



# SETPOINT CMS Visualization

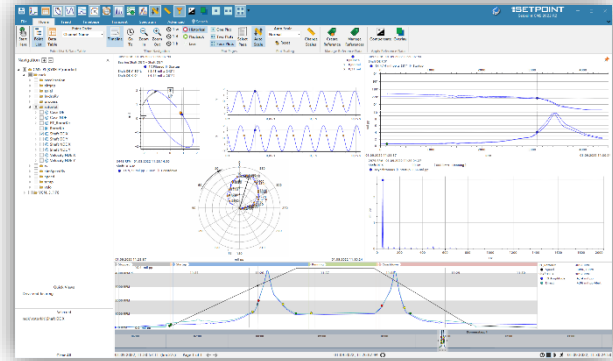
## Product Specifications and Ordering Information

### Overview

SETPOINT® CMS client application and AVEVA™ PI Vision™ provides an easy-to-use plant-wide visualization solution for plant wide condition monitoring of rotating and reciprocating assets.



**SETPOINT® CMS** is used for plant wide monitoring and diagnosing machines when online monitoring with the AVEVA™ PI System™ or SETPOINT® CMS-XC, or offline monitoring with VC-8000 flight recorder data. It is a free download available at [www.bkvibro.com](http://www.bkvibro.com). When used with AVEVA™ PI System™, AVEVA PI Vision serves as the primary visualization environment where the user frequently builds “dashboards” with trend and statuses. SETPOINT® CMS displays are used in these instances as a secondary “drill down” utility to examine detailed waveform data and specialized plot types used by vibration specialists. When used with CMS-XC or flight recorders, SETPOINT® CMS is the only visualization environment available. Its primary use is to allow vibration diagnosticians to visualize data and assess machinery condition details using the specialized plot types unique to vibration.



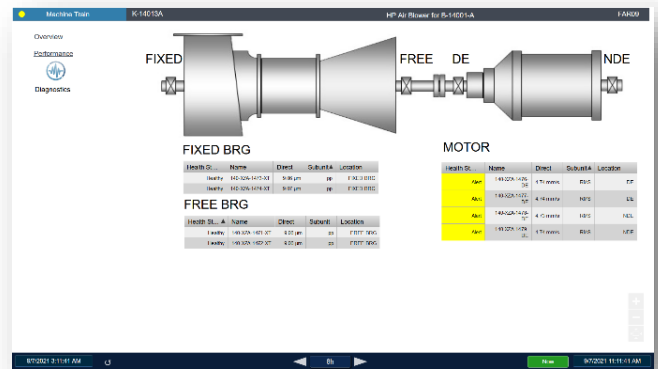
**TABLE NOTES:**

1. APHT = Amplitude / PHase versus Time. Available via standard trend plot capabilities.
2. Requires Compressor Controls Corporation TrainView™ server as data source; consult factory for details.
3. Export format is comma separated variable (.csv).
4. Requires supplementary PI DataLink software from AVEVA™, an Excel toolbar add-in.
5. An open data file format allowing users to export data, share with others, and view using the free SETPOINT® CMS software.

Comparison of Visualization Capabilities		PI Vision	SETPOINT® CMS
<b>SUPPORTED PLOTTYPES</b>	Multivariable Trends	●	●
	Alarm Statuses / Lists	●	●
	Tabular Data	●	●
	APHT	1	1
	Polar		●
	Bode		●
	Spectrum		●
	Orbits		●
	Timebase		●
	Shaft Centerline		●
	Waterfall		●
	Cascade		●
	Compressor Map		2
	Rod Position		●
	Displaced Volume		●
	Crank Angle		●
	Unrolled (Linear) Rotor Profile		●
	Unrolled (Linear) Stator Profile		●
	Circular Rotor Profile (Air Gap)		●
	Plant/Enterprise Diagrams	●	
Machine Train Diagrams	●		
X vs. Y	●		
Point Selection / Navigation	●	●	
Plot overlay support	●	●	
View via Web Browser	●		
Report Generation		●	
Export to Microsoft Excel <sup>3</sup>	4	●	
Export to .cms file format		5	
Multi-state analysis	●	●	
Bearing Fault Frequencies		●	



**AVEVA PI Vision** is used with the AVEVA PI System. It is a web server from AVEVA™ used in thousands of installations worldwide. It connects data sources (AVEVA™ PI Server™) to visualization clients (web browsers) and provides a rich suite of tools for visualizing health and trend information. When used with SETPOINT®, it serves as the platform for basic system navigation, machine train diagrams, machinery health monitoring, asset hierarchy diagrams, alarm lists, statuses, and static data trends. When the user needs to view waveform data for more detailed analysis, quick view links allow navigation to SETPOINT® CMS client launched from within AVEVA PI Vision web pages to bring up appropriate plots for the selected asset.



Simple “Traffic Light” alarm navigation quickly guides users to events enabling quick resolution with AVEVA PI Vision.

