

# TORQSENSE®

RWT450/460 series  
Pulley / Sprocket  
Torque Transducer



## Digital RWT450/460 series Torque Transducer

TorqSense Digital RWT450/460 series pulley / sprocket transducers with separate 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.

The new TorqSense RWT450/460 torque sensors replace the RWT350/360 series and feature all new electronics that have produced significant performance gains in resolution, frequency response, reduced sensor current consumption and faster digital data throughput. Transducer overload has also been increased to 300%.

### Benefits

- Direct replacement for standard pulley/sprocket
- Low inertia – High Speed capability because electronics are not fixed onto shaft
- Non contact/brushless measurement
- High Bandwidth
- 300% 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: 50Nm 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 (SAW) 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.

### TorqSense RWT450 series transducers offer:

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

### Whereas, TorqSense RWT460 series transducers offer:

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

### TORQVIEW Software

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

Features include: 3 types of display, text files compatible with Matlab and Excel and Real time chart plotting. See TorqView datasheet for more details.



LabView VIs are available for users to design their own process control applications. DLLs are also available for users to write their own custom software.

## RWT450/460 Series Torque Transducers - Data Specification

Parameter	Condition	Data	Units						
<b>RWT450/460 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>	From 50 – 10,000	Nm						
		<i>[From 500 – 100,000]</i>	<i>[lbf·in]</i>						
<b>Rotation speed/angle of rotation measurement system</b>									
Measurement method	Magnetic pick-off sensor								
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	<b>Processing Method</b>	<b>Update rate for analog and digital outputs</b>							
	Mode 1 (Slow Method) Frequency Count	3 Pulse/Rev Magnetic Speed Sensor 1	Hz						
Rotational speed (max)	<i>(See Note 3)</i>	Consult factory	RPM						
<b>Temperature</b>									
Measurement method	IR temperature sensor monitoring actual shaft temperature								
Temperature accuracy		±1	°C						
Reference temperature, $T_{RT}$		20	°C						
Operating range, $\Delta T_O$		-10 to +50	°C						
Storage range, $\Delta T_S$		-20 to +70	°C						
Temperature drift (FS)	Max	0.05	%FS/°C						
<b>Specifications</b>									
Combined non-linearity and hysteresis		±0.5	%FS						
Resolution		0.02	%FS						
Repeatability		0.1	%FS						
<b>RWT450 Series Transducers ONLY</b>									
Accuracy	20°C, SM <i>(See Note 4)</i>	±0.5	%FS						
3dB Bandwidth	<i>(See Notes 5&amp;6)</i>	312 (default ave. = 16)	Hz						
<b>RWT460 Series Transducers ONLY</b>									
Digital averaging	<i>(See Note 5)</i>	2	4	8	16	32	64	128	Hz
Accuracy	20°C, SM <i>(See Note 4)</i>	±0.7	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5	%FS
3dB Bandwidth	<i>(See Note 6)</i>	2500	1250	625	312	156	78	39	N
<b>Analog output</b>									
Output voltages (Torque/Speed/Power)	Options available: ±1 / ±5 / ±10 / Unipolar (RWT450 Series default setting is ±5Vdc) (RWT460 Series output voltages are user selectable)			Vdc					
Load impedance	1			KΩ					
Output currents (Torque/Speed/Power)	Options available: 4-20mA / 0-20mA / 12±8mA (RWT460 Series output currents are user selectable)			mA					
4-20mA Loop resistance	Should not exceed 400			Ω					
<b>Digital output (RWT460 Series Transducers ONLY)</b>									
Connections	CAN Bus		RS232	USB					
Configuration	CAN 2.0B, 11bit Message Identifiers		Data Bits: 8, Parity: None, Stop Bits: 1	USB 2.0 Full-Speed					
Baud Rate(s)	1 Mbps, 500 Kbps, 250 Kbps, 100 Kbps		115200 bps, 38400 bps, 9600 bps	12 Mbps					
Output Rate (Note 7)	Up to 10 KHz		Up to 1.1 KHz	Single Transfer Up to 500 Hz Bulk Transfer Up to 10 KHz					
<b>Power supply</b>									
Nominal voltage, $V_S$	12 to 32 (max)			V					
Current consumption, $I_S$	230 (max)			mA					
Power consumption, $W_S$	3			W					
Allowed residual ripple of supply voltage, $V_{ripple}$	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. Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

