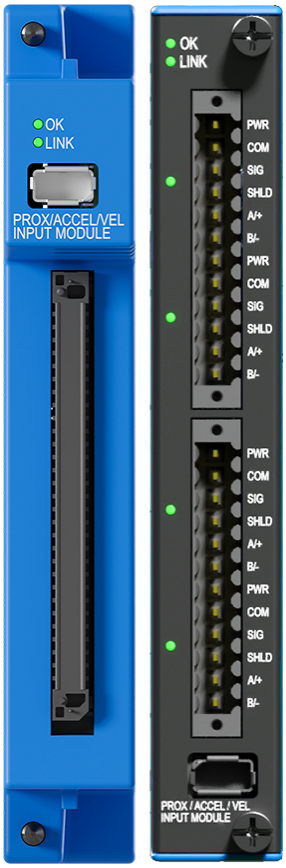
ORBIT 60 SERIES
Dynamic Input Modules
Datasheet

Bently Nevada Machinery Condition Monitoring

137M0698 Rev. G



Description

The primary purpose of the Dynamic Input module is to digitize the sensor signal at a rate that completely encompasses the signal content and provides transducer power for various sensors. The Orbit 60 Series Dynamic Input modules are a set of 4-channel input modules available in both negative and positive dynamic input options. The inputs are also used for speed or Keyphasor signals.

> The PAV, PAS, PAA, PAD and PVT modules can be configured with up to TWO SPEED CHANNELS with a maximum speed of 12,000 rpm and maximum speed impulse rate of 12,000 cpm (200 Hz). For more than two speed channels on a single dynamic input card, speeds greater than 12,000 rpm or speed impulse frequencies greater than 12,000 cpm (200 Hz) a KPH Module is needed.

All dynamic input modules that support speed or Keyphasor signals can be configured to have Primary and Backup Speed Source support, to allow for speed redundancy functionality. 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 Orbit 60 dynamic input modules are designed for use on a broad range of machine trains or individual casings where the sensor point count fits the monitor's channel count and

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where advanced signal processing is desired. The modules are optimized for intensive signal processing required on complex machinery such as gearboxes, planetary gearboxes, reciprocating compressors, and roller element bearing (REB) machines, as well as offering advanced measurement capabilities on conventional monitoring methods such as radial vibration, thrust position, piston rod monitoring, and casing absolute vibration.

Negative Transducer Input Modules

The following cards work with negative-voltage external sensors offering four variants:

- **PAV** Negative Dynamic Sampler (Prox, Accel, Velom)
- **PAS** Negative Dynamic Sampler (Prox, Accel, Seismic)
- **PAA** Negative Dynamic Sampler (Prox, Accel, Aero)
- **PAD** Negative Dynamic Sampler (Prox, Accel, DC LVDT)
- **KPH** High Speed Keyphasor (Prox, Accel, Magnetic Pickup)

Positive Transducer Input Module

The Positive Voltage Transducer (PVT) input module interfaces with industry-standard third-party IEPE sensors, as well as sensors that use a 3-wire (power, common, signal) or a custom 2-wire (A/+ and B/-) positive-voltage interface.

The PVT is the preferred module to use for IEPE sensors, including the Bently Nevada Velomitor (3005xx) and IEPE accelerometers. Using the PVT modules for these sensors improves noise performance of the sensor.

- **PVT** Positive Dynamic Sampler (Prox, Accel, Velom)

The PVT module is recommended for new Velomitor installations only. Projects using the 190501 Velomitor CT or retrofits that reuse other existing Velomitor sensors should use the PAV module unless the user can verify the sensor power limits are appropriate for existing Velomitors.

Connectors

The Dynamic Input module uses an ix Industrial connection to provide access to four buffered transducer output (BTO) connectors for each of the dynamic channels, with short circuit protection. The ix Industrial connection is available on the public and utility side of the module.

