Single-Axis Collection on a TRIO for Junction boxes and other control panels

This procedure explains how to swap from triaxial to single-axis collection via the Sensor Type button as well as guidance for collecting data through Bently Control Panels.

While collecting vibration data along a route, you may find some machines are not set up for triaxial collection with a sensor attachment pad mounted at the collection points. Instead, you may find a junction box, Bently panel, or other remote sensor connection.

These cases require data be collected via a single-axis sensor and not the traditional TRIO triaxial sensor.

TRIO data collectors are designed to easily switch between collecting triaxial and single-axis data. However, it is up to the person using the device to ensure the correct cable is used for collection. Aside from differentiating triax from single-axis, the cable used also determines whether single-axis data is capture via Channel 1 or Channel 4 on the TRIO.

Setting Single-Axis Sensor Mode Defaults

The cable you have determines whether single-axis data will be collected on Channel 1 or Channel 4.

You should configure the TRIO for this channel in advance so you do not have to do it during collection. Once set, the **Sensor Type** button on the data collection screen toggles between triaxial collection on Channels 1, 2, and 3 and single-axis collection on the channel you specify (Channel 1 or Channel 4).

Most TRIOs come with one of two cables:

- **M12-to-Triax+BNC** – This cable enables you have both a BNC cable for single-axis collection and a triaxial sensor connected and ready for use at all time. This assembly was built specifically to eliminate the need to swap cables every time you change between triaxial and single-axis collection. This is the best cable choice for sites that have many single-axis sensor/remote junction boxes. ***This cable collects single-axis data on Channel 4.***

- **M12-to-4BNC** – This cable, nicknamed the "octopus" cable, has four color-coded BNCs. When collecting single-axis data, be sure to use the red BNC, which is also labeled #1. Color coding is used in case the numeric label wears off. When you need to collect triaxial data, you must disconnect this cable assembly and connect a triaxial sensor to the M12 connector of the DP unit. ***This cable collects single-axis data on Channel 1.***

Tip! If you have an M12-to-1BNC, you would also use Channel 1. This cable is not supplied with TRIOs.

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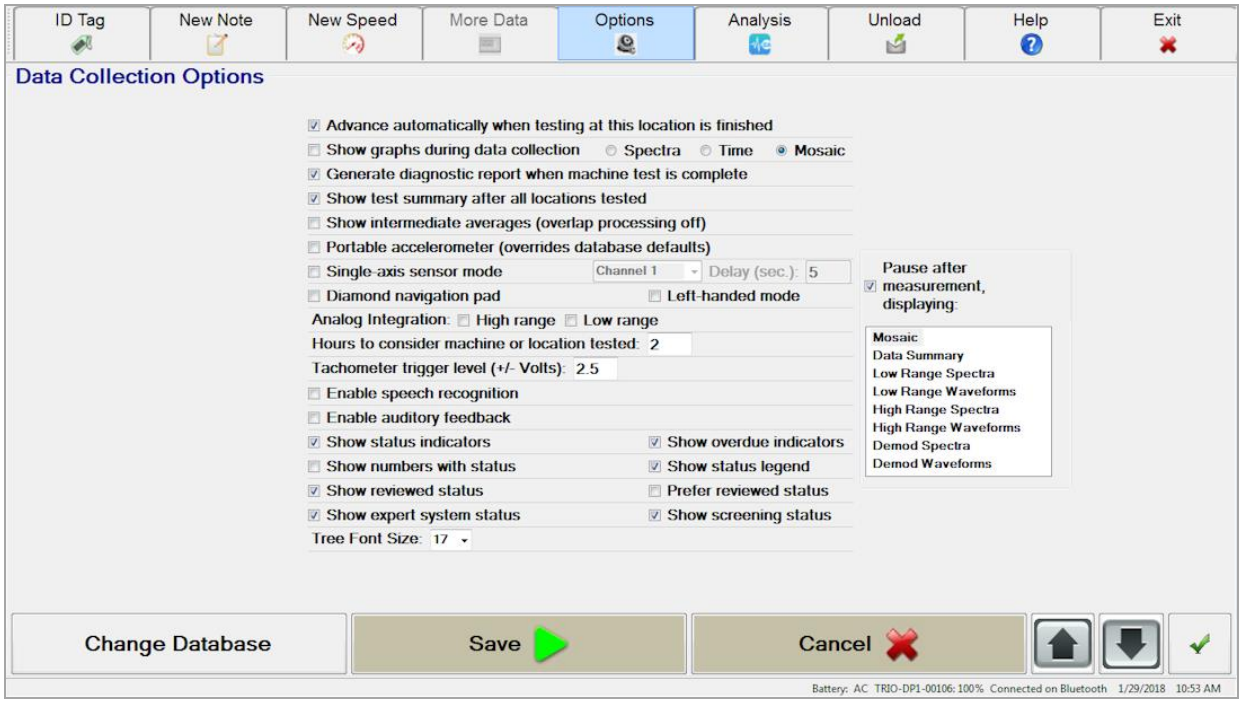
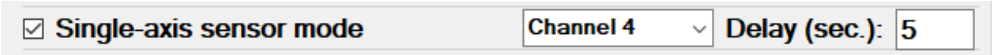
How to specify the default channel for single-axis collection

