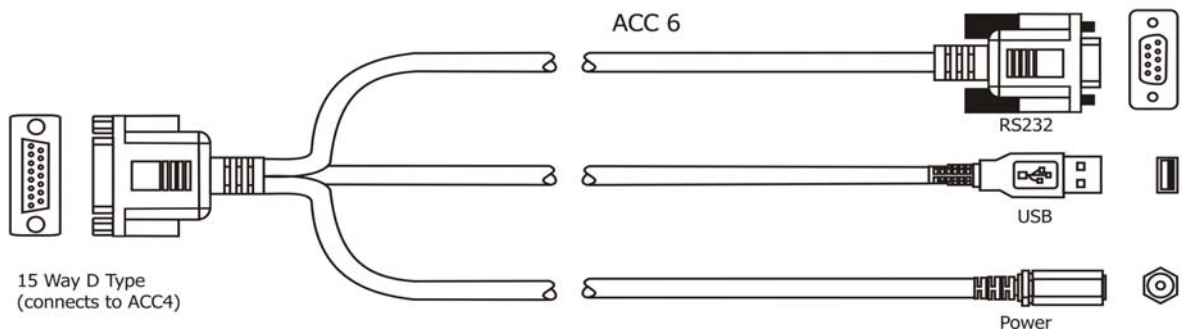
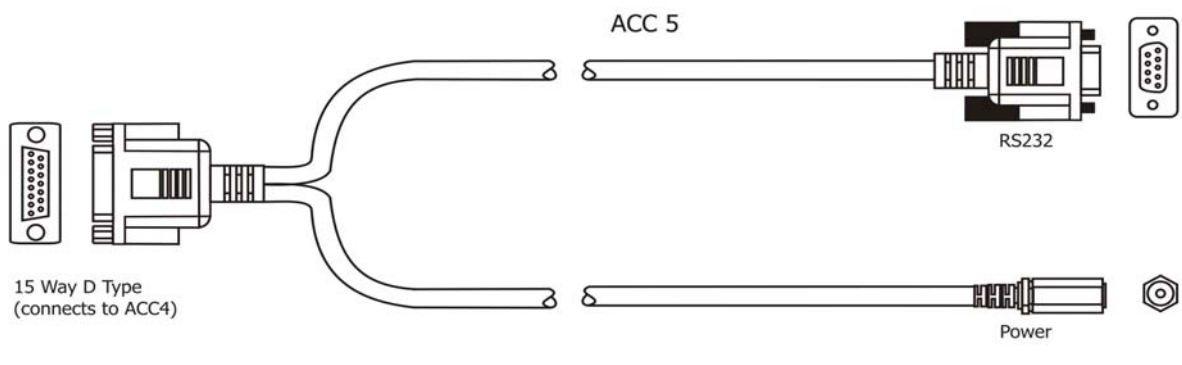
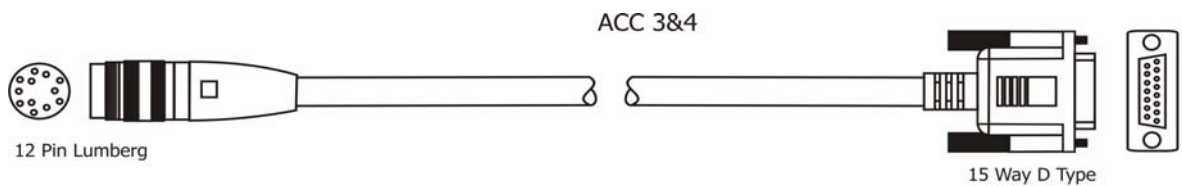
Note 5. 2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque. Channel 2 (voltage/current) – speed or power, if ordered.

## RWT330/340 Series Torque Transducers – Connector and Lead Options

	RWT330/340 Series		Option Code	Remarks/Purpose
	RWT330	RWT340		
<b>Connectors &amp; Leads</b>				
Analog Connector <i>12 Pin Lumberg (female)</i>	◇	◇	ACC 1	<i>For user to self wire</i>
Digital Connector <i>12 Pin Lumberg (male)</i>		◇	ACC 2	<i>For user to self wire</i>
Analog Lead (Length 2.5m) <i>12 Pin Lumberg (female) to 15 way 'D' type connector (female)</i>	◇	◇	ACC 3	<i>For connecting Electronics Module to user's system via 15 pin 'D' connector</i>
Digital Lead (Length 2.5m) <i>12 Pin Lumberg (male) to 15 way 'D' type connector (male)</i>		◇	ACC 4	<i>For connecting Electronics Module to user's system via 15 pin 'D' connector</i>
Digital Lead Adapter (Length 1m) <i>15 Way 'D' type (female) to RS232 and Power Connectors</i>		◇	ACC 5	<i>For connecting Electronics Module to PC via RS232 [Also needs Digital Lead (ACC4) to connect to Electronics Module]</i>
Digital Lead Adapter (Length 1m) <i>15 Way 'D' type (female) to RS232, USB and Power Connectors</i>		◇	ACC 6	<i>For connecting Electronics Module to PC via USB (Option G) or RS232 [Also needs Digital Lead (ACC4) to connect to Electronics Module]</i>

## RWT330/340 Series Torque Transducers – Additional related products

	Code	Remarks/Purpose
Transducer Display ETD	ETD	<i>Display readout</i>
AC Mains Adapter Power Supply	PSU 1	<i>For providing 12-32Vdc</i>
Transducer Signal Breakout Unit	SBU 2	
TorqView	TV	<i>Torque Monitoring Software</i>



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: <b>RWT</b>	<b>331 - 15Nm -</b>	<b>K-CL</b>	A 'basic' transducer with torque and speed outputs, rated and calibrated to 15Nm FSD with keyed ends, ±10v and IP65 protection.
Your transducer requirement: <b>RWT</b>			
Max speed (if applicable)		RPM	
Connector & Lead options		(if applicable) <i>See over</i>	
Additional related products		(if applicable) <i>See over</i>	

### ***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 than 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 than 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.