# ORBIT 60 SERIES System Overview

## Datasheet

Bently Nevada Machinery Condition Monitoring

137M5182 Rev. M

### Plant-wide • One System

The Orbit 60 Series Protection and Condition Monitoring System provides one continuous, online monitoring system for both critical and plant-wide applications.

### Cyber Secure • Data Isolation

Orbit 60 Series data isolation creates a safe industrial data environment designed to meet IEC 62443-4-2 with world class network security features and segregation of protection and condition monitoring functions.

### Modular • Flexible • Scalable

The Orbit 60 Series system is deployable in any combination of rackmounted and distributed hardware. This provides for better alignment of instrumentation to the machinery application.

### High Speed Process Data Integration

Next generation architecture facilitates full bi-directional communications with plant control systems over a suite of standard protocols.

### Extended Field Wiring Length

With the Orbit 60 Series distributed architecture, connection of multiple chassis through Bridge modules decreases overall electrical installation costs, reduces analog ground loops and noise issues, and moves key maintenance activities further from hazardous areas.

### Industry Leading System Capabilities

The Orbit 60 Series supports monitoring of one or multiple machine trains in a single deployment. One System Interface Module (SIM) defines each system and can encompass up to 68 dynamic channels.

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# Overview

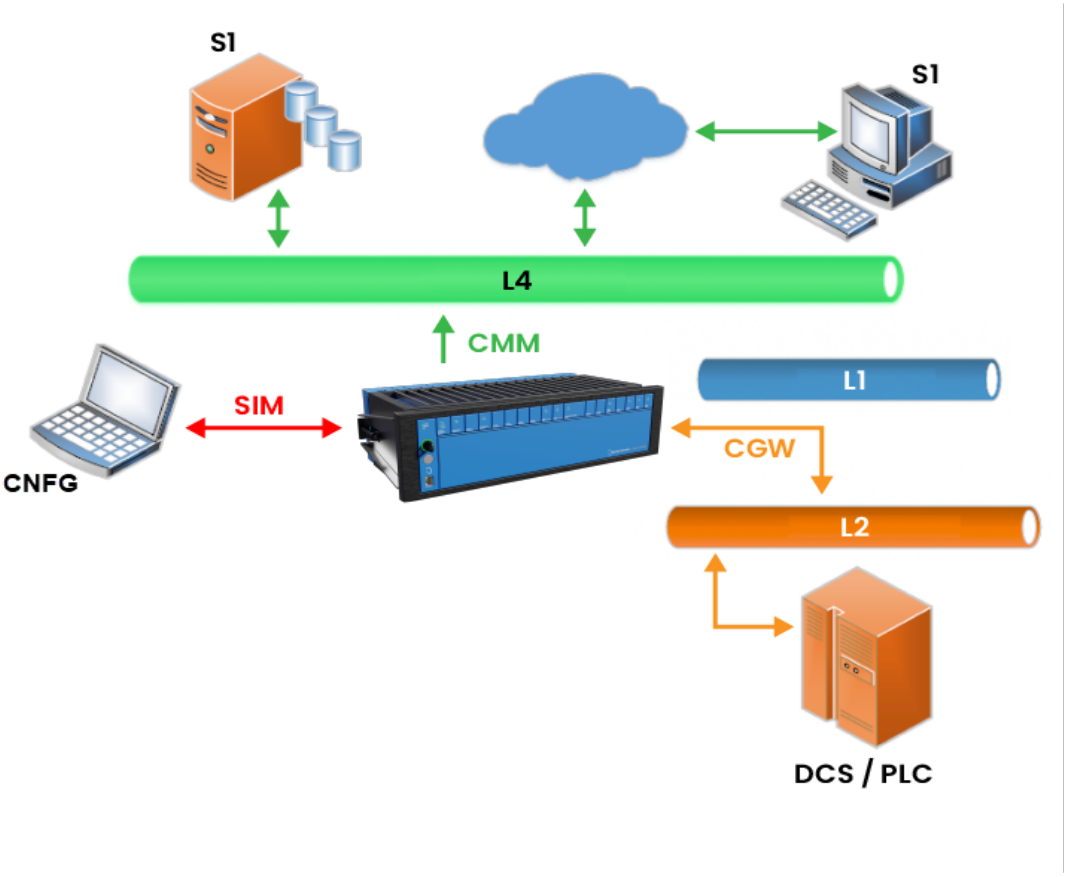
The Orbit 60 Series Protection and Condition Monitoring System provides a single platform for the continuous online monitoring of both critical and plant-wide applications. The Orbit 60 Series system is deployable in any combination of rack, bulkhead, or panel mounted hardwarecreating a seamless connection between chassis to make a single system.

The next table gives a general overview of the components that make up the Orbit 60 platform.

**Table 1: Component Modules**

| | | | |
|---|---|---|---|
| **System Modules** | User Guide (142M9080) | Chassis | 3U Chassis - 19 general purpose slots<br>6U Chassis - 28 general purpose slots |
| | | Power | Power Interface Module (**PIM**) |
| | | Processors | System Interface Module (**SIM**)<br>Protection Processing Module (**PPM**) |
| CMM | User Guide (148M9082) | S1 Interface | Condition Monitoring Module (**CMM**) |
| CGW | User Guide (148M9083) | Comms | Communication Gateway (**CGW**)<br>- Modbus (Ethernet )<br>- EGD (Ethernet) |
| Input Modules | User Guide (137M0804) (168M9885) | Dynamic 4-channel | Negative Dynamic Input (**PAV, PAS, PAA, PAD, KPH**)<br>(provides power for negatively powered transducers)<br><br>Positive Voltage Transducers Dynamic Input (**PVT**)<br>(provides power for positively powered transducers) |
| | | Static 4-channel | Static Displacement Input (**AC LVDT**)<br><br>AC and DC Linear Variable Differential Transducers |
| RTD/TC, Process, Discrete | User Guide (157M8568) | Static 6-channel | RTD/TC Temperature (**RTD**)<br><br>Process Variable Isolated Discrete Input (**PVD**) |
| Output Modules | User Guide (146M5032) | Relays 8-channel | Electro Mechanical Relays (**EMR**).<br>Solid State Relays (**SSR**) |
| Display and CPU | User Guide (137M0702) | Display | External Display (**EXD**) |

## Orbit 60 System Level Diagram




**SIM** - System Interface Module

**CMM** - Condition Monitoring Module

**CGW** - Comm Gateway Module

**S1** - System 1 Server or Client

**CNFG** - Orbit Studio Configuration Software

**DCS/PLC** - Distributed Control Systems/ Programmable Logic Controller

**L1** - Unit Network **L2** -Control Network
**L4** - Business Network

**Figure 1: System Diagram**

One System Interface Module (SIM) defines a system of up to 68 dynamic channels, accommodating multiple machine trains and supporting unrestricted synchronous Keyphasors for any channel. The Condition Monitoring Module (CMM) interfaces to the business network through a cyber-secure access port. The Communications Gateway (CGW) sends (data, status, setpoints) and receives controls (inhibit, reset, trip multiply) with control systems and plant historians.

# Orbit 60 Series Chassis

You can flexibly deploy each chassis option with a public facing side (for rack or panel mounts) and a utility side (for wiring connections and bulkhead mounts). Insert modules and make all wiring connections from the utility side. Provisions for the public side of the chassis include status LEDs, configuration port, Config/Run key, and reset button.

## Chassis Types

3U, 19-Slot
(Bulkhead, Rack, or Panel Mount)

6U, 28-Slot
(Bulkhead, Rack, or Panel Mount)

The system is available in two chassis form factors. A 20 position (19 general purpose slots) single row chassis that fits a 3U 19" system format, and a 29 position (28 general purpose slots) double row version that complies with a 6U 19" system format.

## Mounting Options

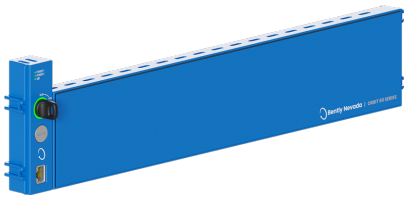
- **Panel Mount Chassis** – Mounts to rectangular cutouts in panels and secures to the panel using clamps supplied with the chassis in 3U 19-inch standard, and 6U 19-inch standard.* configurations. The 6U 19-inch will fit in the space of a 3500 rack.*
- **Rackmount Chassis** – Mounts the 3U or 6U chassis on 19-inch EIA rails. Two 3U units or a single 6U form factor have been designed to fit within the space of a single 19-inch rackmount 3500 unit, as a retrofit.
- **Bulkhead Chassis** - Typically mounts into a protective enclosure fastened to a sub panel in 3U 19-inch standard, and 6U 19-inch standard configurations. NEMA 4 and 4X weatherproof housings are available when required for environmental protection or when purge air is used.

* 6U chassis will be available in later release.

# Front Panel Options

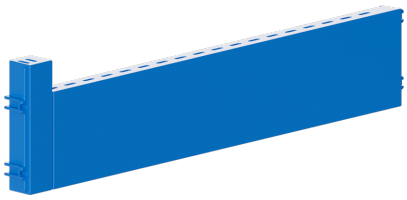
The system front panel features system status LEDs and controls. There are four variations of the front panel: a standard panel and a blank panel for each 3U and 6U form factor.

## Standard Front Panel 3U



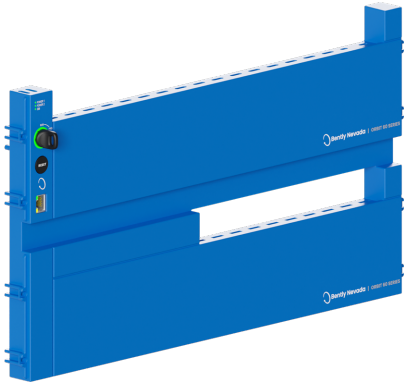
The Standard Front Panel Module is for Orbit 60 chassis that have a SIM module installed in slot two to ensure front panel functionality.

## Blank Front Panel 3U



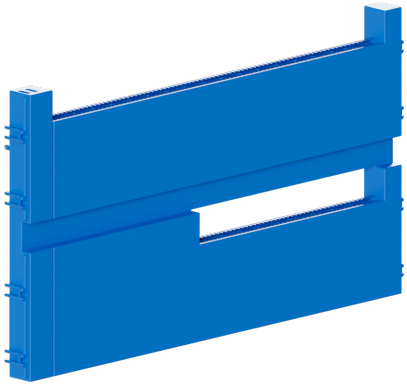
The Blank front panel is built for Orbit 60 chassis that do not have a SIM module installed, or are installed in a Bulkhead configuration.

## Standard Front Panel 6U



The Standard Front Panel Module is for Orbit 60 chassis that have a SIM module installed in slot two to ensure front panel functionality.

## Blank Front Panel 6U



The Blank front panel is for Orbit 60 chassis that do not have a SIM module installed are installed in a Bulkhead configuration.


## Statuses

The Standard Front Panel Module shows the status of the power supplies and the presence and operation of the SIM Module.

## Key Switch


This front panel places the system into the run or program mode of operation using the key switch. When the key is in the RUN position, the ring lights green and configuration changes cannot be made. When the key is in the PRG, or program mode, the ring lights amber and system configuration changes can be made through Ethernet connection to the SIM or front panel.

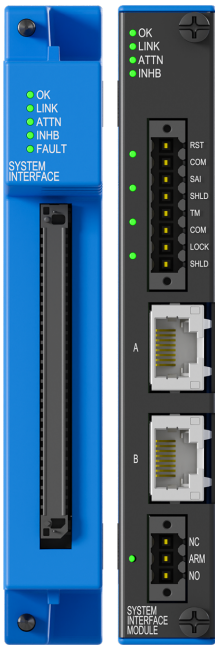
## Reset

A RESET button is located on the Standard Front Panel. This is used to clear latched alarms, relays, and not OK statuses within the system.

## Ethernet

An RJ45 jack provides Ethernet connection to the SIM for external display or configuration tasks from the public side of the system.

## System Interface Module




Each Orbit 60 system requires a single System Interface Module (SIM) The SIM provides the user access to manage protection configuration, local display, system-level diagnostics, system LEDs, system contacts, and the system protection fault relay. The SIM occupies one slot and must be adjacent to the Power Input Module (PIM) in the chassis.

The SIM is the access point for configuring and maintaining the system. The module communicates to the Orbit Studio configuration software and transmits the configuration to other modules in the system. The SIM provides a physical access security feature through a key-lock switch on the public side and a contact on the utility side of the SIM. Either of these controls can be used to secure the system configuration, preventing unauthorized changes.