1. In Data Collector Mode, click the **Options** button in the top toolbar to open the Data Collection Options of your TRIO.

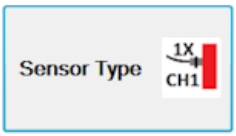
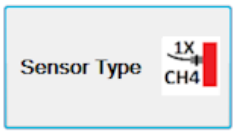


2. Select the **Single-axis sensor mode** check box. This enables its associated drop-down list and the **Delay (sec)** box.
3. Select the channel for the data, based on the cable you are using:
   - Select **Channel 1** from the drop-down list if you are using the M12-to-4BNC cable. (You would also select this channel if you have an M12-to-1BNC cable, which is not supplied with the TRIO.)
   - Select **Channel 4** from the drop-down list if you are using the M12-to-Triax+BNC cable.
4. Enter a value in the **Delay (sec.)** box to accommodate for the settling time of the connected sensor. We recommend you enter **5**.



5. Click the **Save** button to commit your settings. You are returned to the data collection screen.

Now that you have set the single axis channel in the Data Collection Options, the **Sensor Type** button on the main collection screen will toggle between single-axis collection on the channel you specified and triaxial collection. The table below reviews the possible button states:

Sensor Type Button	Directly Correlates to Data Collection Options
	Toggling the **Sensor Type** button to triax (3X) clears the **Single-axis sensor mode** check box, turning off single axis collection. 
 OR 	Toggling the **Sensor Type** button to single-axis (1X), selects the check **Single-axis sensor mode** check box, which turns on single-axis collection for the specified channel (Ch1 or Ch4).  **--OR—**  **IMPORTANT!** The **Sensor Type** button does NOT toggle to both Channel 1 and Channel 4 options. It only toggles to the channel selected from the drop-down list (**Channel 1** or **Channel 4**).

Note: Once you have configured the TRIO for single-axis collection on Channel 1 or Channel 4, you do not have to set it again unless you want to change it.

Most TRIOs come with one of two cables:

- **M12-to-Triax+BNC** – This cable enables you have both a BNC cable for single-axis collection and a triaxial sensor connected and ready for use at all time. This assembly was built specifically to eliminate the need to swap cables every time you change between triaxial and single-axis collection. This is the best cable choice for sites that have many single-axis sensor/remote junction boxes.
- **M12-to-4BNC** – This cable, nicknamed the "octopus" cable, has four color-coded BNCs. When collecting single-axis data, be sure to use the red BNC, which is also labeled #1. Color coding is used in case the numeric label wears off. When you need to collect triaxial data, you will need to disconnect this cable assembly and connect a triaxial sensor to the M12 connector of the DP unit.

