TORQ SENSE ®

RWT350/360 series
Pulley / Sprocket
Torque Transducer

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.
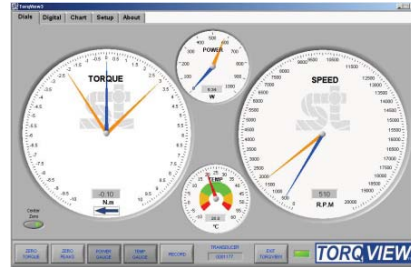
TorqSense RWT350 series transducers offer:
- Fixed voltage or current analog outputs (one for torque and the other for speed or power) for interfacing with legacy analog instrumentation
- BIT Self-diagnostics for letting the manufacturer know that the transducer's torque, speed ratings and calibration 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

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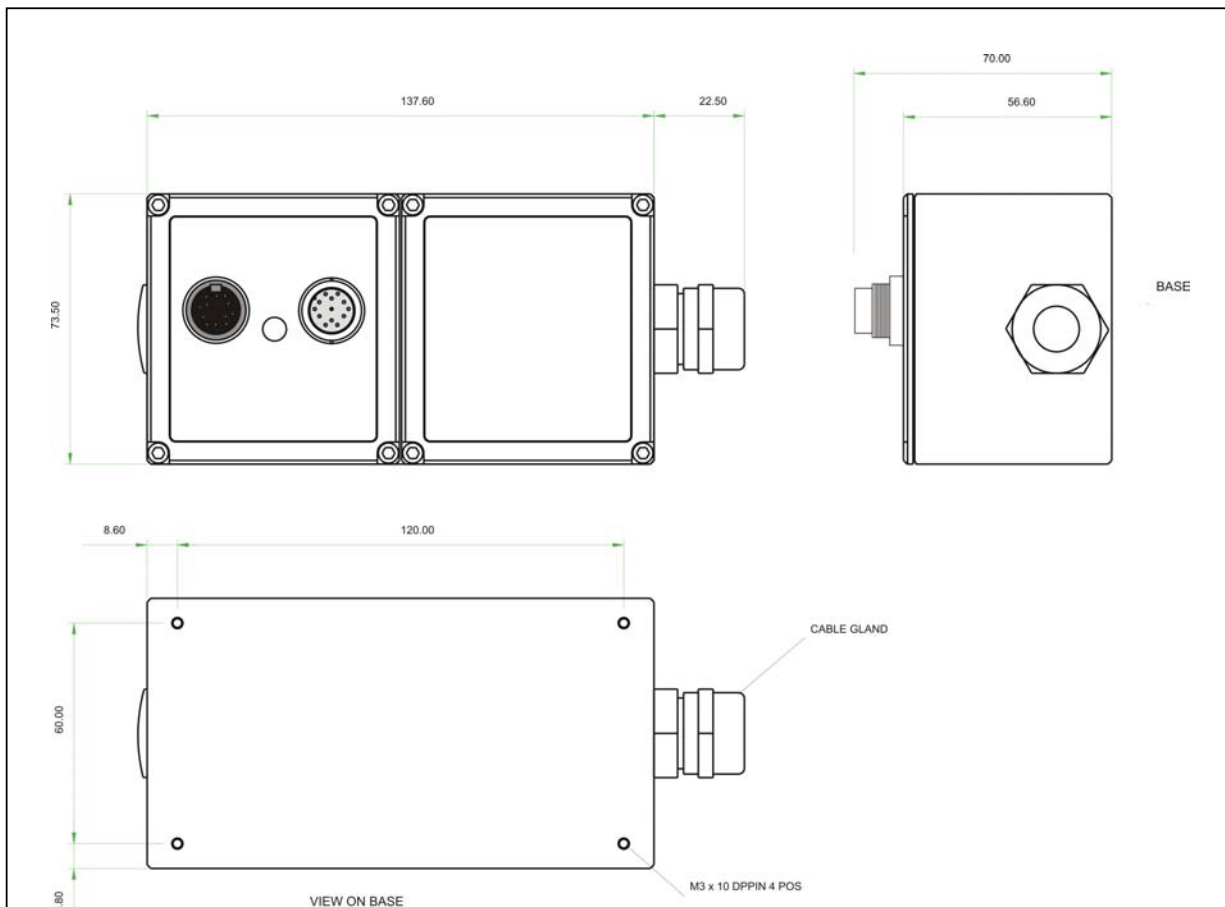
Data parameters measured at +20°C
Sensor Technology Ltd reserves the right to change specification and dimensions without notice.