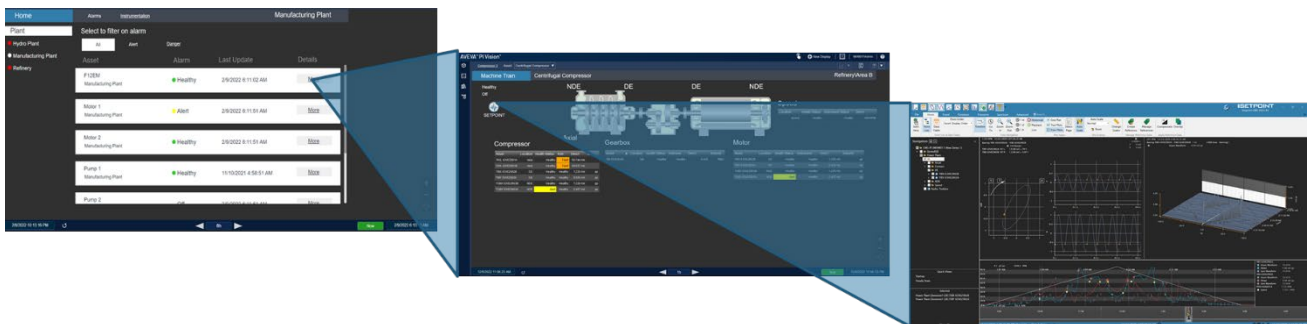


Figure 1, Drill down navigation from enterprise to asset

## Features and Benefits

### Pick up where you left off

You may be an expert in rotating equipment, but you are perpetual beginner when it comes to finding your way around software. A customizable setup, domain specific menus and tooltips make options intuitive to find even if you have not used the app for weeks.

### Simple, intuitive user interface

We designed the user interface by looking at popular stock trading and audio editing software, borrowing the concept of a timeline and time slider to quickly navigate to the data range of interest. Once there, you can easily zoom in and out, drop a cursor, and see data in all of the powerful plot formats you need as a machinery diagnostic professional.

### Never miss important data

There's absolutely nothing worse than incurring a machinery trip, upset, or other event – only to find that the system failed to collect data when it was needed the most. This simply won't happen with SETPOINT®. With VC-8000 we blend a completely unique (and patented) method of collecting waveform snapshots with ultra-fast (80 ms “fast trend”) capture of static data. We then examine the data to see if it reflects significant change from prior data, discarding data that reflects “no change” and keeping data that reflects “change”. The result is a perfectly tailored data profile that retains neither too much nor too little. Tiny but meaningful excursions in machine behavior that other systems miss are caught by SETPOINT®.

### Unparalleled ease of data sharing

We borrowed the concept behind the portable document format (.pdf) and extended it to vibration data for the first time. The concept is simple: customers should pay for the infrastructure that creates the data, not the application that views the data. With SETPOINT® CMS, once data has been collected, it can be saved in an innovative .cms format that preserves everything of interest: machinery hierarchy, configuration parameters,

waveforms, static data, alarms – everything. Simply select the data points and data region of interest, save as a .cms file, and then share with anyone you want, anywhere in the world. To open, view, and interact with the data (including playing back recorded data), they simply download our free SETPOINT® CMS application from the web – completely analogous to using a free PDF viewer. No more cumbersome licenses to administrate when trying to share data with people inside or outside of your organization.

### Easily see when waveforms have been collected

Our trend plots provide intuitive indicators showing exactly where waveforms have been collected. The trend's tic marks indicating waveform collection are color coded so you distinguish synchronous from asynchronous samples, and the height of the tic mark even captures the “interestingness” of the data – in other words, how significantly it has changed relative to surrounding data.

### State Analysis

Easily identify changes in condition with color coded plot data. State based analysis enables comparison of like for like making issues pop out of the screen.

### Plot overlays

Did something change? Easily compare two plots by overlaying them – such as a startup from two separate times to compare a known good baseline data set with a that from a recently refurbished rotor. Did a resonance shift? An amplification factor? The frequency content of two spectra on the same bearing months apart? Plot overlay capabilities make this activity simple and intuitive.

### Replay events with playback

Want to see how an event develop over time? Simply press the play button to automatically review data. No more searching for data one plot at a time.



# SETPOINT® CMS Display

Export data archive and enable pain free remote diagnostics

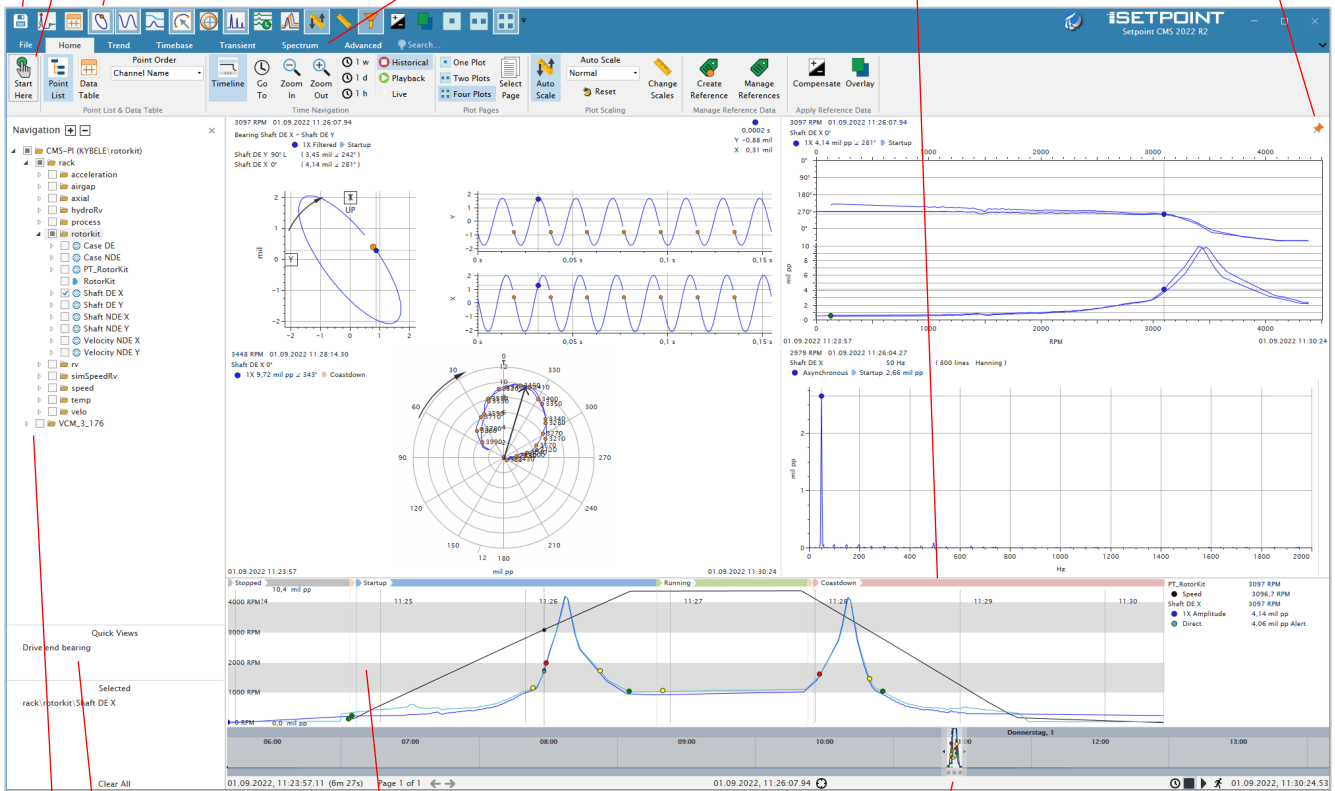
Customize the application to fit how your workflow

