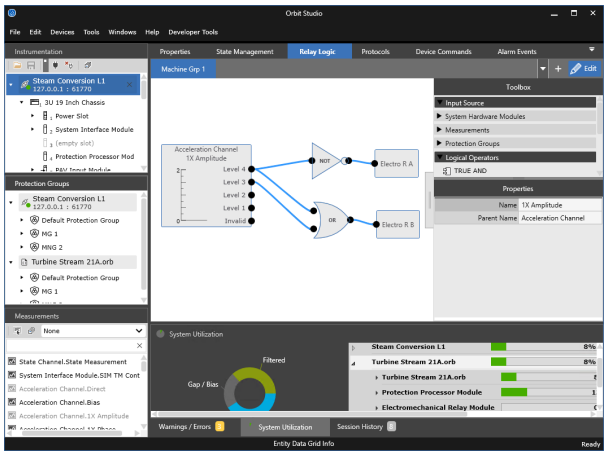
ORBIT 60

Orbit Studio Configuration Software

User Guide

Bently Nevada Machinery Condition Monitoring

137M0696 Rev. A



Bently Nevada
a Baker Hughes business

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

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1. 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 rackmounted and distributed hardware, with Bridge modules creating a seamless connection between chassis to make a single system.

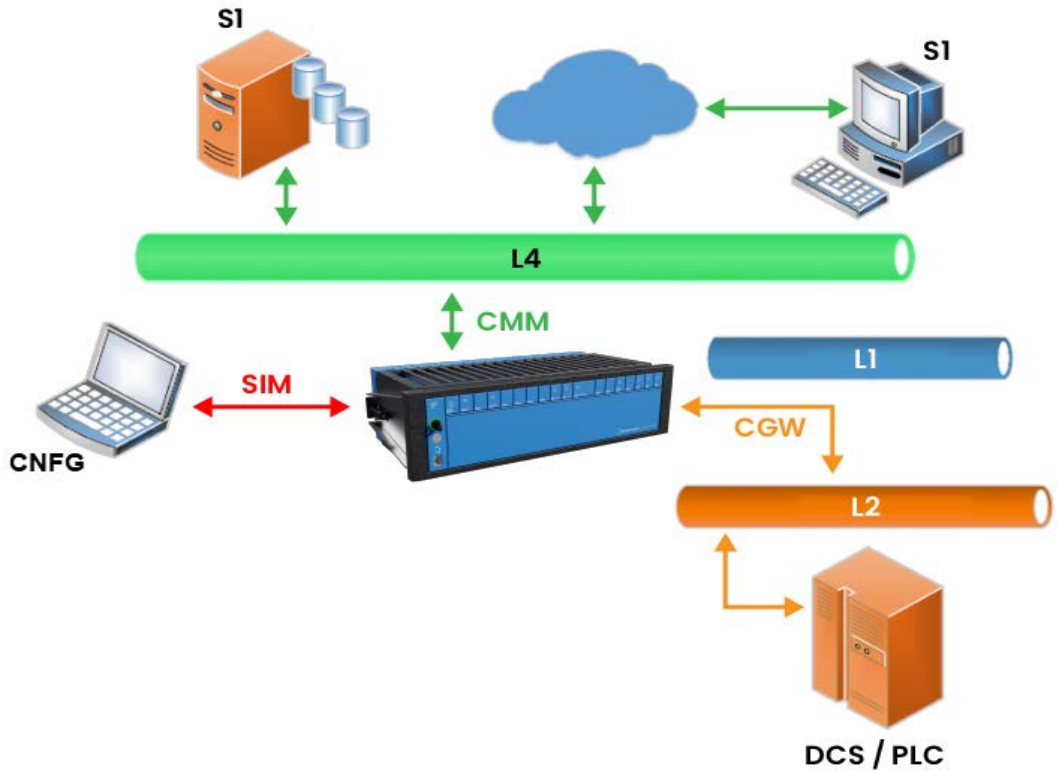
The table below gives a general overview of the components that make the Orbit 60 platform.

Table 1 - 1: Component Modules

System Modules	User Guide (142M9080)	Chassis	3U Chassis- 19 general purpose slots
		Power	Power Interface Module (**PIM**)
		Processors	System Interface Module (**SIM**) Protection Processing Module (**PPM**)
		Connect	Bridge (**BRG**)*
CMM	User Guide (148M9082)	S1 Interface	Condition Monitoring Module (**CMM**)
CGW	User Guide (148M9083)	Comms	Communication Gateway (**CGW**) - Modbus (Ethernet or Serial*)
Input Modules	User Guide (137M0804)	Dynamic 4-channel	Negative Dynamic Input (**PAV, PAS*, PAA, PAD*, KPH**) (provides power for negatively powered transducers) Positive Dynamic Input (**PVT***) (provides power for positively powered transducers) Linear Variable Differential Transformer (**AC LVDT***)
RTD/TC, Process, Discrete	User Guide (157M8568)	Static 6-channel	RTD/TC Temperature (**RTD**) Isolated TC Temperature (**ITC***) Isolated Discrete Input or Process Variable (**PVD**)
Output Modules	User Guide (146M5032)	Relays 8-channel	ElectroMechanical Relays (**EMR**) Solid State Relays (**SSR**)
		Rec Outs 8-channel	Recorder Outputs (**REC***)
Display and CPU	User Guide (137M0702)	Display	External Display (**EXD**)

* Modules not available in first release.

1.1 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 - 1: System Diagram

One System Interface Module (SIM) defines a system of up to 88 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(inhibit, reset, trip multiply)* high speed process data with the control systems. Bridged (BRG) connections allow up to 3 chassis to act as a single system while decreasing overall installation costs, reducing ground loops, and minimizing electrical noise.

* Features not available first release.

1.2 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.

Multiple Systems Configuration

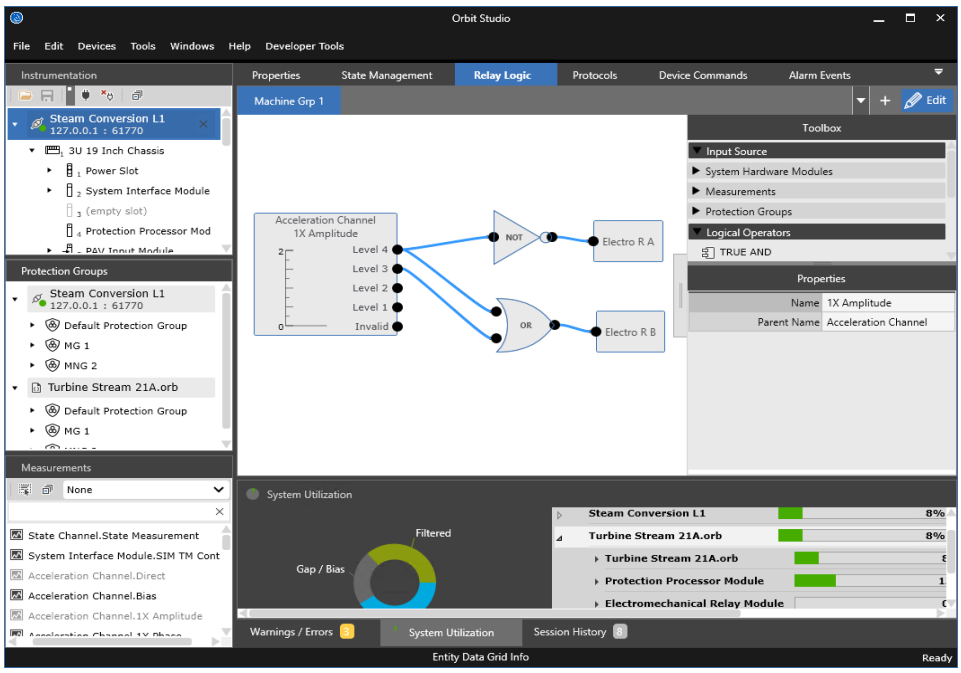
Connect multiple systems from a single Orbit Studio client session, opening multiple offline configuration files alongside actively connected systems to allow for easy cross-referencing across systems, while enabling security through user-based permissions. Copy and paste modules and channels across 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 with 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.

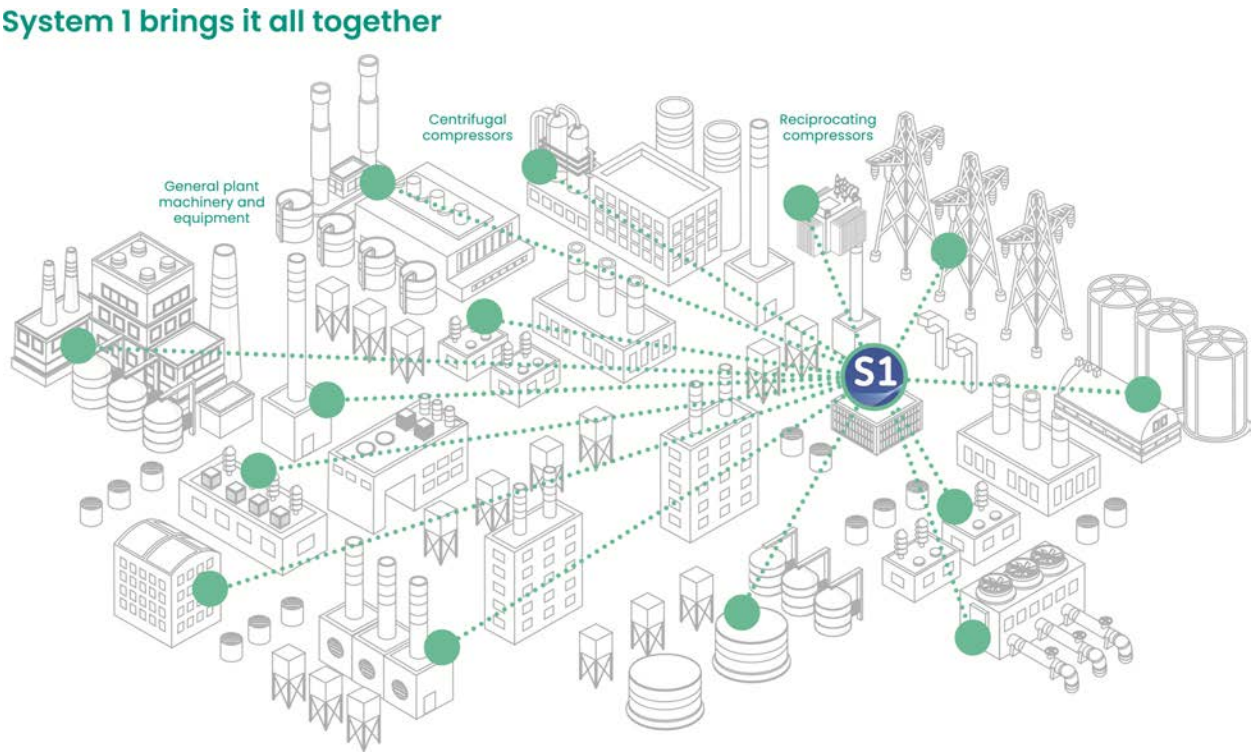


To configure the Orbit 60 system, refer to the Orbit Studio online help or Orbit Studio Configuration Software User Guide (137M0696).

1.3 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. When used in conjunction with the Comm Gateway module (CGW), you can relay high speed process data to System 1 along with system measured data.



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.

2. Installation

The Orbit 60 Series Monitoring System provides continuous, online monitoring suitable for machinery protection applications. The system's modular design enables you to create multiple configurations and connect to several systems using a single client. You can easily copy and paste configurations across systems.

The system's modular design allows you to choose a hardware option that meets your needs, from a simple rack mount to distributed chassis that interact to behave as a single system. Orbit 60 interfaces with multiple external systems and controls them using various protocols and physical connections. It meets the requirements of the American Petroleum Institute's API 670 standard for such systems.

2.1 Set Up Computer

Setup System

To connect to the device for the first time, configure the network settings.

Connect to Network

To acquire the system network:

1. To configure the system, you must connect an Ethernet cable to the top Ethernet port in the rear of the SIM .
2. The IP Addresses:
    a. Utility Port A (upperport): 192.168.2.101, Subnet 255.255.255.0
    b. Utility Port B (lowerport): 192.168.0.101, Subnet 255.255.255.0
    c. Public Port: 192.168.3.101, Subnet 255.255.255.0
3. The default port is 61780.
4. Ethernet login credentials:
    a. Username: "Admin"
    b. Password: "Admin+01"

Under rare circumstances, you may accidentally configure the Ethernet port and make it unreachable. If this happens, first attempt to Reset the SIM or CMM to Factory Settings. If that fails, contact Bently Nevada Support for recovery steps.

Install Software

To install software, run the setup.exe file. Once installed, launch Orbit 60.

2.2 Manage Device Connections

You can connect Orbit 60 to multiple devices at one time. You can connect to a System 1 device only if the data historian is PostgreSQL.

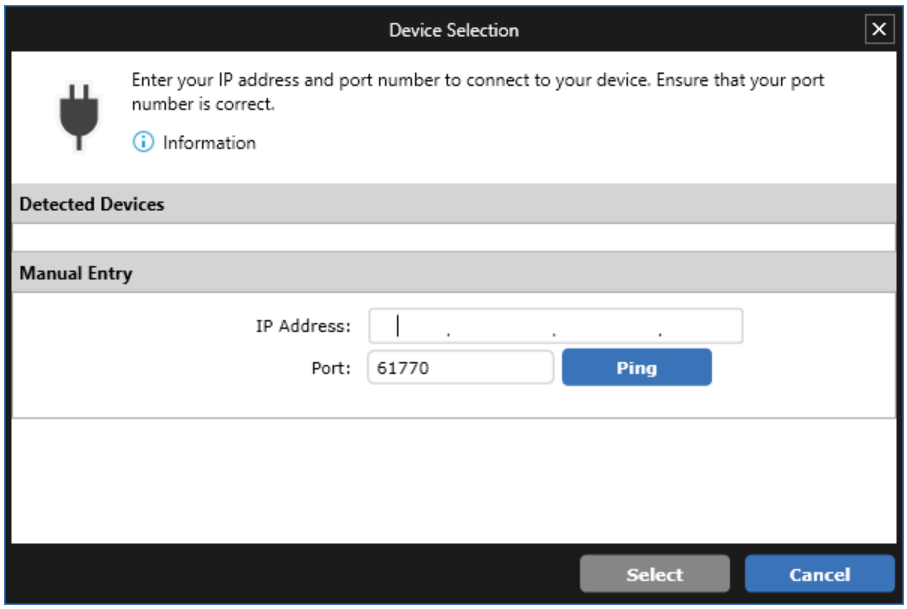
The Condition Monitoring Module (CMM) interfaces to the business network through a cyber-secure access port.

Orbit 60 uses built-in data isolation within the condition monitoring module from the protection system and plant network, the Orbit 60 connects seamlessly to your condition monitoring software for proactive monitoring and diagnostics.

Connect Devices

To connect devices:

1. Select **Devices > Connect**. (Alternatively, select **Devices > Recent Devices**.) The **Device Selection** dialog box is displayed.



2. To connect:
   - **Detected Devices:** select the device(s) you want to configure.
   - **Manual Entry:**
     a. Enter an **IP Address** and **Port**.
     b. To validate the connection, click **Ping**.
3. To initiate the connection, click **Select**. The **Device Connect** dialog box is displayed.
4. Enter your **User Name** and **Password** and click **Connect**. The device is connected and a configuration lock is enabled.

> The first time you connect to any device, you are required to reset the default password. To modify password settings, see User Management.

Lock Configuration

The first user with administrative rights to connect to a system obtains a configuration lock. The lock is maintained for one hour in program mode. You are prompted to renew the lock before it ends.

To request a configuration lock:

1. Select **Devices > Lock Configuration**. (Alternatively, right-click on a system and choose **Lock Configuration**.)
2. The configuration lock status is displayed in the Session History pane.

Disconnect a Device

You can disconnect all devices or a single Orbit 60 device.

To disconnect all devices, select **Devices > Disconnect All**. All Orbit 60 Devices are disconnected.

To disconnect a single device:

1. Select the device you want to disconnect in the **Instrumentation pane**.
2. Select **Devices > Disconnect <Device Name>**. The **Device** is disconnected.

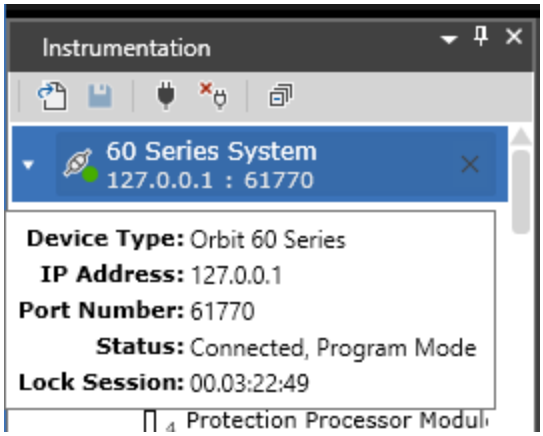
Reconnect to a Device

To reconnect a device:

1. Select the device you want to reconnect in the **Instrumentation pane**.
2. Right-click on the device and choose **Reconnect**. The **Device Reconnect** dialog box is displayed.
3. Enter the device password and click **Connect**. If the device is not locked by another user, the device is reconnected.

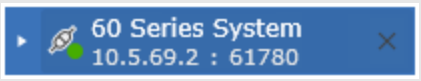
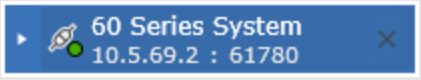
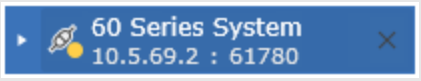
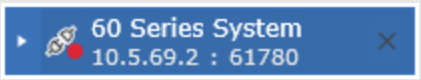
Connection Health

Connection status is indicated by an icon displayed in the Orbit 60 System. A tool tip displays the current status.



Connection Status Messages

If the System status displays a Protection Group icon, see Protection Mode States.

System	Tooltip	Status	Resolution
	Connected Program Mode	Device is connected and authenticated. The key lock LED on the front of the SIM is amber, indicating PRG mode.	-
	Unsent Configuration Changes	Device is connected and authenticated. There are unsaved configuration changes.	Sync configuration
	Connected Run Mode	Device is connected and authenticated. The key lock LED on the front of the SIM is green, indicating RUN mode.	-
	Connected Read Only, Program Mode	Device is connected and authenticated. Another user has locked the configuration or the lock has expired.	Reconnect
	Disconnected	The connection has been lost. The system is unable to reconnect.	Reconnect
	-	Offline configuration.	-
	Unsaved Changes	Offline configuration with unsaved changes.	-

Resolve Configuration Mismatch

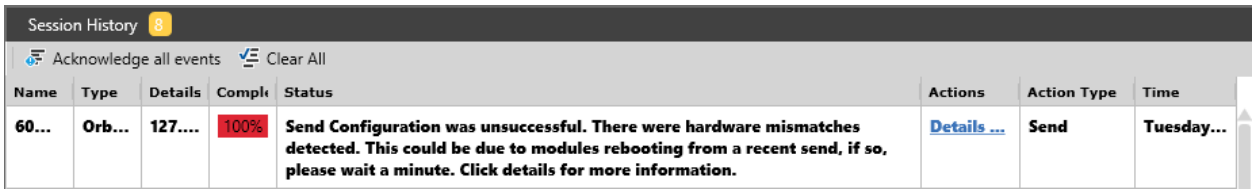
If you change modules, or if the hardware changes, you can experience a configuration mismatch.

Configure Software Mismatch

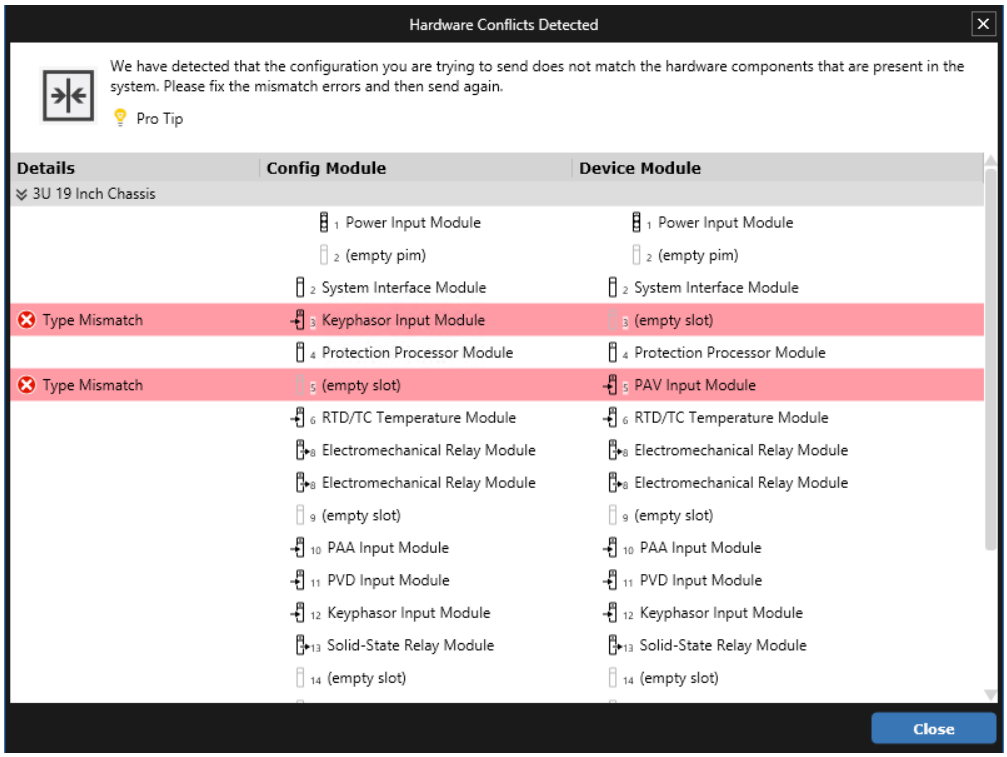
When you add, remove or change a module type and the modules do not match the hardware, Orbit Studio detects a configuration mismatch when you send the configuration. It displays a Sending Configuration error. The error is also displayed in the Session History pane.

To resolve the hardware mismatch:

1. Select **Windows** > **Session History**. A send configuration error is displayed in the **Session History** pane.



2. Select the **Actions** column and click **Details**. (You may need to scroll the pane to the right.) The **Hardware Conflicts Detected** dialog box is displayed.



3. Note which devices are in conflict. Click **Close**.
4. Resolve the conflicts. Choose a method:
    a. Change the physical hardware configuration to match the software configuration.
    b. Discard the software configuration changes that caused the mismatch. Retrieve the configuration from the device.

Physical Hardware Conflict

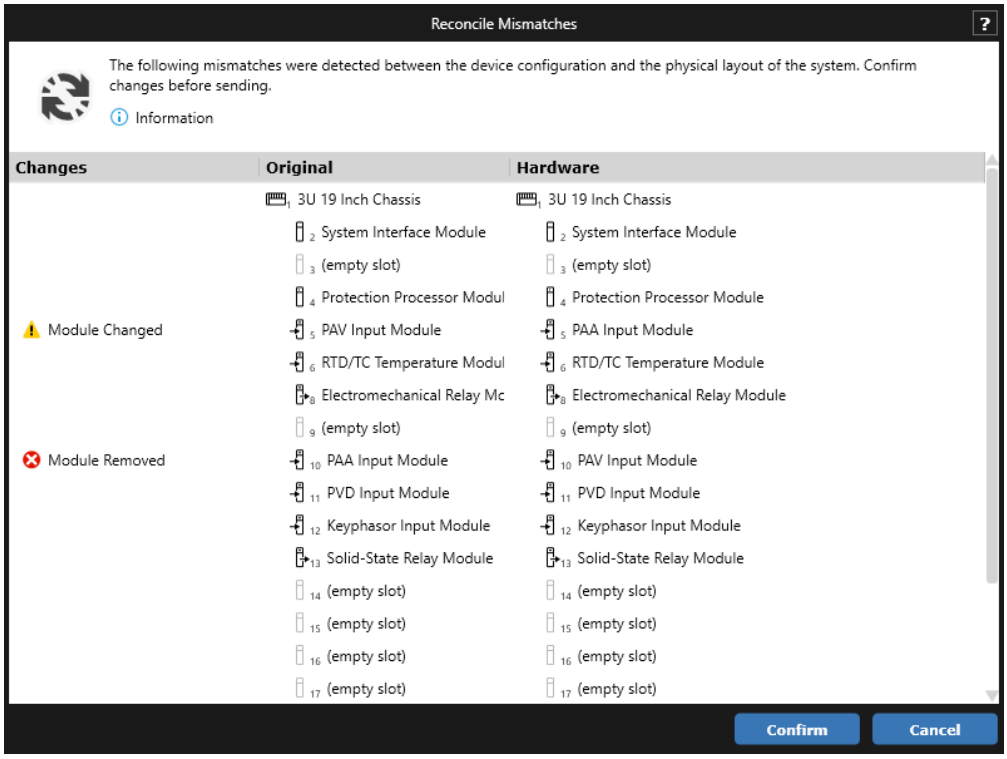
If you or someone else adds, moves, removes or changes the location of a module on the rack, the physical hardware no longer matches the software configuration, which creates a hardware conflict. When you attempt to send the configuration to the hardware, a hardware conflict is detected. The error is displayed in the Session History pane.

To resolve a hardware conflict:

1. Choose a method:
   - Right-click on the System Chassis and choose **Reconcile Mismatches**.
   - Select **Windows** > **Session History**. A configuration mismatch error is displayed in the **Session History** pane.

   Select the **Actions** column and click **Reconcile Mismatches**. (You may need to scroll the pane to the right.)

2. The **Reconcile Mismatches** dialog box is displayed.



3. For each difference between the **Original** and the **Hardware** configuration, select an option in the **Changes** column.
4. Click **Confirm**. The mismatches are resolved and the Orbit Studio Instrumentation pane is refreshed.
5. If prompted, send the configuration to the System.

2.3 Upgrade Firmware

When you upgrade the firmware, the configuration is deleted. First save the configuration, then restore it after you complete the upgrade.

Verify that the current version of Orbit Studio is version 21.1 or later. We recommend you upgrade to the most recent Orbit Studio configuration software. You must have administrative rights.

To upgrade the firmware:

1. Download the latest firmware from Bently.com/support. If you upgrade to a new version of firmware while Orbit Studio is running, you must restart Orbit Studio to use the new version.
2. Use a laptop computer to connect to one of the three Ethernet ports (two on the utility side and one on the public side) on the Orbit 60 System Interface Module (SIM).

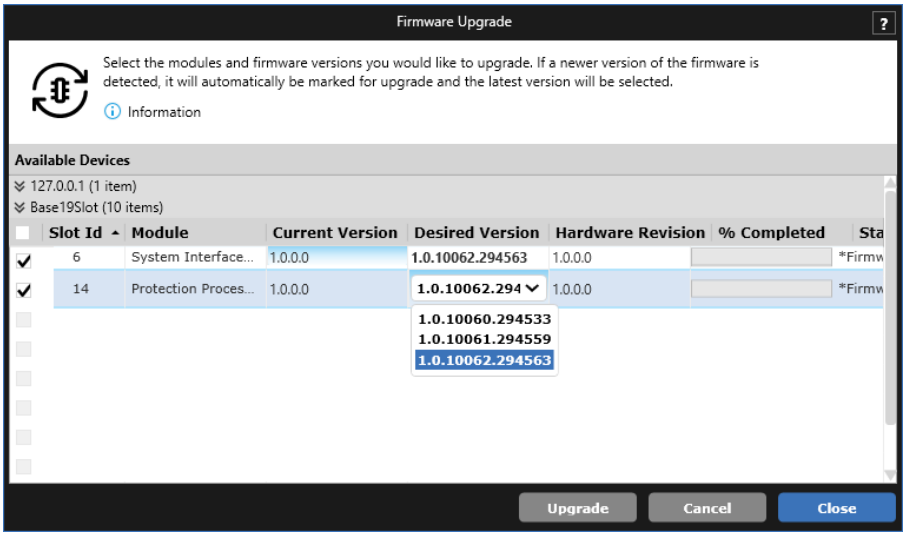
CAUTION

PROTECTION LOSS

During a firmware upgrade, modules are unable to monitor protected assets. Take necessary precautions during this time.