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

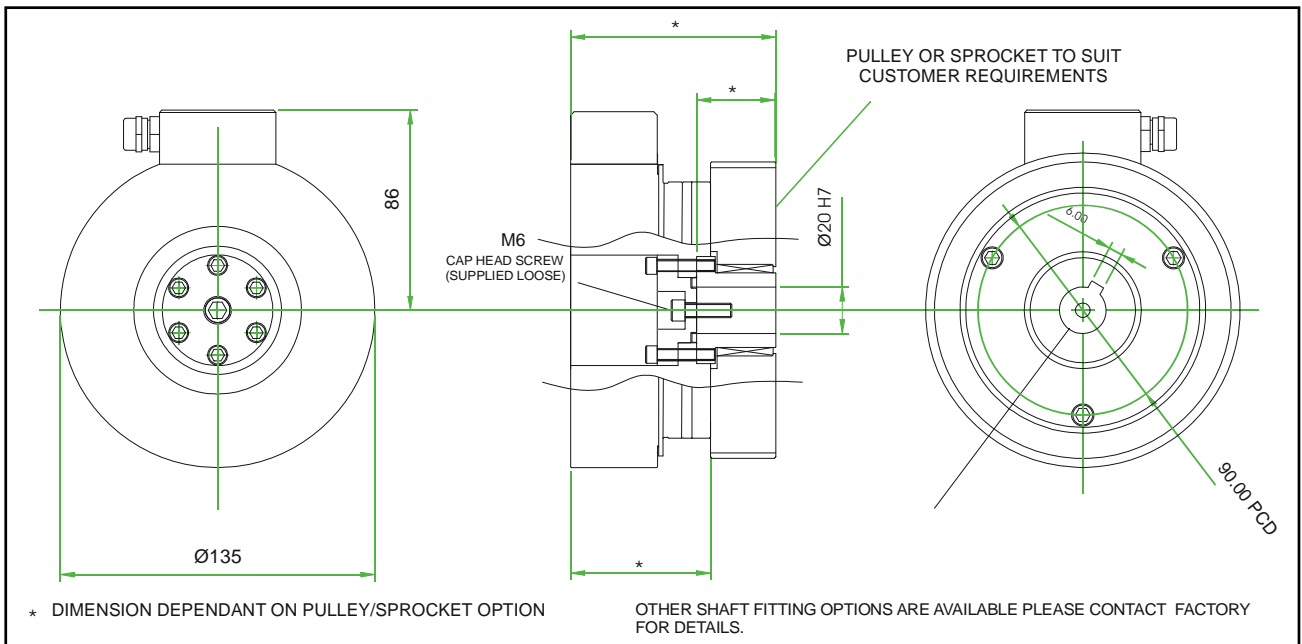
Note 5: Digital averaging can be configured by user to optimise accuracy/frequency response for specific user applications. Digital averaging default setting is N=16. For details see User Manual.

Note 6: >5Khz Sample Rate. Up to 10Khz sample rate possible, please consult factory. Digital averaging also affects the analog output, max analog output 3dB Bandwidth = 5KHz when digital average is 1.