The SIM has three independently configurable Ethernet ports. Each port can be used for system configuration, system time synchronization, temporary troubleshooting, or an external display.

For additional details, see the System Interface Module Datasheet (142M9054).


## Communication Gateway Module

The Communication Gateway Module (CGW) provides information to external hosts including measurements, alarms, statuses, and system controls using standard industrial protocols. The CGW is designed for integration with process control and other automation systems.

The Communication Gateway module occupies a single slot and has two RJ-45 Ethernet ports supporting Modbus and EGD protocols.

The Comm Gateway Module includes two Ethernet ports which provide TCP/IP communications capabilities. The supported industrial protocols are:

- **Modbus TCP/IP:** Modbus over Ethernet is available for connection to HMI's, unit control systems, or other plant automation equipment. The module can only be configured as a server and supports configurable Modbus addresses within the 40000 address range.
- **Ethernet Global Data (EGD):** EGD is a GE protocol used on Mark VI and Mark Vie controllers and by GE Programmable Automation Controllers and certain 3rd party automation equipment. Version 3.04 and backward compatibility with previous versions is supported.

For additional details, see the Communication Gateway Module Datasheet (137M0700).

## Protection Processing Module


The Protection Processing Module (PPM) serves as the computational engine for the Orbit 60 monitoring system. It extracts all machinery measurements for the protection system and performs alarm determinations. The PPM analyzes signals from transducers, generates measurements and statuses and publishes them to other modules for data collection and external communication. Each PPM occupies a single slot within the system.

Each PPM provides computational capacity for a large number of sensors and can support typical monitored machine trains. The PPM capacity is a function of the type of processing required on each input. If the system requires more processing than a single PPM can provide, additional PPMs can be added to the system for complex monitoring deployments. For protection systems, redundant PPMs are recommended.

The Orbit Studio Configuration Software provides a System Utilization Calculator to evaluate the remaining capacity of the PPMs in your system. If a PPM processing capacity reaches 90%, a warning indicator is displayed in Orbit Studio software, and it is recommended to add another PPM or two PPMs if the system is redundant.

For additional details, see the Protection Processing Module Datasheet (142M8515).

## Condition Monitoring Module


The Condition Monitoring Module (CMM) listens to all information within the system, including all measurements, waveforms, digital transducer signals, system controls, status information, system configuration information, process data from external systems, and alarm and events logs. It only listens, with no capability to write, allowing interface to System 1 over the business networks, with no risk to the protection system.

Each module occupies two slots within the system. Placing multiple CMM modules allows the connection of two independent System 1 clients to the Orbit 60 System. Data is transferred to System 1 continuously, but in the event the connection is lost, non-volatile storage buffers historical data until the information is off-loaded to the host software. System 1 can configure the CMM module to extract additional measurements and waveforms from system sensor data. Without System 1, the customer can use the CMM module to collect data to diagnose machinery issues when an alarm event occurs in the hardware.

For additional details, see the Condition Monitoring Module Datasheet (145M9028).

# Power Input Module


The Power Input Modules (PIM) always reside in a special-purposed slot located in the first slot of the chassis. This slot accommodates two PIMs for redundancy. At least one PIM must power every chassis, and every chassis requires its own PIMs and power sources. Redundant PIMs and power sources are strongly recommended.

The PIM is a half-height module that connects an external power source to the system. Each Orbit 60 Series chassis supports two stacked redundant power input modules. Failure of one power source does not affect the operation if the system uses both power inputs. The PIM employs out-of-range protection for miswiring, overvoltage, and overcurrent protection for the input power sources.

The PIMs support input voltages ranging from +21 Vdc to +32 Vdc. The most common power source comes from external DIN rail mounted AC/DC +24 Vdc output power supplies. The Instrument Common(IS) and Protective Earth ⏚ connections for the system are made at the utility side of the PIM. External redundant power supplies are recommended for the system.

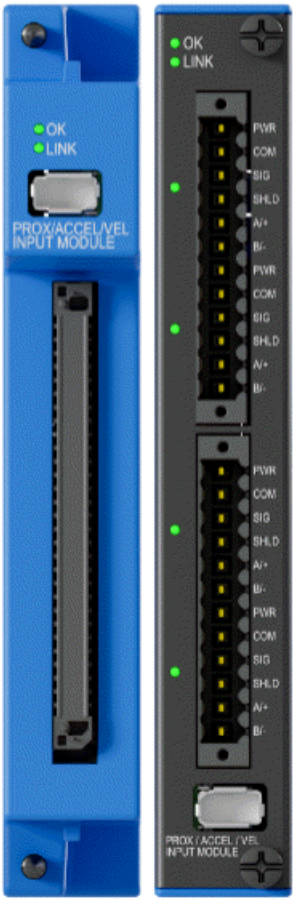
Removal and insertion of a single Power Input Module is supported without disrupting system operation, as long as the other PIM remains installed and connected to its input power source.

Note: The markings on the above image are for illustrative purposes only. The markings on your PIM may vary depending on its version.

For additional details, see the Power Input Module Datasheet (163M5233).

For detailed information on required Power Supply, see associated datasheet (142M8947).

# Dynamic Input Modules




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.

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

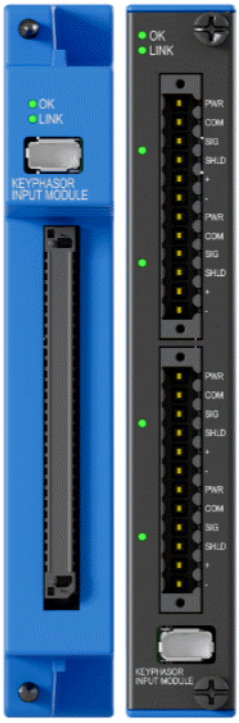
The PVT module is recommended for new Velomitor installations only. Projects using the 190501 Velomitor CT or retrofits that reuse other existing Velomitor sensors should use the PAV module unless the user can verify the sensor power limits are appropriate for existing Velomitors.

## 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.


For additional details, see the Dynamic Input Modules Datasheet (137M0698).

# Keyphasor Input Module




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 serve as 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 works with the following transducers:

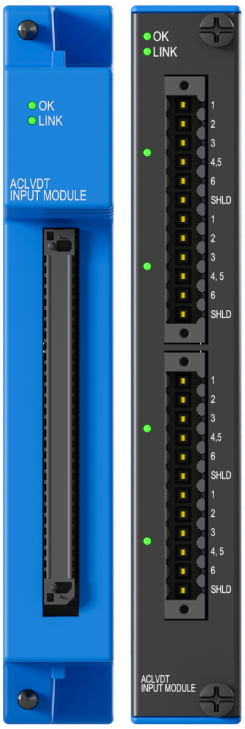
- Magnetic pickup
- 3-wire Prox
- 3-wire Accel

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.

For additional details, see the Keyphasor Input Module Datasheet (157M8566).

# AC LVDT Input Module




The Orbit 60 Series AC LVDT Input Module provides inputs to interface with four AC Linear Variable Differential Transformers for position measurements. The module's primary use is the measurement of case expansion and valve position. The AC LVDT input module occupies a single slot.

The four AC LVDT configured channels can connect to a:

- 5-wire AC LVDT
- 6-wire AC LVDT

Note: To configure the 6-wire, 3 and 4 pins are shorted together.

The module's OK LED indicates when the module is functioning properly, and the LINK LED indicate when the module is communicating to the rest of the system. Four channel status LEDs, located on the utility side of the module, indicate that each AC LVDT sensor is connected and functioning properly.

For additional details, see the AC LVDT Input Module Datasheet (173M3153).

# Temperature Input Modules


## TC/RTD Temperature Module

The primary purpose of temperature modules is to interface to the temperature transducers and convert the signal into a digital representation. These modules condition and digitize the inputs at a rate that completely encompasses the signal content and allows for removal of typical noise sources.

The Orbit 60 Series TC/RTD Temperature Input Modules provide six channels of either Thermocouple (TC) or Resistive Temperature Detector (RTD) temperature input sensors.

Each channel of the Orbit 60 Series TC/RTD input module is individually configurable for sensor type and range using Orbit Studio configuration software.

The RTD/TC inputs reference the internal system ground, and for this reason, should only connect to transducers isolated at the sensing end.

## Sensor Types

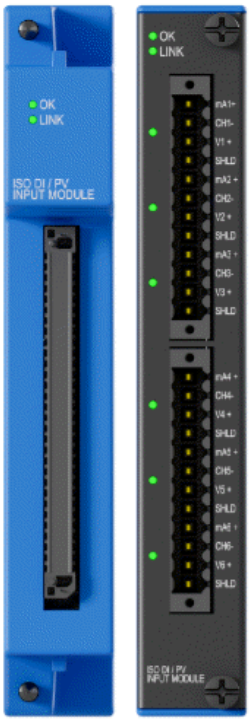
**TC sensors** - The thermocouple configured channels provide cold junction compensation for any J, K, E, or T Type Thermocouple.

**RTD sensors** - The RTD configured channels can be connected to the following:

- 3-Wire 100 Ohm Platinum 0.00392 RTD
- 3-Wire 100 Ohm Platinum 0.00385 RTD
- 3-Wire 10 Ohm Copper RTD
- 3-Wire 120 Ohm Nickel RTD

For additional details, see the Temperature Module Datasheet (137M0706).

# Isolated Process Variable / Discrete Input Module (PVD)




The Orbit 60 Series Isolated Process Variable and Discrete (PVD) Input module processes machine-critical parameters such as pressure, flow, temperature, and levels that merit continuous monitoring. The module conditions and digitizes the signals so the result can be compared with user-programmable alarm setpoints. The user can program the PVD module using the Orbit Configuration software to perform current, voltage or discrete input measurements. This module provides discrete inputs for essential operational commands, such as Trip Multiply for machine start-up and Alarm Inhibit.

The monitor accepts +4 to +20 mA current inputs or any proportional voltage inputs between -10 Vdc and +10 Vdc, in addition to monitoring “dry” or “wet” contacts which can be a sensor, switch, or relay.

Primary purposes of the PVD Module:

- Continuously process input from monitored parameters to be compared against configured alarm setpoints to drive alarms for machinery protection.
- Allow provision of essential machine information, such as Trip Multiply for machine startup and Alarm Inhibit for both operations and maintenance personnel.

These modules occupy a single slot. The module OK LEDs indicate proper functioning, and the LINK LEDs indicate good system communication. Six Channel Status LEDs on the utility side of the module indicate a connected sensor in OK condition.

For additional details, see the Process Variable and Discrete Input Module Datasheet (145M9027).

# Relay Modules

Relay modules may be programed to actuate based on alarm conditions defined in other modules. Use standard logic elements (True AND, Normal AND, OR and NOT) to combine various alarms and statuses (e.g. OK statuses, Bypass, Protection State, Inhibit, Attention, Protection Fault, etc.) into relay activation conditions. Orbit Studio is used to program the voting logic.

Relays can operate as a system or group protection fault relay, if programmed to do so, especially when the protection fault relay on the SIM does not provide adequate granularity of system health - typically for multiple machines in one system.

Pairs of relays within the module function as a single Double-Pole, Double-Throw relay when appropriately configured. Both relay types are available for SIL system implementation. See Orbit 60 SIL User Guide (134M0398) for additional details and design considerations.


## Electromechanical Relay (EMR)

This relay drives a load directly, or through, an interposing relay. This module takes two slots. It features **8 Epoxy Sealed, Single-Pole Double-Throw Electromechanical Relays.** This module supports an AC voltage range of 5-250 Vac for loads of 100 mA to 4 A. The module also supports DC voltages and loads of 5-30 Vdc at 4 A.

## Solid State Relay (SSR)

This relay connects to an external system's discrete input for low current communication. It occupies a single slot and features **8 Solid-State Relays.** This module supports secondary voltages from 1 Vdc up to 125 Vdc and loads of 0.01 to 125 mA.

For additional details, see the Relay Modules Datasheet (137M0699).

## 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 | X | X | X | X | X | X | | | |
| Magnetic Pickups | Speed | | | | | | X | | | |
| Accelerometer (3-wire) | Acceleration[1] | X | X | X | X | X[2] | X | | | |
| Charge Amplifier (3-wire) | Acceleration[1] | X | X | X | X[2] | X[2] | 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] | | | | | 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[3] | | | | X[2, 3] | | | | |
| Velomitor CT | Velocity[1] | X | | | | | | | | |
| Seismoprobe (2-wire) | Velocity[1] | | X | | | | | | | |
| IEPE Positive Constant Current (2- wire) | Velocity[1] | X[3] | | | | X | | | | |
| Amplifier/Interface Modules | Dynamic Pressure | | | X | | | | | | |
| Pressure Transducers | Dynamic Pressure | | | | | 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 |
| 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.

