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Published in Apr.2012

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CMS Condition Monitoring System

Vibration Analysis & Diagnostic System

infiSYS RV-200

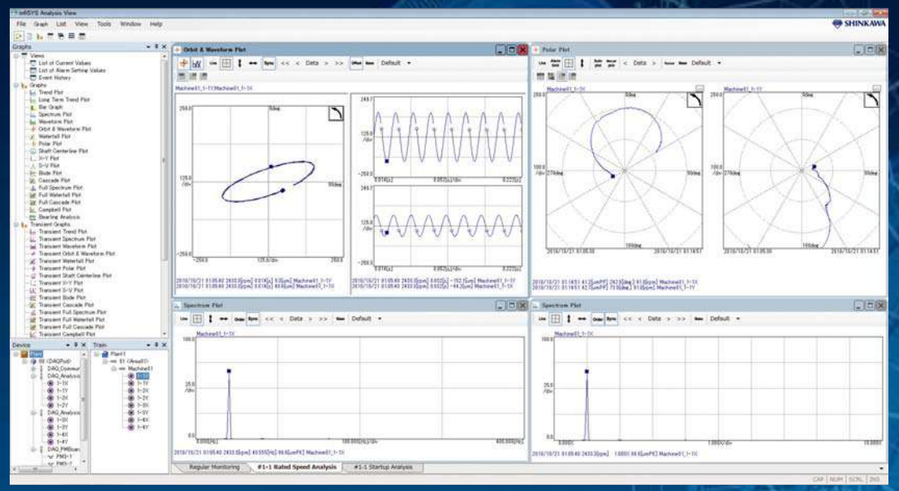
An analysis & diagnostic system for all rotating machinery

infiSYS

SHINKAWA

Vibration analysis & diagnostic system that is applicable to a variety of rotating machinery, helps safe operation and to improve operational efficiency.

infiSYS RV-200 precisely keeps track of and quickly feeds back conditions of rotating machinery which are the key production assets of plants.

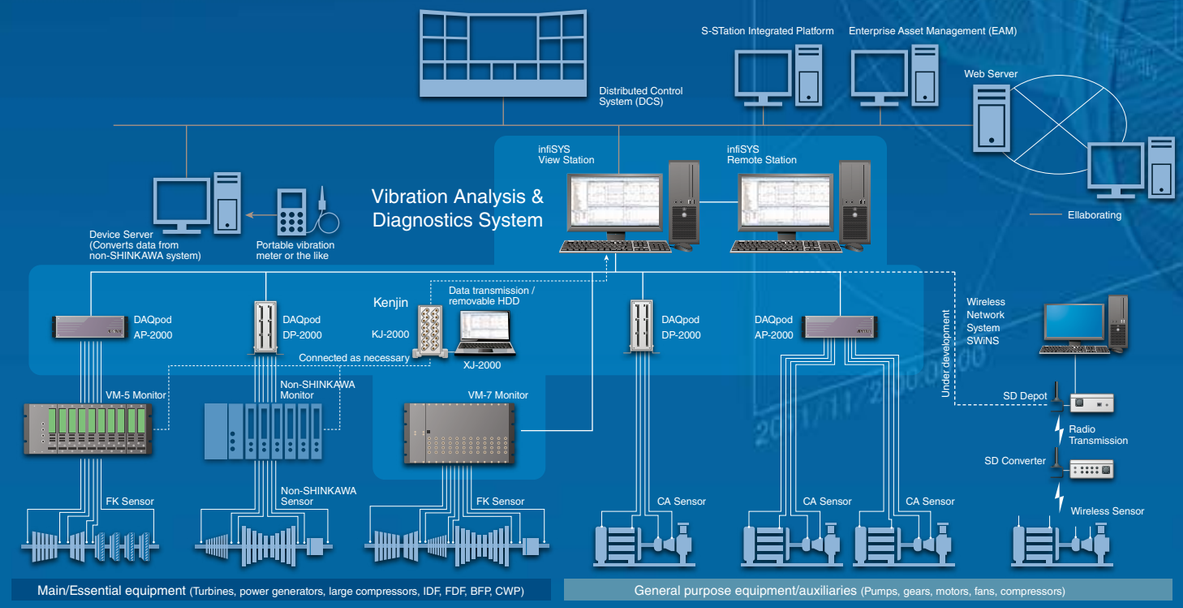


SHINKAWA CMS Overall Configuration

CMS (Condition Monitoring System)

SHINKAWA's CMS is applicable to various rotating machinery monitoring, from comprehensive condition monitoring of large rotating machinery, including shaft vibration, axial position, phase mark, rotation speed, etc., to bearing vibration monitoring for small rotating machinery.