Bring commonly used tools to the quick access bar

Color data to see states at a glance

Easy find settings in plot specific tabs

Flag plots to keep them for later use



Quickly bring up previously used displays

Easily identify and change selected points

Synchronize cursors across the app

Intuitive time slider shows full range of data at a glance; grab handles to isolate/expand

Zoom into selected data range, showing more states and annotations to simplify diagnostics

Data playback aids in finding anomalies

## Typical PI Vision Display

Easily build / clone additional train, unit, plant, and enterprise diagrams and hierarchies using PI Vision's extensive tool set.

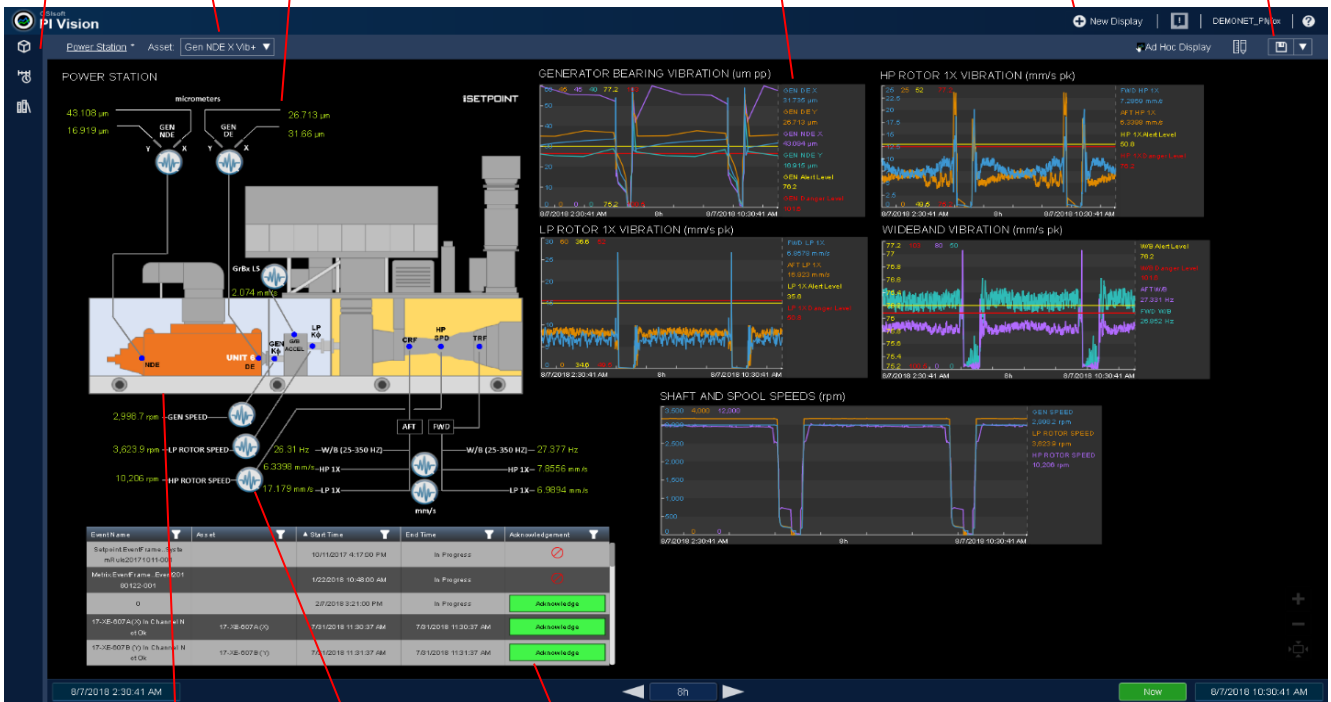
Share displays with other users

Switch displays to show related assets.

Best in class trend plots.

Points labeled clearly and intuitively.

Each user can make displays to meet their needs



Attractive, professional graphics depicting machines, bearings, valves, meters, and any other asset can be easily imported or selected from AVEVA PI Vision's extensive library.

Event list with acknowledgements, and reason code to manage events directly on the display

Quickly navigate time with time controls.

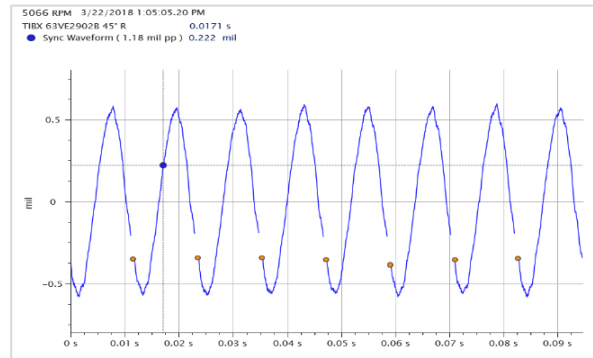
Double click on CMS "Quick View" icons to launch CMS Display and view waveforms and measurement plots for selected point(s).