Dynamic Input Modules

Dynamic Input Modules	
PAV	(-) (Prox, Accel, Velom)
PAS	(-) (Prox, Accel, Seismic)
PAA	(-) (Prox, Accel, Aero)
PAD	(-) (Prox, Accel, DC LVDT)
PVT	(+) (Prox, Accel, Velom)
Speed and Keyphasor	
Speed Range	1-12,000 ppm (pulses per minute)
Minimum Pulse Width	Keyphasor Pulse Width must be greater than or equal to 10 micro-seconds.
Power Consumption	
Maximum	11 W
Typical (All Modules)	7.5 W
Accuracy and Frequency Response	
PAV	**Prox/Accel (3-wire)** 0-40 kHz 1% of Full Scale **Velom (2-wire)** 5 Hz-20 kHz 1% of Full Scale Recommended top scale = 1 in/s to meet 1% accuracy 20-40 kHz 2% of Full Scale
PAS	**Prox/Accel (3-wire)** 0-40 kHz 1% of Full Scale **Seismic (2-wire)** 5 Hz-20 kHz 1% of Full Scale 20-40 kHz 2% of Full Scale

Dynamic Input Modules	
PAA	**Prox/Accel (3-wire)** 0-40 kHz 1% of Full Scale **Aero (4-wire)** 5 Hz-20 kHz 1% of Full Scale 20-40 kHz 2% of Full Scale
PAD	**Prox/Accel (3-wire)** 0-40 kHz 1% of Full Scale **DC LVDT (4-wire)** 5 Hz-20 kHz 1% of Full Scale 20-40 kHz 2% of Full Scale
PVT	**Prox/Accel (3-wire)** 0-40 kHz 1% of Full Scale **Velom (2-wire)** 5 Hz-20 kHz 1% of Full Scale Recommended top scale = 1 in/s to meet 1% accuracy 20-40 kHz 2% of Full Scale
Dynamic Inputs	
Analog Input	See Input Module Sensors and Channels on page 8.
Channels Supported	4 Dynamic Inputs
Sampling Rate	102.4 kHz
Input Interface Impedance (Typical)	
PAV	**Prox/Accel (3-wire)** 10 kΩ

Dynamic Input Modules	
PAS	**Prox/Accel (3-wire)** 10 kΩ **Seismic (2-wire)** 10 kΩ
PAA	**Prox/Accel (3-wire)** 10 kΩ **Aero (4-wire)** 100 kΩ
PAD	**Prox/Accel (3-wire)** 10 kΩ **DC LVDT (4-wire)** 1 MΩ
PVT	**Prox/Accel (3-wire)** 10 kΩ
Input Interface Signal Range [V]	
PAV	**Prox/Accel (3-wire)** Min. -22, Max. 0 **Velom (2-wire)** Min. -24, Max. -2
PAS	**Prox/Accel (3-wire)** Min. -22, Max. 0 **Seismic (2-wire)** Min. -14, Max. 0
PAA	**Prox/Accel (3-wire)** Min. -22, Max. 0 **Aero (4-wire)** Min. -22, Max. 0

Dynamic Input Modules	
PAD	**Prox/Accel (3-wire)** Min. -22, Max. 0 **DC LVDT (4-wire)** Min. -10, Max. 10
PVT	**Prox/Accel (3-wire)** Min. 0, Max. 24 **Velom (2-wire)** Min. 2, Max. 24
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	

Dynamic Input Modules	
This is a true analog signal from the input, not digital to analog reconstitution of the input signal.Some Transducers have an offset BTO bias.	
Transducer Power	
PAV	**Prox/Accel (3-wire)** -24 VDC, Max. 40 mA **Velom (2-wire)** 3.3 mA (Constant current)
PAS	**Prox/Accel (3-wire)** -24 VDC, Max. 40 mA
PAA	**Prox/Accel (3-wire)** -24 VDC, Max. 40 mA **Aero (4-wire)** -24 VDC, Max. 40 mA
PAD	**Prox/Accel (3-wire)** -24 VDC, Max. 40 mA **DC LVDT (4-wire)** -10 to 10 VDC, max. 40 mA
PVT	**Prox/Accel (3-wire)** 24 VDC, Max. 33 mA **Velom (2-wire)** 9.5 mA (Typical)
LEDs	
Channel Status LED (Rear Utility side only)	1 per input channel indicates when the connected sensor is in an OK condition
Module OK LED	Indicates when the module is functioning properly

Dynamic Input Modules	
System Communication 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: -30°C to +70°C (-22°F to 158°F) ⚠ 6U Chassis: -30°C to +65°C (-22°F to 149°F) ⚠ Temperatures over 50°C (122°F) require forced air convection with a minimum airspeed of 0.5 m/s.
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)

Environmental Limits	
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
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.