3. Run Orbit Studio and choose an upgrade method:
   - Select a specific module.
     a. In the Orbit Studio **Instrumentation** pane, select a device.
     b. Right-click on the device and select **Upgrade**. The **Firmware Upgrade** dialog box is displayed.
   - Select multiple devices.
     a. Select **Devices > Upgrade**. The **Firmware Upgrade** dialog box is displayed.
     b. Deselect the devices you do not want to upgrade.

4. All modules are displayed along with any available firmware upgrades.



If more than one firmware upgrade for a device is available, the most current version is selected in the **Desired Version** column. If needed, you can select another.

5. Click **Upgrade**. The firmware update is sent to each of the selected devices in series.

   Each update may take up to ten minutes to complete. The progress bar turns green or red to indicate success or failure. After the firmware upgrade is completed, the hardware reboots and verifies the firmware version. If you upgrade the SIM firmware, the status changes to yellow; you must reconnect the device.

   > If you cancel a firmware upgrade, only modules that have received the firmware package are updated. To prevent damage to the device that may make it inoperable, do not remove the device you are upgrading from the rack or turn off power to the rack.

6. After the device is rebooted, verify that the status LEDs display green.

3. Configuration

After the Orbit 60 system has been installed and network connections established, create a configuration so the system can respond as anticipated. Add modules and channels. Set properties, setpoints, protection groups, states, enable alarms, and relay logic. Then send new configurations to each module in the system.

3.1 Set up System Configuration

You can manage custom Orbit 60 configurations for different devices on multiple systems.

Create a New System Configuration

To create a new system configuration:

1. Select **File** > **New** > **60 Series System**. The **New Configuration** dialog box is displayed.
2. Enter a custom **Name**.
3. Use the default **Location** (set in Preferences) or click **Browse** to choose another.
4. (Optional) Enter a **Description**.
5. Click **Create**. The new configuration is displayed in the **Instrumentation** hierarchy.
6. Add:
    a. A new Chassis.
    b. Only one System Interface Module.
    c. At least one and preferably two Power Input Modules.
    d. At least one and preferably two Protection Processing Modules.
7. Add input modules and configure the devices as needed.
8. Add output modules and configure the devices as needed.
9. Send the configuration to the hardware.
10. Verify that sensors are sending data.

Open an Existing Configuration

To open an existing configuration:

1. Select **File** > **Open**. The Windows **Open** dialog box is displayed.
2. Navigate to and select the configuration (*.ORB) file you want to open.
3. Click **Open**. The new configuration is displayed in the **Instrumentation pane** .

You can copy chassis, modules, and channels between configurations.

Retrieve an Existing Configuration

To retrieve an existing configuration:

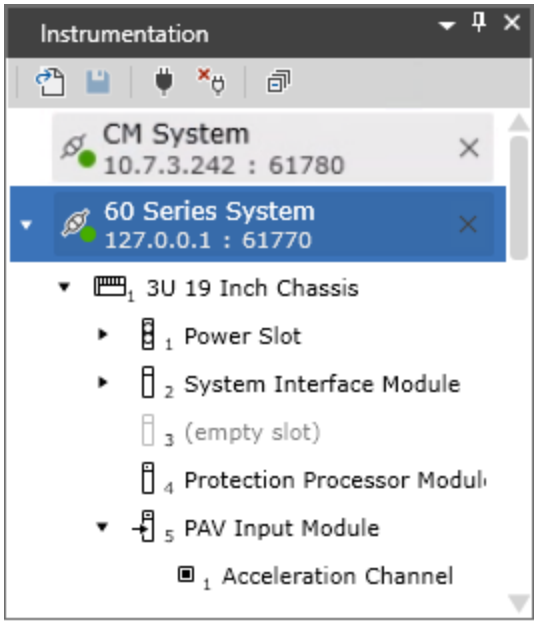
1. Select a system in the Instrumentation pane.
2. Select **Device** > **Retrieve**. The **Select Devices** dialog box is displayed.
3. Select the devices whose configuration you want to retrieve.
4. Click **Select**.
5. The retrieved configuration is displayed in the **Instrumentation pane** .

3.2 Configure System Properties

Modify System Properties

To modify the System Properties of the active configuration:

1. In the **Instrumentation pane**, select the **System**.



2. Select **Properties** > **General**.
3. Edit the **Name** or **Tag Name** as needed.

Network Configuration

The ports displayed on the **Network Configuration** tab are the physical network ports on the card. Use **Network Settings** to enable or disable a physical port.

Depending on how you modify the network settings, you may lose the connection to the device. When this happens, you must use the modified settings to reconnect to the device. If you change the subnet mask, you may make the device unreachable on your current subnet.

To configure **Network Settings**:

1. In the **Instrumentation pane**, select the system.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **Network Settings** tab.
4. Both ports are active by default. To disable a port, clear the **Active** checkbox.
5. For each **Port Type** displayed, enter an **IP address** and other network addresses required. Each port must be on a different network.
6. (Optional) Select **Enable DHCP**.
7. Click **Apply**.

Time Configuration

To configure time:

1. In the **Instrumentation pane**, select the SIM or CM Module.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **Time Configuration** tab.
4. The **System Information** pane displays the current date, time, and time zone. The default time and zone is based on the computer's system time.
5. To configure **Time Mode**, select either:
   - **Manual Entry** and enter a date and time. Alternatively, to use current UTC time, click **Now.**
   - **NTP** (Network Time Protocol) and enter an IP address of a valid NTP server. To verify the connection, click **Ping**.
6. Click **Apply**. The NTP server may take up to 5 minutes to update system time.

User Management

User roles control the rights users have to modify the configuration.

To manage user accounts and passwords:

1. In the **Instrumentation pane**, select the system.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **User Management** tab.
4. The **User Accounts** subtab displays current users and their roles.

5. To add a user, click **Add User** + . The **Add User** dialog box is displayed.
   a. Enter a **User Name** and **Role**.

   > If you are adding a Display Account for Orbit Display, select the **Display** role.

Role	Permissions
Administrator	User Management, Configuration, Device Management, Config Override, Protection Setpoints, Management Setpoints, Alarm Management, System Events Management, Secure Events Viewing, Reset, Alarm Control, Notes, Device Update.
Display	View, Alarm Management, System Events Management, Reset, Alarm Control
Management	Same as Administrator excluding User Management.

   b. Click **Set Password**. The **Password** dialog box is displayed.
   c. Enter a valid password. Click **OK**.
6. To force the user to reset their password upon next log in, click **Settings** . The **Account Settings** dialog box is displayed.
   a. Enable **Force Reset Password on Next Login**.
   b. Click **Apply**.

To delete a user, right-click on the user name and select **Delete**.

Port Configuration

You can select **Encryption** and **Port Configuration** options to control which ports are used for transmitting data. By default, we encrypt all data and use Transport Layer Security (TLS) to send data.

> Under certain circumstances, some companies require configuration and data to be sent over an unencrypted port. While we support this feature, we do not recommend it. Login credentials and account management data are always encrypted.

To configure ports:

1. In the **Instrumentation pane**, select the system.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **Port Configuration** tab.

4. To send data unencrypted, in the **Encryption** pane:
   - Clear **Configuration Data Encrypted**.
   - Clear **Device Data Encrypted**.

   The **Port Configuration** pane **Unencrypted** field is enabled. The designated port is used to send the selected data.
5. To use custom port numbers for communication, enter valid port numbers in the **Port Configuration** pane.

   If the **Configuration Write** port you enter is blocked by firewall settings, the configuration is read-only. The **Session History** pane displays the status message **Partially Communicating**.
6. To use a specific port to send write-only configuration data, in the **Port Configuration** pane, select **Enabled**. The selected port number is used to transmit only configuration data.

Security

To display a read-only summary of current security settings:

1. In the **Instrumentation pane**, select the system.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **Security** tab. The **Security** tab displays current details of all configured ports. Use this information to verify that the port connection(s) defined in the Port Configuration tab are established and communicating as configured.

Optionally, you can copy and paste the contents of this tab to a third-party application.

System Mode

Use the physical key on the front of the chassis to change the system mode. The color of the Key Lock LED and the Contact LED both change to reflect the mode state.

Key	Color	Mode
	Green	Run mode. No configuration changes can be made.
	Amber	Program mode. Enables you to add modules, channels, and measurements as needed; update firmware; modify Run Mode Permissions.

Enable Program Mode

You must have an Ethernet connection to the SIM.

To enable program mode, choose a method:

- Short the LOCK and COM contacts on the SIM. When you short the contacts, the key lock color and the Contact LED changes to amber, although the key remains in Run Mode.
- Turn the physical key on the front of the chassis to program mode.

Enable Run Mode

To enable Run Mode, turn the physical key on the front of the chassis to run mode and verify that the lock contacts on the SIM between the LOCK and COM are open.

Configure Run Mode Permissions

Use these settings to configure various **Run Mode** permissions. Settings are disabled by default for security purposes. You can enable certain permissions in Orbit 60 and Orbit Display.

To configure **Run Mode Permissions**, you must have a config lock and Orbit 60 must be in program (PRG) mode.

To configure Run Mode permissions:

1. In the **Instrumentation pane**, select the system.
2. Right-click and select **Settings**. The **Properties** dialog box is displayed.
3. Select the **Run Mode Permissions** tab.
4. In the **Function** pane, enable the functions you want to enable during Run Mode. You can choose whether these settings apply to **Orbit Studio** or **Orbit Display**. Select the options you want to apply:

Field	Description
Alarm Inhibit	Disables alarm state outputs and is used to alter the alarm behavior for the machine being monitored.
System Reset	Clears latched alarms and relays. It does not enable users to reset latched accumulative/peak measurements.

5. In the **System Settings** pane, enable the options you want to enable when Orbit 60 is in Run Mode.
6. Click **Apply**.

3.3 Set General Preferences

Preferences enable you to set the color theme, language, and default database folder for Orbit 60.

To set preferences, select **File** > **Preferences**. The **Preferences** dialog box is displayed.

Visual Experience

To apply a custom color theme:

1. In the **Visual Experience** pane, select **Edit**. The **Theme Editor** dialog box is displayed.
2. To load an existing theme:
    a. Click **Load**. The Windows **Load** dialog box is displayed.
    b. Navigate to the location of your *.THEME file.
    c. Select a *.THEME file and click **Open.**
3. To create a custom theme:
    a. Click **Edit**. Select the colors you want for each UI element.
    b. Click **Save**. The Windows **Save** dialog box is displayed.
    c. Enter a file name for the Color Theme. Click **Save**. The *.THEME file is saved.
4. Click **OK** and click **Save**. Restart Orbit 60. The Color Theme is applied to the user interface.

Environment

Use these settings to enable or disable tool bars and the **Session History** and **Warnings / Errors** panes.

To restore application settings to their default, click **Clear All Application Settings**. These include:

- Properties grid layout
- Custom color theme
- Window layout
- Dialog display settings

Language Settings

The default language of an application is that of the operating system. To choose another, select the **Language** drop-down list box.

New Configuration

To set the default location of new configurations:

1. In the **New Configuration** pane, click **Browse**. The **Browse for Folder** dialog box is displayed.
2. Navigate to the folder location in which you want to create a new folder.
3. Click **OK**. The **Default Database Folder** field is updated.

3.4 Add Modules

You can arrange Orbit 60 Series modules in a wide variety of configurations in a rack and/or distributed method. The modules provide system level, input, and output functionality in centralized and distributed installation configurations.

To build a hardware configuration, add these modules. For details, see add modules.

When you have added the necessary modules, you can add channels and configure them.

System Modules

There are two ways to add a module, from the **Instrumentation pane** or from the **Library**. We describe how to use the **Instrumentation pane**, but choose the method you prefer.

After you add an Orbit Chassis to your configuration:

1. You must first add the system modules:
   - System Interface Module.
   - At least one and preferably two Power Input Modules.
   - At least one Protection Processing Module per system.
   - A Condition Monitoring Module.
2. Then add these modules:
   - Input Modules.
   - Output Modules.
3. Configure System Properties.

Orbit 60 Series Chassis

The Orbit 60 Series Chassis contains the modules making up the entire system. The Orbit 60 configuration software enables you to configure the physical modules. Each chassis:

- Can have only one System Interface Module (SIM).
- Must have at least one and preferably two Power Input Modules (PIMs).
- Must have at least one and preferable two Protection Processor Modules (PPMs).

When assembling the physical chassis, the SIM must be located in the slot next to the PIMs.

To add a system chassis to your configuration:

1. In the **Instrumentation pane** , right-click on the top node in the hierarchy and select **Add** > **Infrastructure Module** > **3U 19 Inch Chassis.**. The 3U chassis has 20 slots. The new chassis is displayed in the hierarchy.
2. You can copy a chassis within an Orbit 60 System or to another System in the

Instrumentation pane . You can copy and paste one chassis onto another.

3. Rename each chassis with a unique name.

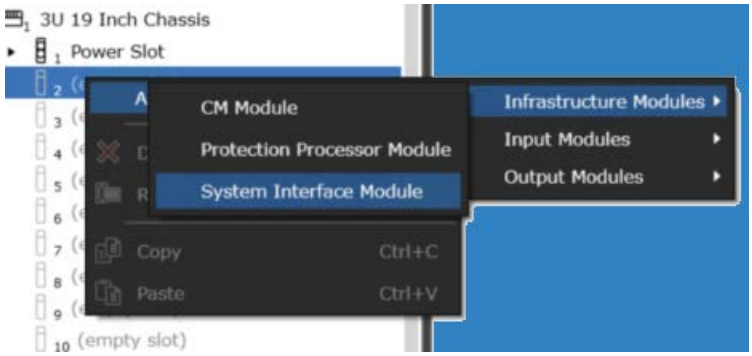
System Interface Module

The System Interface Module (SIM) is the external communication interface for the Orbit 60 system. To prevent unauthorized changes to the configuration settings, you must use a key-lock switch on the front of the SIM to enable configuration. Each Orbit 60 system configuration must contain only one System Interface Module.

To add a System Interface Module:

1. In the Orbit Studio **Instrumentation pane**, expand the **Chassis**.
2. Right-click on Slot 2 in the Instrumentation pane.
3. Select **Add or Replace** > **Infrastructure Module** > **System Interface Module**.

> If you replace a SIM, you must clear the configuration.



4. The **System Interface Module** is displayed in the **Instrumentation pane** .
5. Right click on the SIM module and Configure System Properties.

   The **System Interface Module** contains a **SIM TM Contact**. The contact enables you to use a single discrete input to control the protection states in the system. By default, the **Trip Multiply** protection state is assigned to the SIM TM contact.

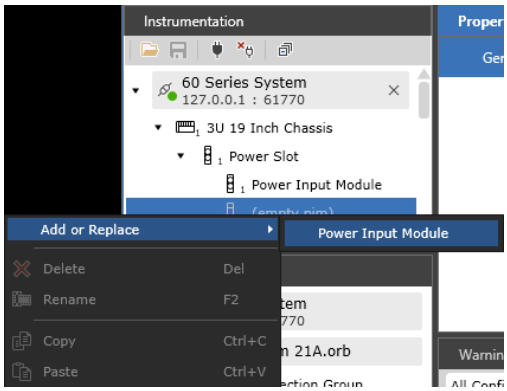
Power Input Module

Each chassis configuration must contain at least one **Power Input Module** (PIM). To maximize system redundancy, we recommend you add a second PIM.

Add Power Input Channel

To add a Power Input Module:

1. In the Orbit 60 **Instrumentation** pane, select a **Power Slot**.
2. Right-click on an **empty PIM** and select **Add or Replace** > **Power Input Module**..



The Power Input Module is displayed in the Instrumentation pane.

Edit Channels

- **To move a Power Input Module**, select it and drag and drop it above or below the other **Power Input Module** in the same **Power Slot**. The **Power Slot** property is refreshed.
- **To delete a Power Input Module**, right-click and select **Delete**.
- **To rename a Power Input Module**, right-click and select **Rename** or press **F2**.

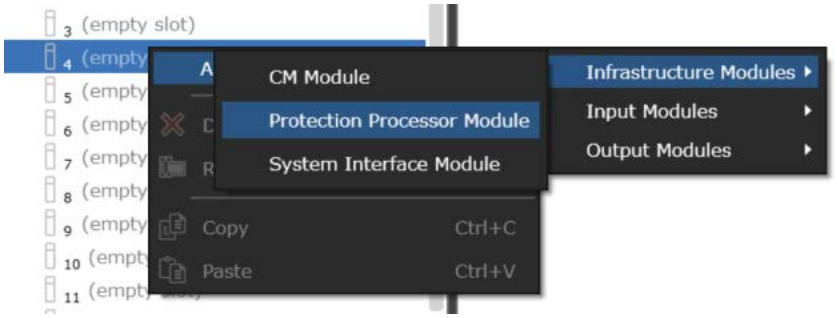
Protection Processor Module

The Protection Processor Module (PPM) occupies one slot in the Instrumentation pane.

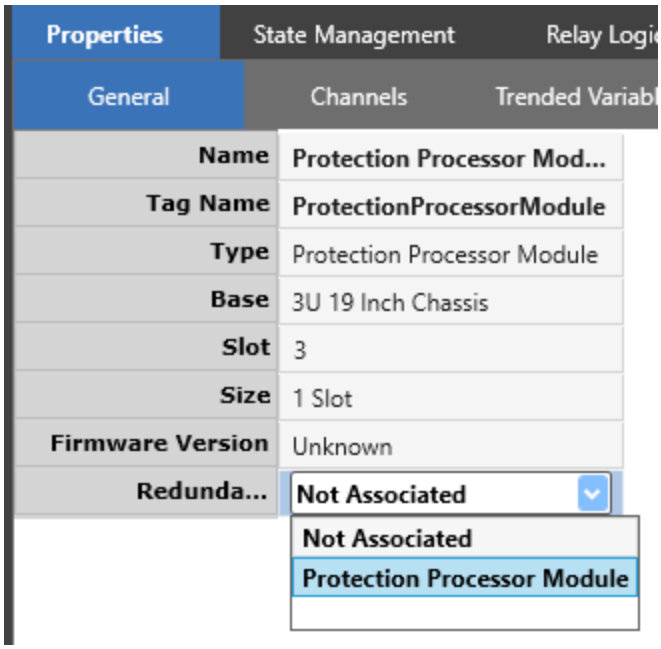
To maximize system redundancy, we recommend you add a second PPM and pair them. Both PPMs must use the same version firmware.

To add a Protection Processor Module:

1. In the Orbit 60 **Instrumentation pane**, right-click on a **empty node**.
2. Select **Add or Replace** > **Infrastructure Modules** > **Protection Processor Modules**.



3. To pair a second PPM:
    a. Select **Properties** > **General**.
    b. In the **Redundant Processor** field, select the name of the other processor. You cannot assign measurements to the redundant processor. If the primary processor fails, the secondary processor takes over.



4. When you add a channel to be processed, you should specify which Protection Processor you want to associate with the channel.

The **Instrumentation pane**, the **General Properties** tab, and **Trended Variables** tab are refreshed. The **Processor Module** displays measurements associated with it.

Ethernet Comm Gateway Module

Use the Ethernet Communications Gateway Module (CGW) to export measurements, setpoints, and statuses to third-party systems using the selected protocol. The CGW occupies one slot in the hardware shown in the Instrumentation pane.

If you are connected to the hardware and have retrieved the configuration, select the **Comm Gateway Module** in the **Instrumentation pane** .

Add a Ethernet Communication Gateway Module

To add an Ethernet Communications Gateway Module:

1. In the Orbit Studio **Instrumentation** pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click and select **Add or Replace** > **Output Modules** > **Ethernet Comm Gateway Module**. The **Ethernet Communications Gateway Module** is displayed in the **Instrumentation pane** .
3. Select **Properties** > **General**. In the **Protocol** field, select **Modbus**. To set the register addresses, see Configure Communication Protocol .
4. Choose **File** > **Save**.

Configure Network Settings

To configure the Ethernet Communications Gateway Module:

1. In the Orbit Studio **Instrumentation pane**, select an **Ethernet Communications Gateway Module**.
2. Select the **Properties** > **General** tab.

Name	**Ethernet Communications Gateway Module**
Tag Name	**EthernetCommGatewayModule**
Type	Ethernet Communications Gateway Module
Base	IndiaBurn_1
Slot	5
Size	1 Slot
Protocol	**None**
Firmware Version	Unknown
Port A IP Address	**10.5.68.242**
Port A Subnet Mask	**255.255.224.0**
Port A Gateway	**10.5.64.1**
Port A Port Number	**502**
Port B IP Address	**10.0.0.210**
Port B Subnet Mask	**255.255.255.0**
Port B Gateway	**10.0.0.1**
Port B Port Number	**502**

3. Modify **Port A** and **Port B IP Addresses**, **Subnet Mask**, **Gateway**, and **Port Number** as needed. For initial release, the **Port number** is set to the Modbus default of 502. Only fixed IP addresses are supported. If you add a second Communications Gateway module, the port subnet mask and gateway IP address must be unique for each module.

Port [1]	Location	IP Address	Gateway Address [2] [3]	Subnet Mask	Notes
Port A	Utility Side on top	192.168.2.110	192.168.0.1	255.255.255.0	-
Port B	Utility Side on bottom	192.168.0.110			DHCP Disabled

[1] If you configure the two ports on the same CGW module, the IP address must be on separate subnets.

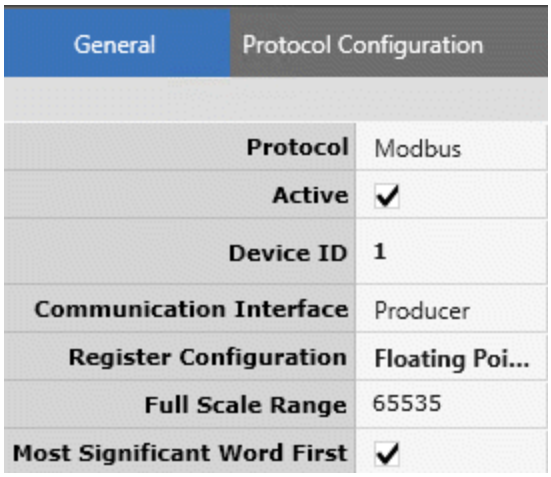
[2] Both network ports on a single CGW module must be configured to use the same gateway address.

[3] If you add a second CGW module, the port subnet mask must be unique for each module. The gateway IP address must be the same for all CGW modules.

Configure Communication Protocol

To configure the communication protocol and registers:

1. Select the Communication Gateway module you want to modify.
2. Select **Windows** > **Protocols**. The Protocols > General tab is displayed.

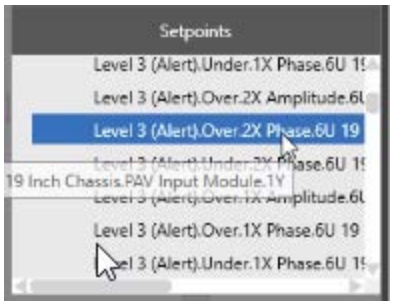


3. Select **Active**. Modbus is enabled.
4. If you have multiple Comm Gateway modules, you can set a unique **Device ID**.
5. Choose a **Register Configuration**.
   - **Fixed Point** All fixed point data are scaled to the user-configurable **Full Scale Range**. All floating point data types (measurements and setpoints) occupy a single register.
   - **Floating Point** All floating point data types (measurements and setpoints) occupy two registers.
6. If you selected **Fixed Point** as the **Register Configuration**, enter a value for **Full Scale Range**. The maximum value is 65535.
7. (Optional) **Most Significant Word First**. Applies to the value selected in **Register Configuration**.

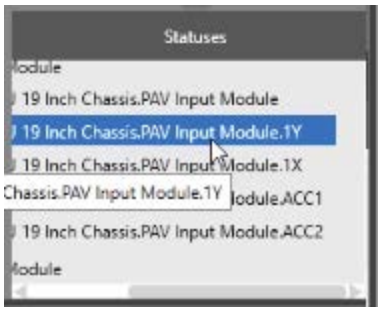
- **Default** The word order is Little Endian. The *least* significant byte (the "little end") of the data is placed at the byte with the lowest address.
- **Enabled** The word order is Big Endian. The *most* significant byte (the "big end") of the data is placed at the byte with the lowest address.

8. Select the **Protocols** > **Protocol Configuration** subtab.
   - The **Server** subtab displays **Register Settings**.
   - The **Sources** pane displays **Measurements**, **Setpoints**, and **Statuses**.
9. In the **Sources** pane, drag and drop as needed **Measurements** onto the **Register** map. The **Register Offset** range and **Data Type** fields are updated based on the **Sources** you select.

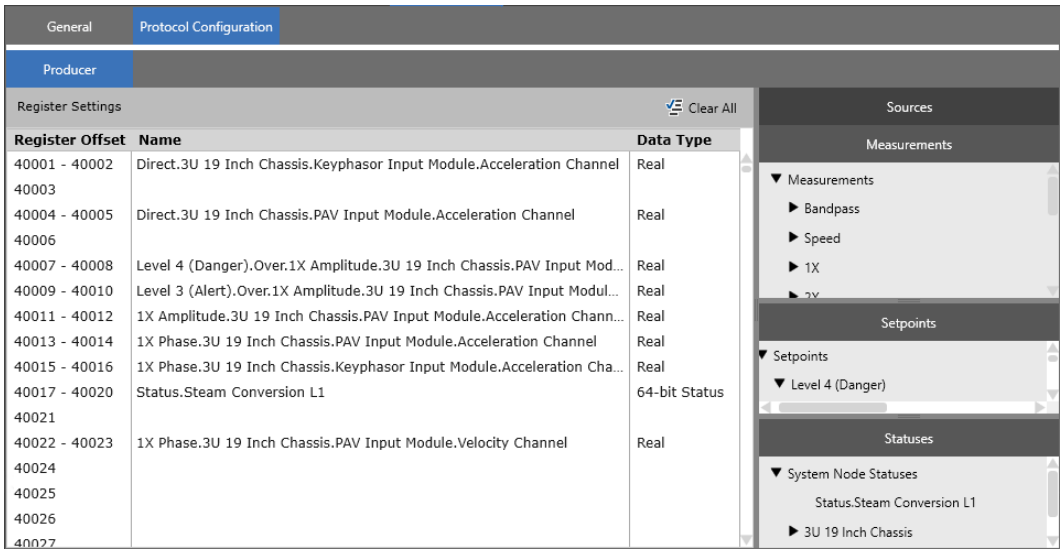
10. In the **Setpoints** pane, drag and drop **Measurement Setpoints** onto the **Register** map.



11. In the **Statuses** pane, drag and drop **Measurement Statuses** onto the **Register** map.



12. To delete settings, choose a method:
    - To delete all register settings, click **Clear All**.
    - To delete one or more register setting, select the settings you want to remove, right-click, and select **Delete**.



Condition Monitoring Module

The Condition Monitoring Module (CMM) occupies two slots in the **Instrumentation pane**.

To add a Condition Monitoring Module:

1. In the Orbit Studio **Instrumentation pane**, right-click on an **empty slot** adjacent to a second empty slot.
2. Select **Add or Replace** > **Infrastructure Module** > **CM Module**.

> If you move or replace a CMM, you must clear the configuration.

The **Instrumentation pane** and the properties pane are refreshed. Right click on the CM module and **Configure Condition Monitoring Module**.

Port	Location	IP Address	Gateway Address	Subnet Mask	Notes
Port A	Utility Side on top	192.168.2.120	192.168.0.1	255.255.255.0	-
Port B	Utility Side on bottom	192.168.0.120			DHCP Disabled

The default Ethernet login credentials are **Username:** "Admin" and **Password:** "Admin+01". Once logged in, enter your own username and password.

> For security reasons, the Username and Password for CMM login are not recoverable. Be sure to record the new login information.

Input Modules

> There are two ways to add a module, from the **Instrumentation pane** or from the **Library**. We describe both, and you can choose how to use the **Instrumentation pane**, but choose the method you prefer.

After you add a chassis, you can add input modules. The input modules interface with multiple transducers and sensors and receive measurements and data.

Add these input modules as needed to your configuration:

- Keyphasor Input Module
- PAV Input Module
- PAA Input Module
- PVD Input Module
- RTD/TC Temperature Input Module

PAV Input Module

The Proximitor / Accelerometer / Velomitor (PAV) Negative Voltage input module is a four-channel input module that accepts input from a variety of proximity, acceleration, and velocity transducers. The types of channels available depend on the type of transducer attached to the card. The PAV input module can support a custom 2-wire IEPE transducers like velocity or accelerometers that require constant current.