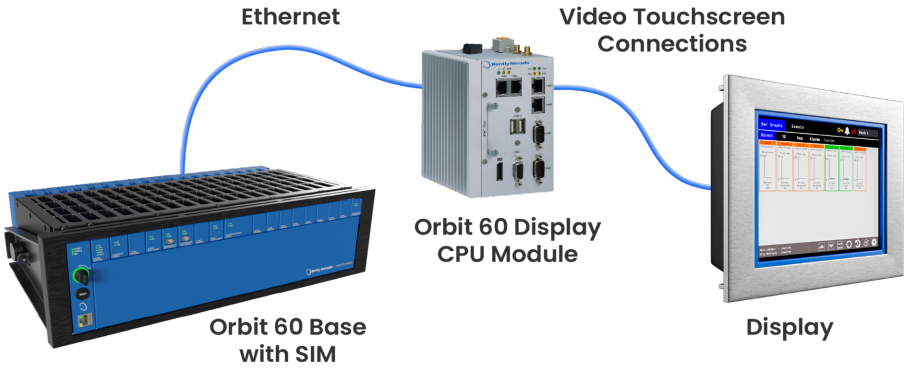
[3] PVT modules are recommended for new installations only. Projects using the Velomitor CT or retrofits that reuse existing sensors should use PAV or verify sensor power limits.

The PVT is only for positively biased sensors.

The Velomitors® and IEPE sensors can be configured on the PAV as a custom transducer.

# External Display

The external display utilizes an industrial computer connected to the SIM via Ethernet. The computer and display placement varies based on application needs. The 10.4", 15", and 21.5" VGA touchscreen displays provide excellent viewing quality for industrial applications. The 10.4" display is suitable for use in hazardous area locations across the world. The 15" display is certified for hazardous areas for North America only. The 21.5" display is intended for non-hazardous (safe) area applications only.




## Display Mounting Options

You can mount the displays in a remote enclosure, panel, or rack.

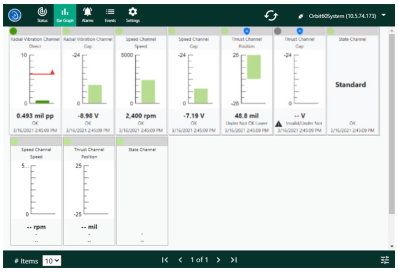
- **10.4" Display** Can be mounted in a rack, panel, and enclosure.
- **15" Display** Can be mounted in a rack, panel, and enclosure.
- **21.5" Display** Can be mounted in a rack or panel.

## Bently Nevada Industrial Computer

The Orbit 60 Series Industrial Computer is certified for hazardous environments when installed in a NEMA3 or NEMA4 enclosure. The industrial computer communicates with an Orbit 60 Base SIM module to gather and output data to supported displays. The small form factor of 5.2 x 4.8 x 3.4 (132 x 122 x 87 mm) enables DIN-rail mounting.

## Orbit Display Software

By default, a bar-graph screen shows all measurements. The Orbit Display software can show bar graphs, alarm lists, event lists, and statuses. Up to 12 Orbit 60 systems can be viewed on one display.



- System-event list
- Alarm-event list
- All module and channel data
- Alarm and OK status

# Orbit Studio Configuration Software

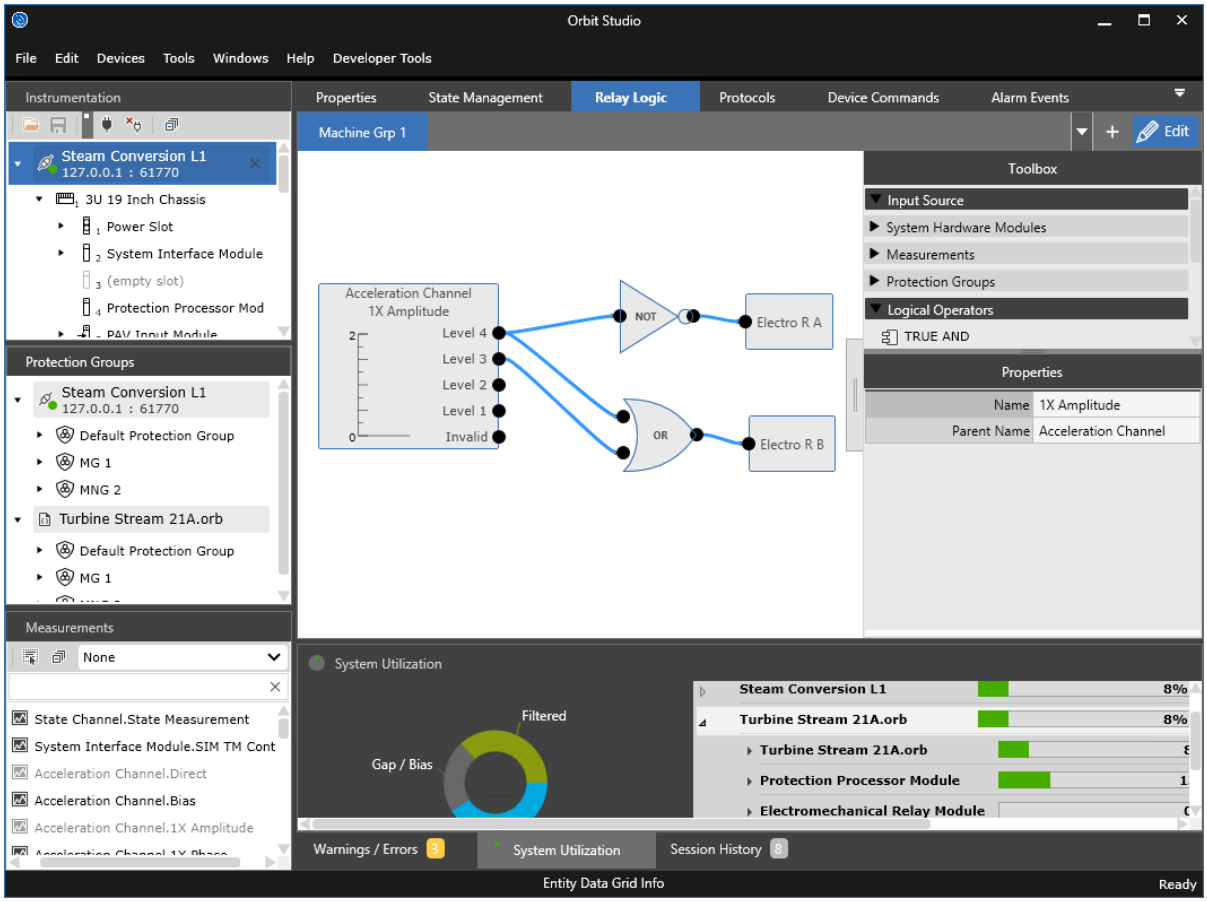
The Orbit Studio software configures Orbit 60 chassis, modules, channels, measurements, setpoints, relays, and many other aspects to protect plant assets. It is also the primary method used to verify systems. For more information, see Orbit Studio online help or Orbit Studio Configuration Software User Guide (137M0696).

## Multiple Systems Configuration

You can connect multiple systems from a single Orbit Studio client session. This opens multiple offline configuration files alongside actively connected systems allowing for easy cross-referencing across systems, while enabling security through user-based permissions. You can copy and paste modules and channels across systems and configuration files, as well as send and retrieve configurations for multiple systems at once.

## Graphical System and Relay Configuration

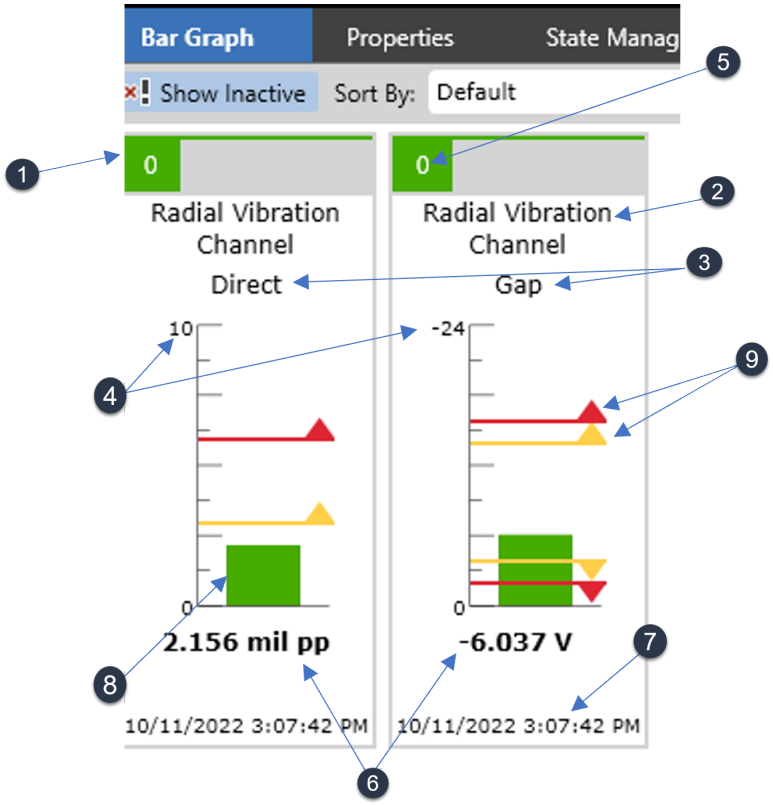
Create and manage multiple pages of relay logic by graphically configuring using drag and drop elements and connectors. You can also graphically assemble your system by dragging and dropping components from a library of modules. The resulting assembly produces a hierarchical representation of the system for access to individual channels.



## Current Values and Loop Check

View current value data across all channels within a system. You can use the bar graphs and tabular lists to complete loop checks from channels throughout the system.

To configure the Orbit 60 system, refer to the Orbit Studio online help .




1. Overall Health
2. Channel Name
3. Measurement
4. Full Scale Range
5. Alert Level
6. Measurement Value
7. System Time
8. Measurement Health
9. Alarm Levels