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

Ⓔx 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)

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				

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.

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.

PAV (Prox/Accel/Vel) Module

Ordering Option	Description
60R/INP01-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

PAA (Prox/Accel/Aero) Module

Ordering Option	Description
60R/INP02-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

PAS (Prox/Accel/Seismic) Module

Ordering Option	Description
60R/INP03-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

PAD (Prox/Accel/DCLVDT) Module

Ordering Option	Description
60R/INP04-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

PVT (Prox/Accel/Velom)

Ordering Option	Description
60R/INP05-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

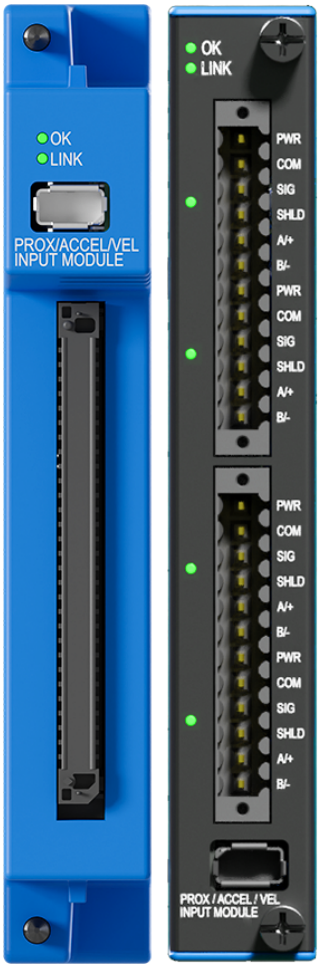
Part Number	Description
175502	3-pin Transducer Barrier
177241	2-pin Velomitor Barrier
175990 or 170M3559	Thermocouple Barrier
170M3559	RTD Barrier