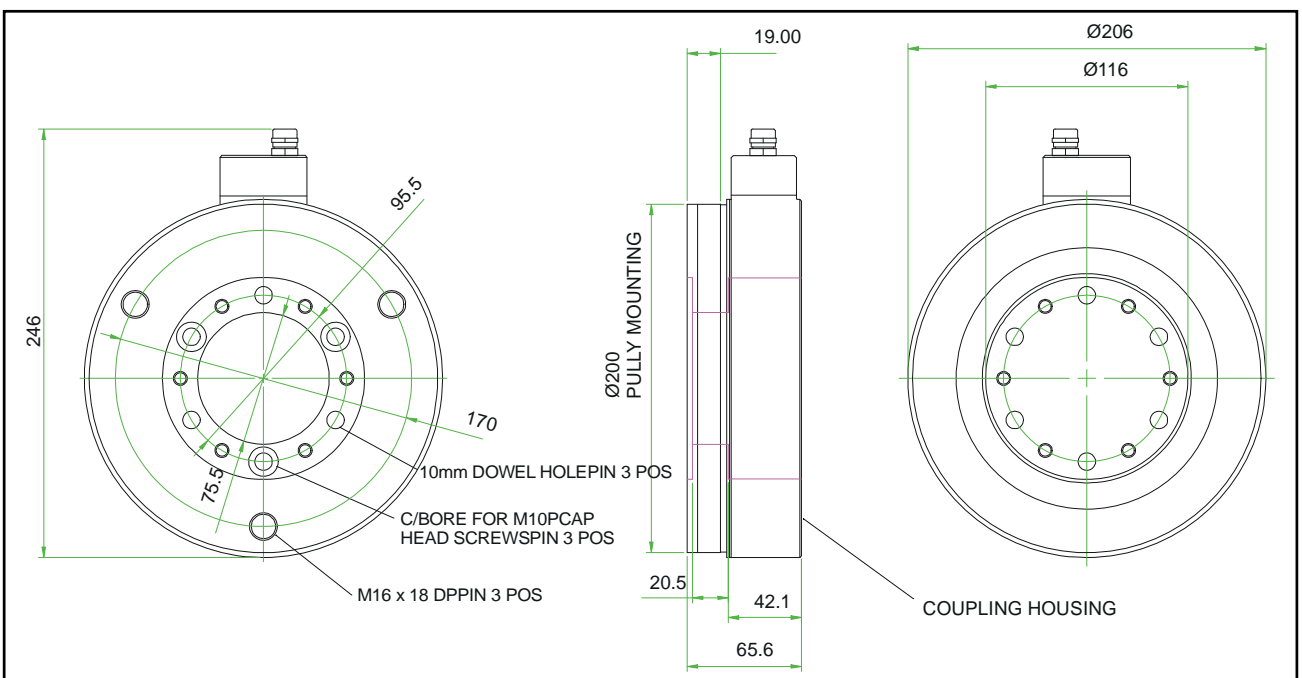
Note 7: Output rate figures are calculated from the time taken to capture 10000 torque readings. Testing was conducted with each connection method configured at its maximum baud rate. The maximum output rate available for CAN and USB is dependant on the transducers setup. USB - USB is a host based bus architecture, because of this the output rate achievable will be affected by other bus traffic and host activity. USB has two transfer modes, Single Transfer which requests 1 reading at a time and Bulk Transfer which transfers readings in blocks of 50 Torque/Speed pairs. CAN Bus - to achieve a Torque reading output rate of 10KHz, the Speed reading output rate must be reduced to 100Hz.