The PAA and PAV modules support some of the same transducers with exceptions depending on the wire input. You can copy and paste channels from the one module to the other, although validation messages may be displayed depending on the transducer on the selected channel's transducer.

To add a PAV Input Module:

1. In the Orbit Studio **Instrumentation** pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Input Modules** > **PAV Input Module**. The **PAV Input Module** is displayed under the **chassis** in the hierarchy.

You can cut and paste channels from the PAV module to the PAA module, though validation errors may be displayed if the transducer is not supported by the PAV module.

The PAV module supports four channels:

- Speed Channel
- Acceleration Channel
- Radial Vibration Channel
- Velocity Channel

PAA Input Module

The Proximitor / Accelerometer / Aeroderivative (PAA) Input Module supports 3- and 4-wire input connection to transducers. It does not support 2-wire constant-current IEPE transducers. The types of transducers available depend on the type of channel attached to the card.

The PAA and PAV modules support some of the same transducers with exceptions depending on the wire input. You can copy and paste channels from the one module to the other, although validation errors may occur if the copied channel's transducer is not supported by the target module.

To add a PAA Input Module:

1. In the Orbit Studio **Instrumentation** Pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Output Modules** > **PAA Input Module**. The **PAA Input Module** is displayed under the **chassis** in the hierarchy.

You can cut and paste channels from the PAA module to the PAV module, though validation errors may be displayed if the transducer is not supported by the PAV module.

The PAA module supports these channels:

- Acceleration Channel
- Dynamic Pressure Channel
- Radial Vibration Channel
- Speed Channel
- Thrust Channel
- Velocity Channel

Keyphasor Input Module

To calculate machinery speed and create a phase timing reference, add a high-speed Keyphasor Input Module. This module supports machinery applications that require accurate phase detection at machinery speeds greater than 12,000 rpm. The Keyphasor Module occupies one slot in the chassis.

To add a Keyphasor Module:

1. In the Orbit Studio **Instrumentation** pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Input Modules** > **Keyphasor Module**. The **Keyphasor Module** is displayed under the **chassis** in the hierarchy.

The Keyphasor Module supports these channels:

- Acceleration Channel
- Radial Vibration Channel
- Thrust Channel
- Speed Channel

RTD/TC Temperature Input Module

Use Resistance Temperature Detector/Thermocouple (RTD/TC) Temperature Input Modules to connect up to six channels of Resistive Temperature Detector (RTD) temperature input sensors. The RTD inputs are referenced to the internal system ground and should only be connected to transducers that are isolated at the sensing end.

To add a Temperature Input Module from the **Instrumentation pane**:

1. In the Orbit Studio **Instrumentation pane**, right-click on an **empty slot**.
2. Select **Add or Replace** > **Input Module** > **RTD/TC Temperature Input Module**.
3. Add up to six Temperature Channels to the module.

PVD Input Module

The Process Variable / Discrete Input (PVD) Module is a six-channel input module that only accepts input from **Discrete Channels**.

To add a PVD Input Module:

1. In the Orbit 60 **Instrumentation** pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Input Modules** > **PVD Input Module**. The **PVD Input Module** is displayed under the **chassis** in the hierarchy.

Add Discrete Channels.

Output Modules

There are two ways to add a module, from the **Instrumentation pane** or from the **Library**. We describe both, and you can choose how to use the **Instrumentation pane**, but choose the method you prefer.

After you add a chassis and input modules, you can add output modules. The output modules interface with multiple external systems and send commands to them using various protocols and physical connections.

You must attach Relay Channels to Relay Modules to actuate hardware based on alarm conditions defined in other modules. They use standard logic elements to combine various alarms and status information into output that activates relay switches.

Add these output modules as needed to your configuration:

- Electromechanical Relay Module
- Ethernet Communications Gateway Module
- Solid State Relay Module

Electromechanical Relay Module

This module occupies two slots in the **Instrumentation pane**.

Add an Electromechanical Relay Module

To add a Electromechanical Relay Module:

1. In the Orbit Studio **Instrumentation** pane, select a **System Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Output Modules** > **Electromechanical Relay Module**. The **Electromechanical Relay Module** is displayed under the **chassis** in the hierarchy.

Configure a EMR Relay Channel

To configure a Relay Channel:

1. In the Orbit Studio **Instrumentation pane**, select a **Electromechanical Relay Module**.
2. Right-click on the module and select **Add or Replace** > **Relay Channel**. The **Relay Channel** is displayed under the **Electromechanical Relay Module** in the hierarchy.
3. Select **Properties > General.**

4. (Optional) Enable **In the Protection Path**. When active, the system will construct a protection path based upon the Level 1-4 alarms utilized in relay logic for the relay channel. If elements in the protection path are unable to perform their intended function, the system will indicate Protection Fault and trip the SIM's Protection Fault Relay.
5. (Optional) **Enable Latching**. When active, the corresponding relay alarm channel holds the alarm state until it receives a rack reset or the relay is reconfigured.
6. Modify the remaining relay properties as needed.
7. (Optional) Configure **Paired Channels**.

Add Solid State Relay Module

Use this relay for low current communication applications where the relay is connected to a discrete input for an external system. This module supports voltages up to 125 Vdc and loads of 1 mA to 125mA.

The module takes a single slot and supports eight Solid State Relays.

To add a Solid State Relay Module:

1. In the Orbit Studio **Instrumentation pane**, expand the **Chassis**. Expand the hierarchy to display an **empty slot**.
2. Right-click on an empty slot and select **Add or Replace** > **Output Modules** > **Solid State Relay Module**. The **Solid State Relay Module** is displayed under the **chassis** in the hierarchy.

Configure a SSR Relay Channel

To configure a Relay Channel:

1. In the Orbit 60 **Instrumentation pane**, select a **Solid State Relay Module**.
2. Right-click on the module and select **Add or Replace** > **Relay Channel**. The **Relay Channel** is displayed under the **Solid State Relay Module** in the hierarchy.
3. Select **Properties > General.**
4. (Optional) Enable **In the Protection Path**. When active, enables fault indication when power is lost on a Relay Channel.
5. (Optional) **Enable Latching**. When active, temporarily disables repeated non-critical condition monitoring alarms. The corresponding relay alarm channel holds the alarm state until it receives a rack reset, or the relay is reconfigured.
6. Modify the remaining relay properties as needed.
7. (Optional) Configure **Paired Channels**.

3.5 Add Channels

Channels are tied to a type of input device (like proximity probe, accelerometer, seismic sensor, temperature sensor, and so forth) and a specific kind of application (like Keyphasor, thrust, shaft absolute, and so forth). They aggregate all of the relevant information about the input device and the associated measurements and related information.

These measurements and their corresponding levels are used to drive alarms, trigger protection groups, and enable relay logic.

As you add channels, rename each channel with a unique name.

Edit Channels

- **To delete a channel**, right-click and select **Delete**.
- **To rename a channel**, right-click and select **Rename** or press **F2**.
- **To move a channel**, select it and drag and drop it in a new location within the same module. The **Channel** property is refreshed. Any properties that associate the channel with another channel or measurement are not copied.

Acceleration Channel

Acceleration measurements are generally made with an Accelerometer. You typically use these measurements to evaluate the high frequency vibration of a machine casing or bearing housing due to blade passage, gear mesh, cavitation, rolling element bearing defects, and other conditions.

When you add an Acceleration Channel, you must also select a Speed Channel for each 1X, 2X, nX, and Amplitude Extraction - Sync measurement..

Add an Acceleration Channel

To add an Acceleration Channel:

1. In the Orbit 60 Instrumentation Pane, select a PAA, PAV, or Keyphasor Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an empty channel and select **Add or Replace > Acceleration Channel**. The **Acceleration Channel** is displayed in the **Instrumentation pane** under the **Input Module**.
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties. The Keyphasor Input Module only supports 3-wire accelerometers. To add a custom 2-wire input velocity or accelerometer transducer, see Add Custom 2-Wire IEPE Transducer.
4. Verify that the Filter  is displaying **All Properties**.
5. To modify channel properties, select Properties > Channels.

- Select the **Associated Protection Group** for the Channel.
- In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.

6. To modify trended variables properties, select Properties > Trended Variables. To integrate the acceleration signal from acceleration to velocity, enable **Integration**. Integration is only available on Direct, 1X, and 2X measurements. Select a Speed Channel for each 1X, 2X, and nX synchronous measurement.
7. To modify trended variables properties, select Properties > Trended Variables.
8. To modify setpoints, select Properties > Setpoints. The Direct, Bias, 1X Amplitude, 1X Phase, 2X Amplitude, and 2X Phase measurements are displayed.

Add a Bandpass Measurement

You can add multiple Bandpass measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a Bandpass measurement:

1. Select an **Acceleration Channel**.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Bandpass**.
3. The Bandpass measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any Bandpass measurement to rms (root mean square).

Add a nX Measurement

You can add multiple nX measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a nX measurement:

1. Select an **Acceleration Channel**.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **nX**.
3. The **nX** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select a Speed Channel for each nX measurement.
5. Select **Properties > General**. Configure the Order value.

You can change the subunit of any nX measurement to rms (root mean square).

Add an Async Measurement

You can add only one ASync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Acceleration Channel**.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Async**.
3. The **Async** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Add a Sync Measurement

You can add only one Sync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Acceleration Channel**.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Sync**.
3. The **Sync** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Dynamic Pressure Channel

When you add a Dynamic Pressure Channel, you must also select a Speed Channel for each 1X, 2X, nX, and Amplitude Extraction - Sync measurement..

Add a Dynamic Pressure Channel

To add a Dynamic Pressure Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an empty slot and select **Add or Replace** > **Dynamic Pressure Channel**. The **Dynamic Pressure Channel** is displayed under the **PAA Input Module** in the hierarchy.
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties.
4. Verify that the Filter  is displaying **All Properties**.
5. To modify channel properties, select Properties > Channels.
    - Select the **Associated Protection Group** for the Channel.
    - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
    - (Optional) Apply a **Line Rejection Filter** to the measurement frequency.
6. To modify trended variables properties, select Properties > Trended Variables.
7. To modify setpoints, select Properties > Setpoints. The Dynamic, Bias, 1X Amplitude, 1X Phase, 2X Amplitude, and 2X Phase measurements are displayed.

Add a Bandpass Measurement

You can add multiple Bandpass measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a Bandpass measurement:

1. Select a **Dynamic Pressure** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Bandpass**.
3. The Bandpass measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any Bandpass measurement to rms (root mean square).

Add a nX Measurement

You can add multiple nX measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a nX measurement:

1. Select a **Dynamic Pressure** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **nX**.
3. The **nX** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any nX measurement to rms (root mean square).

Add an Async Measurement

You can add only one ASync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Dynamic Pressure** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Async**.
3. The **Async** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Add a Sync Measurement

You can add only one Sync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Dynamic Pressure** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Sync**.
3. The **Sync** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Radial Vibration Channel

Radial vibration is the shaft dynamic motion or casing vibration which is measured in a direction perpendicular to the shaft axis, often called lateral vibration.

When you add a Radial Vibration Channel, you must also select a Speed Channel for each 1X, 2X, nX, and Amplitude Extraction - Sync measurement.

Add a Radial Vibration Channel

To add a Radial Vibration Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA, PAV, or Keyphasor Input Module. Expand the hierarchy to display an **empty channel**.

2. Right-click on an empty channel and select **Add or Replace > Radial Vibration Channel**. The **Radial Vibration Channel** is displayed in the **Instrumentation pane**.
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties.
4. Verify that the Filter is displaying **All Properties** 

.
5. To modify channel properties, select Properties > Channels.
   - Select the **Associated Protection Group** for the Channel.
   - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
6. To modify trended variables properties, select Properties > Trended Variables. Select a Speed Channel for each 1X, 2X, and nX measurement.
7. To modify setpoints, select Properties > Setpoints. The Direct, Gap, 1X Amplitude, 1X Phase, 2X Amplitude, and 2X Phase measurements are displayed.
8. (Optional) You can pair Radial Vibration Channels. For details, see Pair Channels.

Add a Smax Measurement

To add an Smax measurement:

1. Select a paired **Radial Vibration Channel**. For details, see See Manage Paired Channels on page 56..
2. Right-click on one of the paired **Radial Vibration** Channels. Select **Add or Replace > Trended Variables > Smax**. The Smax measurement (the maximum excursion from the center of vibration in the measurement plane) is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

Add a Bandpass Measurement

You can add multiple Bandpass measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a Bandpass measurement:

1. Select a **Radial Vibration Channel**.
2. Right-click on the channel and select **Add or Replace > Trended Variables > Bandpass**.
3. The Bandpass measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any Bandpass measurement to rms (root mean square).

Add a nX Measurement

You can add multiple nX measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a nX measurements:

1. Select a **Radial Vibration** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **nX**.
3. The **nX** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Properties** > **General**. Configure the Order value.

Add an Async Measurement

You can add only one ASync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Radial Vibration** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Async**.
3. The **Async** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that  **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.
7. Select **Windows** > **Properties** > **Trended Variables**. The Async measurement is displayed.

Add a Sync Measurement

You can add only one Sync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Radial Vibration Pressure** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Sync**.
3. The **Sync** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that  **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.
7. Select **Windows** > **Properties** > **Trended Variables**. The Sync measurement is displayed.

Valve Position Channel

A Valve Position channel supports up to four LVDT channels. .

Add a Valve Position Channel

To add a Valve Position Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA, PAV, or Keyphasor Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an empty channel and select **Add or Replace > Valve Position Channel**. The **Valve Position Channel** is displayed in the **Instrumentation pane** .
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties.
4. Verify that the Filter  is displaying **All Properties**.
5. To modify channel properties, select Properties > Channels.
   - Select the **Associated Protection Group** for the Channel.
   - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
6. To modify trended variables properties, select Properties > Trended Variables.
7. To modify setpoints, select Properties > Setpoints tab. The Speed and Gap measurements are displayed. To minimize error rates, all setpoints are within the linear range of the transducer. The **Lower** and **Upper OK Limits** depend on the selected transducer.
8. In the **Trended Variables** tab, modify other properties as needed.
9. To modify setpoints, select the **Setpoints** tab. The Valve Position measurements are displayed.

Add a Bandpass Measurement

You can add multiple Bandpass measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a Bandpass measurement:

1. Select a **Valve Position** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Bandpass**.
3. The Bandpass measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any Bandpass measurement.

Add a nX Measurement

You can add multiple nX measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a nX measurement:

1. Select a **Valve Position** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **nX**.
3. The **nX** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Properties** > **General**. Configure the Order value.

You can change the subunit of any nX measurement.

Add an Async Measurement

You can add only one ASync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Valve Position** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Async**.
3. The **Async** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Add a Sync Measurement

You can add only one Sync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Valve Position** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Sync**.
3. The **Sync** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Speed Channel

About Speed Channels

A Speed Channel monitors the shaft rotative speed of machines in revolutions per minute (RPM). A high-speed keyphasor module is required when the machine RPM exceeds 12,000 RPM or multi-event ratios are used. The high-speed keyphasor module supports up to 120,000 RPM.

If the shaft has multiple notches (or projections), it is configured as multiple events per revolution (or Events Per Revolution [EPR] > 1). When there is more than one event per revolution, you cannot create phase setpoints for synchronous measurements like 1x and 2x. All other setpoints are supported.

You can use a single keyphasor to measure the speed of two shafts on either side of a gearbox. Use the speed ratio (the ratio of the target shaft to the speed shaft) of the gearbox and the

measured shaft speed from the keyphasor to calculate the 1X, 2X, or SMAX measurement of the second shaft.

You can only add a single reverse speed and zero speed measurement to a Speed Channel.

Add a Speed Channel

If you add a reverse speed measurement to the channel, you must also select a Speed Channel for each reverse measurement.

To add a Speed Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA, PAV, or Keyphasor Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an empty channel and select **Add or Replace > Speed Channel**. The **Speed Channel** is displayed in the **Instrumentation pane**.
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties. (Optional) If you add a Speed Channel to a Keyphasor Input Module, you can modify the **Buffered Output** properties.
4. Verify that the Filter  is displaying **All Properties**.
5. To modify channel properties, select Properties > Channels.
    - Select the **Associated Protection Group** for the Channel.
    - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
6. To modify trended variables properties, select Properties > Trended Variables.
7. To modify setpoints, select Properties > Setpoints. The Speed and Gap measurements are displayed.

Add a Reverse Speed Measurement

There are circumstances where a fault causes a machine rotor to spin in the wrong direction. Reverse rotation can cause damage to seals and process valves. To identify reverse rotation, you can add a second transducer and a reverse speed measurement to the speed channel. This enables you to detect the direction of the shaft rotation and to measure the number and peak speed of reverse revolutions.

Detect Reverse Speed

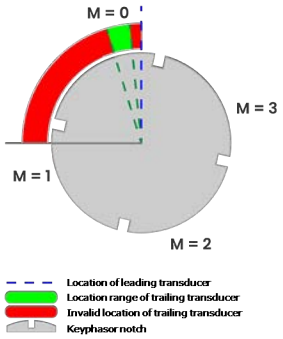
To detect reverse speed, you must install two transducers:

- Both transducers detect the same keyphasor notch, but are located so that the second sensor is installed at an angle that allows the system to identify which sensor detects the keyphasor notch first.
- You can select either transducer as the leading transducer.

- You must associate the reverse measurement with a secondary transducer on another speed channel.
- Both speed channels must have the same number of events per revolution.
- The two transducers must both be within 10% of Full Scale Range.
- Use only non-magnetic speed sensors. Magnetic speed sensors cannot detect rotation speeds less than 100 RPM.
- If you copy and paste the speed channel, you must re-associate the **Second Transducer Source** described below.

Mount Probes

To mount probes, they must be within a specific, relative range of each other, as illustrated below.



A warning is displayed if the orientation of the second transducer does not lag behind the associated transducer with the Reverse Speed Measurement by a calculated value. Use this formula to calculate the separation angle:

$$\frac{360 * M}{N} + \left(\frac{1}{4} * \frac{90}{N}\right) < \chi < \frac{360 * M}{N} + \left(\frac{3}{4} * \frac{90}{N}\right)$$

Where **N** is the total number of notches, and the value for integer **M** increases by section from 0 to N – 1 depending on its position relative to the primary sensor location.

Add a Reverse Speed Measurement

To add a Reverse Speed measurement:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA or PAV Input Module.
2. Expand the hierarchy and select a **Speed Channel**.
3. Right-click on a **Speed Channel** and select **Add or Replace** > **Trended Variables**. Choose which kind of speed you want to measure.

Speed Measurement	Description
Reverse Speed	Only valid once the system has determined that the machine is spinning

Speed Measurement	Description
	backwards. This measurement behaves like a typical speed measurement. By default, an alarm is fixed at 1 rpm on this value so that any reverse rotation activity enables the reverse measurements. You must select a second Speed Channel for the **Second Transducer Source**.
Number of Reverse Rotations	Only valid once the system has determined the machine is spinning backwards and has exceeded the reverse speed setpoint. This measurement cumulatively counts revolutions (adds revolutions onto the existing total count) since the last number of reverse rotations reset command was received. This value is persisted across power cycles, rack resets, and minor configuration changes.
Reverse Peak Speed	Only valid once the system has determined the machine is spinning backwards and has exceeded the reverse speed setpoint. This measurement stores the highest achieved reverse speed measurement since the last peak speed reset command was received. This is a peak hold type function. The valued is maintained across power cycles, rack reset commands, and minor configuration changes.
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. Rotor acceleration is measured by a proximity probe observing a multi-toothed wheel.
Peak Speed	Displays the maximum RPM obtained during monitoring since the last peak speed reset. It is derived from the speed measurement and stores the maximum speed reached. The current maximum RPM measurement is displayed in a bargraph or table view. This measurement can be useful to check the maximum speed that occurred as a result of an overspeed event or an aborted start up. This measurement is preserved during power loss and configuration changes. To reset the Peak Speed measurement, select **Windows** > **Device Commands** > **Resets** > **Channels**. Select **Peak Hold Reset**. Click **Commit**.

4. The **Reverse Speed** measurement you selected is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
5. Select the **Trended Variables** tab.
6. In the **Second Transducer Source** field for the reverse speed measurement, select a secondary transducer.
7. Identify which transducer you want to use as a secondary transducer for calculating the Transducer Orientation Angle. Enable the **Second Source is Leading** field for the measurement associated with that transducer.

8. Select Properties > Setpoints. Configure a **Level 4 (Danger)** setpoint for an over alarm at 1 rpm. This alarm is tripped when a reverse rotation condition is detected.

Velocity Channel

Velocity measurements allow you to evaluate machine housing and other structural response characteristics. These channels can use signals from most seismic or inertial transducers.

When you add a Velocity Channel, you must also select a Speed Channel for each 1X, 2X, nX, and Amplitude Extraction - Sync measurement..

Add a Velocity Channel

To add a Velocity Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PAA or PAV Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an **empty channel** and select **Add or Replace > Velocity Channel**.
3. The **Velocity Channel** is displayed in the **Instrumentation pane** .
4. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties. To add a custom 2-wire input velocity or accelerometer transducer, see Add Custom 2-Wire IEPE Transducer.
5. Verify that the Filter  is displaying **All Properties**.
6. To modify channel properties, select Properties > Channels.
   - Select the **Associated Protection Group** for the Channel.
   - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
7. To modify trended variables properties, select Properties > Trended Variables. To integrate the acceleration signal from acceleration to velocity, enable **Integration**. Integration is only available on Direct, 1X, and 2X measurements.
8. To modify setpoints, select Properties > Setpoints. The Direct, Gap, 1X Amplitude, 1X Phase, 2X Amplitude, and 2X Phase measurements are displayed.
9. Enable and configure measurement setpoints.

Add a Bandpass Measurement

You can add multiple Bandpass measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a Bandpass measurement:

1. Select a **Velocity** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Bandpass**.
3. The Bandpass measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.

You can change the subunit of any Bandpass measurement to rms (root mean square).

Add a nX Measurement

You can add multiple nX measurements to a channel. To configure measurements, you must give each measurement a unique name.

To add a nX measurement:

1. Select a **Velocity** channel
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **nX**.
3. The **nX** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Properties** > **General**. Configure the Order value.

You can change the subunit of any nX measurement to rms (root mean square).

Add an Async Measurement

You can add only one ASync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Velocity** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Async**.
3. The **Async** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that  **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Add a Sync Measurement

You can add only one Sync measurement to a channel.

To add Amplitude Extraction - Async measurements:

1. Select a **Velocity** channel.
2. Right-click on the channel and select **Add or Replace** > **Trended Variables** > **Amplitude Extraction - Sync**.
3. The **Sync** measurement is displayed in **Trended Variables** and **Setpoints**, and added to the **Measurements** pane.
4. Select **Windows** > **Properties** > **Trended Variables**.
5. Select the **Amplitude Extraction** column. (Verify that  **All Properties** are displayed.)
6. Enter values for **Center Frequency** and **Bandwidth**.

Temperature Channel

You can add up to six temperature channels to a RTD/TC Temperature Input Module.

To add a Temperature Channel:

1. In the Orbit Studio **Instrumentation** Pane, select a **RTD/TC Temperature Input Module**. Expand the hierarchy to display an **empty channel**.
2. Right-click on an **empty channel** and select **Add or Replace** > **Temperature Channel**. The **Temperature Channel** is displayed in the **Instrumentation pane**.
3. To configure the transducer, select Properties > General. To add a transducer not listed, select the **Custom** option and add the transducer properties.
4. Verify that the filter  is displaying **All Properties**.
5. To modify channel properties, select Properties > Channels
   - Select the **Associated Protection Group** for the Channel.
   - In the **Associated Processor** field, select the **Protection Processor Module** to associate with the measurements on this channel.
6. To modify trended variables properties, select Properties > Trended Variables
7. (Optional) Configure the default **Temperature Channel** measurements displayed in the Trended Variables Tab and the Setpoints Tab.
8. The Bar Graphs pane displays current values.

PVD Discrete Channel

An Isolated Discrete Input channel does not have any measurements. The channel is binary.

You can group up to five **Discrete Input Channels** on one PVD Input Module into a **Discrete Input Group**. You can also link Discrete Input Channels to specific **System Switches**.

Add a Discrete Channel

To add a Discrete Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a PVD Input Module. Expand the hierarchy to display an **empty channel**.
2. Right-click on an empty channel and select **Add or Replace** > **Discrete Channel**. The **Discrete Channel** is displayed in the **Instrumentation pane**. You can add up to six Discrete Channels to a single PVD Input Module.
3. To configure the transducer wiring, select Properties > General. A discrete channel can only receive signals from a two-wire transducer, enabling you to select a binary measurement.
4. To modify channel properties, select Properties > Channels.
5. To modify trended variables properties, select Properties > Trended Variables.

6. To configure a Discrete Input Group, see Manage Discrete Input Groups.
7. To configure a System Switch, see Configure a System Switch.

Manage Discrete Input Groups

To create a Discrete Input Group, the **System Switch** field must be **None**.

To configure a **Discrete Input Group**:

1. In the **Instrumentation pane**, select a **PVD Input Module**.
2. Right-click on a empty channel and add select **Add or Replace** > **Discrete Channel**.
3. Select Properties > General.
4. In the **Discrete Input Group** field, click **New**. The **Create New Discrete Input Group** dialog box is displayed.
5. Enter a group name.
6. Click **Create**. The properties grid displays the new **Discrete Input Group** name.
7. To group multiple Discrete Channels into a single Discrete Input Group:
   a. Select a **Discrete Channel**.
   b. Select **Properties** > **General**.
   c. In the **Discrete Input Group** field, select the name of an existing **Discrete Input Group** under which you want to group the Discrete Channels.

   Each channel in the Discrete Input Group is represented by a digit, either 0 or 1. The order of the digits represents the order in which you add the channels to the group.
8. Repeat the prior step for up to five Discrete Channels.
9. Select the **Associated Protection Group**.
10. Rename the **Discrete Channel** to give the channel a unique name.
11. Use the **Discrete Input Group** to define a trigger. See Configure Discrete Input Group

Configure a System Switch

To configure a System Switch:

- The **Discrete Input Group** field must be **Not Associated**.
- You must have a configuration lock and have Administrative or Management user rights.

To configure a **System Switch**:

1. Select the System Switch drop-down list box.
2. Select a value. A system switch is available for the protection group.

Switch	Description
None	Default.
Group Alarm	Inhibits an alarm for all devices in the selected Protection Group.

Switch	Description
Inhibit	
Group Reset	Resets all devices in the selected Protection Group.
Group Peak /Count Reset	Resets the forward and reverse peak speeds and reverse rotation counts for devices in the selected Protection Group.
System Alarm Inhibit	Inhibits all system alarms.
System Reset	Clears all latched alarms and NOT OK statuses across the system.

3. Rename the Discrete Channel to give the channel a unique name.
4. Select the **Associated Protection Group**.

Relay Channels

About Relay Channels

Relays are the primary output mechanism for the system. Use Orbit 60 to configure the logic that determines the output relay state. Each relay is set depending on whether the device is normally energized or de-energized and voted one-out-of-one or two-out-of-three. These settings confirm physical DIP switch settings on each of the relay modules to ensure that critical safety applications can be triggered.

A relay may operate in a normally open or normally closed mode. Depending on the destination of relay outputs, it may be necessary for an active state to be indicated by an open contact or a closed contact.

Use Relay Channels as outputs to protect the system when a measurement exceeds a setpoint. To define relay logic, you can use AND and OR logic operands, utilize alarm inputs from input modules, protection group statuses, and individual or combined measured values from any module in the system.

The relay can drive control systems, emergency shutdown systems, and control elements or interposing relays. Depending on your needs, you can add multiple Relay Channels.

Add a Relay Channel

You can add up to eight Relay Channels to an output module.

You must use all active Relay Channels in a Relay Logic Set rule. If you don't want to use a Relay Channel, edit its properties and clear the **Active** check box.

