

Case study

Ranger detects condenser pump bearing failure

Ranger

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RANGER

Project details:

Ranger / Talecris Biotherapeutics / Clayton, NC

Ranger detects condenser pump bearing failure

Five condenser pumps supply cooling water for an ammonia refrigeration system. The pumps are single-stage centrifugal units direct coupled to 1,800 RPM motors. These pumps are essential to the process systems at Talecris as they directly affect the ability to supply cold glycol to our critical air handling units.

As part of our PdM program, vibration data is collected and analyzed from these pumps on a monthly basis. In January 2010, after collecting vibration data, a fault was suspected in the pump outboard bearing (refer to Figure 1).

Our group was currently testing the wireless Ranger system from Commtest. Ranger Sensors were installed on the pump for continuous monitoring of the pump bearings.

Figure 2 shows an overall trend of the vibration amplitude present in the waveform data collected by Ranger. This system was instrumental in providing data alerting us to the extreme degradation rate of the faulted pump bearing. Within 8 days the overall amplitude of the pump bearing changed from approximately 2.5 gRMS to almost 7.0 gRMS. After the pump bearings were replaced, the amplitude level of the bearing lowered to approximately 1.0 gRMS.

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Jason Daniels, PdM Technician

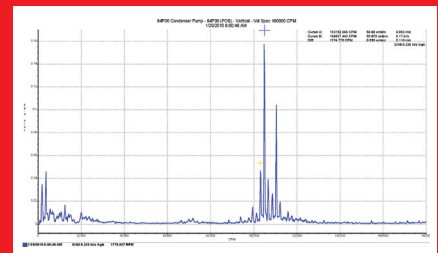


Figure 1. Spectrum



Figure 2. Waveform Overall Amplitude Trend



Figure 3. Ranger Sensors mounted on Talecris machinery

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Specifications	Ranger System	Remarks
Measurement Performance		
Sensing elements	PZT ceramic	Shear mode piezo
Frequency response (+/- 3 dB)	3 Hz to 10 kHz	6 kHz X axis
Dynamic range	± 50 g peak	
Axes	Biaxial	Vertical (Z) and Horizontal (X)
Sample rate	1024 Hz to 51.2 kHz	16 options. Fmax range in Ascent software 400 Hz to 20 000 Hz
Waveform number of samples	1024, 2048, 4096, 8192	FFT resolution in Ascent software 400, 800, 1600, 3200 lines
Max recording duration	4 seconds	
Analog to digital conversion	24-bit ADC	> 95 dB dynamic range
Demodulation	2 Hz to 10 kHz bandwidth	On Z axis
Wake on High Vibration (WoHV) threshold	2 mm/s to 20 mm/s rms	On Z axis, in 10 Hz to 1000 Hz band
Temperature measurement accuracy	± 2 °C	Sensor internal temperature
Ranger Station tachometer input	0.5 Hz to 5000 Hz (30 CPM to 300 000 CPM)	TTL and Keyphasor®. 10.5 V 50 mA supply
Electrical		
Ranger Sensor battery	Lithium Thionyl Chloride, 1/6 D cell	Non-rechargeable, user-replaceable primary cell
Battery voltage	3.6 V	
Battery capacity	1.7 Ah	
Battery life	18 months	Battery life at typical usage*
Ranger Booster power consumption	9 to 36 V, 100 mA	AC power pack supplied
Ranger Station power consumption	9 to 36 V, 350 mA	AC power pack supplied
Wireless Communications		
Wireless protocol	IEEE 802.15.4-2006	Commtest Closed Network (CCN)
Frequency and data rate	2.4 GHz, 250 kbps	International license-free
Wireless range: Ranger Sensor to Ranger Booster	100 m	Line of sight. Orientation dependent. 25 m typical in industrial environments.
Wireless range: Ranger Booster to Ranger Station	500 m	Line of sight. 100 m typical in industrial environments.
RF compliance	FCC part 15, CISPR 22:2006 Class B, ETSI EN 300 440; 301 489	
Network Configuration		
Network comms between Server/PC and Ranger Station	Ethernet v2.0, TCP/IP; Wi-Fi IEEE 802.11b, 2.4 GHz, 128b WEP	Auto senses 10/100 Mbps and full/half duplex Wi-Fi range 100m approx. (greater with directional antenna)
Max Ranger Sensors per Ranger Station	70	
Max hops via Ranger Booster to a Ranger Sensor	5	
Environmental		
Operating temperature: Ranger Sensor	-10 °C to +80 °C	Extreme temperatures reduce optimum battery life
Operating temperature: Ranger Station / Ranger Booster	-10 °C to +65 °C	Below 95% relative humidity, non-condensing atmosphere
Ranger Sensor electronics sealing	Epoxy potted	
Ranger Sensor battery compartment sealing	IP67	O-ring seal
Ranger Booster sealing	IP66	Sealed case and cable gland
Ruggedness: Ranger Sensor	1.2 m (4') drop onto concrete	
Electromagnetic Compliance	CE, IEC6100, ETSI EN301-489	
Physical		
Ranger Sensor Case material	316L stainless steel	Industrial plastic for battery compartment
Ranger Sensor size	42 mm x 46 mm (1.65" x 1.8")	Diameter x height
Ranger Sensor weight	175 g	
Ranger Sensor mounting and torque	¼" 28 UNF stud mount 3 to 7 Nm (2 to 5 ft-lb)	Optional cementing pads (37mm diameter)
Ranger Booster dimensions	140 mm x 65 mm x 45 mm	Mounting via two screw brackets
Ranger Station dimensions	130 mm x 195 mm x 60 mm	Mounts on standard 35mm DIN rail

Notes

* Typical usage is defined as Wake on High Vibe armed, one set of 6 recordings on each axis each day (Velocity, 1kHz, 800 lines). Temperature 25 °C. Revised November 10th 2010. While every effort has been made to provide the most accurate information we advise that information in this document may contain technical inaccuracies or typographical errors. Commtest Ltd. may at any time and without notice make improvements and/or changes to products. All specifications are subject to change without notice.