## RWT450/460 Series Torque Transducers

### Dimensions (50Nm to 100Nm)



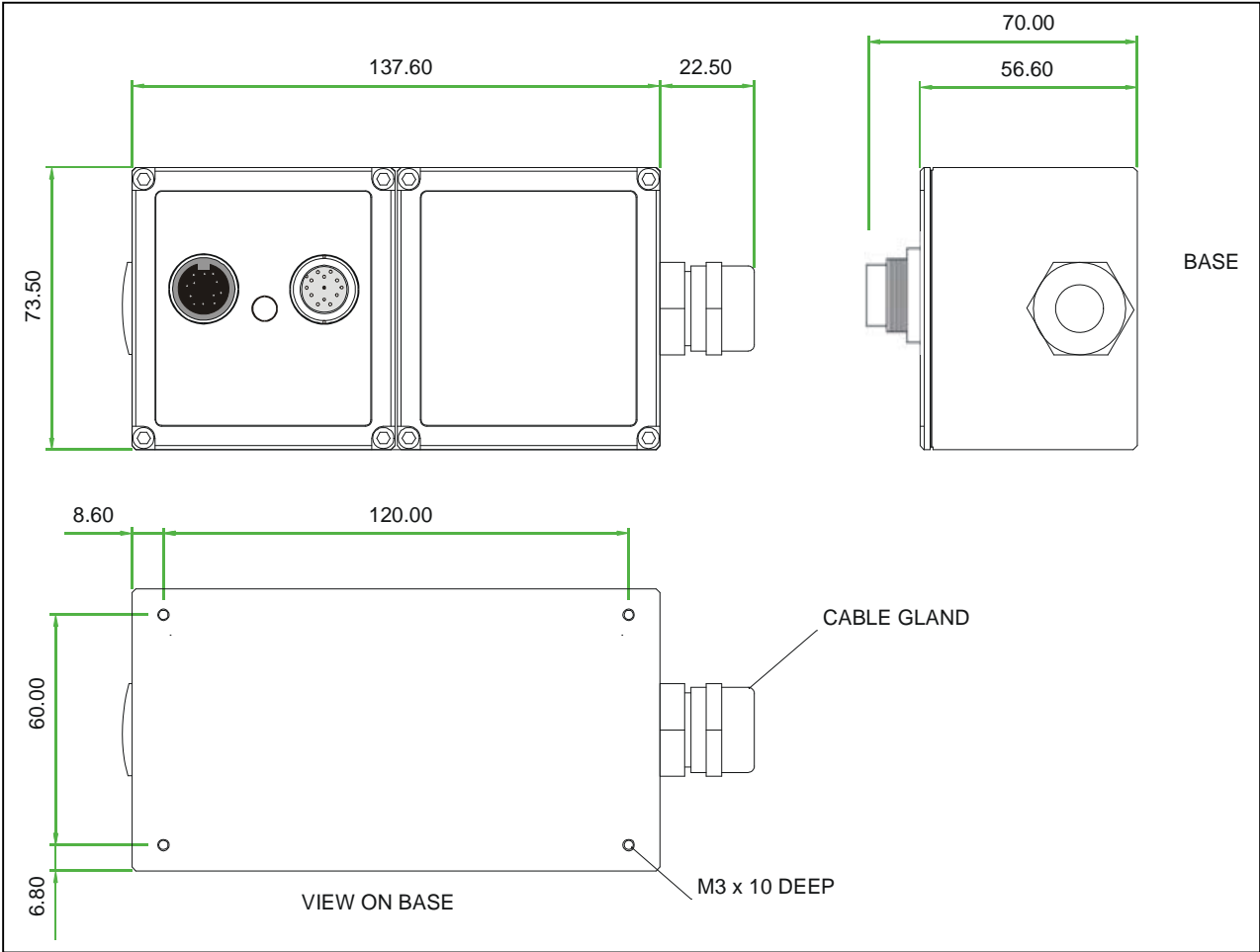
### Dimensions (5KNm)



Please consult factory for other sizes

Data parameters measured at  $+20^{\circ}\text{C}$   
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RWT450/460 Series Electronics Module



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## RWT450/460 Series Torque Transducers - Standard Range

● – Standard feature    ◇ – Optional feature

	RWT450/460 Series		Option Code	Remarks
Torque, Speed, Power Outputs	RWT450	RWT460		
Torque only	450	460		
Torque & Speed (Low Resolution)	451			<i>Specify RPM/FSD (3 pulses / rev)</i>
Torque & Speed (High Resolution)	452			<i>Not yet available (360 pulses / rev)</i>
Torque & Power	453			<i>Specify Power/FSD</i>
Torque & Speed (Low Resolution) or Power		461		<i>User self selectable (3 pulses / rev)</i>
Torque & Speed (High Resolution) or Power		462		<i>Not yet available (360 pulses / rev)</i>
<b>Standard features</b>				
Voltage Output $\pm 5v$ FSD (Fixed)	●		B	
Voltage Output $\pm 1v$ to $\pm 10v$ FSD and Unipolar (Variable)		●		<i>User self selectable</i>
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
<b>Optional features</b>				
Voltage Output $\pm 1v$ FSD (Fixed)	◇		A	<i>In place of Option B</i>
Voltage Output $\pm 10v$ FSD (Fixed)	◇		C	<i>In place of Option B</i>
Customer Specified Voltage Output (Fixed)	◇		U	<i>User to specify</i>
Current Output 0-20mA (Fixed)	◇		D	<i>In place of Options A,B &amp; C</i>
Current Output 4-20mA (Fixed)	◇		E	<i>In place of Options A,B &amp; C</i>
Current Output 12mA $\pm$ 8mA (Fixed)	◇		V	<i>In place of Options A,B &amp; C</i>
Current Output 0-20mA, 4-20mA & 12mA $\pm$ 8mA (Variable)		◇	F	<i>Current output is user selectable and in place of Voltage output. However user can reselect a Voltage output, if required. (Note 8)</i>
USB2.0 full speed 12 Mbps Digital output		◇	G	
CANbus output		◇	H	<i>In place of RS232</i>
High Speed Bearings	◇	◇	J	<i>Consult factory for maximum speed allowances</i>
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 - for sensor and electronics <i>(See Note 9 below)</i>	◇	◇	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	<i>Consult factory for length</i>