**Figure 1: Bar graph Verification Screen for 1 RV Channel**

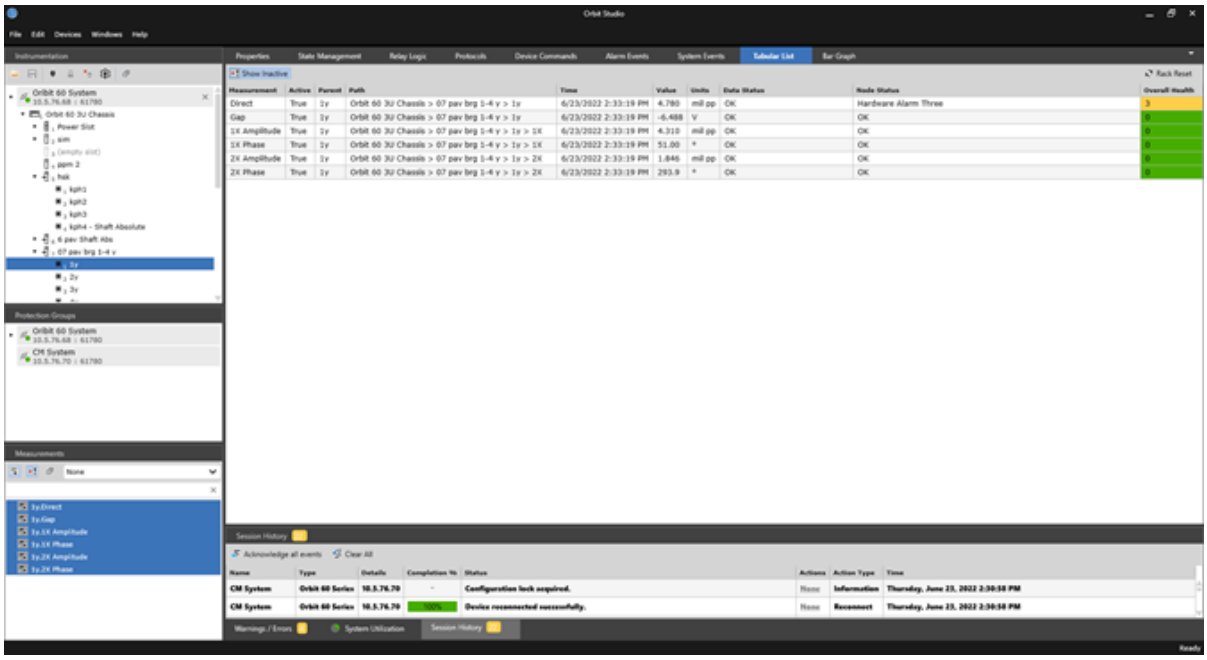
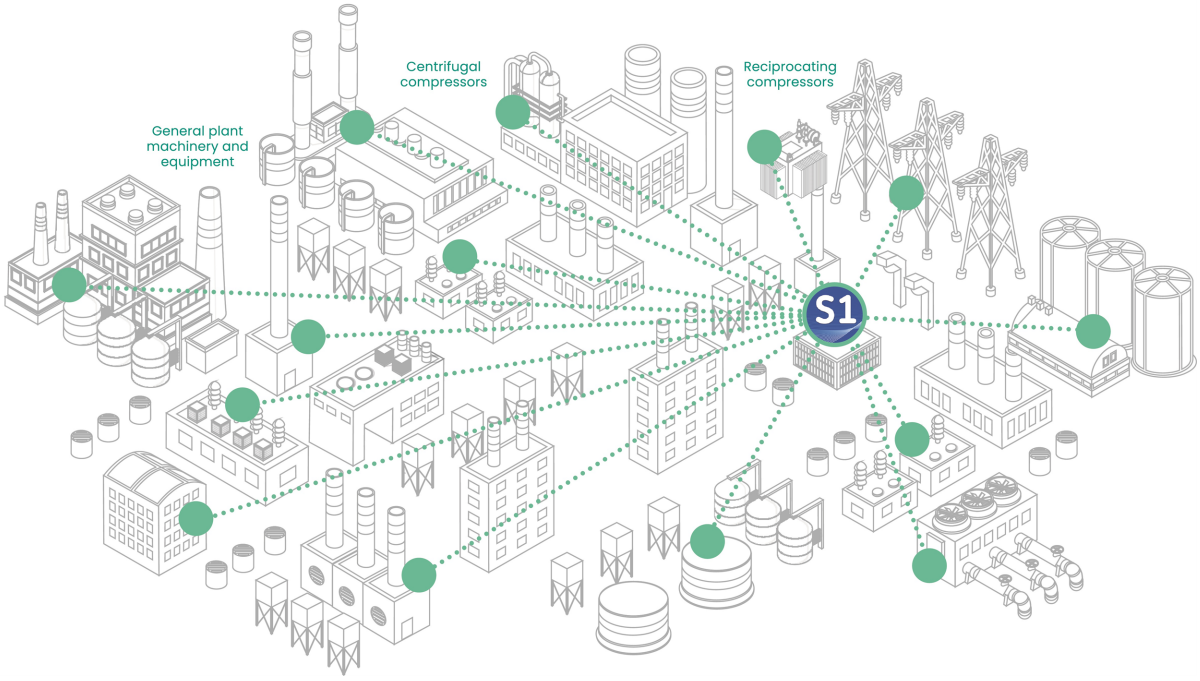


**Figure 2: Tabular List Verification Screen for 1 RV Channel**

## System 1 Integration

Offering plant-wide condition monitoring insights to reduce risk, increase productivity, and minimize unplanned downtime, System 1 streamlines decision-making processes by bringing machine data into a single platform, providing clarity and context to your operations and enterprise. Harnessing the power of Bently Nevada's decades of machinery research and advanced diagnostics expertise, this powerful tool is a key component of successful digital transformation in any industrial facility. By combining its Connectivity, Analytics, and Visualization capabilities, System 1 is the premier Edge historian and condition monitoring platform among industrial operators.

Take full advantage of System 1 Condition Monitoring Software in conjunction with Orbit 60 Series for complete monitoring and advanced diagnostics for all machine types, including roller-element bearings. Use the Orbit 60 Series Condition Monitoring Module (CMM) for a read-only access point to provide a cyber-secure approach for obtaining data through the business network or other systems.




Bently Nevada has a rich heritage in helping customers solve industrial maintenance challenges that is over 60 years strong. Through user research in 25 countries with more than 500 end users, we have studied our customers' team dynamics, site processes, and technology suites to determine how System 1 can best support plant-wide machinery management. The resulting platform is the most comprehensive and user- intuitive condition monitoring solution ever developed.

## System 1 Support for Orbit Channels and Measurements

The Orbit 60 Condition Monitoring Module (CMM) interfaces with System 1. Data is transferred from Orbit 60 to System 1 continuously.

- You can view Orbit 60 alarms and system health events in System 1.
- When a measurement triggers an alarm in Orbit 60, the alarm and system events are visible in System 1.

- Alarm and transient data configured in System 1 Data Collection States and Points are also applied to Orbit measurements.
- Orbit measurements can be used to configure triggers for state events (Start up/Shutdown, Running, Slow Roll, or Machine Off) in System 1.
- You can use replication, OPC/DA (data access), and OPC/UA (unified architecture) to export Orbit channels and measurements from System 1.
- System 1 Audit files contain Orbit channels and measurements.

# Specifications

## Orbit 60 System

| Full-Load Chassis | |
|---|---|
| **Power Consumption** | |
| 3U 19" full load | Typical: 120 Watts<br>Maximum: 180 Watts |
| 6U 19" full load | Typical: 160 Watts<br>Maximum: 300 Watts |

The Orbit 60 Series system was qualified with the power supplies listed in Accessory section of this datasheet. Use of a reduced wattage power supply may result in changed behavior under fault conditions.

| | |
|---|---|
| **Max Current** | |
| 3U Current Draw: | 8.6 Amps Max |
| 6U Current Draw: | 14.3 Amps Max |
| **Characteristics** | |
| Voltage Input | +21 to +32 Vdc |
| Current Draw | 8.6 Amps max |
| Maximum | 8.6 Amps |
| Out of Range Protection | An undervoltage does not harm the PIM.<br>An overvoltage causes the fuse to open. |
| Chassis Loading | No minimum chassis loading is required. |
| **Outputs** | |
| OK LED | Indicates the module is functioning properly. |

| Full-Load Chassis | |
|---|---|
| LINK LED | Indicates the module is successfully communicating on the internal network. |
| **Weight** | |
| 3U 19" Chassis | 32 lbs (14.5 kg) |
| 6U 19" Chassis | 64 lbs (29.03 kg) |

| System Physical Dimensions | |
|---|---|
| **3U Standard Chassis (19")** | |
| Width | 19" (48.26 cm) - with bezel<br>18.87" (47.93 cm) - panel mount without bezel<br>17.53" (44.53 cm) - rackmount without bezel |
| Height | 5.2" (13.21 cm) - with bezel |
| Depth | 9.67" (24.56 cm) |
| **6U Standard Chassis (19")** | |
| Width | 19" (48.26 cm) - with bezel<br>18.87" (47.93 cm) - panel mount without bezel<br>17.53" (44.53 cm) - rackmount without bezel |
| Height | 10.47" (26.6 cm) - with bezel |
| Depth | 9.67" (24.56 cm) |
| **Single Wide Module** | |
| Width | 0.8" (2.03 cm) |
| Height | 5.2" (13.21 cm) |
| Depth | 9.67" (24.56 cm) |
| **Double Wide Module** | |
| Width | 1.64" (4.17 cm) |
| Height | 5.2" (13.21 cm) |
| Depth | 9.67" (24.56 cm) |

# Environmental Limits (All Modules)

| Environmental Limits | |
|---|---|
| Chassis Operating Temperature Range<br><br>(indoor use only) | 3U Chassis:<br>-30°C to +70°C<br>(-22°F to 158°F) ⚠<br>6U Chassis:<br>-30°C to +65°C<br>(-22°F to 149°F) ⚠ |
| Module Temperature Rating - Certification | -30°C to +70°C<br>(-22°F to 158°F)<br>You must still meet the Chassis Operating Temperature Range defined above. |
| Storage Temperature Range | -40°C to +85°C<br>(-40°F to 185°F) |
| Relative Humidity | 0% to 95% rH non-condensing operating and storage |
| Vibration | Without Isolators:<br>0 g to 0.35 g @ 57-500 Hz<br>With Isolators:<br>0 g to 5 g @ 57-500 Hz |
| Shock | 2" Incline Drop |

| Environmental Limits | |
|---|---|
| Altitude | < 2000 m (6,562 ft)<br>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**

If you install the hardware in a location where temperatures may exceed 40° C (104° F) or in excessive humidity, you should consider supplying environmental controls. High temperatures will reduce the operational life of the system.

## System Interface Module

| System Interface Module (SIM) | |
|---|---|
| **Power Consumption** | |
| Typical | 7.6 Watts |
| Maximum | 10.9 Watts |
| **System Contacts** | |
| 4 contacts on utility or rear side | Trip Multiply |
| | Alarm Inhibit |
| | System Reset |
| | Configuration Lock |
| Voltage In | 24 V max |
| Current rating | <1 mA to 125 mA |
| **Protection Fault Relay** | |
| Relay Type | Solid State, Single-Pole, Double Throw |
| Voltage | 1 Vdc to 125 Vdc |
| Current | 0.01 to 125 mA |
| Communications | |
| 1 Ethernet port - public side<br>2 Ethernet ports - utility side | Independent Ethernet ports 1000/100/10 Base-T Auto-negotiation |
| Connector | RJ-45 |
| Supported Connections | NTP time sources<br>Orbit Config - System configuration<br>Orbit Display - Local system display |
| Cable Length | 100 meters (328 feet) max |

| System Interface Module (SIM) |
|---|
| **Cyber Security** |
| - Aligned to the IEC 62443-4-2 standard. |
| - Encrypted communications using latest TLS standards. |
| - PKI implemented signed firmware images to facilitate secure boot and trusted firmware updates. |
| - Device identity management uses certificates for trusted connections. |
| - Configure user, roles and rights account management. |
| - Uses physical Run/Program control |

| System Interface Module (SIM) | |
|---|---|
| **Controls and Contacts** | |
| **RST**<br>Reset Contact or Button | Used to clear all latched alarms and NOT OK statuses across the system. LED indicates reset contact closed. [1] |
| **SAI**<br>System Alarm Inhibit Contact | Used to inhibit all alarms within the system. LED indicates the state of the alarming functions within the system. |
| **TM**<br>Trip Multiply Contact | Used to place the system in Trip Multiply. LED indicates that the system is in Trip Multiply mode. |

| System Interface Module (SIM) | |
|---|---|
| **LOCK**<br>Configuration Lock Contact or Key | **PRG** - Allows configuration changes to be made to the system. Amber LED indicates the system is in Program mode.<br><br>**RUN** - Locks the system, blocking configuration changes. Green LED indicates the system is in Run mode. [2] |
| **NO, ARM, NC**<br>Protection Fault Relay | NO, ARM, and NC contacts are all used to wire the output to an external receiver. A green LED indicates that all the protection functions within the system are operational. Red indicates the protection path is faulted and the Protection Fault Relay is in a tripped state (not energized). |

[1] Performed by either closing the contact on the module or pressing the button on the front panel.

[2] Performed by either closing the contact on the module or setting the key on the front to the RUN setting on the front panel.