## Supported Plot Types

### Timebase

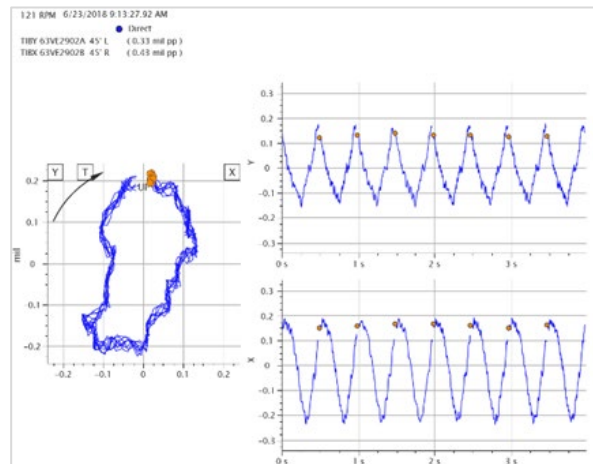
This plot shows the amplitude of the signal along the y-axis and time along the x-axis. Synchronous and asynchronous waveforms can be displayed, and waveforms may be unfiltered or filtered to 1X, 2X and a user-configurable nX value. Synchronous waveforms provide a phase trigger indicator.



### Orbit and Orbit with Timebase

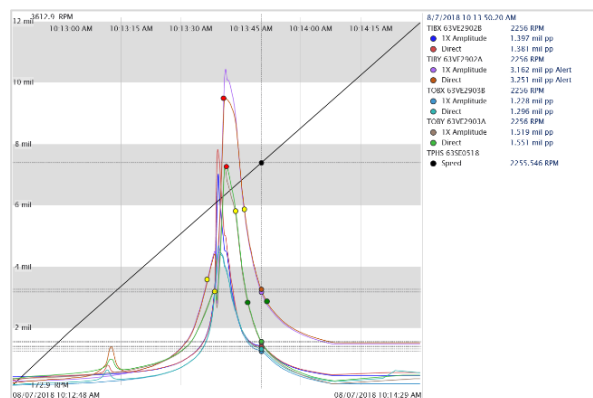
This plot is essentially a Lissajou figure that combines the timebase signals from orthogonal (X-Y) transducers to show the orbital shape of shaft or casing deflection. It visually conveys the shape of the vibration, and is highly useful for identifying many types of malfunctions. Orbits are provided for synchronous and asynchronous data. Unfiltered and filtered (1X, 2X, nX) orbits are available for synchronous data only.

Combines the orbit and timebase presentations into an integrated plot for X and Y transducers. This plot type is available for synchronous and asynchronous data, and may be unfiltered or filtered (1X, 2X, nX) for synchronous data. X and Y timebase plots are arranged vertically with matching time scales and cursor movements.



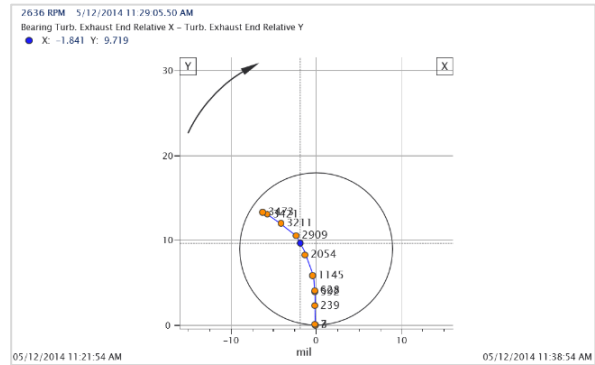
### Trend

In addition to the single- and multi-variable trend capabilities in the CMS display application, users can easily switch back and forth between CMS and PI Vision displays, leveraging the powerful native capabilities of the PI System. This is particularly useful for showing both CMS and non-CMS data side-by-side in the same trend plots. Trend resolution is 80ms, allowing outstanding correlation of cause-effect relationships and powerful zooming capabilities to see sub-second activity with acute clarity.



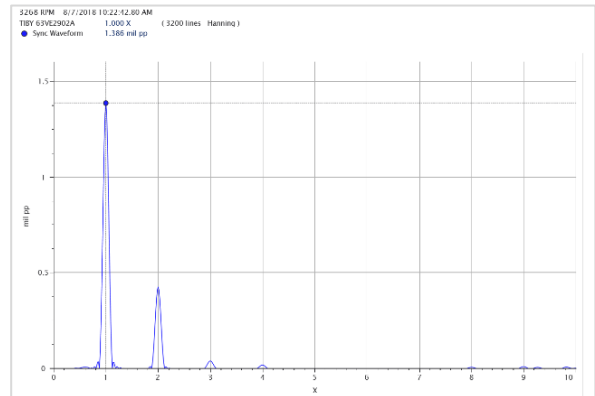
**Shaft Centerline**

This plot is a specialized trend showing movement of the shaft's average position over time and with speed tags affixed. It is highly useful during startup and shutdown conditions to ensure a proper oil wedge is forming in the bearing, allow the shaft to assume its expected attitude angle. The shaft centerline plot is useful for a number of other purposes, such as ensuring that no abnormal pre-loads exist, such as misalignment.