In the CMS scheme, infiSYS RV-200 positions itself as a system which analyzes vibration for phase angle and frequency component, and displays the information in the forms of various analysis graphs necessary for vibration diagnostics.



Features

1 For all rotating machinery

Applicable to all scales from small rotating machinery supported by rolling element bearings to large rotating machinery supported by journal bearings.

2 High-speed and flexible system configuration

While achieving high-speed data acquisition, the system can be configured with various condition monitors, including non-SHINKAWA monitors.

3 Sophisticated data analysis and various graphs

The software provides a variety of analytical graphs which are optimized for the type of machinery and condition, satisfying stringent demands of vibration analysts and other plant personnel.

4 User-friendly operability and plotting functions

Intuitively software interaction with drag & drop graph display manipulation, graph area switching tab, etc.

Advantages

Helps customers improve productivity and reliability by optimizing plant operation.

- Detects abnormal symptoms from vibration characteristics or subtle changes in vibration. Reduces risks of unplanned production shutdown by taking proactive approach.
- Advanced diagnostics realize assumption of causes and areas of anomalies and detailed analysis. Help users practice optimum, efficient maintenance.

Applications



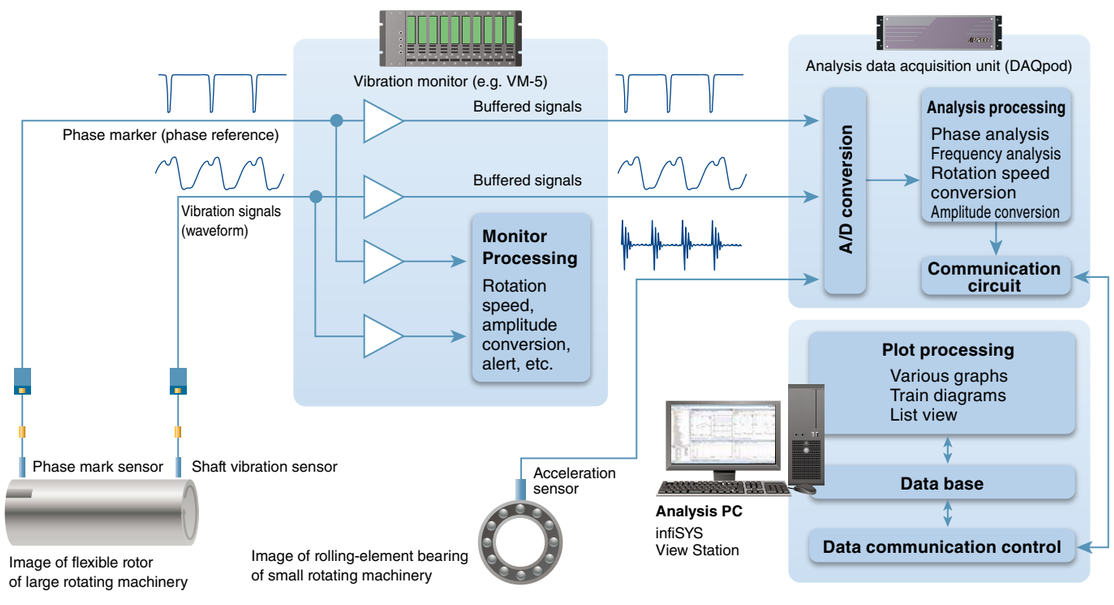

- Steam turbines
- Gas turbines
- Electric generators
- Feed pumps
- Fans
- Blowers
- Compressors
- BOP machinery
- Rotating equipment critical to your facility