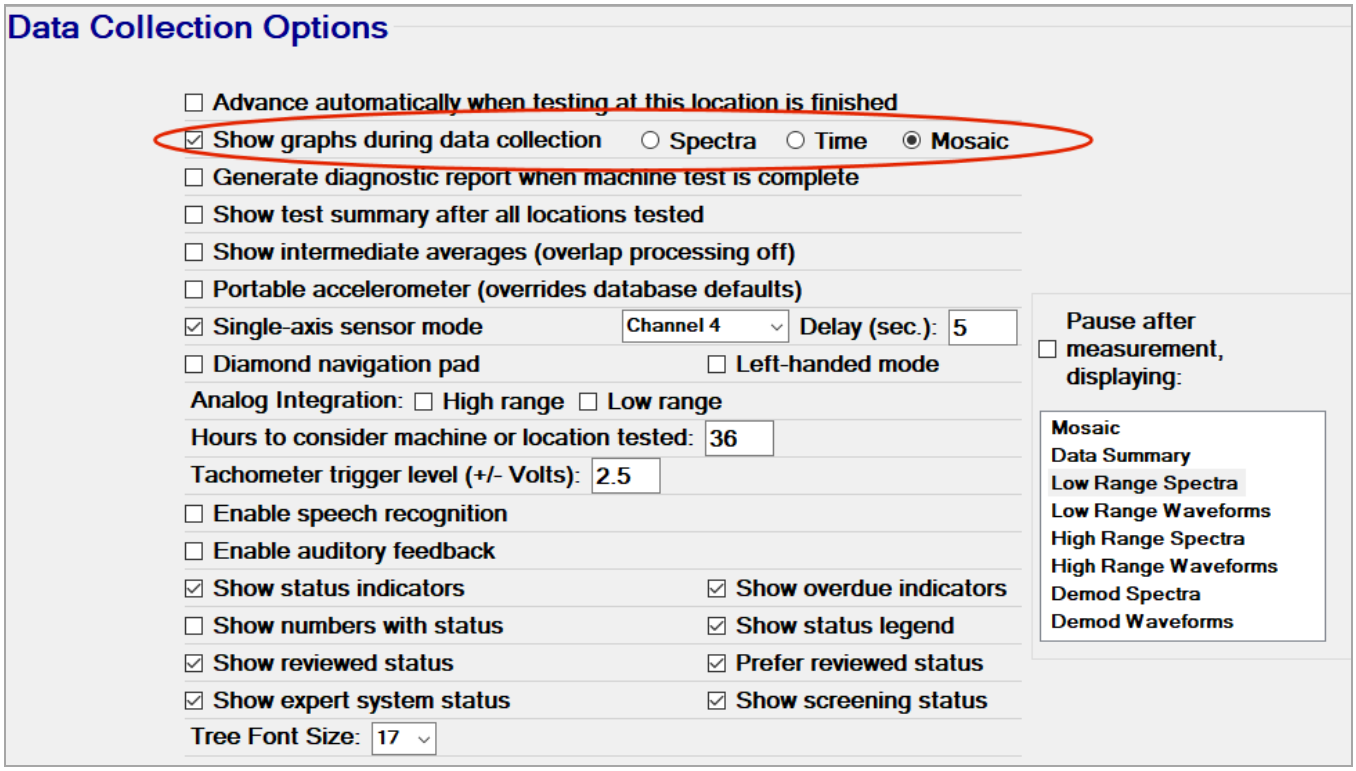
Viewing Data as it Comes In

When collecting single-axis data with a TRIO, best practice is to review the data as it comes in. This helps ensure quality data is available for analysis and reduces the need to return to the machine to re-take tests to replace "bad" data.

Whether you can see data graphically as it comes in is controlled by the Data Collector Options on your TRIO. Select the **Show graphs during data collection** check box and then select the **Mosaic** option button. This displays spectrums and time waveforms as they are collected.

Looking at the data graphically is especially helpful when using the M12-to-Triax+BNC adaptor cable to collect single-axis data. You will learn more about this later in this procedure.