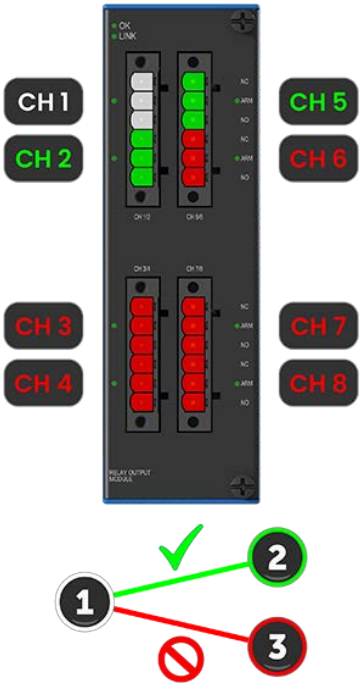
To add a Relay Channel:

1. In the Orbit 60 **Instrumentation** Pane, select a Solid State Relay or an Electromechanical Relay Module. Expand the hierarchy to display an **empty slot**.
2. Right-click on an **empty channel** and select **Add or Replace** > **Relay Channel**. The **Relay Channel** is displayed in the **Instrumentation pane**.
3. The **Properties** tab displays current values. See Relay Channel properties.

For each Relay Channel, Configure Relay Logic.

Pair a Relay Channel

If you need to configure a double-throw, double-pair switch, you can pair two Relay Channels. The two channels must have the same properties.



To pair a Relay Channel:

1. In the **Instrumentation pane**, select a **Relay Channel**.
2. In the **Properties** > **General** pane, select the **Paired Channel** field.
3. Click **Modify**. The **Modify** button is disabled if you do not have sufficient user permissions.
4. The **Paired Channel** dialog box is displayed. Available channels are displayed.

> You can only pair Relay Channels that are physically adjacent to each other. For example, you can pair channel 1 with channel 2 or 5. A validation warning is displayed if you attempt to pair invalid channels.

5. Select the channel you want to pair and click **Pair**. The name of the selected channel is displayed in the **Properties** > **General** tab in the **Paired Channel** field. The selected **Paired Channel** property is also updated.

Manage Paired Channels

If you have more than one channel, you can pair two of them.

This feature is only available for Radial Vibration or Relay Channels. To pair Relay Channels, see Pair a Relay Channel

Pair Channels

To pair channels:

1. In the **Instrumentation pane**, select a channel you want to pair.
2. Verify that the Filter  is displaying **All Properties**.
3. In the **Properties** > **Channels** pane, select the **Paired Channel** field.
4. In the **Paired Channel** field, click **Modify**. The **Paired Channel** dialog box displays available channels for pairing.
5. Select the channel you want to pair and click **Pair**. The name of the selected channel is displayed in the **Properties** > **General** pane in the **Paired Channel** field. The selected **Paired Channel** property is also updated.

Unpair Channels

To unpair channels:

1. In the **Instrumentation pane**, select either of the two paired channels you want to unpair.
2. Verify that the Filter is displaying **All Properties** 

.
3. In the **Properties** > **General** pane, select the **Paired Channel** field.
4. Click the **Modify** button.
5. The **Paired Channel** dialog box is displayed. The paired channels are displayed.
6. Click **Unpair**. The name of the selected channel is removed from in the **Properties** > **General** pane in the **Paired Channel** field. The selected **Paired Channel** property is also updated.

Copy Paired Channels

To copy paired channels:

1. In the **Instrumentation pane**, select the module or chassis containing the paired channels.
2. Right-click on the module or chassis and choose **Copy**.
3. Select the hierarchy location where you want to copy the paired channels. Right-click and choose **Paste**. The paired channels are copied to the new location in the hierarchy.

Add Custom 2-Wire IEPE Transducer

To add a custom 2-wire input IEPE velocity or accelerometer transducer, use the properties for the transducers listed in the table below. If you are using a custom transducer not listed here, make the following adjustment to the given limits:

> Assuming the linear range and OK voltages are in the positive range, subtract 24.58 volts from these limits. This is applicable to PAV where the sensor power supply is negative.

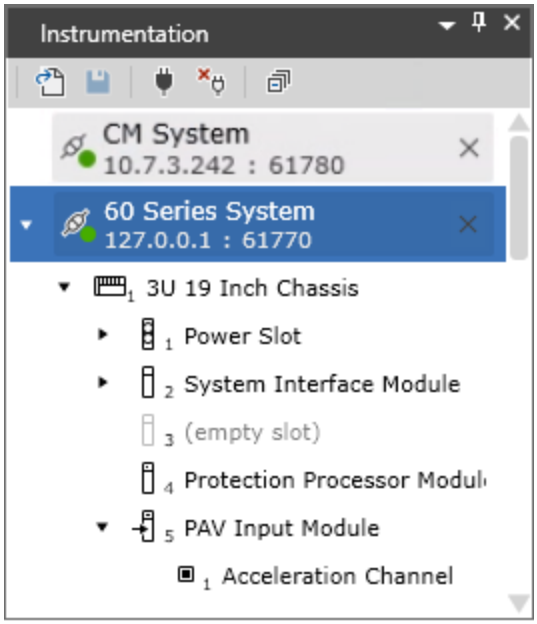
Transducer	OK Limits (Volts)	
	Lower	Upper
200350 Accelerometer	-6.58	-22.58
200355 Accelerometer	-7.33	-21.83
190501 Velomitor CT	-13.20	-15.75
330525 Velomitor	-4.33	-20.83
330750 High Temp Velocity	-6.77	-18.38
330752 High Temp Velocity	-6.77	-18.38
330505 Low Freq Velocity	-9.34	-15.81
330500 Velomitor	-4.33	-20.83

3.6 Configure Condition Monitoring Module

After you connect to and add a Condition Monitoring Module, you need to create a network configuration.

To create a network configuration:

1. In the Instrumentation Hierarchy Pane, right-click on the **Condition Monitoring** module.



2. Select **Settings**. The **Properties** dialog box is displayed.
3. In the **Network Configuration** tab, enter the **IP Address** of the module, **Subnet Mask**, and **Gateway**.
4. If needed, modify **User Management**, **Port Configuration**, and **Run Mode Permissions**. For details, see Configure System Properties
5. Click **Apply**.

The CM Module stores log files of system and alarm events, alarm and transient data. This information can help you analyze machine events. For details, see Retrieve Offline Diagnostic Files.

3.7 Sync Device Configuration

To add devices, see Connect to Devices.

Before you can send the configuration:

- You must be physically connected to the hardware rack using Ethernet.
- Have a configuration lock and have Administrative or Management user rights.
- Resolve any pending validation errors displayed in the Warning / Errors pane.

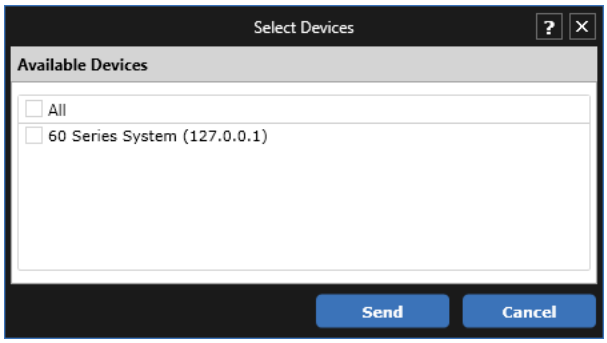
Sync All Devices

The **Send** command is disabled if you do not have configuration lock.

Unsynchronized connected systems are indicated with an asterisk next to the system name, as illustrated below.

To send a configuration to all devices:

1. If you have not yet connected to the device, see Connect to Devices.
2. Choose **Devices** > **Send**, or right-click on the system and choose **Send to Device**.
3. If you syncing an offline configuration, right-click on the offline configuration file and choose **Send to Device**. The **Select Devices** dialog box is displayed.
4. Select **All** or the specific devices you want to update.



5. Click **Send**.

   If the client detects a conflict between the software configuration and the hardware, or if you connect to a newer version of a hardware device, the **Session History** pane displays a red progress bar indicating a device mismatch or conflict. See Resolve Configuration Mismatch.

6. The configuration is sent to the selected devices. The devices are rebooted, which may take up to 90 seconds.

Sync a Single Device

Before you can send a configuration to a device, you must resolve any pending validation errors displayed in the Warning / Errors pane.

To send a configuration to a single device:

1. In the Orbit 60 **Instrumentation** Pane, select a connected device.
2. Right-click on the device and select **Send**.

> If the client detects a conflict between the software configuration and the hardware, or if you connect to a newer version of a hardware device, the **Session History** pane displays a red progress bar indicating a device mismatch or conflict. See Resolve Configuration Mismatch.

The configuration is sent to the selected device.

3.8 Send Device Commands

Use device commands to inhibit alarms, bypass channels, reset latched alarms, relays and peak measurements from the device commands tab.

To send device commands, you must have the required administrative user rights.

Reset Latched Alarms and Relays

To reset latched alarms and relays:

1. Choose a method:
   a. Select a channel in the Instrumentation Hierarchy.
   b. In the **Protection Group** pane, select a Default or Custom **Protection Group**.
2. Select **Device Commands**.
3. In the right side of the header, click **Rack Reset**. All latched alarms and relays in the selected system are reset, excluding Peak Hold measurements to protect reverse speed measurements.

Inhibit Alarms

To inhibit alarms:

1. In the **Protection Group** pane, select a Default or Custom **Protection Group**.
2. Select **Device Commands** > **Inhibits and Bypass**. All available channels are displayed. Currently inhibited alarms are displayed in green.
3. Select which level alarms you want to inhibit.
4. Click **Commit**. All selected Alarms in the selected system are inhibited.

Reset Latched Alarms, Relays, and Peak Hold Measurements

To reset latched alarms, relays, and peak hold measurements:

1. In the **Protection Group** pane, select a **Default** or **Custom Protection Group**.
2. Select Device Commands > Resets. All available channels are displayed.
3. Select the channel you want to reset.
4. Click **Commit**. All selected latched alarms, relays, and peak hold measurements are reset.

Bypass Channels

To bypass channels:

1. In the **Protection Group** pane, select a **Default** or **Custom Protection Group**.
2. Select **Device Commands** > **Inhibits and Bypass**. All available channels are displayed. Currently bypassed channels are displayed in green.
3. Select the channel(s) or relay(s) you want to bypass.
4. Click **Commit**. All selected channels in the selected system are bypassed

3.9 Create Protection Group

About Hardware Protection Groups

You can group channels and measurements into specific protection groups. All channels and measurements are automatically assigned to the Default Protection Group. Protection States determine if the machine is in **Trip Multiply**, **Running**, **Off**, or **Test mode**.

You can create additional Custom Protection Groups and subgroups and use each group to drive a protection fault status. You can then add alarms to over setpoints. You can use the protection fault status in a relay or export it via a Communications Gateway to notify a control system that the system is unable to protect the machine.

You can configure a maximum of 27 hardware protection groups. The default protection group names are:

Names	Description
Trip Multiply	Use Trip Multiply to temporarily increase Danger and Alert setpoint values. Trip Multiply identifies a speed range during which the measurement transitions through resonance and an alarm is not triggered.
Running	Set a lower measurement trigger since the machine is no longer at resonance and tends to need lower triggers.
Machine Off	Set a measurement below a certain speed to trigger a running gear.
Test	Set a measurement to meet specific test requirements.

Create Custom Hardware Protection Group

To configure a protection group:

1. In the Instrumentation Hierarchy pane, select the **Protection Group** pane. (You can move panes as needed.)
2. Right-click on an Orbit 60 chassis and click **Add Protection Group**. A new **Custom Protection Group** is displayed the **Protection Group** pane.
3. (Optional) Create protection subgroups. In the **Protection Groups** sub-tab, right-click on a **Custom Protection Group** name and select **Add Sub-Group**.
4. Rename the Protection Group to a meaningful name that distinguishes it from other protection groups.
5. Assign a Protection Processor Module to each protection group.
    a. Select **Properties** > **General**.
    b. In the **Associated Processor** field, select a **Protection Processor Module**.
6. Add at least one channel to each group. To add or move a channel to a protection group:
    a. Select the **Properties** > **Channels** tab. All existing channels are displayed. Scroll to the right.

b. In the **Associated Protection Group** column, select a protection group from the drop-down list.
c. The custom protection group in the **Protection Groups** sub-tab displays the added channel.

After you create a Protection Group, you can Define Triggers.

Add Custom States

Aside from the four default event states, you can add and manage custom states.

To add custom states:

1. In the Instrumentation Hierarchy pane, select the **Protection Group** pane. (You can move panes as needed.)
2. Select **State Management** > **States**. The protection group **States** tab is displayed.
3. Click the **Add States** + button at top right. The **Enable States** dialog box is displayed.
4. Select a new **Operating State** field. Rename it as needed. Click the **Enable** check box.
5. Click **Apply**. The new custom state is displayed in the **States** tab.

The next step is to define triggers for each state.

Protection Mode States

The protection mode status is displayed in the System in the **Instrumentation pane** .

System	Description
	Protection fault detected. A Not OK status is detected in the protection path.
	Protection compromised detected. A Not OK status is detected in a redundant protection path.

3.10 Configure Protection Group States

Define Triggers

Before you can define triggers, you must create a protection group.

You can trigger selected protection states based on input from a **Measurement Channel** or a **Discrete Input Channel**. You must first include the channels in the protection group associated with the trigger. For details, see PVD Discrete Channel.

To define a trigger:

1. In the Orbit 60 **Protection Group** Pane, select the **Protection Group** you want to apply triggers to.

2. Select **State Management** > **States**.
3. Select the state you want to modify and select the **Active** check box.
4. In the **Trigger Definition** field of any state, click **Edit...** . The **Trigger Definition** dialog box is displayed.
5. Configure a **Trigger** for all active **States**. In the **Trigger Selection** pane, select a value in the **Trigger** field. Choose one of these options:
    a. **SIM TM Contact**. Use the dedicated SIM contact on the System Interface Module to drive the **State**. When the Trip Multiply protection state is triggered, it is displayed in the bar graph for State Measurement, and a System Event in Software is recorded.
    b. A **measurement channel**. The system displays channels based on the measurements included in the protection group. Select an **Operator** and values for each state.
    c. A **Discrete Channel**. If you select a **Discrete Input Group**, you must configure a **Condition** for at least one **State** displayed in the **State Definition** pane. See Configure Discrete Input Group.
6. Select a Protection Alarm:
    - Choose **Standard** alarming to evaluate data against the configured alarm levels for the standard set of setpoints regardless of what device state the machine is operating in.
    - Choose **State-Based** to configure setpoints for:
        - Device-calculated measurements such as Direct.
        - Software-calculated measurements such as spectral bands.

        State-Based setpoints are deleted from the configuration if its associated protection state is marked as inactive or if the protection state's alarm is set to standard.

    - Choose **Suppressed** to prevent alarms.

Configure Discrete Input Group

You can group up to five Discrete Channels into a single Discrete Input Group. See Manage Discrete Input Groups.

To configure a Discrete Channel, select any channel in the protection group as a trigger. All channels that you added to the Discrete Input Group are displayed.

- Each digit in the number represents a channel. The number of digits indicates the number of channels.
- A zero (0) digit indicates the corresponding channel must have a 0 value to trigger the conditional.
- A one (1) digit indicates the corresponding channel must have a 1 value to trigger the conditional.
- You cannot reuse a **Discrete Input Group**.

In the illustration below, the selected Discrete Input Group has five channels: DC1 through DC5. To combine channels, select a group of digits representing the state required to trigger the protection state. For example, in this illustration, the sixth option (00011) requires:

- DC1 to be 0
- DC2 to be 0
- DC3 to be 0
- DC4 to be 1
- DC5 to be 1

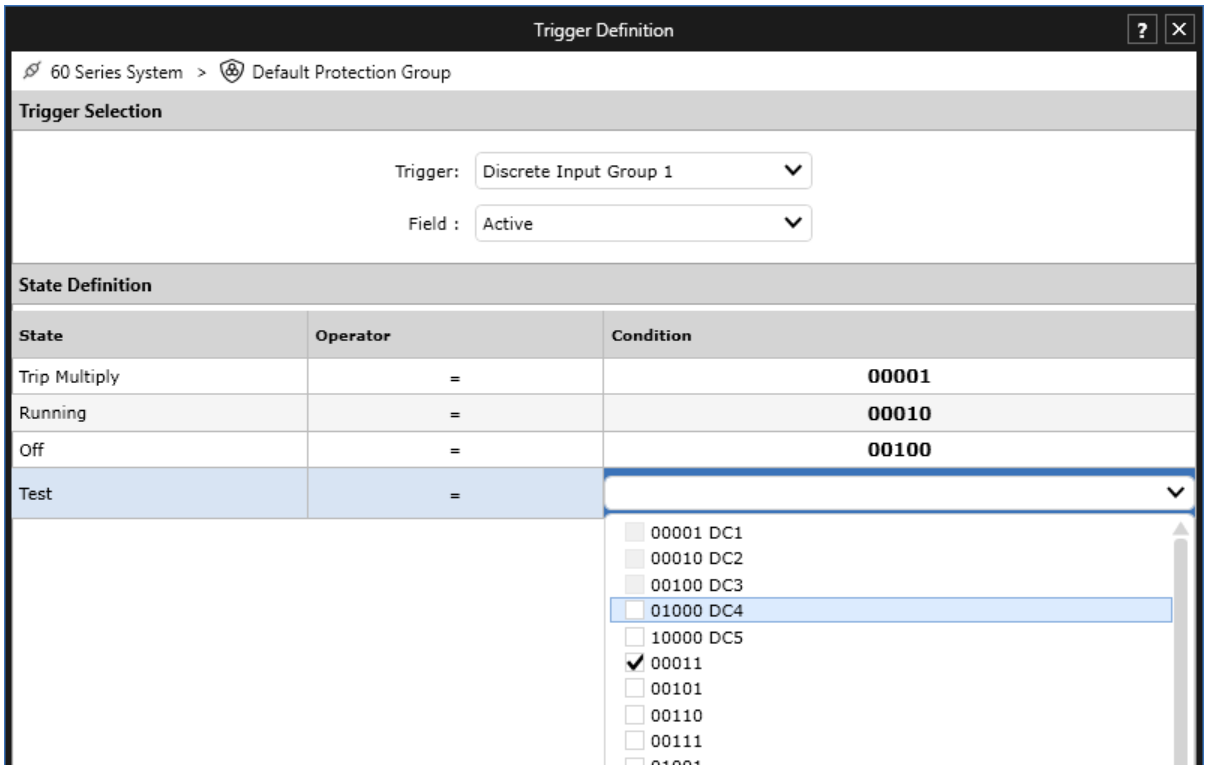


Figure 3 - 1: Example of Discrete Input Group Channels

3.11 Configure Setpoints

Use setpoints to set upper and lower limits for monitored parameters on your machinery assets. Depending on what you are monitoring, you can set upper and lower limits for different levels. Default setpoint parameters and supported alarm types depend on the measurement type. You can use measurement setpoints to trigger relays that operate hardware and protect equipment.

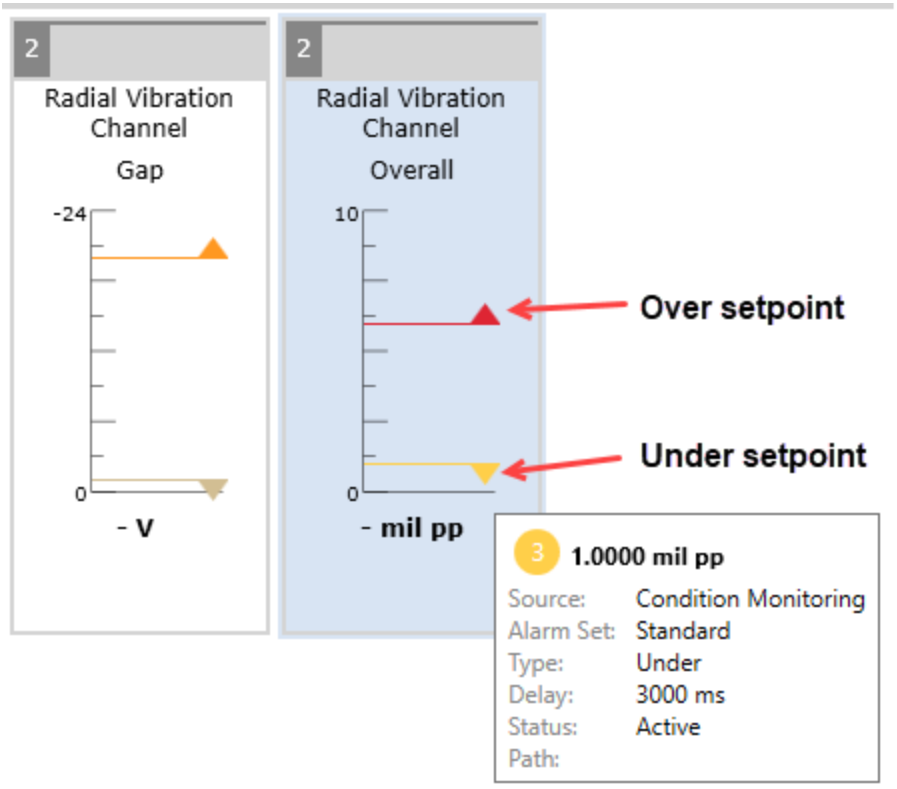
Before you can configure setpoints, you must add input channels.

The time delay property is constrained from 100ms to 60000ms.

About Setpoints

You can configure four setpoint severity levels for each measurement. When values cross these thresholds, an alarm is triggered, notifying you of the alarm condition in the Alarm Events pane. You can use the measurement setpoints to trigger relays that operate hardware and protect equipment.

- Trending variables are displayed in the Bar Graphs tab.



- To display setpoint details, hover your mouse over the setpoint.
- Setpoints are shown in the Bar Graph view as lines with arrows pointing in the direction of the setpoint. An over setpoint arrow points up, and an under setpoint arrow points down.

Configure Setpoints

To configure setpoints:

1. Select the channel name and the measurements to which you want to apply setpoints.
2. Select Properties > Setpoints. The Setpoints tab is displayed.
3. Expand the setpoint level you want to configure.
4. Enable the setpoint level.
5. Select and configure each **Alarm Type**:
    - **Over**: The high setpoint value that triggers an alarm.
    - **Under**: The low setpoint value that triggers an alarm.
    - **Out of band**: The setpoint value is outside the setpoint value range.

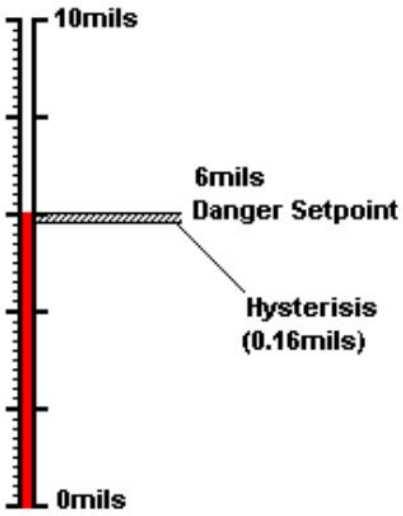
- **In Band**: The setpoint value is within the setpoint value range.
- **Latching:** Temporarily disable repeated non-critical condition monitoring alarms. When enabled, the corresponding relay alarm channel records the alarm and the status is latched, or remembered. The component does not leave the latched state even if the status returns to normal until you reset the rack or reconfigure the relay. For example, if a transducer is known to be in an invalid state and is continually sending alarms but can't be immediately replaced, you may choose to latch the device status.
- **Delay**: The time a measurement must remain at or above (or, depending on the setpoint, below) the setpoint for the alarm to be activated.

Alarm Hysteresis

When a channel exceeds an alarm setpoint, it must fall back below the setpoint, less the hysteresis, before it can go out of alarm.

- All channel types, except speed: the alarming hysteresis is 1/64th of Full Scale.
- For speed channel types: the alarming hysteresis is 10 rpm, unless the unit of speed is hertz, then it is 10 rpm * (multi-event ratio)/60.

For example, consider a regular channel configuration with a 0 - 10 mils Full Scale and an alarm setpoint at 6 mils as illustrated below:



- The hysteresis = 10 mils* 1/64 = 0.16 mils.
- The channel input must fall below 6 mils - 0.16 mils = 5.84 mils before the channel is out of alarm.

3.12 Configure Relay Logic

Use Relay Logic to trigger a relay based on an input source's setpoints. The relay can drive control systems, emergency shutdown systems, control elements or interposing relays. Before you can configure Relay Logic, you must create Relay Channels.

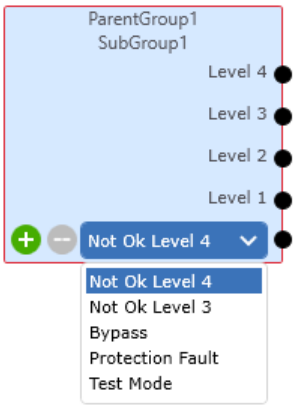
The system displays **Relay Logic** tabs based on the chassis or device you select in the Instrumentation Hierarchy Pane pane. To display all **Relay Logic** tabs, select the parent chassis in the Instrumentation pane.

Add Relay Logic

To add Relay Logic:

1. In the Orbit 60 **Instrumentation** pane, select an output module with an active Relay Channel.
2. Select **Windows** > **Relay Logic**. The default **Logic Set** canvas is displayed.
3. Click **Edit**  . The **Toolbox** is displayed. To minimize or maximize the **Toolbox**, click on the **Toolbox** handle.
    - To add a new **Logic Set** canvas, select the parent output module and click **Add**  .
    - To rename the **Logic Set** canvas, double-click on the tab name.
    - To delete a **Logic Set** canvas, right-click on the tab name and select **Delete**.
4. In the **Toolbox Input Source** pane, expand the available input sources.
5. Select an input source. Double-click the source or drag and drop it on the **Logic Set** canvas. The source and its setpoints are displayed.
    - If you double-click two objects of the same type in the **Toolbox** twice, the second instance may overlay the first instance.
    - The **Toolbox Properties** pane displays properties for the selected object.
6. In the **Output Sources** pane, select an unused **Relay Channel** and add it to the **Logic Set** canvas. The **Relay Channel** is displayed.
7. In the **Logic Set** canvas, add **Logical Operators** from the **Toolbox** as needed. You can add a maximum of eight inputs to a Logical Operator node: one on top and up to seven to the bottom connector.

8. When you add a Protection Group as a node to a **Logic Set** canvas, you can select a Protection Group state as a trigger.



9. Draw connections and add logic needed between an **Alarm Level** input and a **Relay Channel** output.

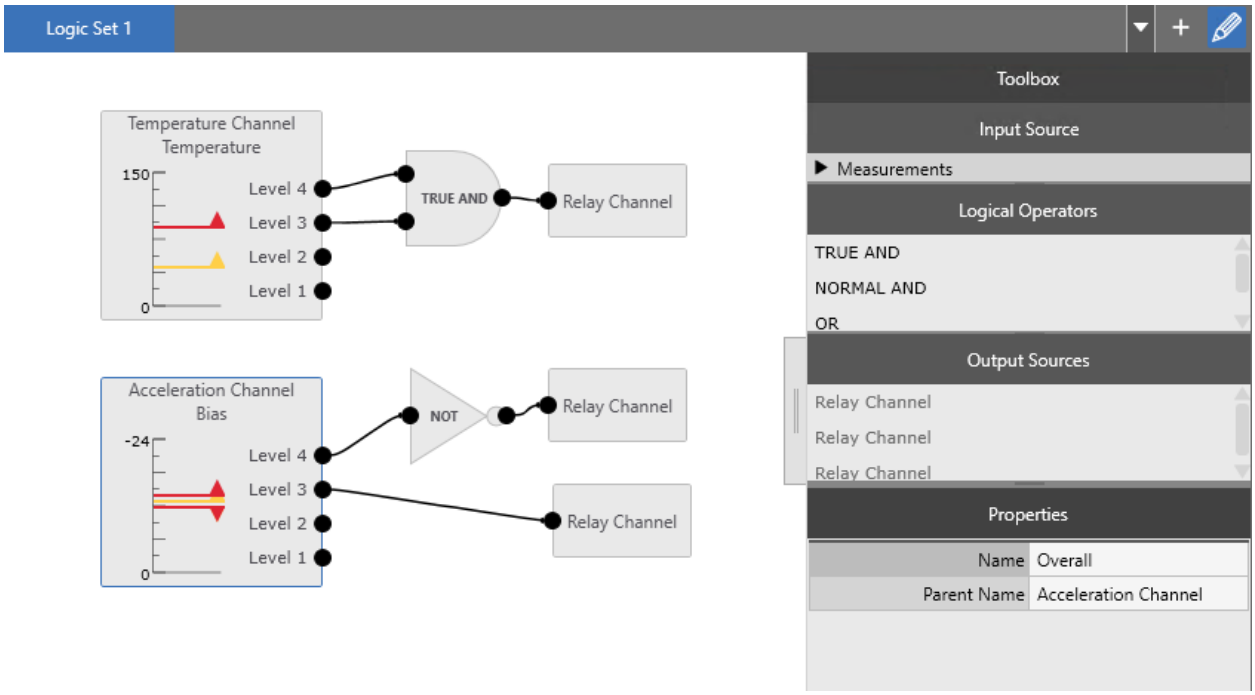


Figure 3 - 2: When a setpoint level is triggered, the Relay Channel sends a signal to the hardware device to trigger a physical relay.