RWT350/360 Series Torque Transducers

Dimensions (5KNm) (Please consult factory for other sizes)
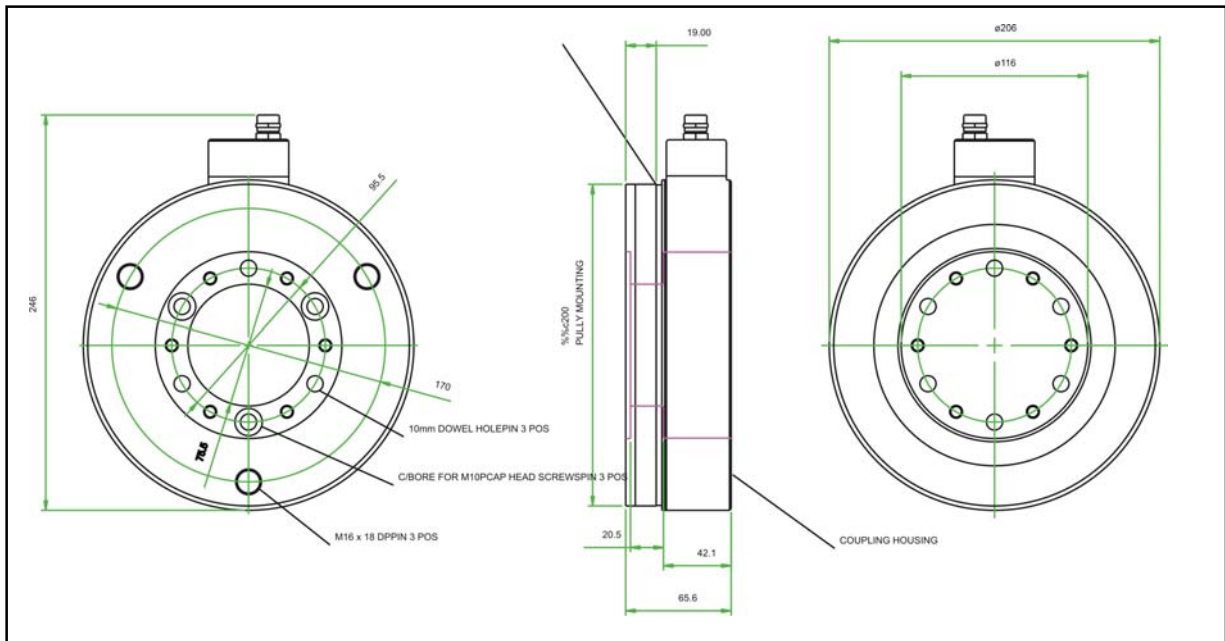
RWT350/360 Series Electronics Module

Data parameters measured at +20°C
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RWT3437R (Rev2)

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	
Sealed Bearings	◇	◇	S	
Ingress Protection (IP) 65 - for sensor and electronics (See Note 7 below)	◇	◇	L	*Consult factory for maximum speed allowances*
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.*
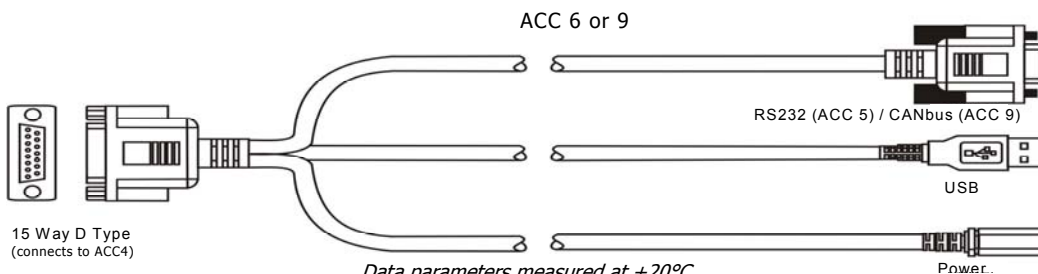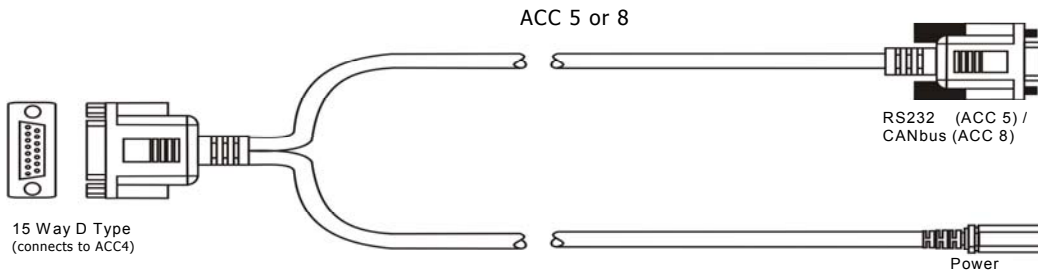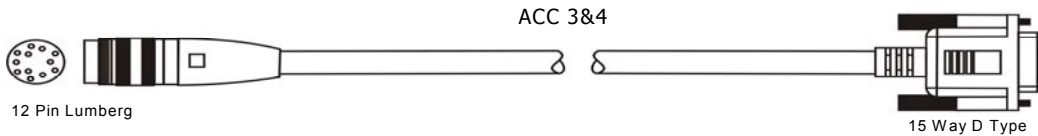
Data parameters measured at +20ºC
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RWT350/360 Series Torque Transducers – Connector and Lead Options

Connectors & Leads	RWT350/360 Series		Option Code	Remarks/Purpose
	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*

ACC 3&4

12 Pin Lumberg — 15 Way D Type

ACC 5 or 8

15 Way D Type (connects to ACC4) — RS232 (ACC 5) / CANbus (ACC 8) — Power

ACC 6 or 9

15 Way D Type (connects to ACC4) — RS232 (ACC 5) / CANbus (ACC 9) — USB — Power

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.