You can turn it off at any time by clearing the **Show graphs during data collection** check box in the Data Collection Options.

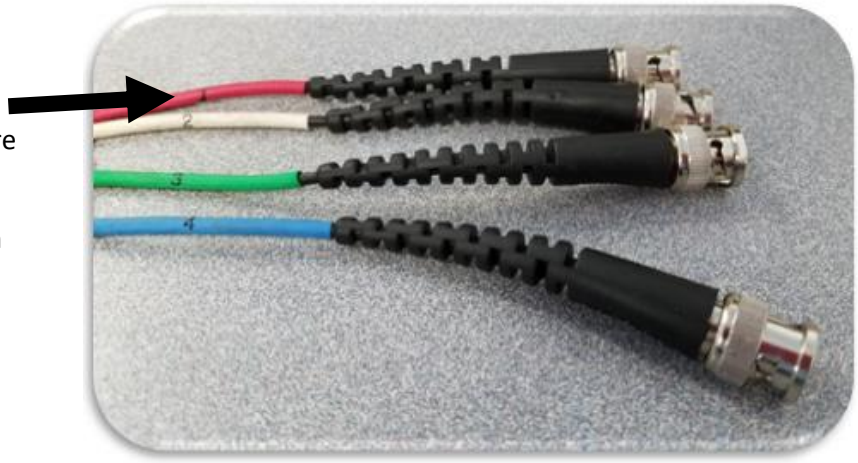


To Collect Single-Axis Data with a TRIO

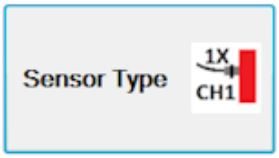
Perform the following steps to collect single-axis data on a TRIO.

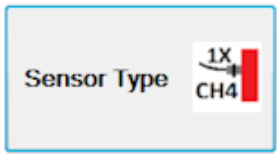
1. Connect the BNC cable to the connector on the junction box.

   IMPORTANT! If you are using the M12-to-4BNC cable, be sure to use the red BNC marked #1:



2. Toggle the **Sensor Type** button for single-axis collection (1X). You will see either 1X CH 1 or 1X CH4, depending on your Data Collection Settings (explained earlier).





3. Click **Start Test**.
4. When testing is complete, disconnect the BNC cable from the junction box.
5. Do one of the following, depending on the location from which you will collect data next:

   – If you are collecting from another BNC junction box, do one of the following depending on the type of box:

      - For a switchbox, connect with your BNC cable, select the measurement location from the tree, turn the junction box dial to the proper channel, and click **Start Test**.
      - For a connection box, connect the BNC cable to the proper channel, select the measurement location from the tree, and click **Start Test**.

   – If you are collecting with a portable triaxial sensor, turn off single-axis sensor mode:

      a. Toggle the **Sensor Type** button to 3X. (This turns off single-axis collection and re-enables triaxial collection.)

      b. Collect triaxial data as usual. If you are using the M12-to-Triax+BNC cable, your triaxial sensor is already connected and ready to go. If you are using the M12-to-4BNC cable (or an M12-to-1BNC cable), you will need to switch cable assemblies to for triaxial collection.