The bar graph in the Logic Set canvas displays the same data displayed in the Bar Graph tab. When offline or while editing Relay Logic, the bar graph does not display data.

10. Add additional input sources and **Logical Operators** as required.
    - An input node must be connected to at least one other object.
    - An active Relay Channel must be connected to at least one input.
    - You must connect all nodes of each **Logical Operator**.
11. Connect each input source to a **Relay Channel**.
    - To modify a **Relay Channel**, select the **Relay Channel** in the **Logic Set** rules canvas. In the Toolbox **Properties** pane, edit any fields displayed in bold.

The processing bandwidth for each relay module is displayed in the System Utilization pane.

Modify Relay Logic Canvas Objects

To edit or copy objects on the Relay Logic canvas:

Click **Edit**  . The **Toolbox** is displayed.

- To delete an input source, connector, or output source, select it and press **Delete**.
- To copy objects, press **CTRL**+**C**. Use **CTRL**+**V** to paste the elements on any Relay Logic canvas for this system or any other system.
- If you copy an input source from one system to another, the source is cleared, and **Missing Source** is displayed.
- You cannot reuse **Relay Channels**.
- You cannot reuse a measurement on a canvas that already contains the same measurement.
- To replace an input or output node, right-click on the node and select **Replace**. Select the replacement node and click **OK**.

Edit Nodes and Connections

To edit nodes and connections:

1. Click **Edit**  . The **Toolbox** is displayed.
2. Select the nodes and/or connections you want to modify.
3. Drag the mouse to select multiple elements. Selected elements are displayed with a blue border.

Navigate the Relay Logic Canvas

If the relay logic diagram is larger than the canvas, use the mouse scroll wheel in combination with a keyboard key.

To navigate the Relay Logic canvas:

- To pan the canvas, press the **Space Bar**.
- To scroll horizontally, press the **SHIFT** key.
- To zoom, press the **CTRL** key.

3.13 Add Custom 2-Wire IEPE Transducer

To add a custom 2-wire input IEPE velocity or accelerometer transducer, use the properties for the transducers listed in the table below. If you are using a custom transducer not listed here, make the following adjustment to the given limits:

> Assuming the linear range and OK voltages are in the positive range, subtract 24.58 volts from these limits. This is applicable to PAV where the sensor power supply is negative.

Transducer	OK Limits (Volts)	
	Lower	Upper
200350 Accelerometer	-6.58	-22.58
200355 Accelerometer	-7.33	-21.83
190501 Velomitor CT	-13.20	-15.75
330525 Velomitor	-4.33	-20.83
330750 High Temp Velocity	-6.77	-18.38
330752 High Temp Velocity	-6.77	-18.38
330505 Low Freq Velocity	-9.34	-15.81
330500 Velomitor	-4.33	-20.83

4. Verification

Once you configure the devices, you need to verify that communication is established and measurements are being received.

4.1 Verify Measurements

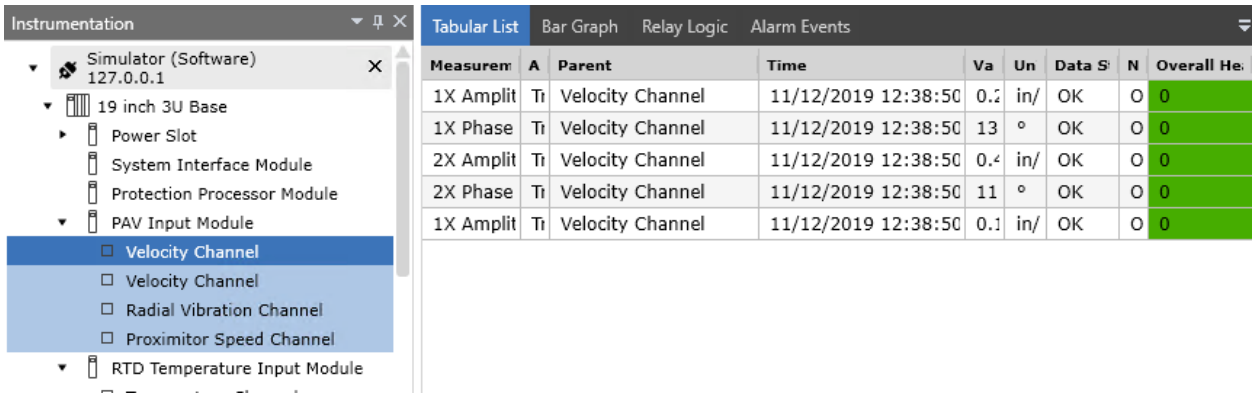
After you add modules and channels and configure the devices, you need to make sure the channels are working. To verify that measurement data is being received, view data in the Bar Graphs and Tabular List tabs. Only enabled setpoints are displayed.

To verify measurements are being received:

> If data is not displayed, check the Warnings/Errors pane for messages. Data is not retrieved if there are any warnings or errors.

1. In the **Instrumentation pane**, select a module. The corresponding measurements are grouped by measurement type in the **Measurements** pane.
2. Use CTRL+click or SHIFT+click to select multiple measurements.
3. To verify measurements are being received, select **Windows** > **Tabular List**

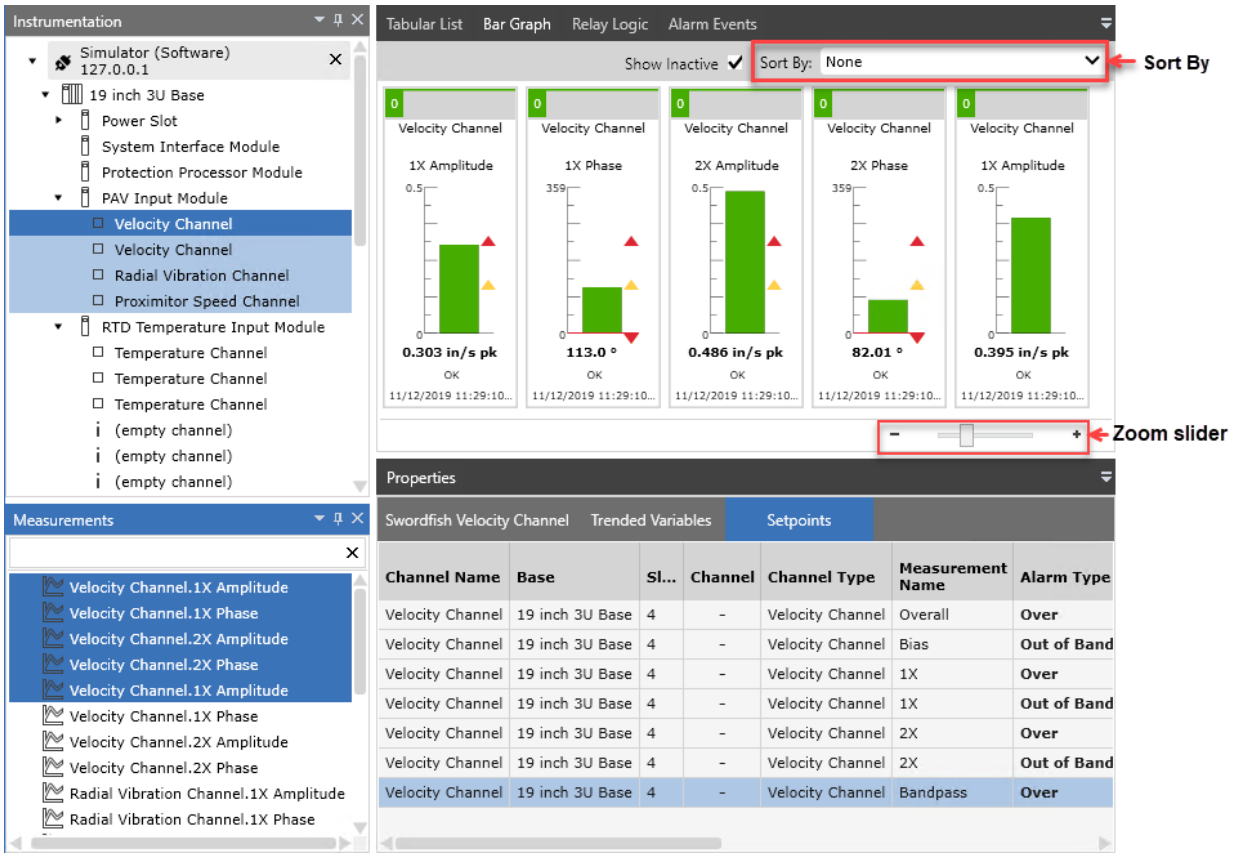
   The connection health is indicated by the color in the Overall Health column. See Tabular List.



Bar Graphs

The connection status is indicated by the color of the bar graph. See Bar Graphs.

- Setpoints are shown as lines with triangles indicating the direction of the setpoint.
- The color of the bar graph indicates the measurement status.



Channel Name	Base	Sl...	Channel	Channel Type	Measurement Name	Alarm Type
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	Overall	Over
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	Bias	Out of Band
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	1X	Over
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	1X	Out of Band
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	2X	Over
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	2X	Out of Band
Velocity Channel	19 inch 3U Base	4	-	Velocity Channel	Bandpass	Over

- To sort the bar graphs by type, select the **Sort By** field.
- To display only active Bar Graphs, clear **Show Inactive**.
- To resize the **Bar Graph** pane, select the zoom slider at the bottom right of the window.

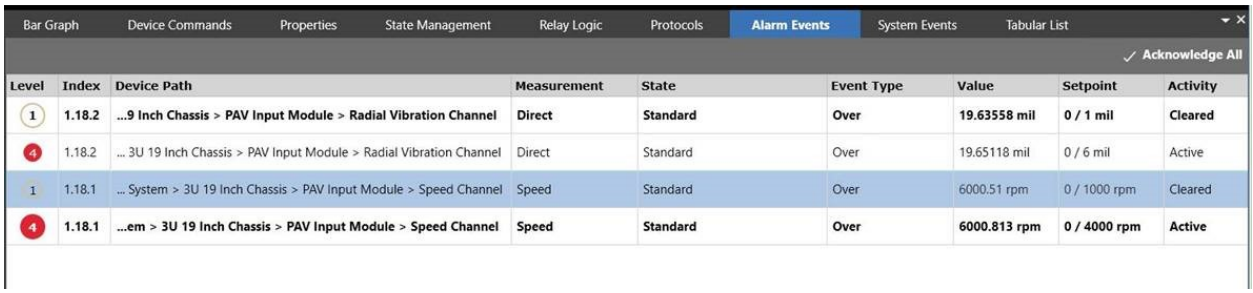
4.2 View Alarm Events

The **Alarm Events** tab displays alarms created when thresholds you set in the **Setpoints Properties** are exceeded.

To inhibit alarms and relays, see Send Device Commands.

To view alarms:

1. To filter which alarms are displayed, select a module or channel in the Instrumentation Hierarchy Pane.
2. Select Windows > Alarm Events. The **Alarm Events** pane is displayed. Current alarms, if any, are shown. New events are displayed in bold. To view the exact channel, hover over the **Index** number for the alarm.



3. To view specific time periods for alarms, select the **Mini-Trend Bar** at the bottom of the **Alarm Events** pane.
   - To modify the date range, click the **Time Range** selectors and select a beginning and end date.
   - To select a current value, enter an integer value and select a current value button:
     - **H** - Hours
     - **D** - Days
     - **W** - Weeks
     - **M** - Months
     - **Y** - Years

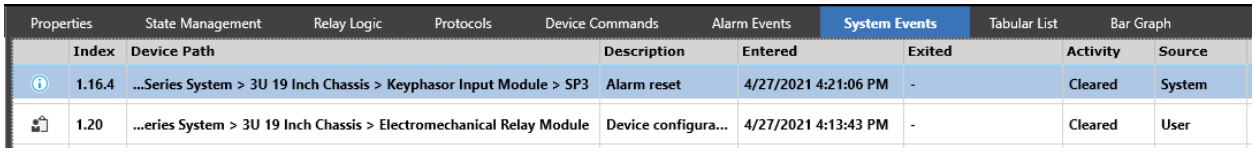
   - The current value displays as selected window of time. For example, to view 2 weeks, enter **2** and click **W**.
4. To acknowledge alarms, choose a method (you can use keyboard shortcuts to multiselect events):
   - To acknowledge individual alarms, right-click and select **Acknowledge**.
   - To acknowledge all alarms, click **Acknowledge All**.
5. The **Alarm Events** properties are updated.

4.3 View System Events

The **System Events** tab displays events created when alarms and other configuration thresholds are exceeded.

To view System Events:

1. Select the system for which you want to view events.
2. Select the **System Events** tab. Current System Events are displayed based on the selected hierarchy.



3. (Optional) Modify the date range.
   - Click the **Time Range** selectors and select a beginning and end date.
   - To select a current value, enter an integer value and select a current value button:
     - **H** - Hours
     - **D** - Days
     - **W** - Weeks
     - **M** - Months
     - **Y** - Years

   - The current value displays as a selected window of time. For example, to view 2 weeks, enter **2** and click **W**.
4. Events are displayed based on the selected Time Range. All columns are sortable. To select events, press CTRL+A or multi-select events with your mouse and press CTRL +C to copy events to the Windows clipboard, then paste them into a third-party application.

For more details about system events, view device log files. See Manage Log Files.

4.4 Manage Log Files

Log files are created as a result of system events and failures. You must connect to the device to view Log Files. Connect to the SIM module or CM Module to obtain log files. You can use log files to obtain assistance when troubleshooting issues with Bently Nevada Support.

To retrieve application log files:

1. Select **Tools** > **Retrieve Log Files**. The **Retrieve Log Files** dialog box is displayed.
2. Select the **Available Devices** associated with the log files you want to save.
3. Click **Browse** and navigate to the file location where you want to save the files.

4. Click **Retrieve**. The log files are saved.
5. Click **Close**.

4.5 Retrieve Offline Diagnostic Files

Log files are created as a result of system and alarm events, alarm and transient data. After you retrieve diagnostic files, you can then import the log file into System 1 for additional insight into machine-related issues and to analyze the recorded events and data.

To retrieve diagnostic log files:

1. Verify that you are connected to the CM module.
2. Select **Tools** > **Retrieve Offline Diagnostic Files**. The **Retrieve Offline Diagnostic Files** dialog box is displayed.
3. Select the **Available Devices** associated with the log files you want to retrieve.
4. Click **Browse** and navigate to the file location where you want to save the files.
5. Click **Retrieve**. The .ODF log files are saved.
6. Click **Close**.
7. Import the data into System 1.

4.6 Clear Configuration

In rare circumstances, Orbit Studio may repeatedly display a message that it is unable to connect. This can occur in two instances:

- When your replace a System Interface Module (SIM) module.
- When you move the Condition Monitoring Module (CMM) to a different slot.

If the CMM is connected to System 1, we recommend that you create a System 1 Machine Audit file and/or a backup before you proceed. In Orbit Studio, If you are able, save the last valid configuration as a *.ORB file. Even though Orbit Studio reports it cannot connect, it may be possible to save the configuration.

This step is only recommended if no other option is available. If you need to clear the configuration, you must first clear events and alarms generated by the CMM in System 1 before you reconnect to System 1. For assistance clearing events and alarms, contact Bently Nevada Support. Users and network settings are retained.

If Orbit 60 is connected to another data source like System 1, the Orbit 60 device is orphaned and only displays historical data in System 1. After you clear the configuration, you must remove and re-add the CMM to System 1 as a new device. If Orbit 60 is not connected to another device, all offline data is deleted.

To clear the device configuration:

1. Select **Tools** > **Clear Configuration**. The **Clear Configuration** dialog box is displayed.
2. If you:
    - Replaced the SIM, enter the SIM **IP Address** and **Port**.
    - Moved the CMM, enter CMM **IP Address** and **Port**.
3. Enter an authorized **User Name** and **Password**.
4. Click **Connect**. The **Clear Configuration** dialog box is displayed.
5. Acknowledge the warning displayed. Click **OK**. The SIM and CMM configurations are cleared.
6. Reconnect to the SIM module. All the modules are displayed in the Instrumentation hierarchy.
7. When reconnected to System 1, if you created a System 1 backup, restore the configuration and resync to System 1.
8. (Optional) If you were able to save an ORB file, send the configuration to the device, or copy and paste parts of the configuration as needed. If not, reconfigure the system.

5. Troubleshooting

5.1 Upgrade Firmware

When you upgrade the firmware, the configuration is deleted. First save the configuration, then restore it after you complete the upgrade.

Verify that the current version of Orbit Studio is version 21.1 or later. We recommend you upgrade to the most recent Orbit Studio configuration software. You must have administrative rights.

To upgrade the firmware:

1. Download the latest firmware from Bently.com/support. If you upgrade to a new version of firmware while Orbit Studio is running, you must restart Orbit Studio to use the new version.
2. Use a laptop computer to connect to one of the three Ethernet ports (two on the utility side and one on the public side) on the Orbit 60 System Interface Module (SIM).

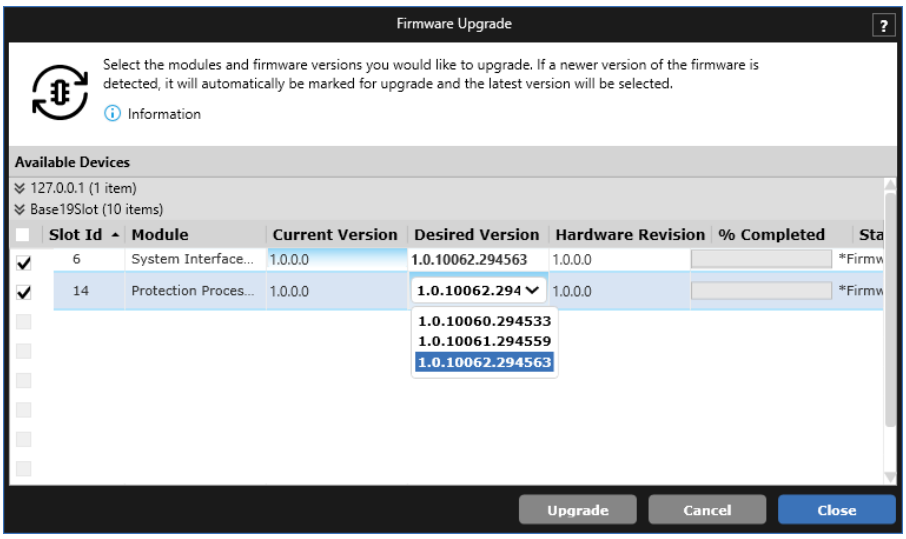
CAUTION

PROTECTION LOSS

During a firmware upgrade, modules are unable to monitor protected assets. Take necessary precautions during this time.

3. Run Orbit Studio and choose an upgrade method:
   - Select a specific module.
     a. In the Orbit Studio **Instrumentation** pane, select a device.
     b. Right-click on the device and select **Upgrade**. The **Firmware Upgrade** dialog box is displayed.
   - Select multiple devices.
     a. Select **Devices > Upgrade**. The **Firmware Upgrade** dialog box is displayed.
     b. Deselect the devices you do not want to upgrade.

4. All modules are displayed along with any available firmware upgrades.



   If more than one firmware upgrade for a device is available, the most current version is selected in the **Desired Version** column. If needed, you can select another.

5. Click **Upgrade**. The firmware update is sent to each of the selected devices in series.

   Each update may take up to ten minutes to complete. The progress bar turns green or red to indicate success or failure. After the firmware upgrade is completed, the hardware reboots and verifies the firmware version. If you upgrade the SIM firmware, the status changes to yellow; you must reconnect the device.

   > If you cancel a firmware upgrade, only modules that have received the firmware package are updated. To prevent damage to the device that may make it inoperable, do not remove the device you are upgrading from the rack or turn off power to the rack.

6. After the device is rebooted, verify that the status LEDs display green.

5.2 Reboot Hardware

If the Orbit 60 System becomes unresponsive, reboot the hardware:

1. Turn off the AC-DC power converter.
2. Wait 60 seconds.
3. Turn on the AC-DC power converter.
4. The SIM, PPM, CGW, and CMM take about a minute to boot. The LEDs may be off during the 60 second boot process. If the LEDs don't turn on after a couple minutes, there is a problem with the module.
5. If you are still experiencing issues, restart Orbit Studio configuration software.

5.3 Discrepancy in PAV input voltage for 2-wire IEPE sensors

You will experiece an inconsistency in PAV raw data versus bar graph and trended values.

The PAV module, with its negative input range and transducer supply, includes circuitry which inverts the signal to correct for the phase reversal of the transducer's output. Therefore, the transducer's bias voltage measured at the A+/B- input terminal points of the PAV will be different than the Bias measurement showing in the Orbit Studio software. The PAV's correction circuitry for 2-wire IEPE sensors also affects the BTO (Buffered Transducer Output) analog signals.

To correct the descrepancy between BIAS/BTO measurements and measured values like bar graphs or trended values, use the following conversion equations:

- Voltage across the AB pins on the utility side of the PAV module

```
VoltageA+/B- = - VoltageBIAS - 24.58 V
```

- Analog signal from BTOs (bufferred transducer outputs).

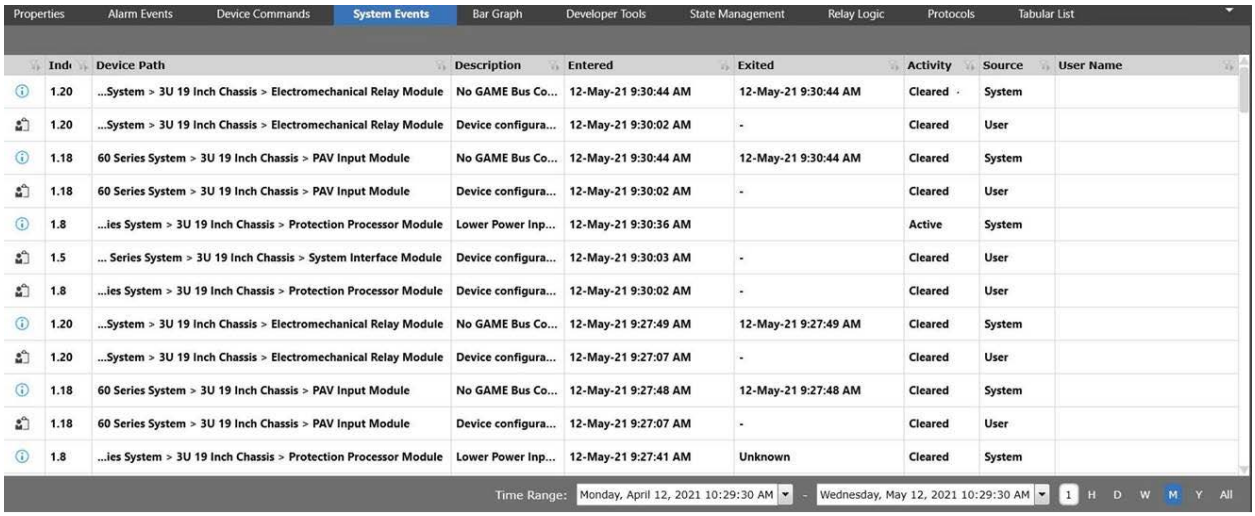
```
VoltageA+/B- = - VoltageBTO - 24.58 V
```

The Bias and BTO voltage measurement is shown as a negative value.

To configure a custom 2-wire IEPE transducer, See Add Custom 2-Wire IEPE Transducer on page 71.

5.4 Event Lists

System Event List Messages



Ind	Device Path	Description	Entered	Exited	Activity	Source	User Name
1.20	...System > 3U 19 Inch Chassis > Electromechanical Relay Module	No GAME Bus Co...	12-May-21 9:30:44 AM	12-May-21 9:30:44 AM	Cleared	System	
1.20	...System > 3U 19 Inch Chassis > Electromechanical Relay Module	Device configura...	12-May-21 9:30:02 AM	-	Cleared	User	
1.18	60 Series System > 3U 19 Inch Chassis > PAV Input Module	No GAME Bus Co...	12-May-21 9:30:44 AM	12-May-21 9:30:44 AM	Cleared	System	
1.18	60 Series System > 3U 19 Inch Chassis > PAV Input Module	Device configura...	12-May-21 9:30:02 AM	-	Cleared	User	
1.8	...ies System > 3U 19 Inch Chassis > Protection Processor Module	Lower Power Inp...	12-May-21 9:30:36 AM		Active	System	
1.5	... Series System > 3U 19 Inch Chassis > System Interface Module	Device configura...	12-May-21 9:30:03 AM	-	Cleared	User	
1.8	...ies System > 3U 19 Inch Chassis > Protection Processor Module	Device configura...	12-May-21 9:30:02 AM	-	Cleared	User	
1.20	...System > 3U 19 Inch Chassis > Electromechanical Relay Module	No GAME Bus Co...	12-May-21 9:27:49 AM	12-May-21 9:27:49 AM	Cleared	System	
1.20	...System > 3U 19 Inch Chassis > Electromechanical Relay Module	Device configura...	12-May-21 9:27:07 AM	-	Cleared	User	
1.18	60 Series System > 3U 19 Inch Chassis > PAV Input Module	No GAME Bus Co...	12-May-21 9:27:48 AM	12-May-21 9:27:48 AM	Cleared	System	
1.18	60 Series System > 3U 19 Inch Chassis > PAV Input Module	Device configura...	12-May-21 9:27:07 AM	-	Cleared	User	
1.8	...ies System > 3U 19 Inch Chassis > Protection Processor Module	Lower Power Inp...	12-May-21 9:27:41 AM	Unknown	Cleared	System	

A System Event List Message displays this information:

Column	Field	Description
1		System Generated Event
		User Generated Event
2	Position Index	Indicates the chassis within the system and the slot within the chassis associated with the modules. (1.17 means Chassis 1 Slot 17)
3	Device Path	Identifies the location of the device in the instrumentation hierarchy prompting the event.
4	Description	The type of system event.
5	Entered	Date/time in which module entered event.
6	Exited	Date/time in which module left event.
7	Activity	Indicates whether the event is cleared or active.
8	Source	Identifies whether the event is from the system or a user.

System Event Descriptions

Event	Description	Action
Upper Power Input Not OK	PIM in the upper slot is Not OK.	Verify power supply wiring polarity. Verify power supply output voltage.
Lower Power Input Not OK	PIM in the lower slot is Not OK.	Verify power supply wiring polarity. Verify power supply output voltage.
Internal Network Failure	Indicates that the modules mounted in the system are not able to communicate with each other.	May be a hardware problem. Contact your system administrator for assistance.
Bridge Disconnected	(not implemented yet)	(not implemented yet)
Bridge Connection Compromised	(not implemented yet)	(not implemented yet)
Firmware Update Successful	New firmware has been downloaded to the module successfully.	No action required.
Firmware Update Failed	New firmware was unable to be downloaded to the module successfully.	Attempt to update the firmware again.
Device Configuration Update Successful	The module's configuration was updated successfully.	No action required.
Device Configuration Update Unsuccessful	The module's configuration was not updated successfully.	Attempt to update the configuration again.
Event(s) Lost	Alarm and/or System Events were being generated faster than they could be written to non-	As the Alarm and System Event lists are reviewed, keep in mind that some events may be missing in the vicinity of the Event(s) lost event.