Note 8: 2 x analog channels available. Default settings are Channel 1 (voltage/current) – torque.

Channel 2 (voltage/current) – speed or power, if ordered.

Note 9: Transducers fitted for IP65 will have running speeds considerably reduced, increased drag torque and accuracy can be affected.

Data parameters measured at +20°C

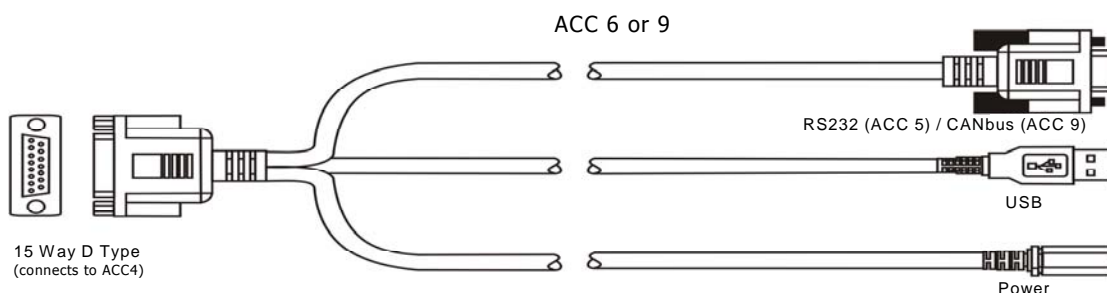
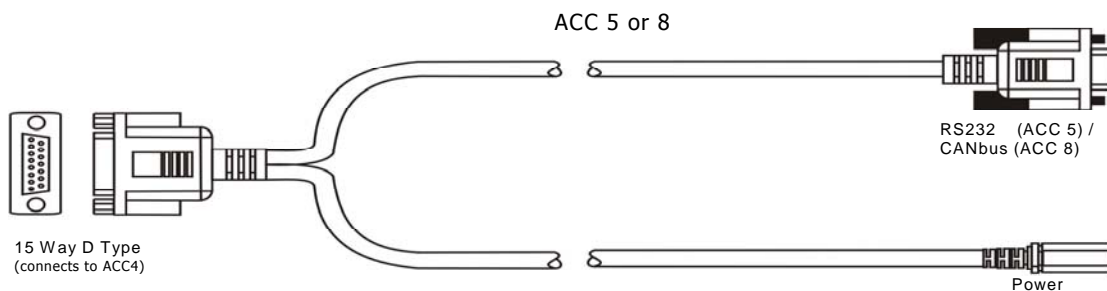
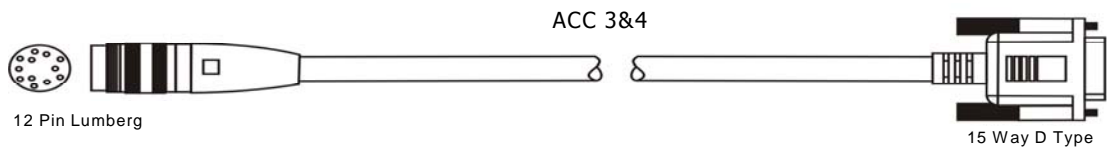
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## RWT450/460 Series Torque Transducers – Connector and Lead Options

	RWT450/460 Series		Option Code	Remarks/Purpose
Connectors & Leads	RWT450	RWT460		
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]

## RWT450/460 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



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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>451 - 100Nm -</b>	<b>CL</b>	A 'basic' transducer with torque and speed outputs, rated and calibrated to 100Nm FSD, ±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 RWT460 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.

*Data parameters measured at +20°C*

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