Channel 4 “Settling Time” Issue: Avoiding Bad Data

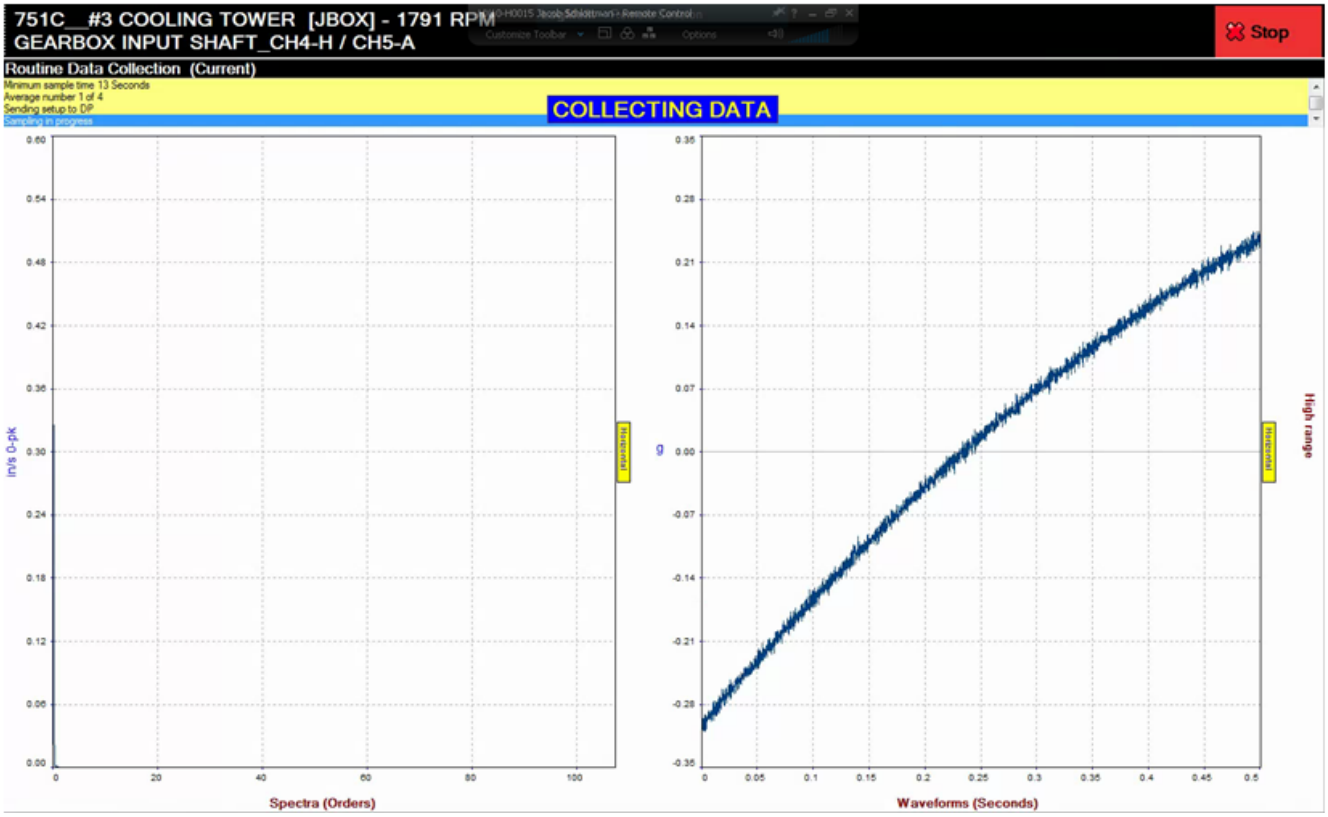
If you are using the M12-to-Triax+BNC cable with Channel 4, you must give the sensor connected to the BNC at least five seconds to reach a stable output before starting the test. This settling time is needed to ensure quality data collection.

A setting in the Data Collection Options lets you specify time for the sensor to settle before collection begins when you click **Start Test**. Enter at least **5** in the **Delay (sec.)** box.

Tip! If you view the data and notice the time waveform is not uniform and/or the spectrum has a “ski slope” appearance, it may be because the sensor needed more time to settle. Retaking the data should provide better results. If this happens continually, try entering more time in the **Delay (sec.)** box—such as **7** or **8** seconds. (There are other reasons for bad data, so if retaking the data or extending the delay does NOT change the results, settling time is probably not the issue.)

Bad Data Example

The following is an example of data captured on Channel 4 when the sensor did not have enough time to settle. The non-uniform time waveform on the right shows a clear settling artifact (DC offset value changing with time). If zoomed in, the spectral data on the left would have a “ski slope” appearance.



Which Cable Do YOU Have?

The cable you have determines whether you select Channel 1 or Channel 4 on your TRIO for single-axis collection via junction box.