Features 1

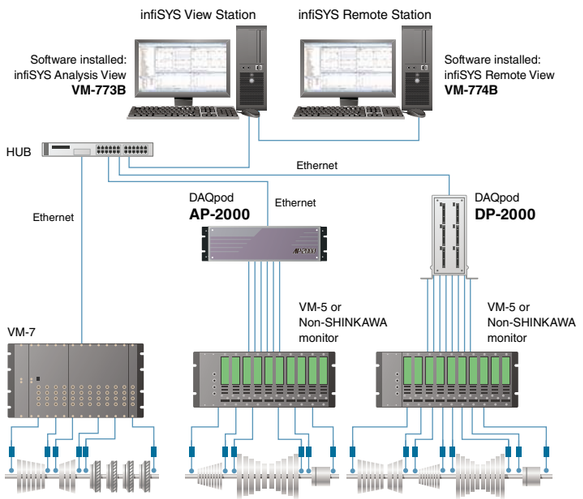
For all rotating machinery

infiSYS RV-200 Basic System

When used for large rotating machinery, it acquires phase mark signals and shaft vibration waveform, processes phase analysis and frequency analysis, and then displays the information in various graphs for further analysis.
For small rotating machinery, infiSYS acquires acceleration vibration waveform of casing and the information is displayed with graphs based on the frequency analysis.

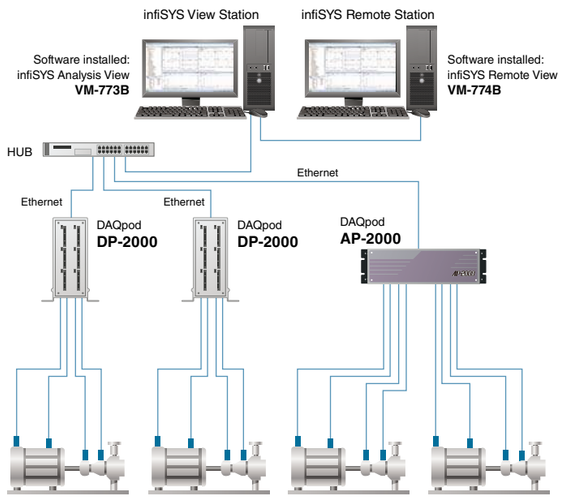


infiSYS RV-200 Configuration Example (for Large Rotating Machinery)



Based on the vibration waveform detected by shaft vibration sensors, the system provides vibration monitoring and anomaly analysis for rated-speed operation, and shaft behavior analysis for critical startup/shutdown.

infiSYS RV-200 Configuration Example (for Small Rotating Machinery)



Based on the vibration detected by acceleration sensors installed on the bearing housings, the system provides trend management and abnormality diagnostics not only on overall vibration but also on vibration of each fault frequency resulting from bearing failure.

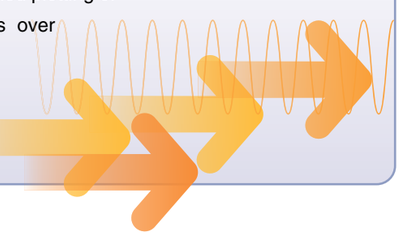
Features 2

High-speed and flexible system configuration

High-speed data acquisition

- Trend data every 1 sec
- Waveform data every 10 sec

Machine's data during startup/shutdown (transient data) are acquired to a level, allowing for detailed plotting of analysis graphs. The gradual changes over time can also be analyzed in real time.



Various system configurations

- VM-7
- VM-5 (with DAQpod)
- Non-SHINKAWA monitors

System can be configured independently of a condition monitor that is already deployed on large rotating machinery. Whether an existing SHINKAWA monitor or non-SHINKAWA monitor, data can be acquired and analyzed via DAQpod, upgrading the customer's existing system to a current analysis-capable system.

* If the monitor is VM-7, DAQpod is not required.

Multi channel

- Maximum number of inputs 480 ch

Integrating, monitoring, and analyzing vibration data of machinery in a plant in one analysis system, the system contributes to plant's stable operation with early detection, analysis / diagnostics of abnormality.

