ORBIT 60 SERIES
Keyphasor Input Module
Datasheet

Bently Nevada Machinery Condition Monitoring

Description

Unlike previous systems, the Orbit 60 Series system supports Keyphasor configurations for any dynamic input channel through the PAV, PAS, PAA, PAD, and PVT input modules. For high-phase accuracy applications (over 12,000 rpm) the Keyphasor Input Module must be used. The input speed limit is 120,000 rpm and can accept input speed signals up to 1,200,000 cpm (20 kHz). Each Keyphasor Input Module can accept up to four speed inputs. Input configurations to this module can also support Acceleration, Differential Expansion, Radial Vibration, and Thrust inputs. The Keyphasor input Module occupies a single slot.

> ✎ Although the system allows the user to configure channels on the Keyphasor Input Module to serve as non-speed input types as described above, there will be a decrease in accuracy on these measurements when compared to PAV, PAS, PAA, PAD, and PVT modules. These non-speed inputs also cannot be utilized in SIL applications. The Keyphasor Input Module can only be utilized in SIL applications when configured for speed inputs.

Any channel on the module can be configured as a once-per-turn Keyphasor or a multiple-event-per-turn speed signal from a rotating shaft or gear used to provide a precision timing measurement. The Keyphasor Input Module Speed Channels can be configured to support Recip Multi-Event Wheel speed signals. The Keyphasor Input Module works with the following transducers:

- Magnetic pickup
- 3-wire Prox
- 3-wire Accel

The module senses the Keyphasor signal when the sensor reads a notch or protrusion in the target, then digitizes and processes the signal to provide machine rotative speed and the phase reference for vector parameters, such as 1X amplitude and phase. The Keyphasor gives phase reference information for vibration measurements, providing key relationships for diagnostic analysis. It also provides speed/phase reference for the synchronously sampled waveforms captured by the Condition Monitoring Module.

The 2-wire input connection provides a galvanically isolated, hi-impedance input which primarily supports magnetic pick-up speed sensors. The isolated input eliminates potential ground loops that can occur when speed sensors are shared between the vibration system and other instrumentation.

The Keyphasor Input Module provides a buffered transducer output for each channel. Within Orbit Studio software, each output can be configured within Orbit Studio Software to be either a true analog signal representative of the input or a conditioned/processed digital TTL signal replicating machine speed and maintaining phase with the input signal.

The Keyphasor Input Module can accept a recip multi-event wheel signal, which is used to track shaft rotation more precisely during a revolution. This 13 tooth gear has a unique tooth used to indicate the crank angle reference for specific recip measurements.

The module supports backup speed source functionality. When configured, if the primary speed source enters an invalid state, a backup speed channel will be utilized to provide a speed reference for configured synchronous measurements. Compensations for differences in shaft speed and phase reference timings can be configured to maintain measurement accuracy upon transitioning to backup speed sources.

The module OK LED indicates when the module is functioning properly, and the LINK LED indicates when the module is communicating to the rest of the system. Four Channel Status LEDs located on the utility side of the module indicate a connected sensor is installed and in OK condition.

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Keyphasor Input Module

Keyphasor Module Inputs (KPH)	
Power Consumption	
Typical	7.5 Watts
Maximum	11 Watts
Inputs	
Analog Input	• Proximitor (3-wire) • Accelerometer (3-wire) • Proximitor Keyphasor (3-wire) • Magnetic Speed Pickups
Input Signal Specifications	
3-wire input voltage range without clipping	+3.5 Volts to -22 Volts
3-wire input voltage range with clipping but without damage	+50 Volts to -50 Volts
2-wire input voltage range without clipping	+5 Volts to -15 Volts
2-wire input voltage range with clipping but without damage	+275 Volts to -275 Volts
2-wire passive magnetic pickups	Passive magnetic pickups Require a shaft rotative speed greater than 200 rpm (3.3 Hz).

Keyphasor Module Inputs (KPH)	
Input Impedance	3-wire non-isolated interface: 10 kΩ
	2-wire isolated interface: 31.8 kΩ
Signal Conditioning	
Speed / Frequency Signal Ranges	Input range of 1 to 120,000 cpm (0.017 to 2 kHz).
Speed / Frequency Signal Accuracy	Specified at +25ºC (+77ºF).
	1 to 100 rpm: ±0.1 rpm
	101 to 10,000 rpm ±1 rpm
	10,001 to 120,000 rpm: ±0.01% of actual rotational speed
Minimum Pulse Width	Keyphasor Pulse Width must be greater than or equal to 10 micro-seconds.
Transducer Conditioning	
Auto Threshold	Minimum signal amplitude for triggering is 1.5 Volts pp.
Manual Threshold	User-selectable from +3 to -13 volts DC for 2-wire transducers.
	User-selectable from +3 to -22 volts DC for all other transducers
	Minimum signal amplitude for triggering is 500 mv pp.
Hysteresis	User-selectable from 0.2 to 2.5 Volts.
Non-Speed Dynamic Input Specifications	
Analog Input	See Input Module Sensors and Channels on page 7.
Channels Supported	4 Dynamic Inputs
Sampling Rate	102.4 kHz