Specifications	Ranger Bridge Device	Remarks
Analog Inputs		
Number of channels	4 to 16	Configurable in blocks of 4
Simultaneous recordings	Dual channel	Any odd # channel with any even # channel
Channel scan rate	≤ 8s per channel	Acceleration 1000 Hz 400 lines
Compatible sensors	Accel, Vel, Displ, Voltage Output, 4-20 mA	
DC-coupled ranges	0 V to 20 V, -10 V to 10 V, -20 V to 0V	Selectable to suit sensor type
AC-coupled ranges	16 V peak-peak	Allows for ± 8 V sensor output swing
Sensor drive current	4 mA @ 24 V	Enable for IEPE/ICP® type sensors
A to D conversion	24-bit	
Input impedance	>100 kΩ	
Analog Measurements		
Measurement types	Single Value, Time Waveform, Spectrum	
Quantities	Accel, Vel, Displ, Demod, User-scaled	User-scaling for voltage and 4-20 mA sensors
Max levels	> 1000 g (10 000 m/s ²), > 1000 in/s (25 000 mm/s), > 100 in (2500 mm), >10 000 Amps	
Spectrum Fmax values	100 Hz to 40 kHz (6000 CPM to 2400 kCPM)	In 23 steps
Sampling rates	256 Hz to 102.4 kHz	In 23 steps
Dynamic range	≥ 95 dB	
Harmonic distortion	Less than -70 dB Typical	Other distortions and noise are lower
Accuracy	± 1% (0.1 dB)	For DC level (%F.S.) and AC measured at 100 Hz
AC frequency response	± 0.1 dB from 10 Hz (AC) or 0 Hz (DC) to 15 kHz ± 3 dB from 1 Hz (AC) or 0 Hz (DC) to 40 kHz	From value measured at 100 Hz
Signal Processing		
Number of spectral lines	400, 800, 1600, 3200, 6400	6400 lines (16 384 samples) max for dual channel recordings
Time waveform samples	1024, 2048, 4096, 8192, 16 384	
Window types	Hanning, Rectangular	
Averaging types	Linear, Exponential, Peak Hold, Synchronous	
Number of averages	1, 2, 4, 8, 16, 32, 64, 128	
Overlap	0, 12.5, 25, 37.5, 50, 62.5, 75, 87.5%	
Demodulation bandwidths	20 bandwidth options	From 125 Hz to 1250 Hz up to 16 kHz and 20 kHz
Order tracking	Up to 6 kHz Fmax, Orders-based	Tachometer required, mounted on high-speed shaft
Order tracking distortion	Less than -65 dB	Within 50% to 200% speed variation during recording
QuickScan Mode		
Scan rate	2 seconds per channel pair 5 seconds per channel pair	For DC-coupled sensors, no integration (e.g. prox probes) For other sensor types
Measurement type	Average DC value or 10 Hz to 1 kHz overall	Accelerometer readings are converted to velocity
Offline Mode		
Storage capacity and duration	8 MB, typically 40 days	At 8 channels, 3 recordings per channel, 4 recordings per day
Recording retrieval to database	Automatic	Upon re-establishment of comms
Tachometer Inputs		
Number	2	Multiplexed
Range	0.5 Hz to 5000 Hz (30 to 300 000 RPM)	Divided by number of pulses per revolution
Recommended sensor	Hall Effect	Also optical, laser and Keyphasor® tachometer sensors
Power supply to sensor	10 V	Current limited to 50 mA
Input type	Optically isolated, accepts TTL	
TTL inputs pulses	2.5 V (2 mA) min, 28 V (5 mA) max, off-state < 0.8 V	
Keyphasor® threshold	13 V ± 1 V	
Serial Data Inputs		
Input type and connector	RS232, RJ12	
Protocol supported	MODBUS RTU	Supports Registers (16 and 32-bit), Inputs, Coils
Scaling of values	via Gain and Offset (both floating point)	Supports all engineering units

Relay Outputs

Number and type	2, SPST normally open	
Voltage and current rating	250 V AC or 30 V DC, 5 A	
Controlled by	OnlineManager software on server	User-configurable, based on alarms

Status Indicators

System status	2 x LEDs	One for power, one for DSP status
Vibration status	2 sets LEDs: red, yellow, green	Indicates alarm state, user-configurable
Relay status	2 x LEDs	Indicate when relays are energized

Communications and Power

Network communications	Ethernet v2.0, TCP/IP, 10/100baseT	Auto-senses 10/100 Mbps and half/full duplex
Network connection, link speed	RJ45 socket, \geq 256 kbps (optimum) 2400 bps (min)	Via any commercially available link
Diagnostics communications	RS232 @ 115 kbaud, RJ12 socket	
Power supply	250 mA @ 9 V to 36 V	

Mechanical

Mounting	Standard 35 mm DIN rail	For installation in enclosed control cabinet
Size	199 mm x 130 mm x 45 mm	60 mm including DIN rail
Optional sealed housing	IP65 / NEMA4	

Environmental

Temperature range	-30 °C to +65 °C (-22 °F to +149 °F)	De-rates to -25 °C to +60 °C (-13 °F to +140 °F) when using relays
Humidity	95% RH non-condensing	
EMC	EN61326	Emissions and immunity

Analysis Software

Name	Ascent Level 3 software	
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Notes

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