Analysis data acquisition unit DAQpod

Analyzes vibration waveform signals received from a condition monitor on large rotating machinery and sends analysis data to the infiSYS View Station. When it is used for bearing vibration analysis on small rotating machinery, acceleration sensors can be directly connected for data collection.

DAQpod AP-2000

DAQpod DP-2000

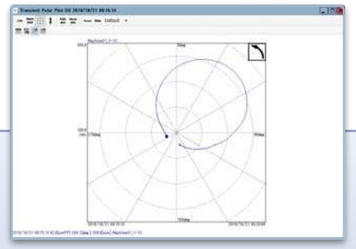
Features 3 Sophisticated data analysis and various graphs

infiSYS RV-200 offers a variety of analysis and plotting functions.

Provides analysis and plotting functions required by vibration analysts certified in accordance with ISO 18436-2.

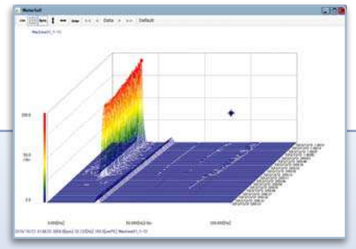
* ISO18436-2: Condition monitoring and diagnostics of machines - Requirements for training and certification of personnel - Part 2 : Vibration condition monitoring and diagnostics

Data display examples



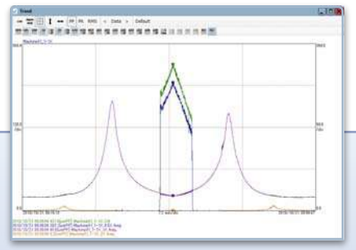
Polar Plot

This shows the vibration vector at the time of critical startup/shutdown of the machine. From this plot, the user can observe the balancing condition, vibration levels and critical speed during the startup/shutdown of the machine.
Displayed data (Switchable display): 1X, 2X
This allows over lay of current data on top of past data.



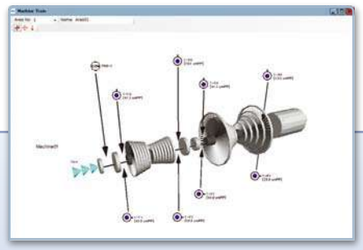
Waterfall Plot

This plot is used to analyze changes in frequency components that occur over time.
Cascade plot can also be displayed with width (z-axis) as rotation speed to analyze changes in frequency components in relation to changes in rotation speed.



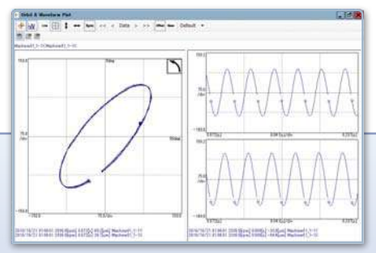
Trend Plot

This plot displays short term and long term chronological changes using a line chart.
Displayed data (multiple selections are allowed): Rotation speed, GAP, OA, 0.5 X amplitude, 0.5 X phase, 1X amplitude, 1X phase, 2X amplitude, 2X phase, Not-1X amplitude, nX1 to nX4 amplitude and phase, Smax amplitude, various alarm setting values.



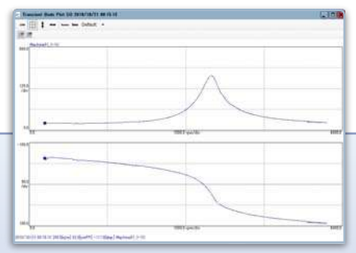
Machine Train Diagram

The 3D illustration of rotating machinery diagram displays the rotation speed as well as the location and the vibration amplitude of each measuring point.
For each machine, current values can be displayed in a list view.



Orbit and Waveform Plot

This plot composes signals from each X and Y sensor and displays the dynamic motion of the center of a rotating shaft.
The Orbit plot helps to identify any abnormal status including imbalance, misalignment, oil whirl and oil whip.



