BACKGROUND

Figure 1: KillerBug®

Understanding how mechanical systems react to different forces is crucial, which is why directly measuring input torque is so important. In wind systems, there can be sudden changes in torque for various reasons, and sometimes the torque can even reverse direction. These persistent torque reversals can put a lot of stress on bearings, leading to more vibration and potentially causing the bearings to fail prematurely if not addressed.

OVERVIEW

Transmission Dynamics have developed KillerBug® — a rapidly deployed, inexpensive, single use strain gauge deployment system designed to directly target transient overloads and torque reversals in transmission systems. KillerBug® is able to detect torque reversals, allowing preventative action to be taken before significant damage occurs.

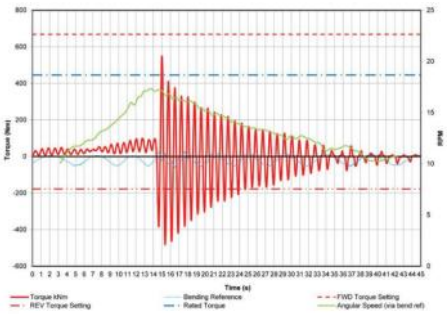

Figure 2: Torque reversals time-domain data

Measuring Ø40 mm x 20 mm, it allows for application in areas with limited space availability. The system is designed to be installed and transmitting data within 5-minutes by non-skilled personnel. The internal battery enables continuous logging for 2 months (with a 100 Hz sampling rate, or 5-6 weeks at 400-800 Hz). Sleep mode extends life up to 5 years. KillerBug® is provided with single strain gauge channel ,+/- 16g tri-axial accelerometer, temperature sensor, and wireless data transfer functionality. It contains a built-in precision shunt resistor, which can be switched across the Wheatstone bridge on demand, and thus measure an accurate gain for the device. Signals are sampled after being processed through a 16-bit ADC pre-amplifier, allowing sub-microvolt ranges at the bridge level to be detected. Accuracies within 5% of the true value can be expected.

OPERATION

The system can be supplied with a local telemetry receiver which offers analogue telemetry output signals for each channel via SMB connections whilst operating in stand-alone mode, which can be interfaced to any data acquisition or control system (0-5 V or 4-20 mA output). The status LED indicates transmitter presence and signal quality, and warns of low battery. The bundled PC application software allows hardware configuration including setting channel offset (zero balancing), on-screen live streaming mode (telemetry) and logging to hard drive in one simple package. Alternatively, our Global Data Network (GDN) gateway enables autonomous analysis and reporting (via SMS or email) of time-domain events on exceedance of a trigger level or changing trends. The GDN gateway allows profiling of statistical data including Rain flow Count, Time-at-Level, battery life, and temperature.

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SIGNAL CONDITIONING	
Transducer supply	3.6 V fixed battery
Output protection	Continuous short-circuit to GND
Input Gain	360x (can be changed at request)
Input filter	2 pole Butterworth active filter -3 dB @ 400 Hz -40 dB roll off per decade
Input bandwidth	Gain dependent, typ 50 kHz @ G =300 (other available)
CMRR	100 dB (min)
Nonlinearity	±0.02 % of FSR
Gain Tempco	± 25 ppm/ °C typ

DIGITAL	
A/D Converter:	16-bit
Sampling rate	104 Hz, 208 Hz, 416 Hz, or 833 Hz
Radio transmission	2.4 GHz ISM (licence free) ~20m range (depending on the environment)

PHYSICAL (1-channel version)	
Size	Ø40 mm x 20 mm
Weight	
Mechanical Protection	±16g

ELECTRICAL	
Power supply	3.6 to 9.5 V (other optional)
Operation temp.	-20 ^{0}C to +80 ^{0}C

Figure 3:
4-channel receiver

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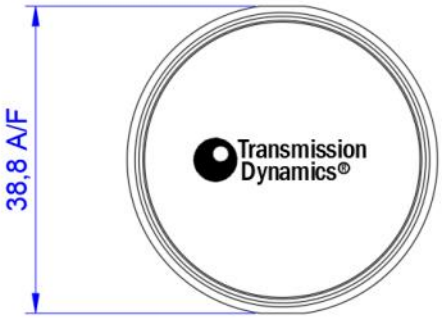
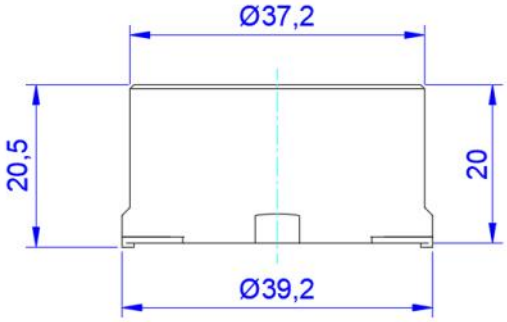
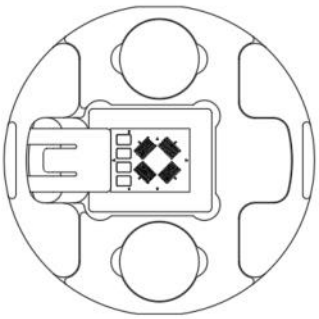
RECEIVER DIMENSIONS