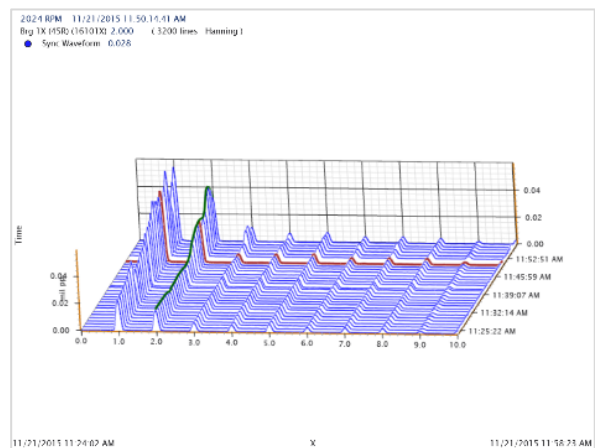
**Spectrum and Full Spectrum**

This plot uses the same data as for timebase presentations, but uses a Fourier transform to generate a frequency-domain view. It is particularly useful for identifying sub- and super-synchronous components that may correlate to machine geometries such as blade pass, gear mesh, or rolling element bearings (which can also be visually identified on the plot). Both synchronous and asynchronous spectra are available, each with powerful zooming and cursor capabilities.



**Waterfall & Cascade**

The waterfall plot is a 3D trend of spectra with frequency on the x-axis, time on the y-axis, and amplitude on the z-axis. It allows spectral changes over time to be easily visualized. The cascade plot is similar, but the y-axis is machine rotational speed, allowing spectral changes during startup or shutdown conditions to be identified. 500 spectra can be presented in a single plot, and advanced features such as 3D surface contours, amplitude color coding, crosshair-type cursor movement and display, and 3D rotation enhance the ability to isolate data of interest. Using the cursor, a single spectrum can be selected and displayed in a separate window for even more powerful diagnostic capabilities.





### Tabular

This plot arranges data numeric values in row/column format, convenient for identifying a sample that will be used for compensation or other purposes. Data is also color-coded to indicate alarm status for easy identification of precise rpm or other conditions at which a channel entered or left an alarm status. Data can be sorted in ascending or descending order by simply clicking on a column header, similar to typical spreadsheet functionality.

3/22/2018 1:07:21 PM										
Name	Speed	Gap	Direct	1X	1X Phase	2X	2X Phase	N	NX	NX Phase
TIBX 63VE2902B	129.8 RPM	-7.0 V	0.28 mil pp	0.37 mil pp	54°	0.04 mil pp	320°	0.5 X	0.00 mil pp	
TIBY 63VE2902A	129.8 RPM	-7.0 V	0.25 mil pp	0.26 mil pp		0.05 mil pp	294°	0.5 X	0.00 mil pp	
TOBX 63VE2903B	129.8 RPM	-6.0 V	0.20 mil pp	0.13 mil pp	33°	0.06 mil pp	38°	0.5 X	0.03 mil pp	
TPHS 63SE0518	129.8 RPM	-11.0 V	129.82 RPM							
TAXL 63VE2901A	129.8 RPM	-11.6 V	-7.13 mil							
TAXL 63VE2901B	129.8 RPM	-11.6 V	-7.15 mil							
TIBD 63TE878E			84.05 °F							
TOBD 63TE878D			73.38 °F							

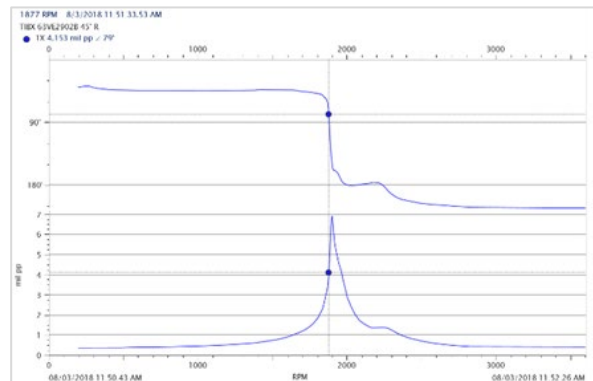
### Alarms and Events

A sequence of events may be determined by using the event list in the SETPOINT® CMS client or AVEVA PI Vision display. In CMS click on the event time stamp to center the data on that event. In AVEVA PI Vision use the event list directly on displays to more easily manage events.

Events	
<b>A</b>	Alert TIBY 63VE2902A Direct 8/9/2018 3:22:03.28 PM
<b>A</b>	Alert TIBY 63VE2902A Direct 8/9/2018 3:22:02.40 PM
<b>A</b>	Alert TIBX 63VE2902B Direct 8/9/2018 3:22:02.24 PM
<b>D</b>	Danger TIBX 63VE2902B Direct 8/9/2018 3:22:01.76 PM
<b>A</b>	Alert TIBX 63VE2902B Direct 8/9/2018 3:22:00.68 PM
<b>D</b>	Danger TIBX 63VE2902B Direct 8/9/2018 3:21:59.96 PM
<b>A</b>	Alert TIBY 63VE2902A Direct 8/9/2018 3:21:59.68 PM

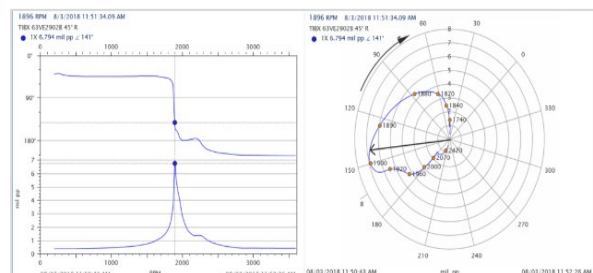
### Bode

A trend of vibration amplitude and phase versus shaft rotative speed, using cartesian coordinates, and highly useful for identifying critical speeds (resonances), amplification factors, and damping. 1X, 2X, and nX filtered bode plots are available and utilize data collected at 80ms resolution. Like trend plots, multiple channels can be overlaid on one another, useful for identifying differences in rotor system response in horizontal and vertical planes, or at different ends of the machine. Also, like trend plots, color-coded markers identify when the measurement entered or left an alarm condition.