## Communications Gateway

| Communications Gateway (CGW) | |
|---|---|
| **Power Consumption** | |
| Maximum | 10.2 Watts |
| Typical | 6.8 Watts |
| **Data Communications** | |
| 2 Ethernet ports - utility or rear side | Independent Ethernet ports 1000/100/10 Base-T Auto-negotiation |
| Connector | RJ-45 |
| Cable Length | 100 meters (328 feet) max |
| **Updated Rate** | |
| Modbus | 50 ms |
| EDG | 20 ms |
| **LEDs** | |
| Module OK LED | Indicates when the module is functioning properly |
| System Communication LED | Indicates when the module is communicating to the rest of the system |
| **Physical Characteristics** | |
| Required Rack Space | 1 Slot |

## Protection Processor Module

| Protection Processor Module (PPM) | |
|---|---|
| **Power Consumption** | |
| Typical | 6.1 Watts |
| Maximum | 9.7 Watts |

| Protection Processor Module (PPM) | |
|---|---|
| **Channel Types** | |
| • Acceleration<br>• Case Expansion<br>• Differential Expansion<br>• Process Variable<br>• Dynamic Pressure<br>• Radial Vibration<br>• Speed<br>• Temperature<br>• Thrust<br>• Valve Position<br>• Velocity | |
| **Measurements and Signal Processing** | |
| 1X/2X/nX Amplitude and Phase | In a complex vibration signal, notations for signal components having frequencies equal to fractions of rotative speed. Also called subharmonic and subsynchronous. |
| Amplitude Extraction | Amplitude Extraction measurements can be based on synchronous or asynchronous sampling. |
| Bandpass | Adjustable lowpass and highpass corners based on the frequency range of the transducer. |
| Bias | Applicable to Acceleration and Velocity sensor inputs. The DC voltage used by the system as a bias for the transducer. Can be used as a diagnostic tool for evaluating system integrity. Note: The bias voltage measurement contains no information about the condition of the machinery being monitored. It is provided only for monitoring system diagnostics. |

| Protection Processor Module (PPM) | |
|---|---|
| Case Expansion | A measurement of the axial position of the machine casing relative to a fixed reference, usually the foundation. The measurement is typically made with a Linear Variable Differential Transformer installed on the foundation at the opposite end of the machine from the point where the casing is attached to the foundation. Changes in casing axial position are the result of thermal expansion and contraction of the casing during startup and shutdown. |

| Protection Processor Module (PPM) | |
|---|---|
| Complimentary Input DE (Composite of Differential Expansion Channel measurements) | Complementary Input Differential Expansion (CIDE) is a method of measuring Differential Expansion. Two proximity probes are mounted and gapped so that the measurement range is twice the range of a single proximity probe. One probe is in its linear range during the first half of the measurement range and the second probe is in range during the second half of the measurement range. The monitor is configured so that it will switch from one probe to the other probe when the gap voltages are at the switch point. The switch point is termed the Cross Over Voltage. The monitor uses the Direct static value from each probe to determine the overall expansion value. The overall expansion value is termed the Composite static value and it is the value used for machine protection and machinery management information. |

| Protection Processor Module (PPM) | |
|---|---|
| Differential Expansion | The measurement of the axial position of the rotor with respect to the machine casing at some distance from the thrust bearing. Changes in axial position relative to the casing affect axial clearances and are usually the result of thermal expansion during startup and shutdown. The measurement is typically made with a proximity probe transducer mounted to the machine casing and observing an axial surface (e.g., collar) of the rotor. |
| Direct | Data or a signal which represents the original transducer signal without significant filtering. Sometimes called unfiltered, raw, all pass, or overall data or signal. Bently Nevada signal processing does some filtering to create "direct" data, but it still contains broadband frequency information. |

| Protection Processor Module (PPM) | |
|---|---|
| Dual Ramp (Composite) | Dual Ramp Differential Expansion is a method of measuring Differential Expansion and is a subset of a number of measurement methods, generally termed Ramp Differential Expansion, which make use of ramps to measure axial position. Two proximity probes observe different ramps. The two ramp sections must be mirror images with the same ramp angle. The two probes mount on the same side of the rotor and in the same axial plane. The monitor uses the direct static values from both channels to measure axial position and compensate for the effect of radial movement. The compensated result is termed the Composite static value and is the primary value used for machine protection and machinery management information. |
| Eccentricity | The radial displacement of the rotor journal centerline from the geometric center of a fluid lubricated bearing. Eccentricity is measured while the turbine is on slow roll (1 to 240 RPM below the speed at which the rotor becomes dynamic and rises in the bearing on the oil wedge) and requires special circuitry to detect the peak- to-peak motion of the shaft. |

| Protection Processor Module (PPM) | |
|---|---|
| Gap | The physical distance between the face of a proximity probe tip and the observed surface. The distance can be expressed in terms of displacement (mils, micrometres), or in terms of voltage (millivolts). Standard polarity convention dictates that a decreasing gap results in an increasing (less negative) output signal. |
| Integration/RMS | Available for Velocity and Acceleration channels to be applied to Direct, Bandpass, 1X, 2X, nX an SMAX measurements. |
| Non-Standard Single Ramp DE (Composite) | Nonstandard Single Ramp Differential Expansion is a method of measuring Differential Expansion and is a subset of a number of measurement methods, generally termed Ramp Differential Expansion, which make use of ramps to measure axial position. Two proximity probes observe the same ramp. The two probes are mounted on opposite sides of the rotor ( 180 degrees apart). The monitor uses the direct static values from both channels to measure axial position and compensate for the effect of radial movement. The compensated result is termed the Composite static value and is the primary value used for machine protection and machinery management information. |

| Protection Processor Module (PPM) | |
|---|---|
| Number of Reverse Rotation | Valid when the machine is spinning backwards and has exceeded the reverse speed setpoint, counting revolutions. |
| Position | Position has a variety of applications. For the Thrust and Differential Expansion it is the change in axial direction with respect to a fixed reference. Also used in Case Expansion to measure case growth and Valve Position to measure how open or closed a valve is. |
| Process Variable | The Process Variable Channel accepts current and voltage proportional inputs from a transmitter for the purpose of monitoring process variables (temperature, pressure, flow, etc.). |
| Reverse Peak Speed | Valid when the machine is spinning backwards and has exceeded the reverse speed setpoint, storing the highest achieved reverse speed. |
| Reverse Speed | Valid when the machine is spinning backwards. This measurement behaves like a typical speed measurement. |
| Rotor Acceleration | Rotor acceleration is a ramp rate of a rotor (in rpm / min) as its speed increases from zero rpm to the machine's running speed value. |

| Protection Processor Module (PPM) | |
|---|---|
| Shaft Absolute | Shaft Absolute vibration is the measurement of the shaft motion referenced to free space. It is measured using a vector summation of shaft relative motion and bearing seismic motion. A proximity sensor and an integrated velocity sensor must be mounted at the same location. Shaft Absolute Direct and 1X measurements are available on Radial Vibration channels. |
| SMAX | Measurement of the maximum excursion from an axial position. |
| Speed | Measurement of the rate of rotational motion. |

| Protection Processor Module (PPM) | |
|---|---|
| Standard Single Ramp DE (Composite) | Standard Single Ramp Differential Expansion is a method of measuring Differential Expansion and is a subset of a number of measurement methods, generally termed Ramp Differential Expansion, which make use of ramps to measure axial position. One proximity probe, termed the ramp transducer, observes a ramp and the other probe, termed the flat transducer, observes the shaft. The two probes are mounted on the same side of the rotor and in the same axial plane. The ramp transducer measures axial position and the flat transducer measures radial position. The monitor uses the flat channel Direct static value to compensate the ramp channel Direct static value for the effect of radial movement. The compensated result is termed the Composite static value and is the primary value used for machine protection and machinery management information. |
| Valve Position | Measurement of the percentage open or closed of a valve. |

| Protection Processor Module (PPM) | |
|---|---|
| Zero Speed | A channel whose transducer is used to monitor the shaft rotational speed of a large rotor machine in revolutions per minute (under 100 rpm) below which the turning gear engagement can safely occur. Continuous shaft rotation during machine shutdown is imperative to prevent shaft bow that could lead to possible machine damage during startup. The channel receives a signal from a transducer whose output frequency is proportional to the speed of a rotor. |
| **Alarming** | |
| Alarm Time Delays | 100 ms to 60 sec for vibration and position measurements.<br>1 sec to 60 sec for speed measurements. |
| Setpoints | Four setpoint levels available at a each measurement. |
| Protection States | Up to 32 Protection States that be controlled by Discrete contacts or configurable measurement ranges. Alarm setpoints are adjustable for different Protection States. |

| Acceleration Channel | |
|---|---|
| **Direct/Bandpass** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Integration | Option allowed |
| Units | g pk<br>g rms<br>m/s^2 pk<br>m/s^2 rms |
| Integrated Units | in/s pk<br>in/s rms<br>mm/s pk<br>mm/s rms |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | User can set values below the low pass frequency.<br>Range of 0.0625 to 39,999 |

Frequency response of the transducer needs to be considered.

| Bias | |
|---|---|
| Units | V |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |

| Acceleration Channel | |
|---|---|
| **1X and 2X (Default Variables)** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Integration | Option allowed |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |
| **nX (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40kHz |
| Integration | Option allowed |
| Order | 0.1 to 100 X; with precision of 0.1 x |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |

| Acceleration Channel | |
|---|---|
| Maximum Speed | **Keyphasor source:**<br><br>High Speed Keyphasor =<br><br>120,000 rpm<br>when 0.1x ≤ n orders ≤ 12.5x<br><br>60,000 rpm,<br>when 12.5x < n orders ≤ 25x<br><br>30,000 rpm,<br>when 25x < n orders ≤ 50x<br><br>15,000 rpm,<br>when 50x < n orders ≤ 100x<br><br>Dynamic Input Module =<br><br>12,000 rpm |
| **Amplitude Extraction (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Integration | Option allowed |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Spectral Lines | 100, 200, 400, 800, 1600, 3200 |
| Frequency Span (Asynchronous) | 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 40000 Hz |
| Samples Per Rev (Synchronous) | 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 |
| Number Of Revs (Synchronous) | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 |
| Number of Averages | Up to 128 |
| Minimum Speed | 50 rpm |

| Acceleration Channel | |
|---|---|
| Maximum Speed | Keyphasor Source:<br>High Speed keyphasor = 120,000 rpm<br>Dynamic Sampled Input Module = 12,000 rpm |
| Center Frequency and Bandwidth | Configurable over the supported spectral range (up to 40 kHz for Asychronous or up to 1600X for Synchronous sampling)<br>Bandwidth ≥ 0 |

| Case Expansion Channel | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| **Position** | |
| Units | V |
| Direct | in<br>mm |
| **Composite (Additional Variable)** | |
| Units | in<br>mm |

| Differential Expansion Channel | |
|---|---|
| **General Tab Properties** | |
| Probe Configuration | 1. Single Channel Differential Expansion<br>2. Standard Single Ramp Differential Expansion Flat Section<br>3. Standard Single Ramp Differential Expansion Ramp Section<br>4. Dual Ramp<br>5. Non-Standard Single Ramp Differential Expansion<br>6. Complementary Input Differential Expansion |

The desired Probe Configuration can be set for the Differential Expansion Channel.

Options 2-6 require the channel to also have a Composite Trended Variable added per Channel pair.

| Position and Composite (Additional Variable) | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±2% maximum |
| Units | in<br>mm |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5 Hz |
| **Gap** | |
| Units | V |

| Differential Expansion Channel | |
|---|---|
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5 Hz |
| **Bandpass (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Unit | in<br>mm |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | 0.0626 to 40,000<br>( must be < LPF) |
| **nX (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Integration | Option allowed |
| Order | 0.1 to 100 X; with precision of 0.1 x |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |

| Differential Expansion Channel | |
|---|---|
| Minimum Speed | 50 rpm |
| Maximum Speed | **Keyphasor source:**<br>High Speed Keyphasor =<br>120,000 rpm<br>when 0.1x ≤ n orders ≤ 12.5x<br>60,000 rpm,<br>when 12.5x < n orders ≤ 25x<br>30,000 rpm,<br>when 25x < n orders ≤ 50x<br>15,000 rpm,<br>when 50x < n orders ≤ 100x<br>Dynamic Input Module =<br>12,000 rpm |

| Dynamic Pressure Channel | |
|---|---|
| **Dynamic** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Units | psi pp<br>psi dpp<br>psi rms<br>mbar pp<br>mbar dpp<br>mbar rms |
| Low Pass Poles | 1, 2, 4, 6, 8 |

| Dynamic Pressure Channel | |
|---|---|
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | User can set values below the low pass frequency.<br>Range of .0625 to 39,999 |

Frequency response of the transducer needs to be considered.

| Bias | |
|---|---|
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |

| Bandpass | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz" |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | User can set values below the low pass frequency.<br>Range of 0.0625 to 39,999 |

| Dynamic Pressure Channel |
|---|

Frequency response of the transducer needs to be considered.