Event	Description	Action
	volatile memory.	
Escalation Timer Started	(not implemented yet)	(not implemented yet)
Escalation Timer Reset	(not implemented yet)	(not implemented yet)
Channel Bypass Enabled	Bypass has been enabled/disabled either through the software or through industrial protocol.	No action required.
Protection State Changed	The system has transitioned from one Protection State to another Protection State within a specific Protection Group.	No action required.
Alarm Reset	Alarm/Relay/Not OK Reset has been set through SW.	No action required.
Alarm Inhibit Enabled	Alarm Inhibit has been enabled/disabled either through the software, industrial protocol, or hardware contact.	Look at the Instrumentation column to see if this command originated through software, industrial protocol, or hardware contact. Since the system should not be left in this state indefinitely, verify the event has exited.
No GAME Bus Communications	Indicates that the modules mounted in the system are not able to communicate with each other.	May be a hardware problem. Contact your system administrator for assistance.
Module Inserted	A module was added to the system.	Look at the Instrumentation column to see which module was inserted.
Module Removed	A module was	Look at the Instrumentation column to see which

Event	Description	Action
	removed from the system.	module was removed. This causes a loss of machinery protection if the affected I/O module had alarms configured on it, or if it was a Relay Output module.
One Wire Fault		May be a hardware problem. Contact your system administrator for assistance.
System Fault Level 3	A failure has been detected on a module or channel that compromises the system's ability to monitor and protect. The Instrumentation column indicates what module has failed or recovered.	(not implemented yet)
System Fault Level 4	A failure has been detected on a module or channel that impacts the system's ability to monitor and protect. The Instrumentation column indicates what module has failed or recovered.	The following steps may result in a loss of monitoring, and potentially cause a change in relay states. Check if the event has been cleared and if there is an exit timestamp on the event. If so, the module is currently working correctly and no action is required. Another way to determine if a module currently has a hardware fault is to check if the MODULE OK LEDs on the module are green. If the problem reoccurs or if the module is still in the fault state, remove it and inspect the connector on the module and the connector on the base to make sure there is no physical damage or contamination. Plug the module back in and see if the fault recovers. If not, power cycle the base and see if the fault occurs again. If it does, replace with a new module.
Asset Information Fault		May be a hardware problem. Contact your system administrator for assistance.
Software Switch Read Failure		Attempt to send the device command again. If problem persists, contact your system administrator for assistance.
Software Switch Write Failure		Attempt to send the device command again. If problem persists, contact your system administrator

Event	Description	Action
		for assistance.
Unplanned Module Reboot	The module rebooted unexpectedly. It has booted up successfully.	May be a hardware problem. Contact your system administrator for assistance.
Module Failed Self Test	A health check was not properly performed at the expected time.	May be a hardware problem. Contact your system administrator for assistance.
Flash Memory Failure		May be a hardware problem. Contact your system administrator for assistance.
Hard Drive Degraded		May be a hardware problem. Contact your system administrator for assistance.
Hard Drive Failed		May be a hardware problem. Contact your system administrator for assistance.
Storage Full	Internal storage on the module has filled and the oldest data shall be purged as newer data is stored.	No action required.
Entered Transient		No action required.
Configuration File Not Present	A failure has occurred that caused the monitor to lose its configuration or it has not been configured yet.	After the monitor restarts, connect to the monitor with the application and try to retrieve the configuration. If a message states the monitor is not configured. You must send the configuration to the monitor again.
Protection Fault	There is a hardware fault that is impacting alarm determination.	Check the alarm event list for channel Not OK events. Refer to wiring fault indications section in the module manual. Correct wiring faults if necessary. Check the system event list for system module, Input module, or relay module diagnostics errors. Correct environmental problems or replace modules if necessary.
Peak Values Reset	Measurements that stored accumulated or	No action required.

Event	Description	Action
	peak values have been reset through software or industrial protocol.	
Module Factory Reset	All network configuration and user account definitions have been reverted back to factory defaults.	Reconfigure network communication settings and add in appropriate user accounts to provide access to the Orbit 60 device.
Redundant Module Fault	A module that has been marked as redundant with another module in the system has faulted.	Protection may have been degraded due to this fault. Inspect the system and alarm event lists for instrumentation alarms that may have been generated while the redundant module faulted.
Data Capture Storage Full		No action required.
Entered Startup	(not implemented yet)	(not implemented yet)
Entered Shutdown	(not implemented yet)	(not implemented yet)
Entered Overspeed	(not implemented yet)	(not implemented yet)
Key Switch in Program Mode	The Config Lock hardware contacts have been opened.	No action required.
Config Token Acquired	Only one authorized user is allowed to make changes to the configuration. All other authorized users will only be allowed to view the configuration information until the user with the token has	No action required.

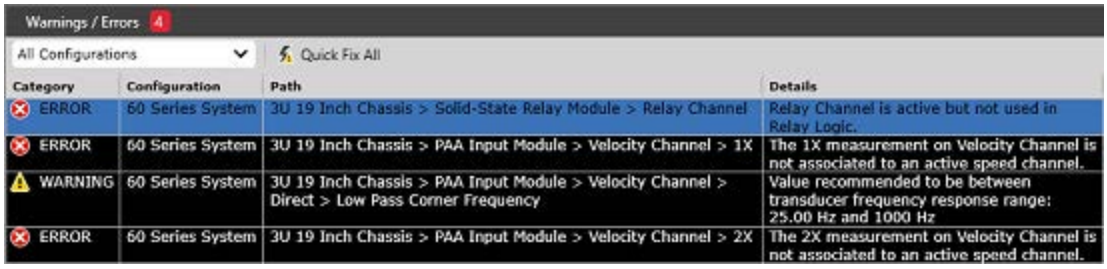
Event	Description	Action
	disconnected from the system.	
Cyber Attack	The system has detected unexpected activity that could compromise the health of the device.	Review all System Events to identify unexpected activities such as user account changes, network configuration changes and general protection setting changes.
Alarm Trip Multiply Enabled	Trip Multiply has been enabled/disabled either through the software, industrial protocol, or a hardware contact on the SIM.	No action required.

Warnings / Errors

When errors are displayed in the Warnings / Errors pane, you can save but not send the configuration to the named device(s). You must resolve the errors before you can send the configuration. To navigate to the source of an error, double-click on the warning / error message.

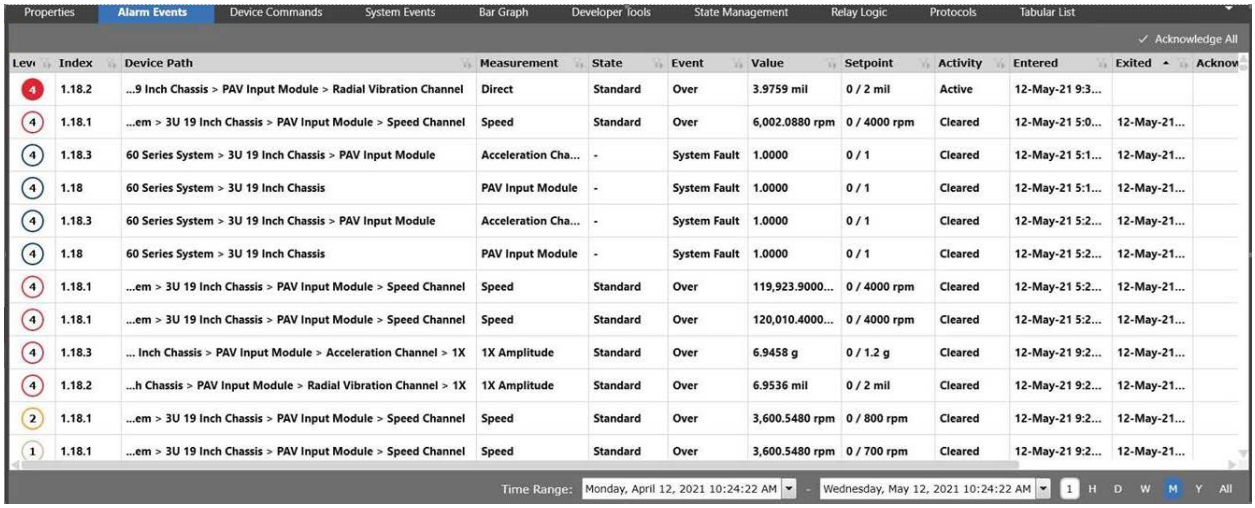
To clear items in the list, choose a method:

- Double-click on the warning. The associated issue is displayed.
- Right-click on a warning. Select **Quick Fix** and the preferred option.
- To accept the first fix listed for each item, click **Quick Fix All**.



Alarm Event List Messages

The Orbit Studio Configuration Software displays these Alarm Event List Messages:



About Alarm Events

Active alarms are alarm events that have not yet been acknowledged by user. Once the alarm has been acknowledged, then they are cleared.

- 4 Active alarms are displayed with a solid color circle behind the level.
- 4 Cleared alarms are displayed with a colored ring around the level.

Column	Field		Description
1	Level 4	4	Critical Hardware Alarm resulting from configured setpoints on measurements
		4	Critical Not OK relates to the status of the Orbit 60 system
	Level 3	3	Severe Hardware Alarm resulting from configured setpoints on measurements
		3	Severe Not OK relates to the status of the Orbit 60 system
	Level 2	2	Moderate Hardware Alarm resulting from configured setpoints on measurements
		2	Moderate Not OK relates to the status of the Orbit 60 system
	Level 1	1	Minimal Hardware Alarm resulting from configured setpoints on measurements

Column	Field		Description
		1	Minimal Not OK relates to the status of the Orbit 60 system
2	Index		Indicates the chassis within the system and the slot within the chassis associated with the modules (1.17.2 means Chassis 1 Slot 17 Channel 2).
3	Device Path		Identifies the location of the device in the instrumentation hierarchy prompting the event.
4	Measurement		Indicates which measurement triggered the alarm.
5	State		Standard
6	Event		Hardware Under Alarm
			Hardware Out-of-Band Alarm
			Hardware In-Band Alarm
			Monitor Not OK
			Channel Not OK
			Protection Compromised Alarm
			Module Reboot
			Protection Fault Relay Channel
			System Fault
7	Value		Shows the measurement value.
8	Setpoint		Displays the setpoint range.
9	Activity		Indicates whether the alarm is cleared or active.
10	Entered		Date/time in which module entered alarm.
11	Exited		Date/time in which module left alarm.
12	Acknowledged By		Indicates the user who acknowledged the alarm.
13	Acknowledged Date		Logs the date when the alarm was acknowledged.

Alarm Event Descriptions

Event	Description	Action
System Fault	A failure has been detected on a module or channel that may impact the system's ability to monitor and protect. The Instrumentation column will indicate what module has failed or recovered. If the Severity for this fault is a 4, then the failure has impacted the system's ability to monitor and protect.	The following steps may result in a loss of monitoring, and potentially cause a change in relay states. Check if the event has been cleared and if there is an exit timestamp on the event. If so, the module is currently working correctly and no action is required. Another way to determine if a module currently has a hardware fault is to check if the MODULE OK LEDs on the module are green. If the problem reoccurs or if the module is still in the fault state, remove it and inspect the connector on the module and the connector on the base to make sure there is no physical damage or contamination. Plug the module back in and see if the fault recovers. If not, power cycle the base and see if the fault occurs again. If it does, replace with a new module.
Hardware In Band Alarm	The In-Band alarm activates when a measured parameter enters a prohibited region bounded by a maximum and a minimum setpoint.	Determine if there is a problem with the machine.
Hardware Out of Band Alarm	The Out-of-Band alarm activates when the measured parameter falls outside the band set by a maximum and minimum setpoint.	Determine if there is a problem with the machine.
Hardware Over Alarm	The measurement amplitude exceeded an over setpoint level for the configured alarm time delay.	Determine if there is a problem with the machine.
Hardware Under Alarm	The measurement amplitude was less than an under setpoint level for the configured alarm time delay.	Determine if there is a problem with the machine.
Protection	There is a hardware fault	Check the alarm event list for channel not OK events.

Event	Description	Action
Fault Relay Channel Triggered	that is impacting alarm determination.	Refer to wiring fault indications section in the module manual. Correct wiring faults if necessary. Check the system event list for system module, Input module, or relay module diagnostics errors. Correct environmental problems or replace modules if necessary.

5.5 LED Fault Conditions

The Orbit Studio Configuration Software System provides system health status using these visible LED indications:

LED Label	Modules	LED Location	Color Indication	Color Meaning
Power OK (No Label)	PIM	Utility Side	Green	Input voltage to PIM is within acceptable limits.
			Off	Input voltage to PIM is outside operating limits OR Input voltage to PIM is outside of acceptable limits, but within operating limits.
POWER 1 and **POWER 2**	Front Panel	Public Side	Green	Input voltage to PIM 1 or 2 is within acceptable limits.
			Off	Input voltage to PIM 1 or 2 is outside operating limits OR Input voltage to PIM 1 or 2 is outside of acceptable limits, but within operating limits.
SIM	Front Panel	Public Side	Green	SIM is present in chassis.
			Red	SIM is not present in this chassis
OK	All Modules (except PIM and Front panel)	Public and Utility Side	Green	Module and and all channels are OK. Configured module has good input on all configured and non-bypassed channels and is in an operation state.
			Red	**Module or channels are Not OK**. This communicates that a

LED Label	Modules	LED Location	Color Indication	Color Meaning
				module is in Level 4 Not Ok, a channel is Not OK, or the module has a configuration error that prevents proper operation. Also seen for a short duration during module boot.
			Amber*	Module Compromised. A Level 3 Module Not OK has occurred. A condition is detected within the module that does not affect the functionality of the module, but indicates that one or more problems should be investigated.
			Off	No power to the module or complete failure of module.
LINK	All Modules (Except PIM and Front Panel)	Public and Utility Side	Green(solid)	A successful communications link is established between the module and the internal systems communications bus, but there is no activity on the link between the module and the communications bus.
			Green (blinking)	A successful communications link is established between the module and the internal systems communications bus and there is activity on the link.
			Red	Attempts to establish a communications link between the module and the communications bus were unsuccessful.
			Amber	The communications

LED Label	Modules	LED Location	Color Indication	Color Meaning
				between the module and the communications bus is compromised. This communicates that a potentially problematic condition is detected with the link between the module and the communications bus that is not affecting the basic functionality of the communications, but may be an indication that there are one or more problems that have been detected that should be investigated.
			Off	No power to Module
ATTN (Attention)	SIM	Public and Utility Side	Amber*	The system has one or more unacknowledged alarm events.
			Green	No unacknowledged alarm events.
			Off	There is no power to the module or the module has suffered a complete failure of functionality.
INHB (Inhibit Status)	SIM	Public and Utility Side	Red	One or more protection path functions is Inhibited by the user.
			Off	No protection path functions have been Inhibited by the user.
RST (Reset contact)	SIM	Utility Side	Amber*	Contact is shorted and a rack reset is being sent to the system.
			Green	Contact is open and the contact is not sending a rack reset (my be invoked via other sources).
			Off	There is no power to

LED Label	Modules	LED Location	Color Indication	Color Meaning
				module or the module has suffered a complete failure of functionality.
SAI (System Alarm Inhibit contact)	SIM	Utility Side	Amber*	Contact is shorted and all alarms are being inhibited.
			Green	Contact is open and the System Alarm Inhibit switch is not active.
			Off	There is no power to module or the module has suffered a complete failure of functionality.
TM (Trip Multiply contact)	SIM	Utility Side	Amber	Contact is shorted and the Trip Multiply state is being driven.
			Green	Contact is open and the Trip Multiply state is not being driven by the contact (may be invoked via other sources).
			Off	There is no power to module or the module has suffered a complete failure of functionality.
LOCK (Config Lock contact)	SIM	Utility Side	Green	RUN - The system is in Run state.
			Amber*	PROG - The system is in Program state.
			Off	There is no power to module or the module has suffered a complete failure of functionality.
FAULT (ProtectionFault Status)	SIM	Public Side	Red	Protection Fault relay status is true.
			Green	Protection Fault relay status is false.
			Off	There is no power to the module or the module has suffered a complete failure

LED Label	Modules	LED Location	Color Indication	Color Meaning
				of functionality.
RUN and PRG (Run and Program)	Front Panel	Public Side	Green Ring	The system is in Run state.
			Amber Ring	The system is in Program state.
			Off	There is no power to the module or the module has suffered a complete failure of functionality.
Input Channel OK (No label)	PAV PAA KPH TC/RTD	Utility Side	Green	Channel Input is OK.
			Red	Input Channel is Not OK. One or more diagnostic checks has determined that there is an issue with the input signal or sensor.
			Amber*	Input Channel is Bypassed.
			Off	Input Channel is disabled/No power to module.
Discrete Input Channel OK (No label)	PVD (Discrete only)	Utility Side	Green	Discrete input channel is configured, health status is OK, and contact input is false.
			Red	Discrete Input Channel is Not OK. One or more diagnostic checks has determined that there is an issue with the input signal or sensor.
			Amber	Discrete Input channel is configured, health status is OK, and contact input is true.
			Off	Discrete Input Channel is disabled, there is no power to module, or the module has suffered a complete failure of functionality.
RELAY	Relay Module	Public Side	Green	At least one relay Channel is configured and all

LED Label	Modules	LED Location	Color Indication	Color Meaning
(Relay Status)				configured relay channels are in the non-alarm and non-bypassed state.
			Red	At least one relay channel is configured and in a trip (alarm state).
			Amber*	At least one relay channel is configured and is bypassed and no other relay channels are in trip (alarm state).
			Off	All relay channels are inactive or unconfigured.
Relay Channel Status (No label)	Relay Module and SIM	Utility Side	Green	Relay channel is in a normal (non-alarm) state.
			Red	Channel is in a trip (alarm state).
			Amber*	Channel is is bypassed.
			Off	No power to the module / Complete failure of module / Relay channel is disabled.

* LEDs shall blink amber while the module is unconfigured.

5.6 Reset the SIM or CMM to Factory Settings

In extremely rare circumstances, you may need to reset the IP Address and Communication Port address of the SIM or CMM to factory settings. When you reset a module, you also remove all user groups.

To reset a device to factory settings:

1. Gain physical access to the rack and the device.
2. Remove the device from the backplane.
3. Remove the network Ethernet cable from the device.
4. Use an Ethernet cable to connect the SIM or CMM network connection A directly to network connection B on the device.
5. Reinsert the device into the backplane.
6. Observe the LED lights to verify that the device reboots successfully. The correct sequence is one second Red, one second Amber, one second Green, one second OFF.

7. Remove the Ethernet cable that connects A to B.
8. Reinsert the network Ethernet cable to the primary Ethernet port.
9. Reconnect and re-login to the device. Use the default login ID and password (Admin and Admin+01). You are required to reset the password.
10. In Orbit Studio, reconfigure the device communication and user group settings.

6. Appendix

6.1 About

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

6.2 Support Options

Bently Nevada Technical Service Agreements

You need to get the most out of your production assets. Your goal is to meet production commitments while lowering operating and maintenance expenses. We work with you to accomplish that goal. A service agreement from Bently Nevada product line is a customized asset care service program designed to maximize the value of your investment in asset condition monitoring technology. We'll ensure your system is properly maintained and being used to its full potential. To learn more about our support agreements, visit Bently.com/support.

License Agreements

To open and read your license agreement, in Orbit 60, select **Help** > **About** > **License Agreement.**

Other license agreements are in the **Resources/Licenses** directory where Orbit 60 is installed.

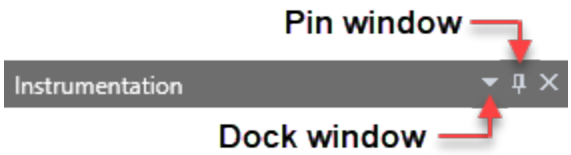
Bently Nevada Support

All Bently Nevada asset condition monitoring products are covered by a renewable Technical Support Agreement. Support options includes self-help resources such as manuals, expert knowledge libraries, software downloads, and telephone and e-mail support. VisitBently.com/support. Registration is required.

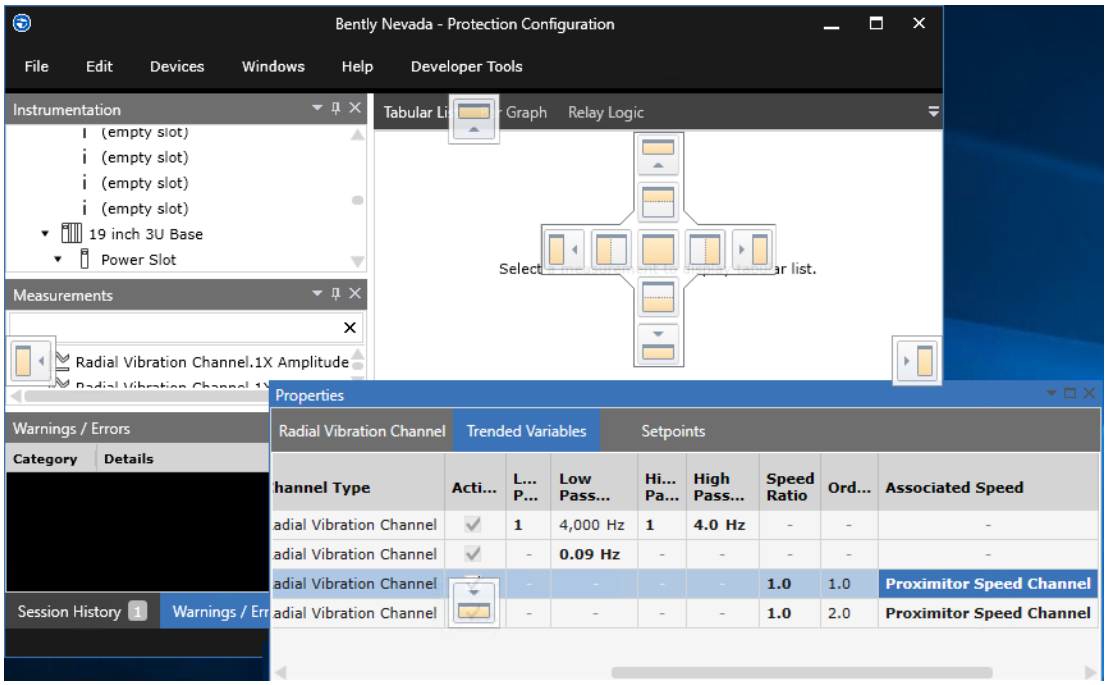
6.3 Orbit 60 User Interface

Manage Windows Layout

- To display a specific window, select the **Windows** menu.
- To float a window, drag the tab header to a new position.
- To lock or unlock the windows layout, choose **Windows** > **Lock Window Layout**.
- To pin a window to the left or right side of the Orbit 60 window, click the thumbtack icon in the header.



- To dock or hide a window, click on the drop-down arrow icon in the header, or drag the tab header to a new position.



Rename Instrumentation Nodes

You can rename Orbit 60 Chassis, modules, and channels. Simply right-click on a node and select **Rename**.

Copy and Paste

Orbit 60 supports standard Windows cut, copy and paste commands using SHIFT and CTRL, and undo and redo.

This feature applies to chassis, modules, channels, and properties. You can access these commands using standard keyboard short cuts, the right-click context menu, **F2**, and the **Edit** menu.

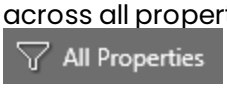
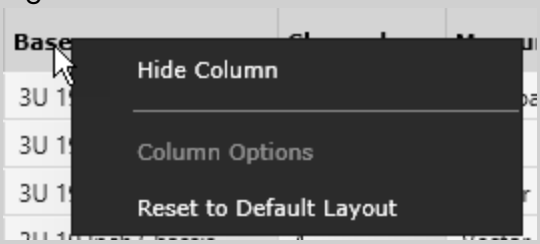
Edit Properties

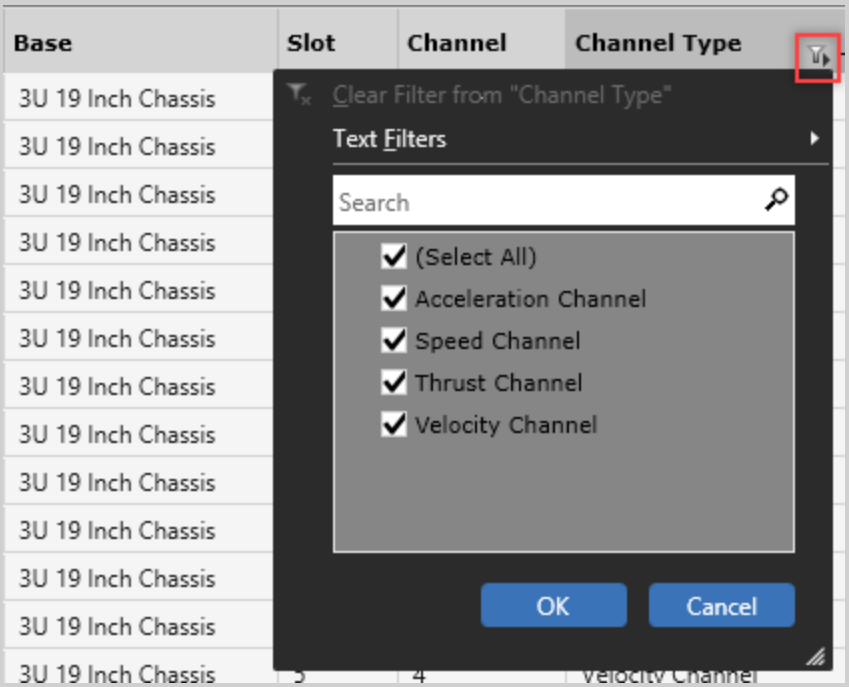
By default, basic properties and all values are displayed in the properties grid.

Fields that can be edited are indicated with:

- **Bold** text.
- A question mark (**?**)

Filter the Display

To Filter	Select
Properties displayed	The Filter button at the top right of the properties grid. The filter persists across all properties. 
Columns displayed	Right-click on the column header and select **Hide Column**. 
Columns displayed at left	Right-click on the column header and click the pin icon. The selected column is pinned to the left of the property grid. 
Property values displayed	1. Select a column in the properties header. 2. Click on the name in the property header, then click on the filter icon displayed.

To Filter	Select
	 3. Select which values you want displayed in the column. 4. Click **OK**.

Edit Multiple Fields

To edit multiple fields at once:

1. Select the fields you want to modify. If needed, you can use SHIFT and CTRL keys to select fields, for example, specific tag names or measurements for multiple channels.
2. Enter the new field value. All selected fields compatible with the value you entered are modified.

Add a Module

You cannot move a module after you configure it. If you need to modify the layout of the physical hardware, you must clear the configuration and restart the process. Some modules require two slots. If you select an invalid slot, a message is displayed.

To add a module, choose a method:

- Select a module in the **Library** and drag and drop it on the hierarchy.
- Right-click on a node in the **Instrumentation pane** and select a new module.

To use the **Instrumentation pane** to add modules:

1. In the Orbit 60 **Instrumentation pane**, right-click on a module you want to replace or on an **empty slot**.

2. Select **Add or Replace** and select the module you want to add. The selected module is displayed in the **Instrumentation pane** . Depending on which module you added:
    - The default values for **Trended Variables** and **Setpoints** are displayed in the **Properties** pane.
    - The default **Velocity Channel** measurements are shown in the **Measurements** Pane.
3. Rename each module with a unique name.

Associated module values and measurement setpoints, if any, are displayed in the **Properties** pane.

Modify Hardware and Settings

- To modify the System Properties, see Configure System Properties.
- To upgrade device firmware, see Upgrade Firmware.
- To delete a module, right-click and select **Delete**.
- To rename a module, right-click and select **Rename**or press **F2**.
- To move a module, select it and drag and drop it in a new location within the same system. The **Slot** property is refreshed.

Properties

Depending on the properties you select, you can filter the data displayed.

Chassis

To view chassis properties, select a chassis in the Instrumentation pane. Then select **Properties** > **General**.

Field	Editable?	Description
Name	✓	Name of the selected chassis.
Tag Name	✓	Custom label. The default is the same as the original name.
Type	✗	The type of chassis selected.
Rack Mount Options	✓	The type of physical rack to which the chassis is mounted.
Serial Number	✗	A unique alphanumeric string identifying the hardware.
PWA Number	✗	
PWA Revision	✗	
Modification	✗	

Field	Editable?	Description
Modification Revision	✗	
Catalog Part Number	✗	
Base ID	✗	

Module Tab

Select a module in the **Instrumentation pane** and then **Properties** > **General**. The system displays fields based on the module you select. Editable fields are displayed in **bold**.