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Keyphasor Module Inputs (KPH)	
Accuracy and Frequency Response	
KPH	Prox/Accel (3-wire)
	0-40 kHz 2% of Full Scale
Outputs	
Analog Buffered Transducer (BTO)	Short circuit protected output signal available through BTO connector on public and utility side.
BTO Accuracy	**AC**
	> 0 to < 10 kHz, ±1% of input signal
	10 kHz to < 20 kHz, ±2% of input signal
	20 kHz to < 30 kHz, ±4% of input signal
	30 kHz to ≤ 40 kHz, ±6% of input signal
	DC
	±100 mV over voltage range of Input Module
BTO Output Impedance	500 Ω
BTO Connector	

> ✏️ When configured as an analog output, this is a true analog signal from the input and not a digital to analog reconstitution of the input signal. When configured as a processed output, this is a 5 V or 3.3 V compatible TTL signal with the same machine speed and phase as the input signal. Some Transducers have an offset BTO bias.

Keyphasor Module Inputs (KPH)	
Keyphasor Transducer Power Supply	-24 Vdc, 40 mA maximum per channel.
LEDs	
Channel Status LED (Rear Utility side only)	1 per input channel indicates when the connector sensor is in an OK condition
Module OK LED	Indicates when the module is functioning properly
LINK LED	indicates when the module is communicating to the rest of the system
Physical	
Required Rack Space	1 Slot

Environmental Limits		
Chassis Operating Temperature Range (indoor use only)	3U Chassis: -30ºC to +70ºC (-22ºF to 158ºF)	⚠️
	6U Chassis: -30ºC to +65ºC (-22ºF to 149ºF)	⚠️
	❗ Temperatures over 50ºC (122ºF) require forced air convection with a minimum airspeed of 0.5 m/s.	

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Environmental Limits	
Module Temperature Rating Certification	-30°C to +70°C (-22°F to 158°F)
	⚠ When using a Bridge module, temperatures over 58°C (136°F) require forced air convection with a minimum airspeed of 0.5 m/s.
	⚠ You must still meet the Chassis Operating Temperature Range defined above.
Storage Temperature Range	-40°C to +85°C (-40°F to 185°F)
Relative Humidity	0% to 95% rH non-condensing operating and storage
Vibration	Without Isolators: 0 g to 0.35 g @ 57-500 Hz
	With Isolators: 0 g to 5 g @ 57-500 Hz
Shock	2" Incline Drop
Altitude	< 2000 m (6,562 ft)
	✎ Higher altitudes are possible but are site specific applications. Contact Bently Nevada support if you require higher altitudes.
Pollution Degree	Pollution Degree 2

Environmental Limits	
Installation Category	Category II

⚠ Verify that temperature ratings on the wiring cables match the operating temperature range.

⚠ **CAUTION**

LOCATION TEMPERATURE AND HUMIDITY

While the system has been tested and capable of achieving the design life when operating in environments up to 70°C, whenever operating any electronics system in elevated humidity or temperatures exceeding 40°C, adding environmental controls maximizes the operational life of the system.

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Compliance and Certifications

FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

EMC

European Community Directive:

EMC Directive 2014/30/EU

Standards:

EN 61000-6-2; Immunity for Industrial Environments
EN 61000-6-4; Emissions for Industrial Environments

Electrical Safety

European Community Directive:

LV Directive 2014/35/EU

Standards:

EN 61010-1;
EN 61010-2-201;

RoHS

European Community Directive:

RoHS Directive 2011/65/EU

Cyber Security

Designed to meet IEC 62443-4-2

*Maritime

ABS Rules for Condition of Classification, Part 1

- Steel Vessels Rules
- Offshore Units and Structures

*Recorder Output module, Bridge module, and 6U systems approvals pending

Functional Safety

SIL 2

See the SIL User Guide (134M0398) for details regarding SIL implementation.