Use CHANNEL 1 if you have an M12-to-4BNC cable:

Use CHANNEL 4 if you have an M12-to-Triax+BNC cable:

How to select channel is explained in this document.

Connecting to Bently Control Panels

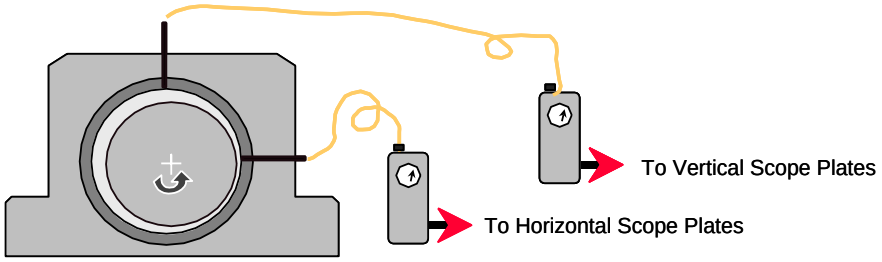
First a word of caution about connecting the TRIO to a Bentley panel (or any online system). Make sure that you are connecting to a "buffered output". Most Bentley systems have some sort of Protection Mode (auto shutdown on high vibration). If you connect directly into the live signal (un-buffered), there is a possibility that the TRIO could inject a stray transient that could trigger a shutdown.

When connecting to other systems, understanding the specification of the installed sensors will be required to configure ExpertALERT to ensure proper data capture. This will include the type of sensor (accelerometer, prox probe, pressure sensor, tach, etc.), the sensitivity (mv/EU), and the location/axis being measured. Sometimes this information can be found on the back of the Bently panel.

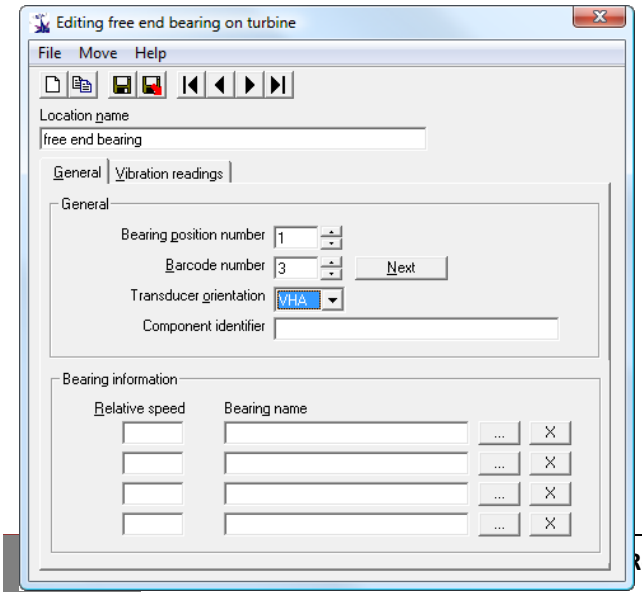
As far as setting up the EA database, it is not much different from using a portable sensor. One difference for an accelerometer is that you need to use a special data collection setup with "ICP Power" unchecked.

Configuration of ExpertALERT

The primary purpose of the installed sensors from a Bently Panel is to plot the shaft motion in the vertical ("V") and horizontal ("H") directions. Bently probes are often installed at 45 degrees from vertical and described as "X" and "Y" probes, instead of "H" and "V" probes. With this information we can determine shaft or journal bearing related issues of a machine. With the ExpertALERT software, we will use these permanently installed proximity probes to graph the relative motion across a defined frequency range.



After a machine is created in the ExpertALERT software, our first step is to configure a test location which will read the proximity probes from the Bently panel.



In this setup we will use the transducer orientation, VHA (or you may use XYZ). The Bently panel will not generally have an axial vibration measurement, so our only real readings that will be collected will be in the Vertical and Horizontal directions.