### Polar

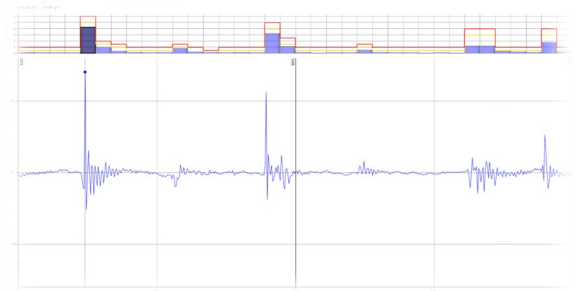
Although the polar plot uses the same underlying data as the Bode, it presents the data using polar coordinates instead of Cartesian. The two plot formats complement one another, as certain characteristics are easier to identify in polar coordinates than in Cartesian, and vice-versa. The screen capture at right, for example, contrasts the same data used for Bode plot representations (left) with their corresponding polar plot representations (right).





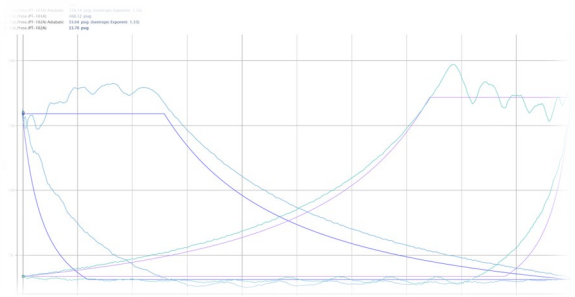
**Crank Angle**

This specialized plot displays any dynamic measurement associated with the reciprocating machine as a function of the shaft crank angle. In addition, segment bar graphs and alarm limits are provided to see at a glance what segments are close to or exceeding alarm limits.



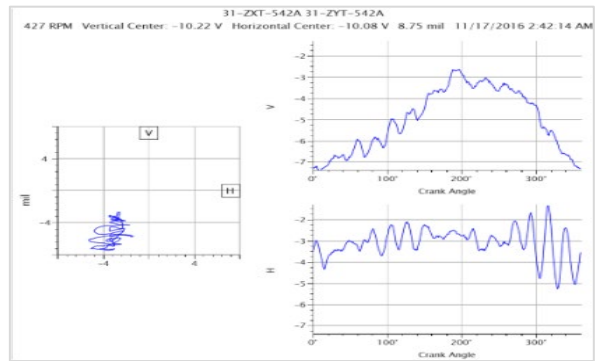
**Displaced Volume**

This plot is a pressure volume diagram where dynamic data associated with a reciprocating machinery. An adiabatic curve may be overlaid to compare the theoretical curve to aid in diagnostics.



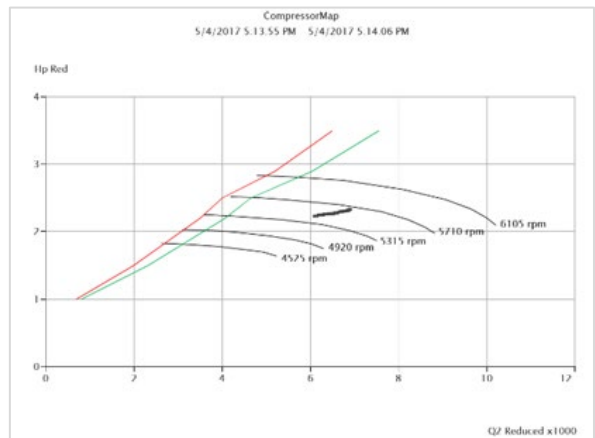
**Rod Position**

This plot displays the position of the reciprocating machine to help identify rider wear and other defects.



**Compressor Map**

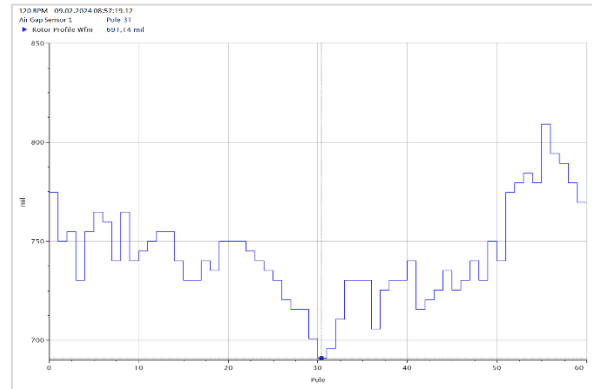
This plot is useful for monitoring incipient surge and comparing with other data available in CSM to dialog a root cause.





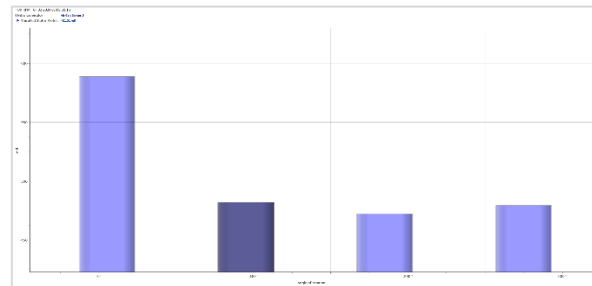
### Unrolled Rotor Profile

The Unrolled (or Linear) Rotor Profile plot displays the profile of the Rotor based on the data from a single air gap sensor. Measurements are evaluated by the distance (gap) between the Rotor and Stator and are plotted versus pole numbers. The shape and location are influenced by operation forces. Air gap problems can be identified, and corrective action taken long before a failure occurs.