Hazardous Area Approvals

> 🖉 For the detailed listing of country and product-specific approvals, refer to the *Approvals Quick Reference Guide (108M1756)*.
>
> For additional technical documentation, please log in to bntechsupport.com and access the Bently Nevada Media Library.

cNRTLus

Class I, Zone 2: AEx/Ex ec nC IIC T4 Gc;
Class I, Zone 2: AEx/Ex nA nC IIC T4 Gc;
Class I, Division 2, Groups A, B, C, D T4;
Class I, Division 2, Groups A, B, C, D T4 (N.I.);

T4 @ Ta= -30°C to +70°C (-22°F to +158°F)

ATEX/IECEx

⟨Ex⟩ II 3 G
Ex ec nC IIC T4 Gc
Ex nA nC IIC T4 Gc

T4 @ Ta= -30°C to +70°C (-22°F to +158°F)

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Input Module Sensors and Channels

Sensor Type Supported	Channel Type	Dynamic Input Module Type (4 channels)							Static Input Module Type (6 channels)	
		PAV	PAS	PAA	PAD	PVT	KPH	AC LVDT	Temp	PVD
Proximitor (3-wire)	Differential Expansion, Radial Vibration, Speed, Thrust, Recip Piston Rod	X	X	X	X	X	X			
Magnetic Pickups	Speed						X			
Accelerometer (3-wire)	Acceleration[1], Recip Impulse Acceleration	X	X	X	X	X^2	X			
Charge Amplifier (3-wire)	Acceleration[1]	X	X	X	X^2	X^2	X			
BN 165855 Cylinder Pressure Transducer	Recip Cylinder Pressure					X				
Interface Modules (4-wire)	Acceleration[1]			X						
High-Temp Accel (4-wire)	Acceleration[1]			X						
High-Temp Accel (3-wire)	Acceleration[1]	X	X	X	X	X^2	X			
Negative Biased Constant Current (2-wire)	Acceleration[1]	X								
IEPE Positive Constant Current (2-wire)	Acceleration[1], Recip Impulse Acceleration					X				
High-Temp Velocity	Velocity[1]	X	X	X		X^2				
Negative Biased Constant Current (2-wire)	Velocity[1]	X								
Velomitor® (2-wire)	Velocity[1]	$X^{2,3}$				$X^{2,3}$				
Velomitor CT	Velocity[1]	$X^{2,3}$								
Seismoprobe (2-wire)	Velocity[1]		X							
IEPE Positive Constant Current (2-wire)	Velocity[1]	X^3				X				

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Sensor Type Supported	Channel Type	Dynamic Input Module Type (4 channels)							Static Input Module Type (6 channels)	
		PAV	PAS	PAA	PAD	PVT	KPH	AC LVDT	Temp	PVD
Amplifier/Interface Modules	Dynamic Pressure			X						
Pressure Transducers	Dynamic Pressure					X				
DC LVDT	Valve Position & Case Expansion				X					
AC LVDT	Valve Position & Case Expansion							X		
3-wire RTD	Temperature								X	
TC-Type J, K, E, T	Temperature								X	
4-20 mA Transmitter, ±10 V Sensor	Process Variable									X
Dry or Wet Contact, TTL Logic	Discrete Channel									X

[1] Designates the ability to integrate these measurements to provide additional measurement types.

[2] These sensors can be configured using a Custom transducer configuration.

[3] PVT modules are recommended for new sensor installations only. Projects using the Velomitor CT or retrofits that reuse existing sensors should use PAV or verify sensor power limits.

> (!) The PVT is only for positively biased sensors.

> (✎) The PVT module is generally recommended because of its positive bias and higher supply current. However, for Orbit 60 installation retrofits using existing Velomitor® sensors, the existing sensors are recommended to be used with PAV modules and configured as custom transducers, unless it can be verified that the sensors are compatible with the PVT with its higher output current.

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Ordering Information

> For the detailed listing of country and product-specific approvals, refer to the *Approvals Quick Reference Guide (108M1756)*.
>
> For additional technical documentation, please log in to bntechsupport.com and access the Bently Nevada Media Library.

Keyphasor Input Module

Ordering Option	Description
60R/INP06-AAA-B	
AAA – Hazardous Area Certifications	
00	No Hazardous Area
01	CSA/NRTL/C (Class I, Div 2)
02	Multi (CSA, ATEX, IECEx)
XXX	Country Specific Approvals
B – SIL Level	
0	No SIL
2	SIL 2

Accessories

Part Number	Description
60X/BTC01	Buffered Transducer Breakout Kit

External Barriers

Part Number	Description
175502	3-pin Transducer Barrier
177241	2-pin Velomitor Barrier

Part Number	Description
175990 or 170M3559	Thermocouple Barrier
170M3559	RTD Barrier

External Galvanic Isolators

Part Number	Description
103M7134	3-pin Transducer Isolator
103M7134	2-pin Transducer Isolator
154M1361	Thermocouple Isolator
103M7138	RTD Isolator

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