External Galvanic Isolators

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

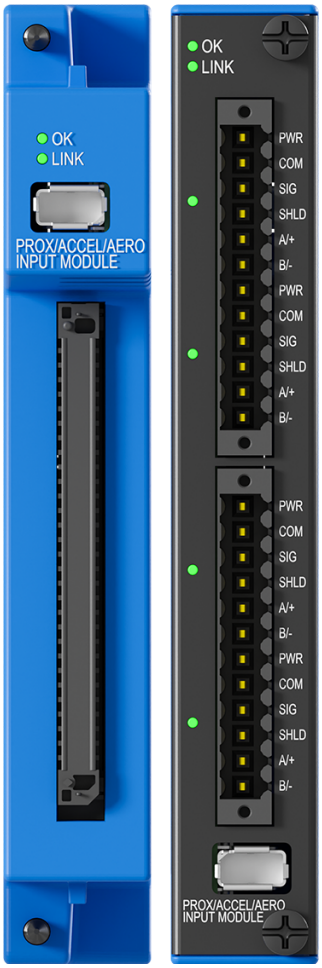
Dynamic Input Module Layout

PAV



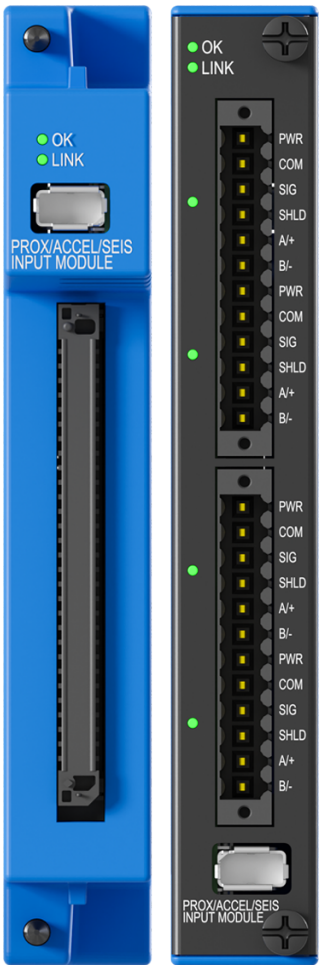
Public Side-Utility Side

PAA



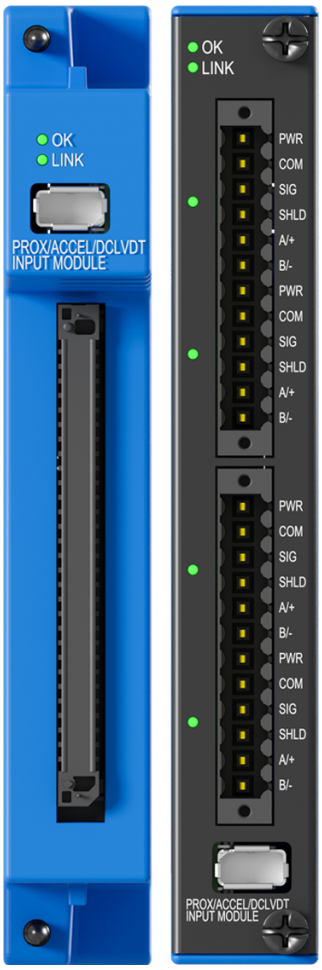
Public Side-Utility Side

PAS



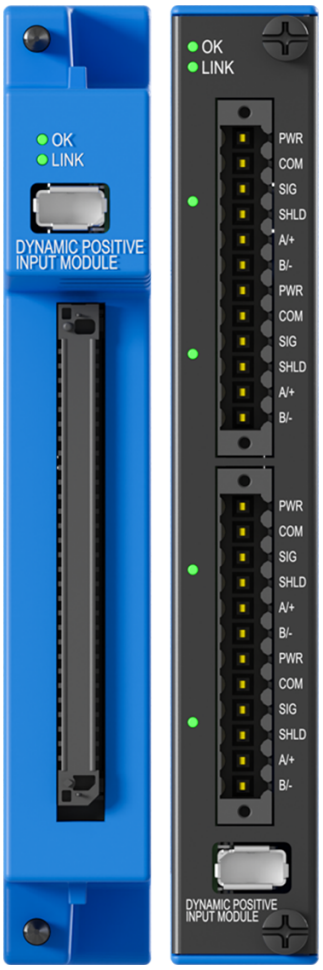
Public Side-Utility Side

PAD



Public Side-Utility Side

PVT



Public Side-Utility Side

Positive Dynamic Sensor Interfaces (PVT Module)

This module accepts one to four sensor inputs.

Recip Cylinder Pressure	
165855	Recip Cylinder Pressure
Custom Cylinder Pressure Transducers	Allows User Definition

Negative Dynamic Sensor Interfaces

These modules accept one to four sensor inputs.

Radial Vibration, Thrust and Speed Measurements	
3300 5 mm, 5M	Proximity Transducer System
3300 5 mm, 9M	Proximity Transducer System
3300 8 mm, 5M	Proximity Transducer System
3300 8 mm, 9M	Proximity Transducer System
3300 HTPS	High Temperature Proximity System
3300 RAM	Radiation Resistant Proximity Transducer
3300 (0.3 in-15 ft)	Radiation Resistant Proximity Transducer
3300 (0.3 in-40 ft)	Radiation Resistant Proximity Transducer

Radial Vibration, Thrust and Speed Measurements	
3300 RAD (0.3 in-110 ft)	Radiation Resistant Proximity Transducer
3300 (0.42 in-15 ft)	Radiation Resistant Proximity Transducer
7200 5 mm	Proximity System
7200 8 mm	Proximity System
7200 11 mm	Proximity System
7200 14 mm	Proximity System
3300XL NSV	Proximity System
3300XL 5 mm, 5M	Proximity System
3300XL 5 mm, 9M	Proximity System
3300XL 8 mm	Proximity System
3300XL 8 mm, 9M	Proximity System
3300XL 11 mm	Proximity System
Magnetic Pickup (MPU)	General Magnetic Pickup Speed Sensor (Supported only on Keyphasor Input Module)
Custom Proximitor	Allows User Definition