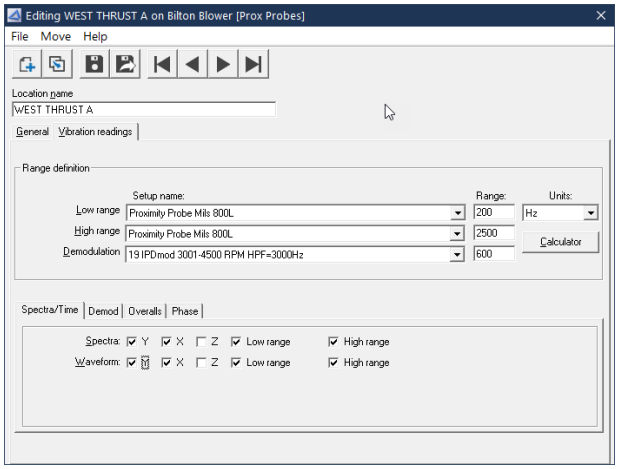
As a review, the three directions listed in the Transducer Orientation field relate to the three channels that the TRIO will acquire simultaneously. As when using a triaxial accelerometer, channel 1 corresponds with the first letter

indicated (V), channel 2 with the second letter indicated (H), and channel 3 with the last letter indicated (A).

Because we need to relate this vertical and horizontal data to the rotation of the shaft, we must also collect a trigger, also known as the key phasor. We will collect this using channel 4. More on this later.

Next we will setup the Vibration readings for this location.

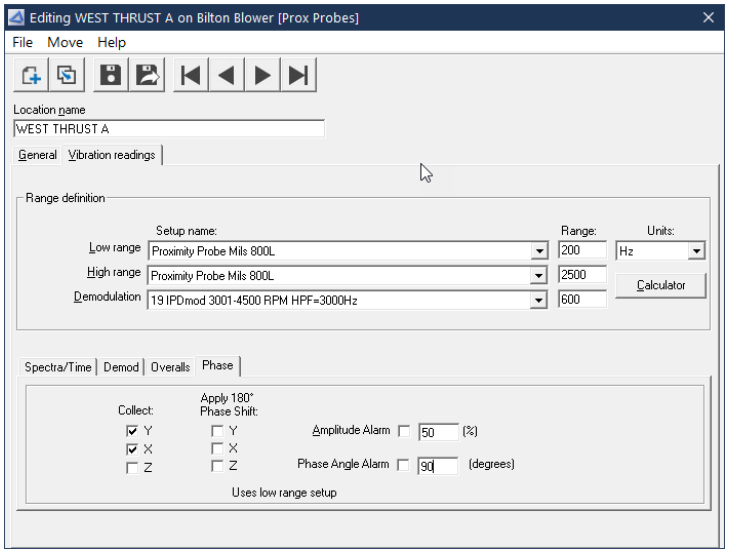
In this tab, we will use the pre-defined Proximity Probe data collection setup. Information on configuring this setup is addressed below.



Here we enter our desired frequency ranges for the low and high ranges (default is 10 orders of low range and 100 orders of high range).

In the Spectra/Time section we will only check the boxes to collect readings from channels 1 and 2, or as previously explained, V and H.

We will not be collecting Demodulation data or Overalls vibration so nothing should be checked under these two tabs.



"Phase" data collection measures the rotation rate amplitude and phase.

The ExpertALERT software will use channel 4 as the default sensor input for a tachometer or reference input. If we check any of the boxes in the phase section, channel 4 must have a signal input for data collection.

For our measurement, we require a phase input selected for the vertical and the horizontal direction.

You can apply a 180 degree phase shift to the measured phase angle. This is used when comparing vibration from multiple test locations. For example, if we have two sensors connected onto a machine at two bearing locations (each side of a coupling, for example) and as these two sensors are mounted, the axial directions are facing opposite of each other (out of phase). When we configure this test we would check the boxes for each direction that would be in-phase and not check the box for the axial component.