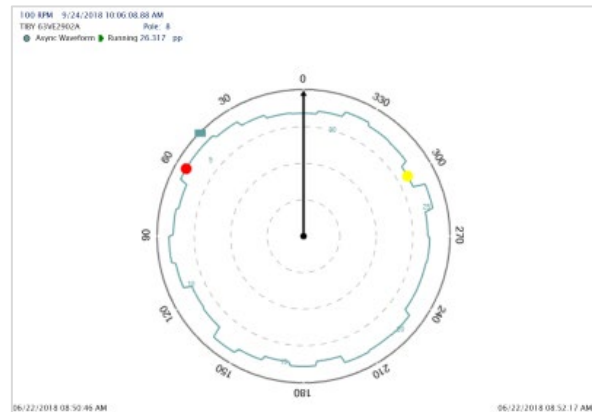
### Unrolled Stator Profile

Visualizes deviations of the Stator from a perfectly circular shape. To this end, the Unrolled (or Linear) Stator Profile plot displays the distance (gap) of multiple Air Gap sensors to a reference Rotor pole. Changes in the Stator shape can thus be detected, monitored, and corrected at early stages.



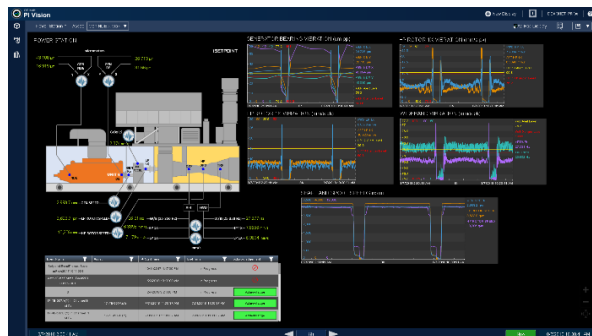
### Circular Rotor Profile

Displays the same data as the Unrolled Rotor Profile plot but on a polar canvas. Additionally, data from multiple connected Air Gap sensors can be compared. In combination, this helps correlating measurement values to geometric features of Rotor and Stator.



### Machine Train Diagrams and Trends

These diagrams are built in PI Vision and can be customized using the full suite of tools provided by the PI System. Bargraphs, numeric displays, trends, statuses, and many other features can be combined as required to develop screens that are intuitive for personnel, and even mimic your DCS or other screens used by operators.



## Specifications

For additional information refer to the following companion documents:

Components	Document
SETPOINT® CMS Overview Specifications	S000029
SETPOINT® CMS Instructions	S1176125

Computer Requirements			
<b>SETPOINT® CMS Client Application</b>	<ul style="list-style-type: none"> <li>Dual-core CPU or better</li> <li>8 GB RAM recommended</li> <li>300 MB hard drive space</li> <li>Microsoft .NET Framework 4.8</li> <li>Display resolution: SXGA (1280 x 1024) or better</li> <li>PI AF Client 2012 or higher*</li> <li>Supported Microsoft Windows Operating System (64Bit)                             <ul style="list-style-type: none"> <li>Windows 10 Pro</li> <li>Windows 11 Pro</li> <li>Windows Server 2019</li> <li>Windows Server 2022</li> </ul> </li> </ul> <p>* The SETPOINT® CMS uses PI AF (PI Asset Framework) when connecting to a PI System.</p>		
<b>PI Vision 2022 (Server)</b>	<ul style="list-style-type: none"> <li>Processor speed: 2GHz or faster</li> <li>6 GB RAM or more</li> <li>Processor cores: 4 or more</li> <li>Windows Server 2016 or newer, including Server Core versions</li> <li>200 MB + 5 MB per user</li> <li>Microsoft SQL Server 2012 64-bit or later</li> <li>Microsoft IIS 8.0 or later</li> </ul>		
System Capabilities			
SETPOINT® CMS software cannot be used to make changes to machinery protection system configuration			
Network Firewall Port Access	Protocol	Port	Direction (Unidirectional)
	AF	5457	To AF
	PI	5450	To PI

Plot Types and Plot Features	
<b>CMS Display</b>	<ul style="list-style-type: none"> <li>Filtered and unfiltered Timebase</li> <li>Filtered and unfiltered Orbit</li> <li>Filtered and unfiltered Orbit/Timebase</li> <li>Spectrum</li> <li>Shaft Centerline</li> <li>Bode</li> <li>Polar</li> <li>Waterfall</li> <li>Cascade</li> <li>Tabular</li> <li>Multi-variable trend &amp; states</li> <li>Compressor Map</li> <li>Crank Angle</li> <li>Displaced Volume</li> <li>Rod Position</li> <li>Unrolled Rotor Profile</li> <li>Unrolled Stator Profile</li> <li>Circular Rotor Profile</li> </ul>
<b>AVEVA PI Vision</b>	<ul style="list-style-type: none"> <li>Single- and multi-variable trend</li> <li>Asset Hierarchies</li> <li>Alarm Lists (PI Vision only)</li> <li>Event Lists (PI Vision only)</li> <li>Machine Train Diagrams</li> </ul>
<b>Plot Header</b>	<ul style="list-style-type: none"> <li>Asset and point names shown</li> <li>Probe orientation shown</li> <li>Date/time shown</li> <li>Rotational speed shown</li> <li>Direction of rotation shown</li> <li>Pk-Pk (or 0-Pk) value shown</li> </ul>
<b>Data Validity</b>	<ul style="list-style-type: none"> <li>Indicates non-valid data</li> <li>Indicated NOT OK transducers or points</li> <li>Indicates if data is in alarm</li> </ul>
<b>Data origin</b>	Both live and historical data display supported
<b>Plot Scaling</b>	<ul style="list-style-type: none"> <li>Auto per Plot</li> <li>Compare Plots</li> <li>Manual</li> </ul>
<b>Units</b>	Imperial and Metric supported