Field Name	Editable?	Description
Name	✓	Name of the selected item.
Tag Name	✓	Custom label. The default depends on the item selected.
Type	✗	The type of the selected module.
Base	✗	The name of the base in the system. To rename the base, edit its properties.
Slot	✗	Position of the parent module in the base. Updated if you move the module in the **Instrumentation pane**.
Size	✗	Number of slots occupied by the physical module.
Device Time Zone	✗	To modify, right-click on the chassis and choose Settings.
Firmware Version	✗	Current version of the hardware firmware. You can update firmware.
Redundant Processor	✓	A secondary Protection Processor Module. If the primary processor fails, the secondary processor takes over.
Serial Number	✗	A unique alphanumeric string identifying the hardware.
PWA Number	✗	
PWA Revision	✗	
Modification	✗	

Field Name	Editable?	Description
Modification Revision	✗	
Catalog Part Number	✗	
Firmware Metadata Version	✗	

Input Channel Tab

All Input Channel properties are described below. The fields displayed for each channel may vary.

Select a channel and then **Properties** > **General**. Editable fields are displayed in **bold**.

Field Name	Editable?	Description
Name	✓	Name of the selected item.
Tag Name	✓	Custom label. The default depends on the item selected.
Base	✓	The name of the base in the system. To rename the base, edit its properties.
Slot	✗	Position of the parent module in the base. Updated if you move the module in the Instrumentation pane.
Channel	✗	Position of the channel in the module.
Active	✓	When selected, enables the item in the configuration.
Channel Type	✗	Type of channel selected.
Scale Factor	✓	The factor by which a signal is increased or decreased to meet the input requirements of an instrument. Also, the change in output per change in input of a transducer.
Transducer	✓	The selected transducer model or name. To configure a custom transducer, select **Custom**. The Keyphasor Input Module only supports 3-wire accelerometers.
Transducer Wiring	⚙	Editable if the Transducer type is **Custom**, except on **Discrete Channel**. How the field wiring is connected into the input terminal blocks. Varies depending on sensor type application.
Enable Lower OK Limit	⚙	Editable if the Transducer type is **Custom**. See **Lower OK Limit**.
Lower OK Limit	⚙	Editable if the Transducer type is **Custom**. Based on the type of collection method used. Rack Buffered outputs from a Bently Nevada monitoring system are negatively biased, for example -19.85V to -4.15V. Mag mounted transducers from a portable device are positively biased, for example 8V to 12V.
Enable Upper OK Limit	⚙	Editable if the Transducer type is **Custom**. See **Upper OK Limit**.

Field Name	Editable?	Description
Upper OK Limit	⚙	Editable if the Transducer type is **Custom**. Based on the type of collection method used. Rack Buffered outputs from a Bently Nevada monitoring system are negatively biased, for example -19.85V to -4.15V. Mag mounted transducers from a portable device are positively biased, for example 8V to 12V.
Lower Frequency Response	⚙	Editable if the Transducer type is **Custom**. Based on the transducer's parameters. The value must be less than Upper Frequency Response.
Upper Frequency Response	⚙	Editable if the Transducer type is **Custom**. Based on the transducer's parameters. The value must be greater than Lower Frequency Response and less 20000 Hz.
Dynamic Range	⚙	Editable if the Transducer type is **Custom**. Equal to transducer scale factor's engineering unit. It is calculated based on values found in the transducer's datasheet.
Transducer Orientation Angle	✔	The angular location of a probe with respect to a unique reference when viewed from the driver end of the machine. Typically, zero degree is at top dead center (vertical or up for a horizontal machine train) on the coordinate system, and increases to 180 degrees to the left or the right. For example, a pair of probes might be mounted at 45 degrees right and 45 degrees left. When using a Reverse Speed measurement, a warning is displayed if the second transducer source does not lag behind the transducer on the Speed Channel containing the Reverse Speed measurement. For details, see Add a Reverse Speed Measurement.
Transducer Orientation	✔	The orientation of the transducer's position.
Normal Positive Direction	✔	Direction of a thrust channel relative to the transducer.
Hysteresis	✔	Half the hysteresis voltage above or below (depending on notch or projection) the threshold value required to trigger the input signal from the transducer.
Default Contact State	✔	Default relay contact state of a Relay Channel.
Default Coil State	✔	Default energized state of a coil on a Relay Channel.
Relay Severity	✔	Severity level associated with the selected Relay Channel.
Zero Position	✔	The zero position of a probe that is installed, gapped, and has

Field Name	Editable?	Description
		the target moved to a position that you want to appear as zero on instruments that display data.
Signal Polarity	✓	In relation to transducers, the direction of output signal change (positive or negative) caused by motion toward or away from the transducer in its sensitive axis. Convention is that motion toward the transducer produces a positive signal change.
Auto Threshold	✓	When enabled, the Keyphasor threshold voltage is automatically set to a value that is midway between the most positive peak and the most negative peak of the input signal. When disabled, the channel uses manual threshold.
Events per Revolution	✓	The number (1-20,000) of pulses in a transducer signal for each shaft rotation.
Running Speed	✓	The running speed of the selected asset measured by the channel.
In the Protection Path	✓	When selected, enables a fault indication when power is lost on a Relay Channel.
Triggered When	✓	The alarm type that triggers the Discrete Channel.
Input Alarm Severity Level	✓	Specifies which alarm level is triggered when the measurement threshold is met.
Discrete Input Group	✓	Group multiple discrete channels within a Orbit 60 System together to perform a specific function, for example, trigger a selected protection state. You can add a maximum of five discrete channels. Disabled if **System Switch** is defined.
System Switch	✓	Use software switches to enable or disable specific channel or module functions and features. You can use the software switches for relay modules to temporarily bypass or inhibit the relay module and channel functions. The Orbit 60 system must be connected and synchronized to the hardware. Select a system control switch that is triggered within one second (100ms target) when the Threshold Level is met. Disabled if **Discrete Input Group** is defined.

Switch	Description
None	Default.
Group Alarm Inhibit	Inhibits an alarm for all devices in the selected Protection Group.

<table>
<tr><th>Field Name</th><th>Editable?</th><th>Description</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>Switch</th><th>Description</th></tr>
<tr><td>Group Reset</td><td>Resets all devices in the selected Protection Group.</td></tr>
<tr><td>Group Peak /Count Reset</td><td>Resets the forward and reverse peak speeds and reverse rotation counts for devices in the selected Protection Group.</td></tr>
<tr><td>System Alarm Inhibit</td><td>Inhibits all system alarms.</td></tr>
<tr><td>System Reset</td><td>Clears all latched alarms and NOT OK statuses across the system.</td></tr>
</table>
</td></tr>
<tr><td>Timed OK Channel Defeat</td><td>✓</td><td>When enabled, defeats the channel when the transducer is in a Not OK state.</td></tr>
<tr><td>Reference Direction</td><td>✓</td><td>The zero location referenced by Transducer Orientation and Transducer Orientation Angle.</td></tr>
<tr><td>Temperature Offset</td><td>✓</td><td>A correction value to be applied to the temperature sensor measurement of a known reference value. Typically used to adjust a measurement to establish a 0 degree C reference.</td></tr>
<tr><td>Associated Protection Group</td><td>✓</td><td>The protection group associated with the channel.</td></tr>
<tr><td>Associated Processors</td><td>✓</td><td>The Protection Processor associated with the channel.</td></tr>
<tr><td>Line Rejection Filter</td><td>✓</td><td>(Optional) If needed, select a frequency to filter data on the Dynamic Pressure Channel.</td></tr>
<tr><td>Paired Channel</td><td>✓</td><td>For details, see Manage Paired Channels.</td></tr>
</table>

Relay Channel

Use the Electromechanical Relay Module and the Solid State Relay Module to add Relay Channels.

Field	Editable?	Description
Name	✓	Name of the selected chassis.
Tag Name	✓	Custom label. The default is the same as the original name.
Base	✗	The name of the base in the system. To rename the base, edit its properties.
Slot	✗	Position of the parent module in the base. Updated if you move the module in the Instrumentation pane.
Channel	✗	Position of the channel in the module.
Active	✓	When selected, enables the item in the configuration.
In the Protection Path	✓	Displays a fault when power is lost.
Default Coil State	✓	Default energized state of a coil on a Relay Channel.
Relay Severity	✓	The severity level that triggers the relay.
Enable Latching	✓	Disables repeated non-critical condition monitoring alarms. The corresponding relay alarm channel holds the alarm state until it receives a rack reset, or the relay is reconfigured.
Paired Channels	✓	See Pair a Relay Channel.
Associated Protection Group	✓	The hardware protection group.
Paired Channel	⚙	See Pair a Relay Channel.

Channels Tab

All Channel properties are described below. The fields displayed for each channel may vary.

Add a channel in the **Instrumentation pane** and then select **Properties** > **Channels**. The system displays fields based on the channel you select. Editable fields are displayed in **bold**.

Field Name	Editable?	Description
Name	✓	Name of the selected item.
Tag Name	✓	Custom label. The default depends on the item selected.
Base	✓	The name of the base in the system. To rename the base, edit its properties.
Slot	✗	Position of the parent module in the base. Updated if you move the module in the Instrumentation pane.
Channel	✗	Position of the channel in the module. Updated if you move the channel in the Instrumentation pane.
Active	✓	Module or channel status.
Channel Type	✗	The type of the channel associated with the trended variable.
Transducer	✓	The selected transducer model or name. To configure a custom transducer, select **Custom**.
Transducer Wiring	✓	Editable only if **Transducer** is **Custom**. Describes the field wiring connected to the input terminal blocks. Varies depending on sensor type application.
Transducer Orientation	✓	The orientation of the transducer's position.
Transducer Orientation Angle	✓	**Single Transducer** The angular location of a probe with respect to a unique reference when viewed from the driver end of the machine. Typically, zero degree is at top dead center (vertical or up for a horizontal machine train) on the coordinate system, and increases to 180 degrees to the left or the right. To detect reverse speed, you must install two transducers oriented at a specific relative angle to each others. For details, see Add a Reverse Speed Measurement.
In the Protection Path	✓	When selected, enables a fault indication when power is lost on a Relay Channel.
Triggered When	✓	The alarm type that triggers the Discrete Channel.

<table>
<tr><th>Field Name</th><th>Editable?</th><th>Description</th></tr>
<tr><td>Input Alarm Severity Level</td><td>✓</td><td>Specifies which alarm level is triggered when the measurement threshold is met.</td></tr>
<tr><td>Discrete Input Group</td><td>✓</td><td>Group multiple discrete channels within a Orbit 60 System together to perform a specific function, for example, trigger a selected protection state. You can add a maximum of five discrete channels. Disabled if System Switch is defined.</td></tr>
<tr><td>System Switch</td><td>✓</td><td>Use software switches to enable or disable specific channel or module functions and features. You can use the software switches for relay modules to temporarily bypass or inhibit the relay module and channel functions. The Orbit 60 system must be connected and synchronized to the hardware.

Select a system control switch that is triggered within one second (100ms target) when the Threshold Level is met. Disabled if Discrete Input Group is defined.
<table>
<tr><th>Switch</th><th>Description</th></tr>
<tr><td>None</td><td>Default.</td></tr>
<tr><td>Group Alarm Inhibit</td><td>Inhibits an alarm for all devices in the selected Protection Group.</td></tr>
<tr><td>Group Reset</td><td>Resets all devices in the selected Protection Group.</td></tr>
<tr><td>Group Peak /Count Reset</td><td>Resets the forward and reverse peak speeds and reverse rotation counts for devices in the selected Protection Group.</td></tr>
<tr><td>System Alarm Inhibit</td><td>Inhibits all system alarms.</td></tr>
<tr><td>System Reset</td><td>Clears all latched alarms and NOT OK statuses across the system.</td></tr>
</table></td></tr>
<tr><td>Default Coil State</td><td>✓</td><td>Default energized state of a coil on a Relay Channel.</td></tr>
<tr><td>Relay Severity</td><td>✓</td><td>Severity level associated with the selected Relay Channel.</td></tr>
<tr><td>Enable Latching</td><td>✓</td><td>When active, temporarily disables repeated non-critical condition monitoring alarms. The corresponding relay alarm channel holds the alarm state until it receives a rack reset, or the relay is reconfigured.</td></tr>
<tr><td>Barrier/Isolator</td><td>✓</td><td>An additional circuit element to protect or isolate the input from electrical noise.</td></tr>
</table>

Field Name	Editable?	Description
Scale Factor	✓	The factor by which a signal is increased or decreased to meet the input requirements of an instrument. Also, the change in output per change in input of a transducer.
Hysteresis	✓	Half the hysteresis voltage above or below (depending on notch or projection), the threshold value is required to trigger the input signal from the transducer.
Auto Threshold	✓	When enabled, the Keyphasor threshold voltage is automatically set to a value that is midway between the most positive peak and the most negative peak of the input signal. When disabled, the channel uses manual threshold.
Threshold Value	✗	Value required to trigger the input signal from the transducer
Rated RPM	✓	The running speed of the selected asset measured by the channel.
Rotation Direction	✓	Direction of the shaft monitored by the transducer.
Events per Revolution	✓	The number (1-20,000) of pulses in a transducer signal for each shaft rotation.
Temperature Offset	✓	A temperature offset for the value reported by the channel's measurements.
Zero Position	✓	The zero position of a probe that is installed, gapped, and has the target moved to a position that you want to appear as zero on instruments that display data.
Normal Positive Direction	✓	When configuring a position measurement, indicates whether a positive change in the signal represents movement upwards or downwards on a bar-graph.
Associated Protection Group	✓	The hardware protection group.
Buffered Output	✓	Configurable on Keyphasor Input Modules only. Provides a buffered, near-identical output signal representing the input signal seen by a channel. **Non-Processed**: The output is sent as the raw signal. **Processed Once Per Revolution Pulse**: The output is sent once per shaft revolution. If the asset contains a multi-event wheel or a multi-stage gearbox, the signal is processed and a single pulse is sent for each revolution.

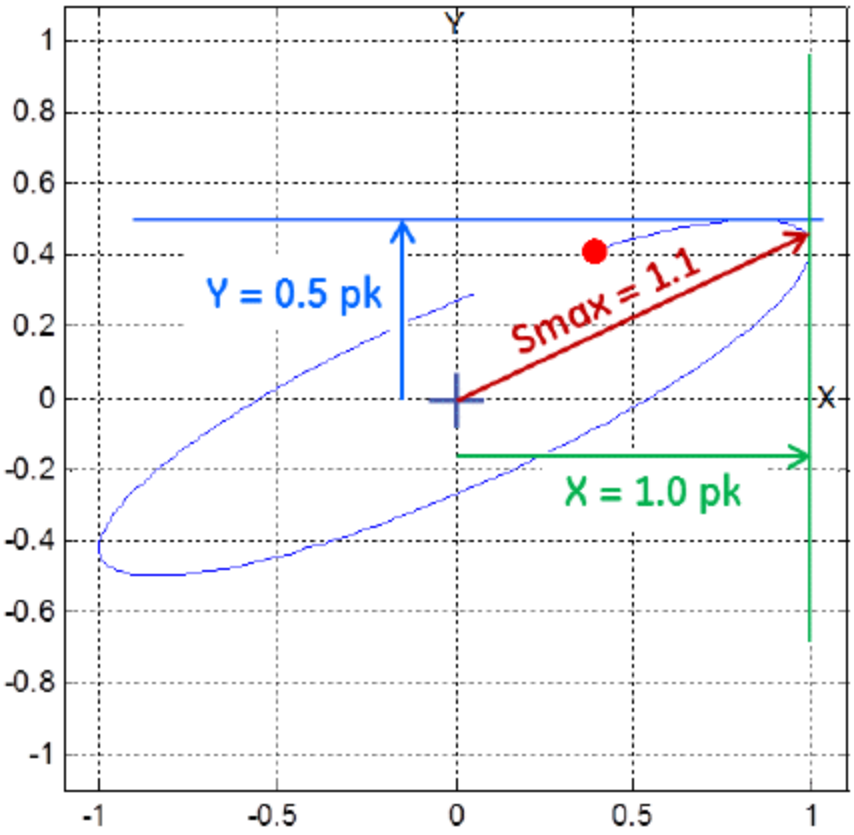
Field Name	Editable?	Description	
		Processed Once Per Event Pulse (Multi-Event)	The output is sent for each pulse multiple times per shaft revolution. If the asset contains a multi-event wheel or a multi-stage gearbox, each pulse is sent as a separate signal.

Channel Measurements

The system displays measurements and properties based on the channel you select.

Measurement	Description
Direct	A Bandpass measurement can be configured with a frequency range between 0.0625 Hz and 40,000 Hz. The number of poles for the low and high pass filters are configurable for 1, 2, 4, 6, or 8 poles. Direct Bandpass is a band-pass measurement. It is configured the same as a standard bandpass.
Bandpass	Bandpass measurements can be configured for root mean square (RMS) in addition to peak or peak to peak (PP). RMS is a statistical measure of the average value/energy contained in a waveform and is less sensitive to data spikes.
Dynamic	
Bias	The transducer bias voltage in volts DC. Level 4 setpoints are not recommended on a Bias measurement.
Position	
Gap	The transducer Gap voltage in volts DC. Used to gap the distance between the probe and the turbine on Proximitor probes.
1X	A 1X measurement measures vibration at the same frequency as the running speed of the machine. In this instance, nX, with n set to 1, the measurement is used to extract the amplitude component that occurs at the rotation speed frequency. Generally high vibration at 1x indicates either unbalance or misalignment. The variables reference a shaft through its associated speed. For example, if a machine runs at 1789 rpm, the 1x vibration would be at 1789 cpm. Before you can send a configuration, you must assign a Speed Channel to a 1X measurement. You can also set the subunit of a 1x and 2x measurement to be drms (derived root mean square).
1X Amplitude	1X filtered peak (or RMS) amplitude of dynamic pressure in psi or kPa
1X Phase	1X phase lag measured in degrees

Measurement	Description
2X	In a complex vibration signal, notation for the amplitude component that occurs at two times the shaft rotation speed. These variables reference a certain shaft through their associated speed. Before you can send a configuration, you must assign a Speed Channel to a 2X measurement. You can also set the subunit of a 1x and 2x measurement to be drms (derived root mean square).
2X Amplitude	2X filtered peak (or RMS) amplitude of dynamic pressure in psi or kPa.
2X Phase	2X phase lag measured in degrees
Speed	The frequency at which a shaft is rotating at a given moment, usually expressed in units of revolutions per minute (rpm). `(100 rpm = 100 pi/30 radians per second (pi=3.14....))`
Temperature	Temperature of the object being measured.
Overall	The overall signal without applying limits on the bandpass, processed with peak to peak, peak, or RMS.
Peak Speed	
Smax	Smax calculates the two-dimensional distance of the rotor center line from a moving average gap reference. The Smax measurement provided a more accurate measurement of shaft relative rotor vibration amplitude at all angular orientations. Smax captures the maximum rotor position excursion relative to a moving average gap value, so by nature it is a peak measurement, not peak-to-peak. The maximum peak value over several revolutions is returned. Smax is calculated relative to a moving average gap reference point, so the results should be interpreted cautiously. Direct peak-to-peak measurements display the instantaneous rotor vibration. Smax provides a one-sided calculation where the gap reference is somewhat stale; because of this, Smax values may not provide a true picture of rotor vibration.

Measurement	Description
	 **Figure 6 - 1: Smax for a 1X-filter orbit. Smax measures the largest distance from the average value (shown as a black cross in the center of the plot).**
Reverse Speed	Only valid once the system has determined that the machine is spinning backwards. This measurement behaves like a typical speed measurement. A setpoint on this measurement enables the following measurements to become valid. By default, an alarm is fixed at 1 rpm on this value so that any reverse rotation activity enables the measurements below.
Num Rev Rotations	Only valid once the system has determined the machine is spinning backwards and has exceeded the reverse speed setpoint. This measurement is a cumulative counter of revolutions (adds revolutions onto the existing total count) since the last number of reverse rotations reset command was received. This value is persisted across power cycles, rack resets, and minor configuration changes.
Reverse Peak Speed	Only valid once the system has determined the machine is spinning backwards and has exceeded the reverse speed setpoint. This measurement stores the highest achieved reverse speed measurement since the last peak speed reset command was received. This is a peak hold type function. The valued is maintained across power cycles, rack reset commands, and minor configuration changes. To reset, Configure a System Switch.

Measurement	Description
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. Rotor acceleration is measured by a proximity probe observing a multi-toothed wheel.
nX	Use the nX filter to extract measurements that indicate anomalies related to running speedX. This enables you to customize a bandpass filter that tracks amplitude and phase based upon the frequency of rotation.
Amplitude Extraction - Async	A scalar amplitude measurement that assesses a vibration signal within a configurable frequency range. The measurement performs a Root Sum Square (RSS) calculation across a user-configurable spectral range to produce a scalar trended value with the same units of the spectrum being assessed. The measurement provides an assessment of the energy within the configured spectral range.
Amplitude Extraction - Sync	

Trended Variables Tab

All Trended Variable properties for all channels are described below. The fields displayed for each channel may vary.

Trended variables describe the quantitative characteristics of the measured parameter. It can also include quantitative values describing the conditions under which the parameter was measured.

To view Trended Variables, select a channel in the **Instrumentation pane**. Then select **Properties** > **Trended Variables**. Editable fields are displayed in **bold**.

Field	Editable?	Description
Measurement Name	✓	The name of the measurement associated with the trended variable. The **Measurement Name** of Sync and Async measurements vary depending on the value you select in the **Center Frequency** field. To reset the **Measurement Name** to that of the **Center Frequency**, right click on the measurement name field and select **Set as Default**.
Measurement Type	✗	The type of the measurement associated with the trended variable.
Channel Name	✓	The name of the channel associated with the trended variable.
Base	✗	The name of the base in the system. To rename the base, edit its properties.

Field	Editable?	Description
Slot	✗	Position of the parent module in the base. Updated if you move the module in the Instrumentation pane.
Channel	✗	Position of the channel in the module. Updated if you move the channel in the Instrumentation pane.
Channel Type	✗	The type of the channel associated with the trended variable.
Active	✓	Module or channel status.
Active (Phase)	✓	When selected, the active hardware.
Associated Processor	✓	The PPM associated with the measurement.
Integrated	✓	When selected, the signal displays: • velocity or displacement from an accelerometer or • a displacement from a velocity transducer Since position, velocity and acceleration are related by time derivatives, you can use Integration to measure an acceleration signal and then compute the velocity and position by mathematical integration.

Measurement	Before Integration	After Integration
Accel – Bandpass Peak	g pk, mm/s^2	in/pk, mm/s pk
Accel – Bandpass RMS	g rms, mm/s^2 rms	in/s rms, mm/s rms
Accel – 1X/2X	g pk, g drms, mm/s^2 pk, mm/s^2 drms	in/s pk, in/s drms, mm/s pk, mm/s drms
Vel – Bandpass Peak	in/s pk, mm/s pk	mil pp, um pp
Vel – Bandpass RMS	in/s rms, mm/s rms	mil rms, um rms
Vel – 1X/2X	In/s pk, in/s drms, mm/spk, mm/s drms	mil pp, mil drms, um pp, um drms

Top Scale	✓	Highest value of selected Full-Scale Range.
Bottom Scale	✓	Lowest value of selected Full-Scale Range.
Unit	✓	Sampled measurement unit. Available units vary depending on the selected channel.
Order	✓	An integer used to filter the content of a dynamic vibration signal at a frequency related to the rotation speed of a machine. The maximum configurable value is 100, with a resolution of 0.1.
Low Pass Corner Poles	✓	The roll off rate for the low pass filter (steepness of the filter or slope).
Low Pass Corner Frequency	✓	A low-pass filter in the available range.
High Pass Corner Poles	✓	The roll off rate for the high pass filter (steepness of the filter or slope).
High Pass Corner Frequency	✓	A high-pass filter in the available range. Configuring the high pass corner on a measurement significantly reduces its settling time (for example, two minutes at .01).
Min Speed	✗	Minimum machine speed.
Max Speed	✗	Maximum machine speed.
Second Transducer Source	✓	For Reverse Speed measurements, the Speed Channel on which the second (or trailing) transducer is located.
Second Source is Leading	✓	For Reverse Speed measurements, the **Second Transducer Source** is selected as the leading transducer.
Speed Hysteresis	✓	For Reverse Speed measurements, the setpoint used to disable hysteresis. Valid values are 1-10 rpm. When the measurement is near the setpoint value, Orbit 60 applies hysteresis to the alarm setpoint to ensure the monitor does not change the alarm state rapidly due to noise. Once the monitor is in alarm state, the value must be less than the setpoint by the value of the hysteresis before the measurement exits the alarm state. For example, if **Speed Hysteresis** is 10, and a measurement has an alarm setpoint of 4250 rpm, the channel input must fall below 4240 rpm (4250-10) before the measurement is out of

		alarm.
Transducer OK % Comparison Enabled	✓	For Reverse Speed measurements, enables **Transducer OK % Comparison.**
Transducer OK % Comparison	✓	For Reverse Speed measurements, limits when reverse rotation is initially detected. Uses the value you enter ("N") to compare the speed measurements between the two transducers and alerts you when they differ in value by less than N% of the measurement's full scale range.
Speed Ratio	✓	The ratio of the target shaft to the speed shaft. Enables a single speed sensor to drive sync measurements off of any shaft. Sync sampling uses every pulse originated by the speed sensor. If you set a speed ratio on assets with multiple shafts, like a gearbox, the RPM setting is propagated with respect to the ratio.
Associated Speed	✓	**Required**. Speed Channel from which the measurement derives synchronous data.

Setpoints Tab

A setpoint is an upper and lower limit on monitored parameters on your machinery assets. Depending on what you are monitoring, you can set upper and lower limits for different levels.

To configure setpoints, select a channel in the **Instrumentation pane**. Then select **Properties > Setpoints**.

Field	Editable?	Description
Measurement Name	✗	The name of the measurement associated with the trended variable.
Measurement Type	✗	The type of the measurement associated with the trended variable.
Channel Name	✗	The name of the channel associated with the trended variable.
Base	✗	The name of the base in the system. To rename the base, edit its properties.
Slot	✗	Position of the parent module in the base. Updated if you move the module in the **Instrumentation pane** .
Channel	✗	Position of the channel in the module. Updated if you move the channel in the **Instrumentation pane** .
Channel Type	✗	The type of the channel associated with the trended variable.

Field	Editable?	Description
Level 4 (Danger) Enabled	✓	When selected, enables a Level 4 alarm.
Level 4 (Danger)	⚙	Editable if the **Level 4 (Danger) Enabled** check box is selected.
Level 4 (Danger) Over	⚙	Editable if the **Level 4 (Danger) Enabled** check box is selected. The high setpoint value that triggers an alarm.
Level 4 (Danger) Under	⚙	Editable if the **Level 4 (Danger) Enabled** check box is selected. The low setpoint value that triggers an alarm.
Level 4 (Danger) Latching	⚙	Editable if the **Level 4 (Danger) Enabled** check box is selected. Select latching to temporarily disable repeated non-critical condition monitoring alarms. When a Severity Level 1-4 condition monitoring alarm occurs and the status of the component is changed, an alarm is recorded and the status is latched. The component does not leave the latched state even if the status returns to normal. To remove latching
Level 4 (Danger) Delay	⚙	Editable if the **Level 4 (Danger) Enabled** check box is selected. The time a measurement must remain at or above (or, depending on the setpoint, below) the setpoint for the alarm to be activated
Level 3 (Alert) Enabled	✓	When selected, enables a Level 3 alarm.
Level 3 (Alert)	⚙	Editable if the **Level 3 (Alert) Enabled** check box is selected.
Level 3 (Alert) Over	⚙	Editable if the **Level 3 (Alert) Enabled** check box is selected. The high setpoint value that triggers an alarm.
Level 3 (Alert) Under	⚙	Editable if the **Level 3 (Alert) Enabled** check box is selected. The low setpoint value that triggers an alarm.
Level 3 (Alert) Latching	⚙	Editable if the **Level 3 (Alert) Enabled** check box is selected. Select latching to temporarily disable repeated non-critical condition monitoring alarms. When a Severity Level 1-4 condition monitoring alarm occurs and the status of the component is changed, an alarm is recorded and the status is latched. The component does not leave the latched state even if the status returns to normal.
Level 3 (Alert) Delay	⚙	Editable if the **Level 3 (Alert) Enabled** check box is selected. The time a measurement must remain at or above (or, depending on the setpoint, below) the setpoint for the alarm to be activated
Level 2 Enabled	✓	When selected, enables a Severity Level 2 alarm.