Acceleration Measurements	
200350	Accelerometer
200355	Accelerometer
23733-03	Accel I/F Module
24145-02	High-Freq Accel I/F Module
330400	100 mV/g Accelerometer
330425	25 mV/g Accelerometer

Acceleration Measurements	
330450	High Temp Accelerometer
350501	Acceleration Charge Amplifier
350900	HTVAS High Temp Velocity and Accel Sensor
3700300	Accelerometer
86517	Accel Interface Module
Custom	Allows User Definition

Velocity Measurements	
9200	Seismoprobe
74712	High Temp Seismoprobe
47633	Seismoprobe
86205	Velocity Transducer (Mag coil design)
190501	Velomitor CT (PAV Only)
330500	Velomitor
330505	Low Freq Velocity Sensor
330525	Velomitor
330530	Radiation Resistant Velomitor
330750	High Temp Velocity Sensor
330752	High Temp Velocity Sensor
350900 HTVAS	High Temp Velocity & Accel Sensor
86517	Accelerometer Interface Module
Custom Seismoprobe	Allows User Definition
Custom	Allows User Definition

Dynamic Pressure Measurements	
350300	Pressure Dynamic Sensor
350500	Dynamic Pressure Charge Amplifier
Custom Pressure Sensor	Allows User Definition

Case Expansion and Valve Position Measurements	
3300XL RPT	Rotary Position Transducer System (Valve Position Only)
24765-01 DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
24765-02 DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
24765-03 DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
135613-01 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
135613-11 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)

Case Expansion and Valve Position Measurements	
135613-02 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
135613-12 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
135613-03 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
135613-13 High Temperature DC LVDT	DC Linear Variable Differential Transformer (PAD Only)
18639-01 +/-0.5in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-02 +/-1 in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-03 +/-0.531 in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)

Case Expansion and Valve Position Measurements	
18639-04 +/-6in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-05 +/-2in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-06 +/-3in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-07 +/-5in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-08 +/-10in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
18639-09 +/-4in AC LVDT	AC Linear Variable Differential Transformer (AC LVDT Module Only)
Custom Proximitor	Allows User Definition (Case Expansion Only)

Differential Expansion	
3300 5mm, 5M	Proximity Transducer System
3300 5mm, 9M	Proximity Transducer System
3300 8mm, 5M	Proximity Transducer System
3300 8mm, 9M	Proximity Transducer System
3300 HTPS	High Temperature Proximity System
7200 5mm	Proximity Transducer System
7200 8mm	Proximity Transducer System
7200 11mm	Proximity Transducer System
7200 14mm	Proximity Transducer System
3300XL 5mm, 5M	Proximity Transducer System
3300XL 5mm, 9M	Proximity Transducer System
3300XL 8mm, 5M	Proximity Transducer System
3300XL 8mm, 9M	Proximity Transducer System
3300XL 11mm	Proximity Transducer System
3300XL 25mm	Proximity Transducer System
3300XL 50mm	Proximity Transducer System
Custom Proximitor	Allows User Definition

Recip Piston Rod	
3300 XL 8 mm	Proximity Probe

Recip Piston Rod	
3300 XL 11 mm	Horizontal and Vertical Proximity Probe
Custom	3-Wire Transducers

Recip Impulse Acceleration	
330400	Accelerometer
330425	Accelerometer
Custom	Transducers

Recip Velocity	
190501	Velomitor CT
330525	Velomitor XA
330500	Velomitor
Custom	Transducers

Custom Transducers

Custom transducers are software configurable within the following ranges:

Custom Transducers	
Scale factor	1mv/Eng Unit to 2000 mv/Eng Unit
Input voltage range	PVT +0 V to +23 V All other modules +0 V to -23 V
OK checking voltage range	PVT +0 V to +23 All other modules +0 V to -23 V
Engineering units	Selection from standard units table or custom unit entry
350900	HTVAS

Custom Transducers	
47633	Velocity Seismoprobe
86205	Velocity Transducer
350500	Pressure Mod
86517	Custom Input

1631 Bently Parkway South, Minden, Nevada USA 89423
Phone: 1.775.782.3611 (US) or Bently.com/support
Bently.com