Plot Types and Plot Features	
<b>Pre-defined plot groupings</b>	<ul style="list-style-type: none"> <li>• Yes, using flag plot feature</li> <li>• Bookmark groups of plots for later reuse</li> <li>• Quick views associated to assets</li> </ul>
<b>Overlay</b>	Use custom events to overlay historical data on top of current context
<b>Full Screen</b>	Expand plot to view on a second screen
<b>Cursors</b>	<ul style="list-style-type: none"> <li>• Right arrow advances in time, left arrow goes back in time</li> <li>• Clicking on a curve advances cursor to that position</li> <li>• Clicking on curve activates cursor if not already shown</li> <li>• Numerical readout of time, speed, state, amplitude, and phase at cursor position</li> <li>• Difference cursor allows comparison of two different features</li> <li>• Harmonic cursor</li> <li>• Sideband cursor</li> <li>• Bearing frequency markers</li> </ul>
<b>Orbit / Timebase</b>	<ul style="list-style-type: none"> <li>• Collects and displays both synchronous and asynchronous orbits for X-Y transducer pairs</li> <li>• Shows direction of rotation</li> <li>• Shows shaft precession via blank/bright phase trigger dot</li> <li>• Zooming supported</li> <li>• Timebase plots scale as orbit plot is scaled</li> <li>• Time and amplitude shown on cursor position</li> <li>• Cursors linked between orbit and timebase plots</li> </ul>

Plot Types and Plot Features	
<b>Spectrum</b>	<ul style="list-style-type: none"> <li>• Half or full spectrum</li> <li>• Selectable for 200, 400, 800, 1600, 3200, 6400, or 12800 lines</li> <li>• Windowing Supported               <ul style="list-style-type: none"> <li>- Hanning</li> <li>- Hamming</li> <li>- Flat top</li> <li>- Blackman</li> </ul> </li> <li>• Frequency Cursor</li> <li>• Amplitude Cursor</li> <li>• Difference Cursor</li> <li>• Harmonic Cursor</li> <li>• Sideband Cursor</li> <li>• Linear Y-axis scaling</li> <li>• X-axis scaling in frequency or orders of running speed</li> <li>• 500 spectra available simultaneously in waterfall and cascade plot types</li> <li>• Spectral overlapping supported when contiguous waveform data is available</li> </ul>
<b>Shaft Centerline</b>	<ul style="list-style-type: none"> <li>• Set Initial Gap with reference</li> <li>• Set in volts and convert to mils</li> <li>• Set bearing clearances</li> <li>• Select data by time</li> <li>• Display speed or time markers</li> </ul>
<b>Timeline</b>	<ul style="list-style-type: none"> <li>• Visually navigate data to easily zoom out to months of data or zoom into a few seconds</li> <li>• Visually find past events</li> </ul>
<b>Crank Angle vs Vibration</b>	<ul style="list-style-type: none"> <li>• Multi-variable scale</li> <li>• Optional gas force, inertial load, and rod load</li> <li>• Optional pressure</li> </ul>
<b>Displaced Volume</b>	<ul style="list-style-type: none"> <li>• Optional adiabatic curve</li> <li>• Adjustable theoretical attributes</li> </ul>

General Features	
<b>Local Time Support</b>	Yes
<b>Supports Data exchange with Excel</b>	Yes
<b>Access Rights</b>	<ul style="list-style-type: none"> <li>• User-Based</li> <li>• Role-Based</li> <li>• View-Only</li> <li>• Administrator</li> <li>• Changes to access rights logged by user, date, and change</li> </ul>
<b>Hardware Alarms</b>	<ul style="list-style-type: none"> <li>• Superimposed on trend plots and time slider</li> <li>• Shown in Alarm list</li> </ul>
<b>Software Alarms</b>	Supported in PI AF
<b>Data playback controls</b>	Supported for both live and historical data
<b>Portable Data</b>	Export CMS data to a file and share it with remote experts
<b>Word Export</b>	Publish plots to a word document to share analysis results
<b>Export Archive Data</b>	From CMS-XC or flight recorder databases export large amounts of data to archive it for future use
<b>Document Management</b>	Available via PI Server
<b>(Machine) State</b>	<ul style="list-style-type: none"> <li>• User added</li> <li>• Automated (VC-8000 Rack based) State displays</li> </ul>
<b>Quick View</b>	Navigation link from PI Vision to SETPOINT® CMS

\* Only applicable for Channel Type Recip Impact, Recip Cylinder Press and Recip Rod Position



## Ordering Information

### Download SETPOINT CMS

SETPOINT CMS® can be downloaded directly from [www.bkvibro.com](http://www.bkvibro.com) or alternatively is delivered with a SETPOINT® solution. For information on ordering a complete server installation of SETPOINT® refer to the SETPOINT® CMS Overview Specifications (S000029).

### Order additional software as required.

AVEVA PI Vision is an optional component that is not strictly required for using CMS. However, it is strongly recommended as PI Vision provides essential features for most users, such as the ability to create machine train diagrams, asset hierarchies, alarm list shortcuts, and event list shortcuts. It also provides powerful trending and analysis tools for static data types.

AVEVA PI Vision can be ordered directly from AVEVA; customers with existing copies of AVEVA PI Vision can use those as well.

**C106808.003**

**PI Vision (per named user) -  
PI Visualization Software**

AVEVA PI DataLink provides a way to query PI data directly from Microsoft Excel and gives an easy way to do additional add-hock analysis.

**C106808.002**

**PI DataLink (per named user) -  
PI Visualization Software**



**AVEVA**

OEM Equipment  
Builder Partner

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