| 1X and 2X (Default Variables) | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40kHz |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br>High Speed keyphasor = 120,000 rpm<br>Dynamic Sampled Input Module = 12,000 rpm |

| nX (Additional Variable) | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Order | 0.1 to 100 X; with precision of 0.1 x |
| Minimum Speed | 50 rpm |

| Dynamic Pressure Channel | |
|---|---|
| Maximum Speed | **Keyphasor source:**<br>High Speed Keyphasor =<br>120,000 rpm when 0.1x ≤ n orders ≤ 12.5x<br>60,000 rpm, when 12.5x < n orders ≤ 25x<br>30,000 rpm, when 25x < n orders ≤ 50x<br>15,000 rpm, when 50x < n orders ≤ 100x<br>Dynamic Input Module =<br>12,000 rpm |
| **Amplitude Extraction (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |
| Spectral Lines | 100, 200, 400, 800, 1600, 3200 |
| Frequency Span (Asynchronous) | 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 40000 Hz |
| Samples Per Rev (Synchronous) | 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 |
| Number Of Revs (Synchronous) | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 |
| Number of Averages | Up to 128 |
| Minimum Speed | 50 rpm |

| Dynamic Pressure Channel | |
|---|---|
| Maximum Speed | Keyphasor Source:<br>High Speed keyphasor = 120,000 rpm<br>Dynamic Sampled Input Module = 12,000 rpm |
| Center Frequency and Bandwidth | Configurable over the supported spectral range (up to 40 kHz for Asychronous or up to 1600X for Synchronous sampling)<br>Bandwidth ≥ 0 |

| Process Variable | |
|---|---|
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| Input Options | 4 - 20 mA<br>1 - 5 V<br>0 - 10 V<br>-10 - 10 V |
| Output Options | Custom units accepted. Upper and Lower Limits must be within 100,000 units of each other. |

| Radial Vibration Channel | |
|---|---|
| **Direct/Bandpass** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Units | mil pp<br>µm pp |

| Radial Vibration Channel | |
|---|---|
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.1 - 40,000 Hz; increments of 0.1 Hz (should be greater than 10 times High Pass Frequency) |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | 0.1 - 40,000 Hz; increments of 0.1 Hz (should be less than 1/10 of Low Pass Frequency) |
| **Gap** | |
| Units | V |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |
| **1X, 2X, SMAX** | |
| 1X/2X Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz" |
| SMAX Accuracy | Within ±5% of full-scale |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minmum Speed | 50 rpm |

| Radial Vibration Channel | |
|---|---|
| Maximum Speed | <u>Keyphasor Source:</u><br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |
| **nX** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz" |
| Order | 0.1 to 100x; increments of 0.1x |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minmum Speed | 50 rpm |
| Maximum Speed | **Keyphasor source:**<br><br><u>High Speed Keyphasor =</u><br><br>120,000 rpm<br>when 0.1x ≤ n orders ≤ 12.5x<br><br>60,000 rpm,<br>when 12.5x < n orders ≤ 25x<br><br>30,000 rpm,<br>when 25x < n orders ≤ 50x<br><br>15,000 rpm,<br>when 50x < n orders ≤ 100x<br><br><u>Dynamic Input Module =</u><br><br>12,000 rpm |

| Radial Vibration Channel | |
|---|---|
| **Amplitude Extraction** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Samples Per Rev (Sync.) | 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 |
| Number Of Revs (Sync.) | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 |
| Frequency Span (Async.) | 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 40000 Hz |
| Spectral Lines | 100, 200, 400, 800, 1600, 3200 |
| Number of Averages | Up to 128 |
| Minmum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |
| Center Frequency and Bandwidth | Configurable over the supported spectral range (up to 40 kHz for Asychronous or up to 1600X for Synchronous sampling)<br><br>Bandwidth ≥ 0 |

| Radial Vibration Channel | |
|---|---|
| Shaft Absolute - Direct | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz; increments of 0.1 Hz<br><br>(should be greater than 10 times High Pass Frequency) |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | User can set values below the low pass frequency.<br><br>Range of .0625 to 39,999 |
| Shaft Absolute - 1X | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz" |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minmum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |
| Eccentricity Peak to Peak / Direct | |
| Low Pass Poles | 1 |

| Radial Vibration Channel | |
|---|---|
| Low Pass Corner Frequency | 0.41 Hz |
| Eccentricity Poles | 1 |
| Eccentricity Corner Frequency | 15.6 Hz |

| Speed Channel | |
|---|---|
| **Speed** | |
| Speed/Frequency Signal Accuracy | KPH modules:<br>0.017 to 100 rpm: ±0.1 rpm<br>101 to 10,000 rpm: ±100 rpm<br>10,001 to 120,000 rpm: ±0.01% of actual rotational speed<br>PAV/PAA/PAS/PAD/PVT modules:<br>1 to 100 ppm: ±0.1 rpm<br>101 to 5000 ppm: ±1 rpm (within 3 seconds)<br>5001 to 12,000 ppm: ±15 rpm (within 3 seconds)<br>Definitions<br>ppm = Pulses Per Minute<br>ppm = EPR * RPM<br>EPR = Events Per Revolution<br>"Within 3 seconds" = At higher ppms, the system requires time to settle to the designated accuracy specifications |

| Speed Channel | |
|---|---|
| Top Scale | KPH modules:<br>Must be between 50 and 120,000 rpm, inclusive<br>PAV/PAA/PAS/PAD/PVT modules:<br>Must be between 50 and 12,000 rpm, inclusive |
| Units | rpm<br>cpm<br>Hz |
| **Gap** | |
| Low Pass Corner Frequency | 0.01 - 5Hz |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| **Reverse Speed** | |
| Accuracy | Refer to Speed/Frequency Signal Accuracy |
| Top Scale | KPH modules:<br>Must be between 50 and 120,000 rpm, inclusive<br>PAV/PAA/PAS/PAD/PVT modules:<br>Must be between 50 and 12,000 rpm, inclusive |
| Units | rpm<br>cpm<br>Hz |
| Speed Ratio | 0.00005 – 20,000<br>(up to 10 digits of resolution) |
| Speed Hysteresis | 0 to 10 |
| % Difference | 1 to 10% |

| Speed Channel | |
|---|---|
| **Reverse Peak Speed** | |
| Measurement requires 2 transducers. | |
| Accuracy | Refer to Speed/Frequency Signal Accuracy |
| Top Scale | KPH modules:<br>Must be between 50 and 120,000 rpm, inclusive<br>PAV/PAA/PAS/PAD/PVT modules:<br>Must be between 50 and 12,000 rpm, inclusive |
| Units | rpm<br>cpm<br>Hz |
| Speed Ratio | 0.00005 – 20,000<br>(up to 10 digits of resolution) |
| Speed Hysteresis | 0 to 10 |
| % Difference | 1 to 10% |
| **Number of Reverse Rotations** | |
| Top Scale | Bottom Scale < Top Scale < = 20,000 |
| Speed Ratio | 0.00005 to 20,000<br>(must support up to 10 digits of precision) |
| Speed Hysteresis | 0 to 10 |
| % Difference | 1 to 10% |
| **Rotor Acceleration** | |
| Accuracy | ±20 rpm/min |
| Top Scale | 100 to 9,999 (rpm/min) |
| Bottom Scale | -9,999 to -100 (rpm/min) |
| Unit | rpm/min<br>cpm/min<br>Hz/min (rpm/min) |
| Speed Ratio | 0.00005 – 20,000<br>(up to 10 digits of resolution) |
| Minimum Speed | 1 to 120,000 |
| **Peak Speed** | |
| Accuracy | Refer to Speed/Frequency Signal Accuracy |
| Top Scale | KPH modules:<br>Must be between 50 and 120,000 rpm, inclusive<br>PAV/PAA/PAS/PAD/PVT modules:<br>Must be between 50 and 12,000 rpm, inclusive |
| Units | rpm<br>cpm<br>Hz |
| Speed Ratio | 0.00005 – 20,000<br>(up to 10 digits of resolution) |
| Clamp Signal Below 1 rpm | Option allowed |
| Minimum Speed | 1 to 120,000 |
| **Zero Speed** | |
| Measurement requires 2 transducers. | |

| Speed Channel | |
|---|---|
| Accuracy | Refer to Speed/Frequency Signal Accuracy |
| Top Scale | 10.0 to 99.9 rpm |
| Units | rpm<br>cpm<br>Hz |
| Second Transducer Source | Lists all available speed channels configured in system |
| Speed Ratio | 0.00005 – 20,000<br>(up to 10 digits of resolution) |
| Clamp Signal Below 1 rpm | Option allowed |
| % Difference | 1 to 10% |

| Temperature Channel | |
|---|---|
| **Direct** | |
| Accuracy | Within ±1 degree typical<br>±3 degrees maximum |
| Units | °F<br>°C |
| Temperature Range | -200C - 1370C depending on TC/RTD selection |

| Thrust Channel | |
|---|---|
| **Position** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| Unit | mil, mm |

| Thrust Channel | |
|---|---|
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5Hz |
| **Gap** | |
| Unit | V |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01-5Hz |
| **Bandpass (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Unit | mil pp<br>µm pp |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Poles | 1, 2, 4, 6, 8 |
| High Pass Corner Frequency | 0.0626 to 40,000<br>( must be < LPF) |

| Thrust Channel | |
|---|---|
| **Amplitude Extraction (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Unit | mil pp<br><br>µm pp |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |
| **nX (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br><br>±1% maximum up to 20 kHz<br>±2% maximum up to 40 kHz |
| Unit | mil pp<br><br>µm pp |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Order | 0.1 to 100 X; with precision of 0.1x |
| Minimum Speed | 50 rpm |

| Thrust Channel | |
|---|---|
| Maximum Speed | **Keyphasor source:**<br><br>High Speed Keyphasor =<br><br>120,000 rpm<br>when 0.1x ≤ n orders ≤ 12.5x<br><br>60,000 rpm,<br>when 12.5x < n orders ≤ 25x<br><br>30,000 rpm,<br>when 25x < n orders ≤ 50x<br><br>15,000 rpm,<br>when 50x < n orders ≤ 100x<br><br>Dynamic Input Module =<br><br>12,000 rpm |
| **Spectral Band (Additional Variable)** | |
| Unit | mil pp<br><br>µm pp |
| Speed Ratio | 0.000000001 – 20,000<br><br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br><br>High Speed keyphasor = 120,000 rpm<br><br>Dynamic Sampled Input Module = 12,000 rpm |

| Valve Position Channel | |
|---|---|
| **Valve Position - Position** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| Units | % Open<br>% Closed |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |
| **Valve Position - Direct (Default)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±1% maximum |
| Units | V |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |

| Velocity Channel | |
|---|---|
| **Direct/Bandpass** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±2% maximum |
| Integration | Option allowed |
| Units | in/s pk<br>in/s rms<br>mm/s pk<br>mm/s rms |

| Velocity Channel | |
|---|---|
| Integrated Units | mil pp<br>µm pp |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.0626 - 40,000 Hz<br>Must be greater than high pass frequency and below Upper Transducer Frequency Response. |
| High Pass Corner Frequency | User can set values below the low pass frequency.<br>Range of .0625 to 39,999 |

Frequency response of the transducer needs to be considered.

| Bias | |
|---|---|
| Units | V |
| Low Pass Poles | 1, 2, 4, 6, 8 |
| Low Pass Corner Frequency | 0.01 - 5.00 Hz |
| **1X and 2X** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±2% maximum |
| Integration | Option allowed |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |

| Velocity Channel | |
|---|---|
| Maximum Speed | Keyphasor Source:<br>High Speed keyphasor = 120,000 rpm<br>Dynamic Sampled Input Module = 12,000 rpm |
| **nX (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±2% maximum |
| Integration | Option allowed |
| Order | 0.1 to 100 X; with precision of 0.1 x |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |
| Minimum Speed | 50 rpm |
| Maximum Speed | **Keyphasor source:**<br>High Speed Keyphasor =<br>120,000 rpm when 0.1x ≤ n orders ≤ 12.5x<br>60,000 rpm, when 12.5x < n orders ≤ 25x<br>30,000 rpm, when 25x < n orders ≤ 50x<br>15,000 rpm, when 50x < n orders ≤ 100x<br>Dynamic Input Module =<br>12,000 rpm |
| **Amplitude Extraction (Additional Variable)** | |
| Accuracy | Within ±0.33% of full-scale typical<br>±2% maximum |

| Velocity Channel | |
|---|---|
| Integration | Option allowed |
| Speed Ratio | 0.000000001 – 20,000<br>(up to 10 digits of resolution) |
| Spectral Lines | 100, 200, 400, 800, 1600, 3200 |
| Frequency Span (Asynchronous) | 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 40000 Hz |
| Samples Per Rev (Synchronous) | 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 |
| Number Of Revs (Synchronous) | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 |
| Number of Averages | Up to 128 |
| Minimum Speed | 50 rpm |
| Maximum Speed | Keyphasor Source:<br>High Speed keyphasor = 120,000 rpm<br>Dynamic Sampled Input Module = 12,000 rpm |
| Center Frequency and Bandwidth | Configurable over the supported spectral range (up to 40 kHz for Asychronous or up to 1600X for Synchronous sampling)<br>Bandwidth ≥ 0 |