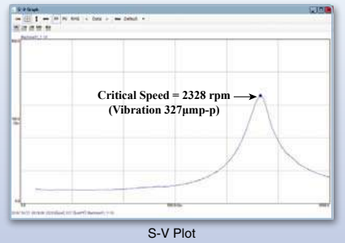
Bode Plot

This plot displays the amplitude and phase in separate graphs with rotation speed used as the horizontal axis.
From this plot, the user can see the vibration status and critical speed during the startup/shutdown of the machine.
Displayed data (Switchable display): 1X, 2X
This allows over lay of current data on top of past data.

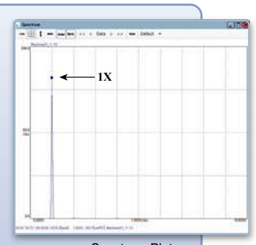
Case Studies

Unbalanced Vibration

The most common abnormal vibration is due to the mismatch between shaft center and mass center, due to manufacturing error or machine components missing.
The characteristic of the vibration generates the rotation synchronous component (1X), which is sine wave or similar. Vibration becomes largest at critical speed.



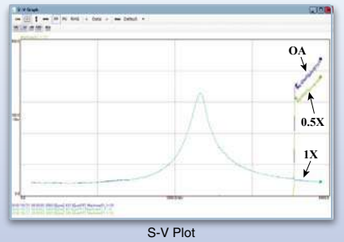
S-V Plot



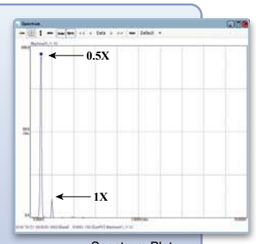
Spectrum Plot

Oil Whirl Vibration

Self-excited, unstable vibration typical for sleeve bearing supported rotating machinery. Possible causes include effects from the shape of the sleeve bearing, oil film characteristics, etc. Normally, this vibration appears at two or less times lower the critical speed, and the frequency is around half the rotation synchronous frequency (0.5X).



S-V Plot

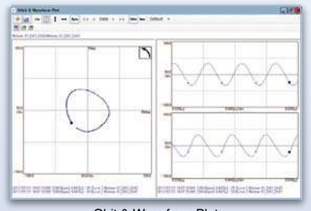


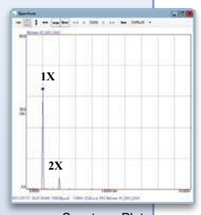
Spectrum Plot

Misalignment Vibration

Vibration that occurs when the shaft centers of driving rotating machinery and its associated driven rotating machinery are not properly aligned. Typically the vibration includes rotation synchronous frequency component (1X) and harmonic components (2X, 3X).

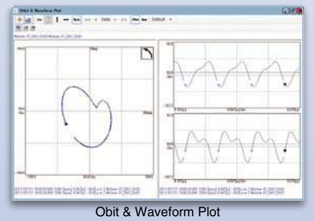
[Normal condition]

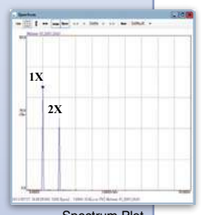

Obit & Waveform Plot



Spectrum Plot

[Misalignment occured]

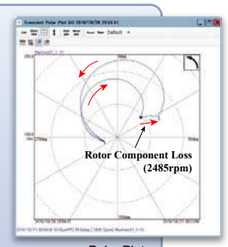

Obit & Waveform Plot



Spectrum Plot

Loss of Rotor Component

When a piece of rotor component is lost/flies off, unbalanced vibration condition suddenly changes. The typical phenomenon includes sudden changes in the amplitude and phase angle (vibration vector) of the rotation synchronous frequency component (1X).



Polar Plot

Features 4

User-friendly operability and plotting functions

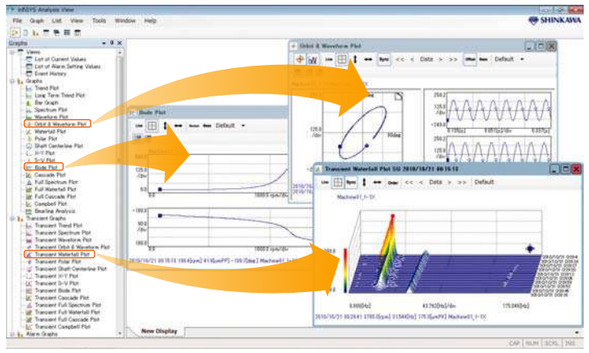
infiSYS RV-200 (hardware & software) has a simple user interface, that is easy and instinctively operated by most plant personnel.