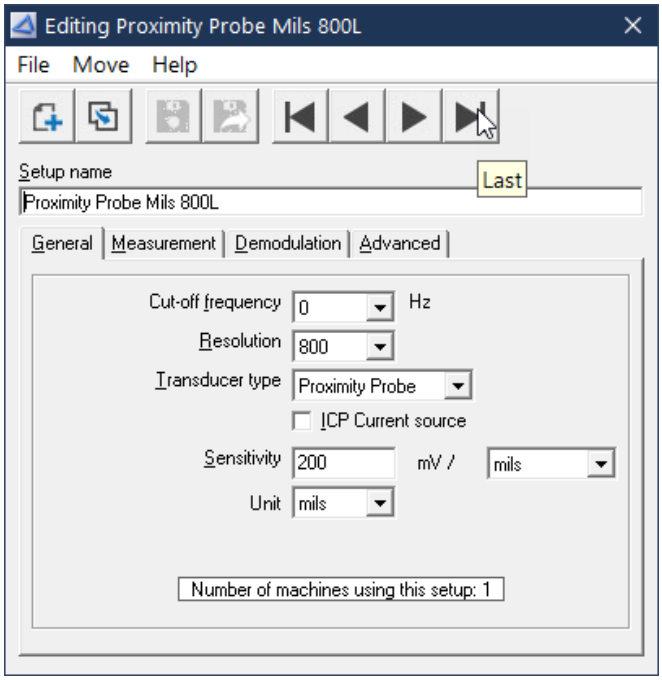
The remaining fields in this section relate to alarm points. We can set an alarm to trigger at a given amplitude change or a phase angle change. This change is relative to the previously collected data.

The setup for collecting data with the Bently Panel is now complete.

Proximity Probe Setup

The prox. probes are just like any other sensor; you configure them in your Data Collection Setups.

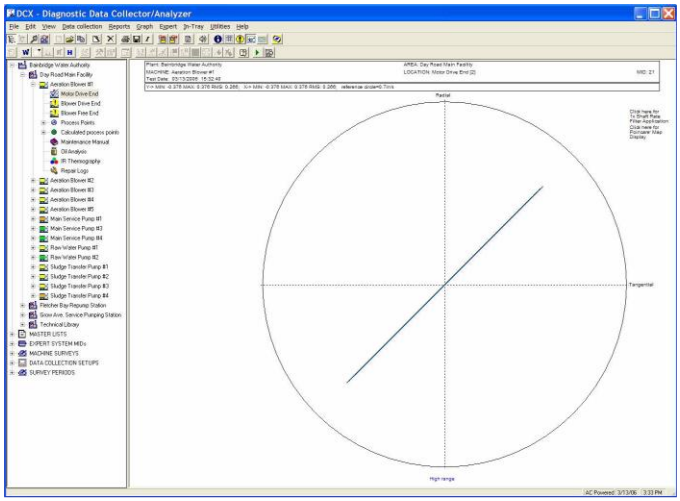
Right click on “Data Collection Setups” in the ExpertALERT tree and select New Setup. For proximity probes, the typical settings are to have a 0 Hz cut-off frequency and 800 lines of resolution. Make sure ICP power is OFF and select the sensor type “Proximity Probe”. The sensitivity is defined in the data sheet as provided by the sensor manufacturer. Typically, the sensitivity is 200mV/mils. Select the desired output displacement unit.



Viewing an Orbit

If you want to view orbits you will need to collect time waveforms in the V and H probes.

To view the orbit, go to graph mode, select “W” for waveforms, then in the icon to the right of that where you normally select single, triax or double triax – you’ll now have a white circle which is the option for the orbit.



Complete!

This completes the procedure.

Additional Documentation

When using a TRIO, the *TRIO User's Guide* and the *ALERT User's Guide* are both available at the Symphony Industrial AI Resource Center at https://knowledge.symphonyindustrial.ai. You can also access the same information in online format by clicking the **Help** button in either Data Collector Mode (for TRIO™ information) or Analysis Mode (for ALERT™ information). When using the WATCHMAN Reliability Portal, detailed information is available from any Portal page via the **Help** icon: 

Need More Help?

Contact Technical Support Team

Phone: 206.316.8918

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