Model	JRD-1099-01-R1
Dimensions	⌀40mm x 20mm
Weight	0.053 kg
Temperature Range	- 40°C to + 85°C
Communication	Bluetooth licence-free frequency range 2.4 GHz
Power	Internal 3.6V Lithium Battery (Up to 2 years battery life)
Warranty	12 Months







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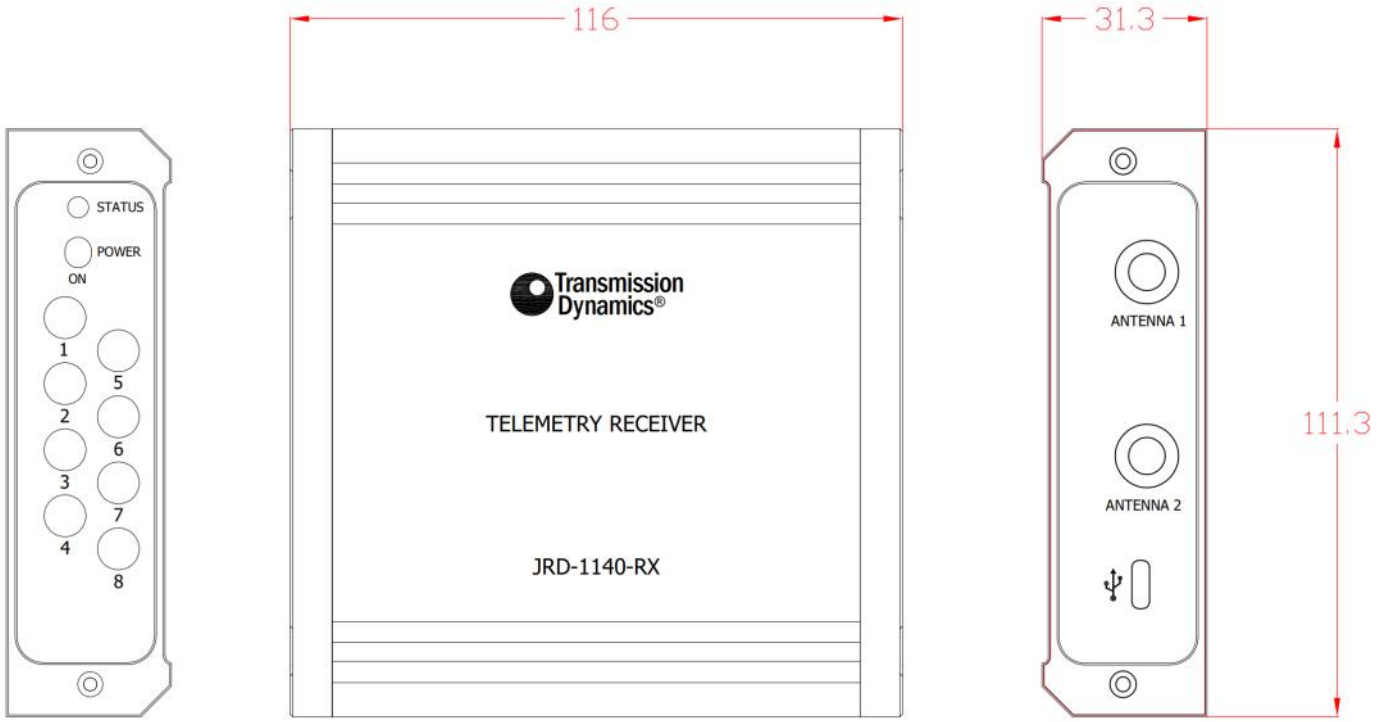
Model	JRD-1140-RX-08
Output signal connectors	SMB
Input power cable	USB-C
Power switch	Yes
Status LED	Green if connected to the transmitter Red if not connected to the transmitter
Receiver side antenna connector	SMA Female
Receiver mounting nuts	Schroff: HF Frame Slide Nut M2.5 [CATALOG #: 21100-112]