## Condition Monitoring Module

| Condition Monitoring Module (CMM) | |
|---|---|
| **Power Consumption** | |
| Maximum | 14.2 W |
| Typical | 10.5 W |
| **Data Communications** | |
| 2 Ethernet ports - utility or rear side | Independent Ethernet ports 1000/100/10 Base-T Auto-negotiation |
| Connector | RJ-45 |
| Cable Length | 100 meters (328 feet) max |
| **LEDs** | |
| 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 | 2 Slots |

## Power Input Module

| Power Input Module (PIM) | |
|---|---|
| **Electrical** | |
| Voltage Input | +21 to +32 Vdc |
| **Current Draw** | |
| | 10.5 Amps @ 24 Vdc<br>7.1 Amps @ 24 Vdc |
| Out of Range Protection | An undervoltage does not harm the PIM.<br>An overvoltage causes the fuse to open. |
| **Physical** | |
| Width | 0.8" (2.03 cm) |
| Height | 5.2" (13.21 cm) |
| Depth | 9.67" (24.56 cm) |

## 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 rpm |
| **Power Consumption** | |
| Maximum | 11 W |
| Typical (All Modules) | 7.5 W |

| Dynamic Input Modules | |
|---|---|
| **Accuracy and Frequency Response** | |
| PAV | **Prox/Accel (3-wire)**<br>0-40 kHz 1% of Full Scale<br>**Velom (2-wire)**<br>5 Hz - 20 kHz 1% of Full Scale<br>20-40 kHz 2% of Full Scale |
| PAS | **Prox/Accel (3-wire)**<br>0-40 kHz 1% of Full Scale<br>**Seismic (2-wire)**<br>5 Hz - 20 kHz 1% of Full Scale<br>20-40 kHz 2% of Full Scale |
| PAA | **Prox/Accel (3-wire)**<br>0-40 kHz 1% of Full Scale<br>**Aero (4-wire)**<br>5 Hz - 20 kHz 1% of Full Scale<br>20-40 kHz 2% of Full Scale |
| PAD | **Prox/Accel (3-wire)**<br>0-40 kHz 1% of Full Scale<br>**DC LVDT (4-wire)**<br>5 Hz - 20 kHz 1% of Full Scale<br>20-40 kHz 2% of Full Scale |
| PVT | **Prox/Accel (3-wire)**<br>0-40 kHz 1% of Full Scale<br>**Velom (2-wire)**<br>5 Hz - 20 kHz 1% of Full Scale<br>20-40 kHz 2% of Full Scale |

| Dynamic Input Modules | |
|---|---|
| **Dynamic Inputs** | |
| Analog Input | See Input Module Sensors and Channels on page 17. |
| Channels Supported | 4 Dynamic Inputs |
| Sampling Rate | 102.4 kHz |
| **Input Interface Impedance (Typical)** | |
| PAV | **Prox/Accel (3-wire)**<br>10 kΩ |
| PAS | **Prox/Accel (3-wire)**<br>10 kΩ<br>**Seismic (2-wire)**<br>10 kΩ |
| PAA | **Prox/Accel (3-wire)**<br>10 kΩ<br>**Aero (4-wire)**<br>100 kΩ |
| PAD | **Prox/Accel (3-wire)**<br>10 kΩ<br>**DC LVDT (4-wire)**<br>1 MΩ |
| PVT | **Prox/Accel (3-wire)**<br>10 kΩ |
| **Input Interface Signal Range [V]** | |
| PAV | **Prox/Accel (3-wire)**<br>Min. -22, Max. 0<br>**Velom (2-wire)**<br>Min. -24, Max. -2 |

| Dynamic Input Modules | |
|---|---|
| PAS | **Prox/Accel (3-wire)**<br>Min. -22, Max. 0<br>**Seismic (2-wire)**<br>Min. -14, Max. 0 |
| PAA | **Prox/Accel (3-wire)**<br>Min. -22, Max. 0<br>**Aero (4-wire)**<br>Min. -22, Max. 0 |
| PAD | **Prox/Accel (3-wire)**<br>Min. -22, Max. 0<br>**DC LVDT (4-wire)**<br>Min. -10, Max. 10 |
| PVT | **Prox/Accel (3-wire)**<br>Min. 0, Max. 24<br>**Velom (2-wire)**<br>Min. 2, Max. 24 |
| **Outputs** | |
| BTO Accuracy | **AC**<br>> 0 to < 10 kHz, ±1% of input signal<br>10 kHz to < 20 kHz, ±2% of input signal<br>20 kHz to < 30 kHz, ±4% of input signal<br>30 kHz to ≤ 40 kHz, ±6% of input signal<br>**DC**<br>±100 mV over voltage range of Input Module |
| BTO Output Impedance | 500 Ω |

| Dynamic Input Modules | |
|---|---|
| BTO Connector |  |

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)**<br>-24 VDC, Max. 40 mA<br>**Velom (2-wire)**<br>3.3 mA (Constant current) |
| PAS | **Prox/Accel (3-wire)**<br>-24 VDC, Max. 40 mA |
| PAA | **Prox/Accel (3-wire)**<br>-24 VDC, Max. 40 mA<br>**Aero (4-wire)**<br>-24 VDC, Max. 40 mA |
| PAD | **Prox/Accel (3-wire)**<br>-24 VDC, Max. 40 mA<br>**DC LVDT (4-wire)**<br>-10 to 10 VDC, max. 40 mA |
| PVT | **Prox/Accel (3-wire)**<br>24 VDC, Max. 33 mA<br>**Velom (2-wire)**<br>9.5 mA (Typical) |

| Dynamic Input Modules | |
|---|---|
| **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 |
| System Communication LED | indicates when the module is communicating to the rest of the system |
| **Physical** | |
| Required Rack Space | 1 Slot |

## Keyphasor Input Module

| Keyphasor Module Inputs (KPH) | |
|---|---|
| **Inputs** | |
| Analog Input | • Proximitor (3-wire)<br>• Accelerometer (3-wire)<br>• Proximitor Keyphasor (3-wire)<br>• Magnetic Speed Pickups |
| **Signal Conditioning** | |
| Speed / Frequency Signal Ranges | Input range of 1 to 120,000 cpm (0.017 to 2 kHz). |
| **Non-Speed Dynamic Input Specifications** | |
| Analog Input | See Input Module Sensors and Channels on page 17. |
| Channels Supported | 4 Dynamic Inputs |
| Sampling Rate | 102.4 kHz |

| Keyphasor Module Inputs (KPH) | |
|---|---|
| **Accuracy and Frequency Response** | |
| KPH | Prox/Accel (3-wire)<br>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**<br>> 0 to < 10 kHz, ±1% of input signal<br>10 kHz to < 20 kHz, ±2% of input signal<br>20 kHz to < 30 kHz, ±4% of input signal<br>30 kHz to ≤ 40 kHz, ±6% of input signal<br>**DC**<br>±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 |

## AC LVDT

| Module Inputs | |
|---|---|
| Channels | 4 differential AC signals from AC LVDT |
| Power Consumption | 5.7 W typical, 10 W maximum |

## TC/RTD Temperature

| Temperature | |
|---|---|
| **Thermocouple (TC) Temperature** | |
| Thermocouple | Type J, K, E, T |
| Channel Supported | 6 |
| **RTD Temperature** | |
| RTD Type | Pt100 (385), Pt100 (392), Ni120, Cu10 |

| Temperature | |
|---|---|

Platinum RTD's with 0.00385 alphas are the worldwide industrial standard and are recommended for all applications.

| Power Consumption | |
|---|---|
| Maximum | 6 W |
| Typical | 3 W |
| **LEDs** | |
| Channel Status LED (Rear Utility Side) | 1 per unit channel indicates when the connected sensor is in an OK condition |
| Module OK LED | Indicates when the module is functioning properly |
| System Communication LED | Indicates when the module is communicating to the rest of the system |
| **Physical Characteristics** | |
| Required Rack Space | 1 Slot |

## Isolated Process Variable / Discrete Input (PVD)

| Isolated PV / Discrete Input (PVD) | |
|---|---|
| **Power Consumption** | |
| Typical | 4.5 W |
| Maximum | 6.5 W |
| **Characteristics** | |
| Channels | 6 |
| Isolation | 500 V Channel to System and 250 V Channel to Channel isolation |

| Isolated PV / Discrete Input (PVD) | |
|---|---|
| **Process Variable 4-20 mA Input** | |
| Process Variable Input (Current) | 4 to 20 mA |
| Process Variable Input (Voltage) | -10 to 10 Vdc<br>0 to 10 Vdc<br>2 to 10 Vdc<br>0 to 5 Vdc<br>1 to 5 Vdc<br>-10 to 0 Vdc |

| Discrete Input | |
|---|---|
| Discrete Input | Dry Contact, Internally Wetted<br><br>Wetted Contact, 0 to 10 Vdc |

## Electromagnetic Relay (EMR)

| Electromagnetic Relay (EMR) | |
|---|---|
| **Power Consumption** | |
| Typical | 6 watts |
| Maximum | 11 watts |
| **Characteristics** | |
| Type | Electromechanical Single-Pole, Double-Throw |
| Number of Relay Outputs | 8 |
| Environmental | Epoxy Sealed |
| Operation | Each relay is configurable for Normally De-Energized or Normally Energized |
| **Contact Rating for Standard Systems** | |
| Minimum Switched Current | 100 mA |

| Electromagnetic Relay (EMR) | |
|---|---|
| DC Maximum Switched Current | 4 A @ 30 Vdc |
| DC Minimum Switched Voltage | 5 Vdc |
| DC Maximum Switched Voltage | 30 Vdc |
| AC Maximum Switched Voltage | 250 Vrms |
| AC Maximum Switched Current | 4 A |
| Maximum Switched Power | 180 W or 1800 VA |
| **Contact Rating for Hazardous Area Systems** | |
| Maximum Switched Current | 4 A |
| DC Maximum Switched Voltage | 30 Vdc |
| AC Maximum Switched Voltage | 160 Vrms |

## Solid State Relay (SSR)

| Solid State Relay (SSR) | |
|---|---|
| **Power Consumption** | |
| Typical | 5 watts |
| Maximum | 9 watts |
| **Characteristics** | |
| Type | Solid State Single-Pole, Double-Throw |
| Number of Relay Outputs | 8 |
| Environmental | Plastic Encapsulated |

| Solid State Relay (SSR) | |
|---|---|
| Arc Suppressor | 150 Vdc, installed standard |
| Maximum Cycling Rate | 1 Hz |
| Operation | Each relay is configurable for Normally De-Energized or Normally Energized |
| Switching Properties | Limited to non-inductive loads |
| **Contact Rating for Standard Systems** | |
| Current Range | 0.0 1-125 mA |
| DC Maximum Switched Current | 125 mA @ 125 Vdc |
| Voltage Range | 1-125 Vdc |
| Maximum Switched Power | 650 mW |
| **Contact Rating for Hazardous Area Systems** | |
| Current Range | 0.0 1-125 mA |
| Voltage Range | 1-50 Vdc |

## 10.4" Hazardous Area Display

| 10.4” Hazardous Area Display | |
|---|---|
| Part Number | 120M8155-01 |
| Warranty | 1 Year |
| **Features** | |
| Video Interface | VGA |
| Touch Screen Type | Resistive Touch Screen |
| Cable Interface | Serial |
| Control Settings | Front panel button |

| 10.4” Hazardous Area Display | |
|---|---|
| Mounting Styles | Panel Mount, 19” EIA Rack Mount, and Independent Mount |
| **Power** | |
| Voltage | 24 Vdc nominal voltage range 10 to 28 Vdc |
| Operating Current | Less than 500 mA |
| **Physical Characteristics** | |
| Dimensions | 15.25 x 9.8 x 1.93 in (387.4 x 248.9 x 49 mm) |
| **Environmental Limits - Indoor Use Only** | |
| IP Rating | Designed for IP54 ingress protection against dust and water spray to the front only. |
| Operating Temperature | -20 to 65°C (-4 to 149°F) |
| **Standards and Certifications** | |
| Refer to External Display Datasheet (154M8401) | |