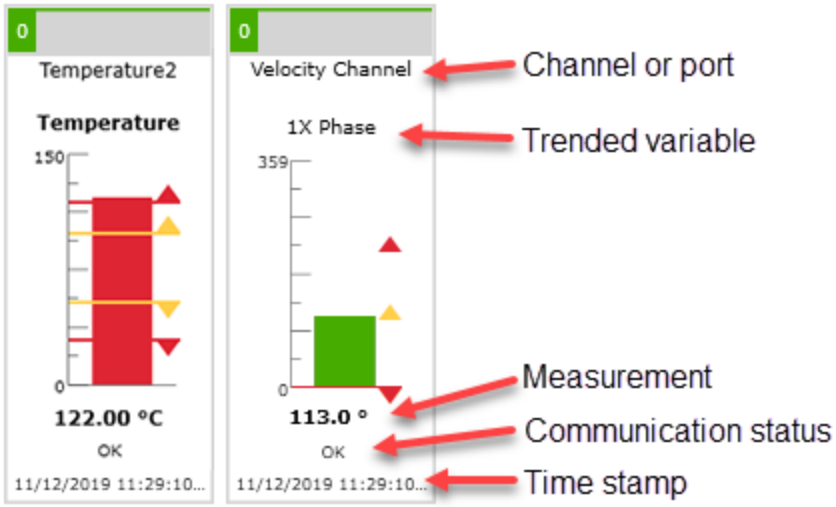
Field	Editable?	Description
Level 2		Editable if the **Level 2 Enabled** check box is selected.
Level 2 Over		Editable if the **Level 2 Enabled** check box is selected. The high setpoint value that triggers an alarm.
Level 2 Under		Editable if the **Level 2 Enabled** check box is selected. The low setpoint value that triggers an alarm.
Level 2 Latching		Editable if the **Level 2 Enabled** check box is selected. Select latching to temporarily disable repeated non-critical condition monitoring alarms. When a Level 1-4 condition monitoring alarm occurs and the status of the component is changed, an alarm is recorded and the status is latched. The component does not leave the latched state even if the status returns to normal.
Level 2 Delay		Editable if the **Level 2 Enabled** check box is selected. The time a measurement must remain at or above (or, depending on the setpoint, below) the setpoint for the alarm to be activated
Level 1 Enabled		When selected, enables a Level 1 alarm.
Level 1		Editable if the **Level 1 Enabled** check box is selected.
Level 1 Over		Editable if the **Level 1 Enabled** check box is selected. The high setpoint value that triggers an alarm.
Level 1 Under		Editable if the **Level 1 Enabled** check box is selected. The high setpoint value that triggers an alarm.
Level 1 Latching		Editable if the **Level 1 Enabled** check box is selected. Select latching to temporarily disable repeated non-critical condition monitoring alarms. When a Level 1-4 condition monitoring alarm occurs and the status of the component is changed, an alarm is recorded and the status is latched. The component does not leave the latched state even if the status returns to normal.
Level 1 Delay		Editable if the **Level 1 Enabled** check box is selected. The time a measurement must remain at or above (or, depending on the setpoint, below) the setpoint for the alarm to be activated
Alarm Source		Description of the protection alarm source.
Processing Location		Description of the location of the protection alarm.

Bar Graphs Tab

After creating your configuration and sending it to the system, use Bar Graphs to verify that sensor connections are sending data. Data is displayed in the Tabular List and Bar Graph panes. Inhibited alarm limits are displayed as a dashed line.

Following the status conventions defined in the Event and Status Indicators topic, the header area of the bar graphs displays the appropriate status icon and indicate current alarm status on the left side. In addition, channel **OK** versus **Not OK** statuses display below the current value near the bottom of the bar graph.

If data is not displayed, check the Warnings/Errors pane for messages. Data is not retrieved if there are any warnings or errors.



Tabular List Tab

After creating your configuration and sending it to the system, use Tabular List to verify that sensor connections are sending data. Data is displayed in the Tabular List and Bar Graph panes.

If data is not displayed, check the Warnings/Errors pane for messages. Data is not retrieved if there are any warnings or errors.

Measurement	Description
Measurement	Identity
Active	True or False. True if data is being received.
Parent	The parent measurement channel.
Time	The date/time the measurement was received.

Measurement	Description
Value	Measurement value.
Units	Measurement unit.
Data Status	OK, Not OK, Invalid, Under Speed, Keyphasor Error, Measurement Settling (not total list)
Node Status	OK if the node is connected.

Protocols Tab

Add an Ethernet Comms Gateway module in the Instrumentation pane and then select the **Properties** > **General**tab. Editable fields are displayed in **bold**.

Field Name	Editable?	Description
Protocol	✗	Modbus
Active	✓	Module or channel status.
Device ID	✓	Custom ID.
Communication Interface	✗	The interface Modbus uses to communicate with the Gateway.
Register Configuration	✓	When **Floating Point** is selected, all floating point data types (measurements and setpoints) occupy two registers and actual values are sent over Modbus. To enable **Full Scale Range**, choose **Fixed Point**. The 64-bit status words are unaffected by the Register Configuration selection (Fixed / Floating Point) and always occupies four registers.
Full Scale Range	⚙	Enabled when **Register Configuration** is **Fixed Point**. Valid values are 1 to 65535. All floating point data types (measurements and setpoints) occupy a single register. The value sent over Modbus is dependent on the current measurement value and is proportional to the Full Scale Range. For example, if a Radial Vibration Channel's Top Scale measurement is 10, and the Modbus Full Scale Range is set at 40000, then the value sent is 40000; if the Top Scale measurement is 5, the value transmitted is 20000.
Most Significant Word First	✓	Applies to the selected Register Configuration. • **Default** The word order is Little Endian. The *least* significant byte (the "little end") of the data is placed at the byte with the lowest address. • **Enabled** The word order is Big Endian. The *most* significant byte (the "big end") of the data is placed at

Field Name	Editable?	Description
		the byte with the lowest address.

Alarm Events

To view alarm events, select **Windows** > **Alarm Events**. Current Alarm Events are displayed.

Alarm Event Properties

Field	Editable	Description
Level	✗	The Alarm Level.
Chassis	✗	Name of the chassis on which the module resides.
Slot Number	✗	Slot number of the module.
Channel Number	✗	Channel number of the device on which the alarm occurred.
Channel	✗	Name of the channel.
Measurement	✗	Name of the measurement on which the alarm occurred.
Event Type	✗	Type of event that triggered the alarm.
Activity	✗	Type of activity associated with the alarm event.
Entered	✗	Timestamp of the initial event.
Exited	✗	Timestamp of the exit event.
Acknowledged Date	✗	Timestamp of the acknowledged event.

Alarm Indicators

To differentiate alarm levels, Instrumentation (Not OK and hardware faults) and Asset (protection and condition monitoring) alarms use two different color palettes. When an asset or instrument returns to a normal status after triggering an unacknowledged alarm event, the alarm status indicator circle displays a normal green circle outlined by the color of the triggered alarm level.

More critical alarms are given precedence when displayed in the Instrumentation pane, and Instrumentation Alarms take precedence over Asset Alarms.

Asset		Instrumentation		Status Name	Alarm Description
Alarm Status	Post Status	Alarm Status	Post Status		
				Level 4	Machinery damage may be imminent.
				Level 3	Prompt operator action is required.
				Level 2	The situation that is not yet critical but needs to be investigated in a timely manner.
				Level 1	The alarm should not be ignored but can be investigated after higher priority alarms.

No Alarm Indicators

When no alarms are present, status colors indicate system and configuration information.

Status Colors	Status Name	Description
	No Data Collected	If no data has been collected for a measurement, the status icon is white.
	Normal	If the data collected for a measurement is not triggering an alarm, the status icon is green.
	No Setpoints	If no setpoints are configured for a measurement, the status icon is light green.
	Disabled	If a measurement is disabled, the status icon is gray.

Device Commands Tab

To enable alarm and relay inhibits, first select a select a Default or Custom Protection Group.

Field Name	Editable?	Description
Selection		Selected system chassis and protection group.
Byass		Temporarily disable all channel functions.
Level 4 (Danger) Alarm Inhibit		Temporarily disable alarm of selected severity. May affects relay status.

Field Name	Editable?	Description
Level 3 (Alert) Alarm Inhibit	✓	
Level 2 Alarm Inhibit	✓	
Level 1 Alarm Inhibit	✓	
Inhibit All Alarms	✓	
Relay Bypass	✓	Temporarily disables Relay Channel and sets it to No Alarm state. Prevents the relay from triggering until it is bypassed.

Resets Properties

Field Name	Editable?	Description
Selection	✗	Selected system chassis and protection group.
Alarm Latching Reset	✓	Reset all latched alarms within the system.
Relay Latching Reset	✓	Reset all latched relays within the system.
Peak Hold Reset	✓	Reset Peak Speed, Reverse Peak Speed, and Num Reverse Rotations measurements.

System Events Tab

To view System Events, select the **System Events** tab. Current System Events are displayed. All columns are sortable. To select events, press CTRL+A or multi-select events with your mouse and press CTRL +C to copy events to the Windows clipboard, then paste them into a third-party application.

Field	Editable?	Description
Device Path	✗	The device hierarchy in the Orbit 60 System.
Description	✗	The type of event recorded.
Entered	✗	Timestamp of the initial event.
Exited	✗	Timestamp of the exit event.

Field	Editable?	Description
Activity	✗	**Active** if currently true, else **Cleared**.
Source	✗	Whether the event was initiated by the system or a user.
User Name	✗	ID of the user who initiated the event, if any.

Unit Abbreviations

	Abbreviation	Description
Displacement	mil pp	mils peak to peak
	µm pp	micrometres peak to peak
	µin pp	microinches peak to peak
	mil dpp	mils derived peak to peak
	µm dpp	micrometres derived peak to peak
	µin dpp	microinches derived peak to peak
Velocity	in/s pk	inches per second zero to peak
	in/s rms	inches per second root mean square
	in/s pp	inches per second peak to peak
	mm/s pk	millimetres per second zero to peak
	mm/s rms	millimetres per second root mean square
	mm/s pp	millimetres per second peak to peak
	in/s dpk	inches per second derived zero to peak
	in/s dpp	inches per second derived peak to peak
	mm/s dpk	millimetres per second derived zero to peak
	mm/s dpp	millimetres per second derived peak to peak
Acceleration	g pk	gs zero to peak
	g rms	gs root mean square
	g pp	gs peak to peak
	m/s^2 pk	metres per second squared zero to peak
	m/s^2 rms	metres per second squared root mean square

	Abbreviation	Description
	m/s² pp	metres per second squared peak to peak
	g dpk	gs derived zero to peak
	g dpp	gs derived peak to peak
	m/s² dpk	metres per second squared derived zero to peak
	m/s² dpp	metres per second squared derived peak to peak
Speed & Frequency	Hz	hertz (cycles per second)
	kHz	thousands of hertz
	cpm	cycles per minute
	kcpm	thousands of cycles per minute
	rpm	revolutions per minute
	krpm	thousands of revolutions per minute
	rad/s	radians per second
Torque	lb•ft	pound feet torque or moment of force
	ft•lb	foot pounds torque or moment of force
	N•m	Newton metres torque or moment of force
Work & Power	bhp	brake horsepower
	hp(M)	horsepower (Metric)
	hp	horsepower (mechanical)
	MW	megawatt
	kW	kilowatt
	W	watt
	N•m/s	Newton metres per second
	Btu	British thermal units
	Vac	volts alternating current
	Vdc	volts direct current

	Abbreviation	Description
Pressure	Psi	pound force per square inch
	Bar	bar
	Pa	pascal
	kPa	kilopascal
Temperature	°C	degree Celsius
	°F	degree Fahrenheit
Flow - Volume	m^3/s	cubic meters per second
	L/min	liters per minute
Phase Measurements	rad	radians
	deg	degrees
Scale Factor	mV/µm	millivolts per micrometre
	mV/mil	millivolts per mil
	mV/(mm/s)pk	millivolts per millimetre per second zero to peak
	mV/(in/s)pk	millivolts per inch per second zero to peak
	$mV/(m/s^2)pk$	millivolts per metre per second squared zero to peak
	mV/g pk	millivolts per g zero to peak

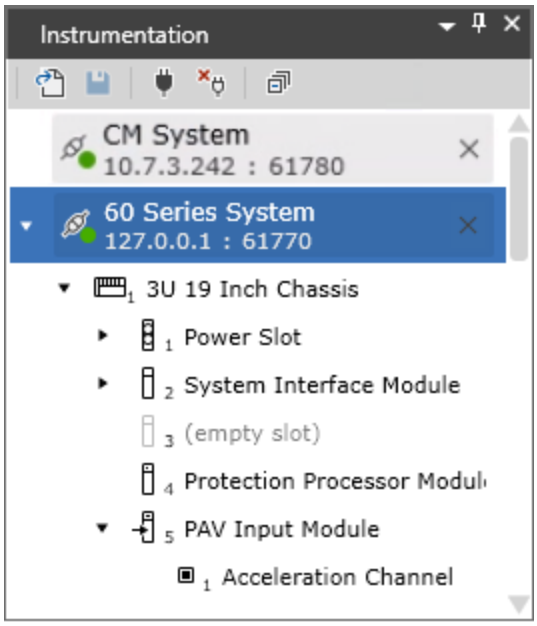
Panes

- Instrumentation Hierarchy Pane
- Protection Group Pane
- Toolbox Pane
- Library
- Measurements Pane
- Warnings Errors Pane
- System Utilization Pane
- Session History Pane

Instrumentation Hierarchy Pane

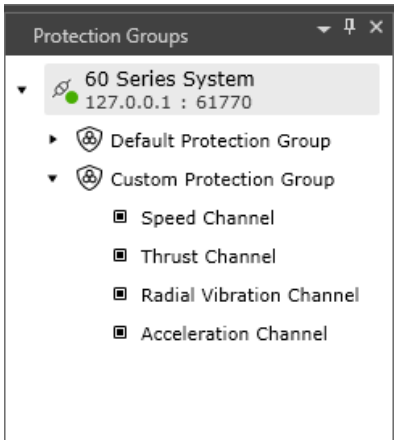
The Instrumentation Hierarchy displays the system chassis, modules, and channels. Use modules and channels as inputs to configure your relay logic output. The connection is indicated by the icon on the Orbit 60 system. The system displays properties and information based on what you select in the hierarchy.

A 60 Series System is selected in the illustration below. Use the Instrumentation Pane buttons to access common functions.



Protection Group Pane

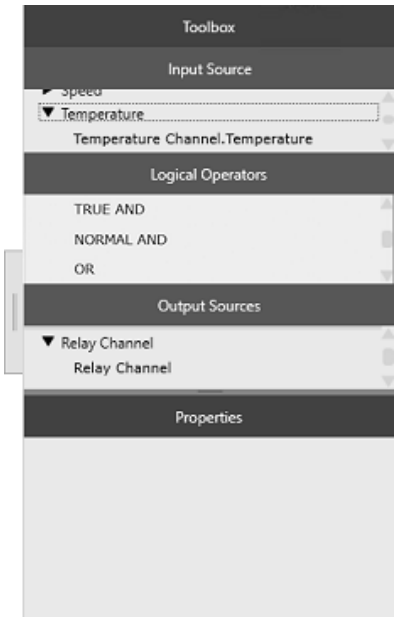
Use Protection groups to organize channels and measurements into groups you can use to drive a protection fault status. See Create Protection Group.



Field	Editable?	Description
Name	✓	You can only edit the names of Custom Protection Groups.
Associated Processor	✓	The Protection Processor Module to associate with the measurements on this protection group.

Toolbox Pane

Use the Toolbox to add Input and Output sources to a Relay Logic rule.



Toolbox	Source
Input Source	
System Interface Modules	
System‡	Setpoints
	Not Ok Level
	Bypass
	System Alarm Inhibit
	Protection Faults
	Attentions
	Protection Compromised
	Test Modes
Chassis‡	Setpoints
	Not Ok Level
	Bypass
	Test Modes

Toolbox	Source
Modules‡	Setpoints
	Not Ok Level
	Bypass
	Test Modes
Channels‡	Setpoints
	Not Ok Level
	Bypass
	Test Modes
Measurements	
Overall / Direct / Bandpass	Radial Vibration Channel.Direct
	Acceleration Channel.Direct
	Velocity Channel.Direct
	Velocity Channel.Bandpass
	Dynamic Pressure Channel.Dynamic
Gap / Bias	Radial Vibration Channel.Gap
	Speed Channel.Gap
	Acceleration Channel.Bias
	Dynamic Pressure Channel.Bias
	Velocity Channel.Bias
	Thrust Channel.Position
	Thrust Channel.Gap
1X Vector	Radial Vibration Channel.1X Amplitude
	Radial Vibration Channel.1X Phase
	Velocity Channel.1X Amplitude
	Velocity Channel.1X Phase
	Acceleration Channel.1X Amplitude
	Acceleration Channel.1X Phase

Toolbox	Source
2X Vector	Radial Vibration Channel.2X Amplitude
	Radial Vibration Channel.2X Phase
	Velocity Channel.2X Amplitude
	Velocity Channel.2X Phase
	Acceleration Channel.2X Amplitude
	Acceleration Channel.2X Phase
Temperature	Temperature Channel.Temperature
Speed	Speed Channel.Speed
Protection Groups	
Default Protection Group Custom Protection Groups	Setpoints Levels
	Not OK Levels
	Bypass
	Protection Fault
	Test Mode
Logical Operators	
TRUE AND	True AND Gate
NORMAL AND	Normal AND Gate
OR	OR Gate
NOT	NOT Gate
Output Source	
Relay Channel	Relay Channel

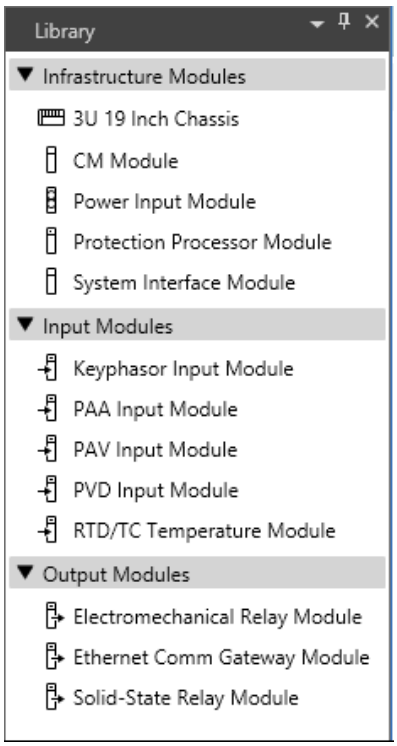
‡ When you select any System Interface Module source as an Input Source, all like Input Sources are logically ORd.

Library

There are two ways to add a module, from the **Instrumentation pane** or from the Library. This describes how to use the Library pane, but choose the method you prefer.

To use the Library pane to add modules:

1. Select **Windows** > **Library**. The **Library** pane is displayed.



2. Select an **Infrastructure**, **Processing**, **Input**, or **Output** module and drag it to the **Instrumentation pane** and drop it on an empty slot.
3. The module is displayed in the **Instrumentation pane** . Associated module values and measurement setpoints, if any, are displayed in the **Properties** pane.
4. Add channels to each module as needed.

Measurements Pane

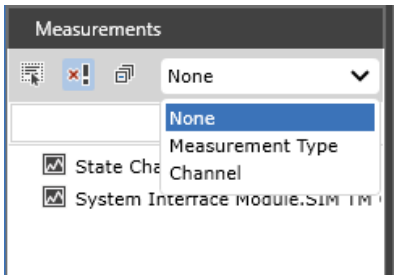
The Measurements pane displays data for the channels associated with the available modules. The measurements displayed depend on what you select in the Instrumentation pane.

If you select:

- An Orbit 60 Chassis, all channels within the chassis are displayed.
- A module, only the channels for that module are displayed. If you have more than one PAV Input Module with multiple channels, the first PAV Input Module displays all channels for all PAV Input Modules.
- A channel, only the measurements for that channel are displayed.

Associated channel variables values and setpoints, if any, are displayed in the Properties pane.

To filter what is displayed in the Measurements pane, select the drop-down list box:



Modbus Register Pane

When you configure the Ethernet Communication Gateway Module, you need to set registers for measurements, setpoints, and statuses.

Supported Function Codes

The Modbus function code 03 is supported to read holding registers for Measurements, Setpoints, and Statuses.

Configuring Holding Registers

Registers can be any consecutive numbers in series from 40,001 to 42,000.

The holding registers contain floating-point data types, delivering Real Data values from channels.

The following outlines how the 64-bit statuses are displayed and laid out. Depending upon the order selected in the protocol configuration, the ordering of the bytes in the registers can be big Endian (most significant word first) or little Endian (most significant word last.)

Most Significant Word First Selection

Most Significant Word First selected	Most Significant Word First NOT selected
4XXX1: <0000000000000000> 4XXX2: <0000110000000000> 4XXX3: <0000000000000000> 4XXX4: <0010000000000001>	4XXX1: <0010000000000001> 4XXX2: <0000000000000000> 4XXX3: <0000110000000000> 4XXX4: <0000000000000000>

When **Most Significant Word First** field is selected, the bytes correspond to the bits as follows:

4XXX1	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
4XXX2	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
4XXX3	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
4XXX4	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01

When **Most Significant Word First** field is NOT selected, the bytes correspond to the bits as follows:

4XXX1	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01
4XXX2	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
4XXX3	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
4XXX4	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49

Node Statuses (64-bit)

Bit numbers not displayed are reserved.

Bit	Name	Notes
No Bit Set	OK	If no bit is set in the data status, then the Measurement is Valid and OK.
0	No Data	No data collected for this measurement.
1	Invalid Configuration	The device has rejected a configuration sent by the software.
3	Hardware Bypass	Bypass is initiated on this channel or the monitor. Bypass is prevented this measurement from alarming. If the bypass was issued at the channel level, it prevents the channel from driving the Protection Fault status, LED, and relay.
4	Level 3 (Alert) Alarm Inhibit	Level 3 (Alert) Alarm inhibit has been invoked on the channel, module or group.
5	Level 4 (Danger) Alarm Inhibit	Level 4 (Danger) Alarm inhibit has been invoked on the channel, module or group.
7	Keyphasor Reassigned	The selected node is currently using its configured backup keyphasor.
8	Level 1 Alarm	The selected node has an active Level 1 alarm.
9	Level 2 Alarm	The selected node has an active Level 2 Alarm.
10	Level 3 (Alert) Alarm	The selected node has an active Level 3 (Alert) Alarm.
11	Level 4 (Danger) Alarm	The selected node has an active Level 4 (Danger) Alarm
12	Group Alarm Inhibit	The selected node has had all alarm levels inhibited.

Bit	Name	Notes
18	Protection Fault	The selected node has a fault that is preventing the system from performing a protection function without a parallel/redundant path.
20	Attention	There are unacknowledged system events at the selected node indicating something that needs to be addressed to keep the system in a healthy running state.
22	Level 1 Severity Alarm Inhibit	The selected node has all severity 1 alarms inhibited.
23	Level 2 Severity Alarm Inhibit	The selected node has all severity 2 alarms inhibited.
31	NotOK	The selected node has a fault that is severer enough to deem the element Not OK.
35	Not OK Level 4	-
36	System Lock	(Only available at the System Level). The status of the RUN / PROG mode driven by the keylock or contact on the SIM.
39	Protection Compromised [Future]	The selected node, while still able to perform protection function, the system is in a compromised state and must be fixed (e.g. one leg of a redundant protection system is faulted leaving a simplex system operational).
41	Relay Level 3 Severity	The node (or below) has an active relay output configured at severity level 3.
42	Relay Level 4 Severity	The node (or below) has an active relay output configured at severity level 4.

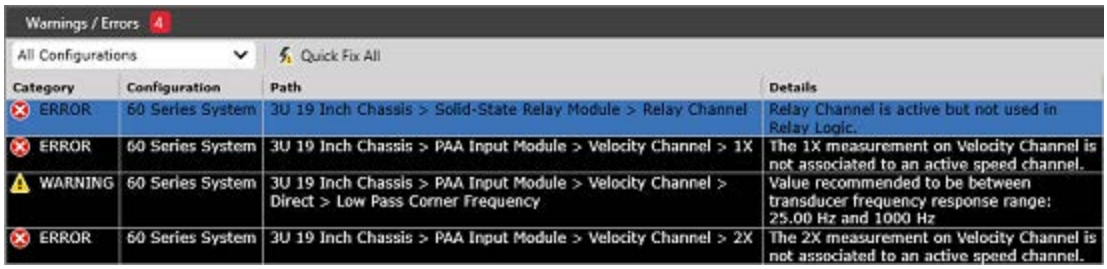
Warnings Errors Pane

Warnings / Errors

When errors are displayed in the Warnings / Errors pane, you can save but not send the configuration to the named device(s). You must resolve the errors before you can send the configuration. To navigate to the source of an error, double-click on the warning / error message.

To clear items in the list, choose a method:

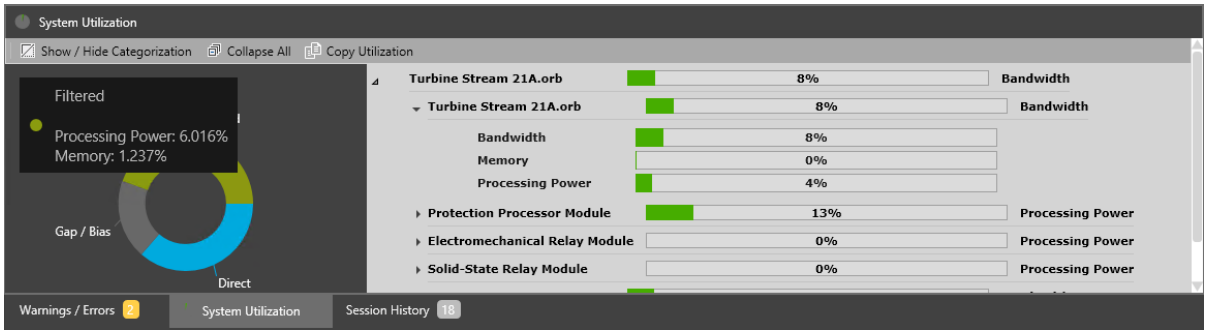
- Double-click on the warning. The associated issue is displayed.
- Right-click on a warning. Select **Quick Fix** and the preferred option.
- To accept the first fix listed for each item, click **Quick Fix All**.



System Utilization Pane

Use the System Utilization pane to view each system's and module's memory and CPU use. To display statistics of subsidiary modules, expand a system. To copy utilization statistics as text, click **Copy Utilization**.

The System Utilization Calculator helps prevent you from sending a configuration that may overload the processor module. When Orbit Studio indicates 100% utilization of the processor module, it includes a safety margin in the hardware/firmware of at least 20% processor utilization. Since the processor module is a real-time system, the actual processing in use fluctuates as the system transitions through various behaviors. If the processor module is overloaded, the data created is invalid and causes a protection fault.



Session History Pane

Use the Session History pane to view a history of connection activity with the device.

To learn more about a item, click **Details**. To resolve device mismatches between the configuration and the physical hardware, see Resolve Configuration Mismatch.

If you have resolved all warnings or errors, click the **Acknowledge all events** or **Clear all** buttons.

If the **Configuration Write** port you enter is blocked by firewall settings, the configuration is read-only. The **Session History** pane displays the status message **Partially Communicating**.


Session History
Acknowledge all events
Clear All
Name
Type
Details
Completion %
Status
Actions
Action Type
Time
60 Series System
Orbit 60 Series
10.5.68.246
-
Configuration Mismatch
Reconcile Mismatches
Status
Monday, August 23, 2021 8:31:43 AM
60 Series System
Orbit 60 Series
10.5.68.246
-
Partially Communicating
Communications
Connect
Monday, August 23, 2021 8:31:43 AM
60 Series System
Orbit 60 Series
10.5.68.246
100%
Configuration retrieved successfully.
None
Retrieve
Monday, August 23, 2021 8:31:43 AM
Warnings / Errors
System Utilization
Session History