## 15" Hazardous Area Display

| 15” Hazardous Location Display | |
|---|---|
| Part Number | 102M8950 |
| Warranty | 1 Year |
| **Features** | |
| Video Interface | VGA and DVI-D |
| Touch Screen Type | 5-Wire Resistive Touch Screen |
| Touch Screen Interface | Serial and USB-B |
| Control Settings | Front panel button |
| Mounting Styles | Panel Mount and 19” EIA Rack Mount |
| **Power** | |
| Voltage | 24 Vdc nominal voltage range 12 to 24 Vdc |
| Operating Current | ~100 mA |
| **Physical Characteristics** | |
| Dimensions | 16.61 x 13.31 x 2.68 in (422 x 338 x 68 mm ) |
| **Environmental Limits - Indoor Use Only** | |
| IP Rating | IP65 ingress protection against dust and water spray compliant to the front only. |
| Operating Temperature | -20 to 60°C (-4 to 140°F) |
| **Standards and Certifications** | |
| Refer to External Display Datasheet (154M8401) | |

## 21.5" Industrial Display

| 21.5” Industrial Display | |
|---|---|
| Part Number | 150M1466 |
| Warranty | 1 Year |
| **Features** | |
| Video Interface | VGA and DVI-D |
| Touch Screen Type | Projected Capacitive Touch Screen |
| Touch Screen Interface | USB-B and Serial |
| Control Settings | Control buttons on rear panel |
| Mounting Styles | Panel Mount and 19” EIA Rack Mount |
| **Power** | |
| Voltage | 24 Vdc nominal voltage range 22 to 26 Vdc |
| Operating Current | ≈ 200 mA |
| **Physical Characteristics** | |
| Dimensions | 21.98 x 13.77 x 1.88 in (558.4 x 349.8 x 47.7 mm ) |
| **Environmental Limits - Indoor Use Only** | |
| IP Rating | IP66 ingress protection against dust and water spray compliant to the front only. |
| Operating Temperature | -30 to 70°C (-22 to 158°F) |
| Storage Temperature | -40 to 75°C (-40 to 167°F) |
| Ambient Relative Humidity | 10 to 90% non-condensing |

| 21.5" Industrial Display |
|---|
| **Standards and Certifications** |
| Refer to External Display Datasheet (154M8401) |

## Industrial Computer for Display

| CPU Module | |
|---|---|
| CPU | Intel Atom processor E3845 (quad-core, 1M cache, 1.91 GHz) |
| System Memory | 4 GB |
| Storage | SD 3.0 (SDHC/SDXC) 128 GB |
| Display | Intel HD Graphics 4000 |
| **Peripherals** | |
| USB | 2 – USB-A 2.0 |
| VGA | Resolution up to 1920 x 1200 pixels at 75 Hz HDDB-15F port |
| DisplayPort | Resolution up to 2560 x 1600 pixels at 60 Hz receptacle |
| Ethernet | 4 – Auto-sensing 10/100/1000 Mbps RJ45 ports Magnetic Isolation Protection 1.5 kV |
| Serial | 2 – RS-232/422/485 DB9M ports |
| **Power** | |
| Voltage | 12/24 Vdc (11.4 to 36 Vdc) |
| Power | Less than 30 W (nominal) |
| **Physical Characteristics** | |
| Weight | 1.75 kg (3.86 lbs.) |
| Dimensions | 132 x 122 x 87 mm (5.20 x 4.81 x 3.43 in.) |

| CPU Module | |
|---|---|
| **Environmental Limits - Indoor Use Only** | |
| Operating Temperature | -40 to 70°C (-40 to 158°F) |
| **Standards and Certifications** | |
| Refer to External Display Datasheet (154M8401) | |

# 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

* 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)

# Ordering Information

## 60R_SYSTEM - Packaged Chassis

To begin your order, contact your sales representative.

| Ordering Option | Description |
|---|---|
| **A - Chassis Type** | |
| 01 | Rackmount Chassis |
| 02 | Panel Mount Chassis |
| 03 | Bulkhead Mount Chassis |
| **B - Power Input** | |
| 02 | Dual DC Power Input Modules |
| **C - Display** | |
| 00 | No Display |
| **D - Agency Approvals** | |
| 00 | None |
| 01 | CSA/NRTL/C (CLASS 1 DIV 2) |
| 02 | Multi (CSA, ATEX, IECEX) |
| XXX | Country Specific Approvals |
| **E – Functional Safety System** | |
| NO | Standard System |
| YES | Functional Safety System |

All chassis orders will include the following modules:

- PIM
- SIM
- PPM
- CMM

## System Interface Module

| Ordering Option | Description |
|---|---|
| **60R/SIM01-AAA-B • System Interface Module** | |
| 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 |

For an Orbit 60 safety system, SIL certification for the SIM is not required.

## Communications Gateway Module

| Ordering Option | Description |
|---|---|
| **60R/CGW01-AAA-B • RJ-45 Ethernet Comm Gateway** | |
| 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 |

## Protection Processor Module

| Ordering Option | Description |
|---|---|
| **60R/PPM01-AAA-B • Protection Processor Module** | |
| **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 |

## Condition Monitoring Module

| Ordering Option | Description |
|---|---|
| **60R/CMM01-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 |

Two PIM modules are included with the Orbit 60 Chassis.

Specific PIM modules are exclusively used with either the 3U or 6U chassis. The 3U and 6U PIMs are not interchangeable.

## 3U Power Input Module

| Ordering Option | Description |
|---|---|
| **60R/PIM01-AAA-B • Power Input Module** | |
| **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 |

## 6U Power Input Module

| Ordering Option | Description |
|---|---|
| **60R/PIM02-AAA-B • Power Input Module** | |
| **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 |

## PAV (Prox/Accel/Vel) Module

| Ordering Option | Description |
|---|---|
| **60R/INP01-AAA-B** | |
| **AAA – Hazardous Area Certifications** | |
| 00 | No Hazardous Area |

| Ordering Option | Description |
|---|---|
| 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 |

## 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 |

## AC LVDT Input Module

| Ordering Option | Description |
|---|---|
| **60R/INP10-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 |

## RTD / TC Temperature Module

| Ordering Option | Description |
|---|---|
| **60R/INP07** | |
| AA – Hazardous Area Certifications | |
| 00 | No Hazardous Area |
| 01 | CSA/NRTL/C (Class I, Div 2) |
| 02 | Multi (CSA, ATEX, IECEx) |
| XX | Country Specific Approvals |
| B – SIL Level | |
| 0 | No SIL |
| 2 | SIL 2 |

## Isolated Process Variable / Discrete Input Module (PVD)

| Ordering Option | Description |
|---|---|
| **60R/INP09** | |
| **AAA – Hazardous Area Certifications** | |
| 00 | No Hazardous Area |
| 01 | CSA/NRTL/C (Class I, Div 2) |
| 02 | Multi (CSA, ATEX, IECEx) |

| Ordering Option | Description |
|---|---|
| XXX | Country Specific Approvals |
| **B – SIL Level** | |
| 0 | No SIL |
| 2 | SIL 2 |

## Electromechanical Relay Module

| Ordering Option | Description |
|---|---|
| **60R/RLY01-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 |
| 1 | SIL 1 |

## Solid State Relay Module

| Ordering Option | Description |
|---|---|
| **60R/RLY02-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 |
| 1 | SIL 1 |

## External Display

Bently Nevada offers three display systems with different resolution, capabilities, mounting options, accessories, and certifications. Not all options are available for all displays.

| 60X/EXDAA-BB-CC | |
|---|---|
| AA – Display | |
| 01 | 10.4" Hazardous Area Display |
| 02 | 15" Hazardous Area Display |
| 04 | 21.5" Display |
| BB – Agency Approvals | |
| 00 | No Approval Certifications |
| 01 | CSA/NRTL/C (Class 1 DIV 2)<br>(only available for the 60X/EXD01 10.4 in display and 60X/EXD02 15 in display) |
| 02 | Multi (CSA, ATEX, IECEX)<br>(only available for the 60X/EXD01 10.4 in display) |
| CC – Mounting Options | |
| 01 | 19" Rack Mount Panel |
| 02 | Panel Mount Kit |
| 03 | Remote Stainless-Steel Enclosure<br>(Select a pole or wall mount option separately as an accessory as needed.) |
| 04 | Independent Mount<br>(only available for the 60X/EXD01 10.4 in display) |

## Industrial Computer for Display

| 60X/CMP01-AA | |
|---|---|
| AA – Agency Approvals | |
| 00 | No Approval Certifications |
| 01 | CSA/NRTL/C (Class 1 DIV 2) |

| 60X/CMP01-AA | |
|---|---|
| 02 | Multi (CSA, ATEX, IECEX) |

Includes DIN Mounting Kit, 24 Vdc 90-Watt DIN Mountable Power Supply, USB Mouse, 24 Vdc Power Cable, 10' (3 m) Ethernet Cable. A 20' Ethernet cable accessory is available.

## Accessories

| Part Number | Description |
|---|---|
| **Dongles and Cables** | |
| 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 |

## Configuration Software

| Part Number | Description |
|---|---|
| 60X/CFG | Orbit Studio Configuration Software |

## AC/DC Industrial Power Supply

| Ordering Option | Description |
|---|---|
| **60X/XPS01-AAA • 240 Watt AC/DC Industrial Power Supply** | |
| AAA – Agency Approvals | |
| 00 | No Hazardous Area |
| 01 | CSA/NRTL/C (Class I, Div 2) |
| 02 | Multi (CSA, ATEX, IECEx) |
| XXX | Country Specific Approvals |
| **60X/XPS02-AAA • 480 Watt AC/DC Industrial Power Supply** | |
| AAA – Agency Approvals | |
| 00 | No Hazardous Area |
| 01 | CSA/NRTL/C (Class I, Div 2) |
| 02 | Multi (CSA, ATEX, IECEx) |
| XXX | Country Specific Approvals |

## Miscellaneous

| Part Number | Description |
|---|---|
| 144M5033-01 | System Key |
| 60R/BLK01 | Blank: Module slot blank cover |

## Glossary of Terms

| | |
|---|---|
| **Accel** | Acceleration |
| **Aero** | Aeroderivative |
| **API** | American Petroleum Institute |
| **BRG** | Bridge |
| **BTO** | Buffered Transducer Output |
| **CE** | Case Expansion |
| **CGW** | Communication Gateway Module |
| **CIDE** | Complementary Input Differential Expansion |
| **CMM** | Condition Monitoring Module |
| **COM** | Common |
| **DCM** | Distributed Condition Monitoring |
| **DCS** | Distributed Control Systems |
| **DR(DE)** | Dual Ramp (Differential Expansion) |
| **EGD** | Ethernet Global Data |
| **ESD** | Emergency Shutdown Device |
| **EIA** | Energy Information Administration |
| **EMR** | electromechanical Relay |
| **HAZLOC** | Hazardous Location |
| **HTVAS** | High Temperature Velocity/Accel Sensor |
| **I/O** | Input/Output |
| **IEPE** | Integrated Electronics Piezo-Electric |
| **ITC** | Isolated Thermocouple |
| **KPH** | High Speed Keyphasor |
| **LVDT** | Linear Variable Differential Transformer |
| **NC** | Normally Closed |
| **NEMA** | National Electrical Manufacturers Association |
| **NO** | Normally Opened |
| **NSSRDE** | Non-Standard Single Ramp Differential Expansion |
| **NTP** | Network Time Protocol |
| **OEM** | Orginal Equipment Manufacturer |
| **PAA** | Prox, Accel, Aero |
| **PAD** | Prox, Accel, Displacement Module |
| **PAS** | Prox, Accel, Seismic |
| **PAV** | Prox, Accel, Velom |
| **PIM** | Power Input Module |
| **PLC** | Programmable Logic Controller |
| **PPM** | Protection Processing Module |
| **Prox** | Proximitor |
| **PVD** | Isolated Process Variable, Discrete Input |
| **PVT** | Positive Voltage Transducer |
| **REB** | Roller Element Bearing |
| **REC** | Recorder Outputs |
| **RMC** | Remote Monitoring Center |
| **RST** | Reset |
| **RTD** | Resistance Temperature Detector |
| **SAI** | System Alarm Inhibit |
| **SCDE** | Single Channel Differential Expansion |
| **SHLD** | Shield |
| **SIL** | Safety Integrity Level |
| **SIM** | System Interface Module |
| **SSR** | Solid State Relay |
| **SSRDE** | Standard Single Ramp Differential Expansion |
| **SW** | Software |
| **TC** | Thermocouple |
| **TLS** | Transport Layer Security |
| **RTD/TC** | Resistance Temp Detector / Thermocouple |
| **TCP/IP** | Transmission Control Protocol Internet Protocol |
| **TM** | Trip Multiply |
| **OEM** | Orginal Equipment Manufacturer |
| **Velom** | Velomitor |



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