Quick learning of graphic display.

Examples of easy operation

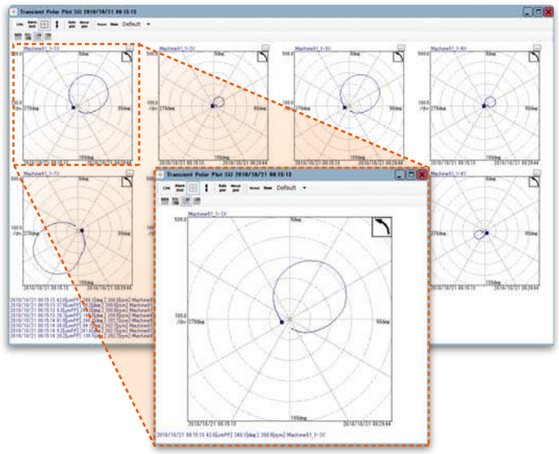
Drag & drop

From tree at left to display area at right, desired plots can be displayed anywhere you want.



Tile display

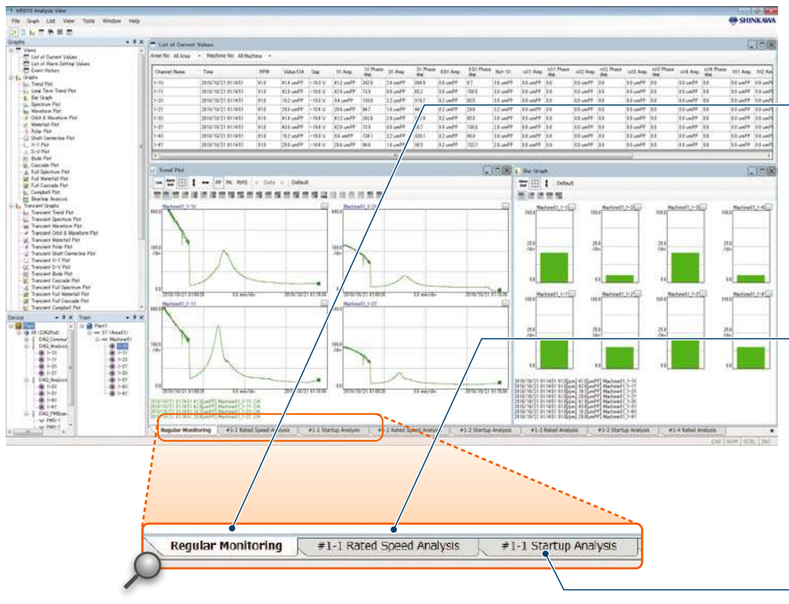
Instant pickup of desired channel plot from tile display window. Channel plot specific window opens with one click.



Page switching tab

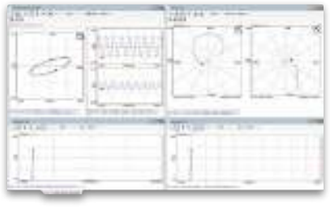
Desired graph display page can be displayed simply by switching the tabs.

A step to create a new page is also simple. (Up to 20 pages.)

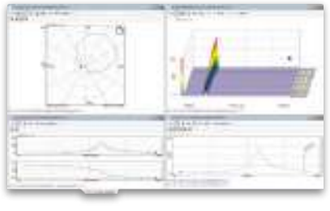


Regular Monitoring Data sample page

Rated Analysis sample page



Startup Analysis sample page



Up to 20 pages can be created.

Pages with desired plots in desired arrangement can be created with specified tab name. Users can lock the displays as well, this allows uniformity and protection on your custom view settings.

The SHINKAWA Network

SHINKAWA is employing global thinking to create a business with a worldwide network currently comprising over 50 bases around the world.

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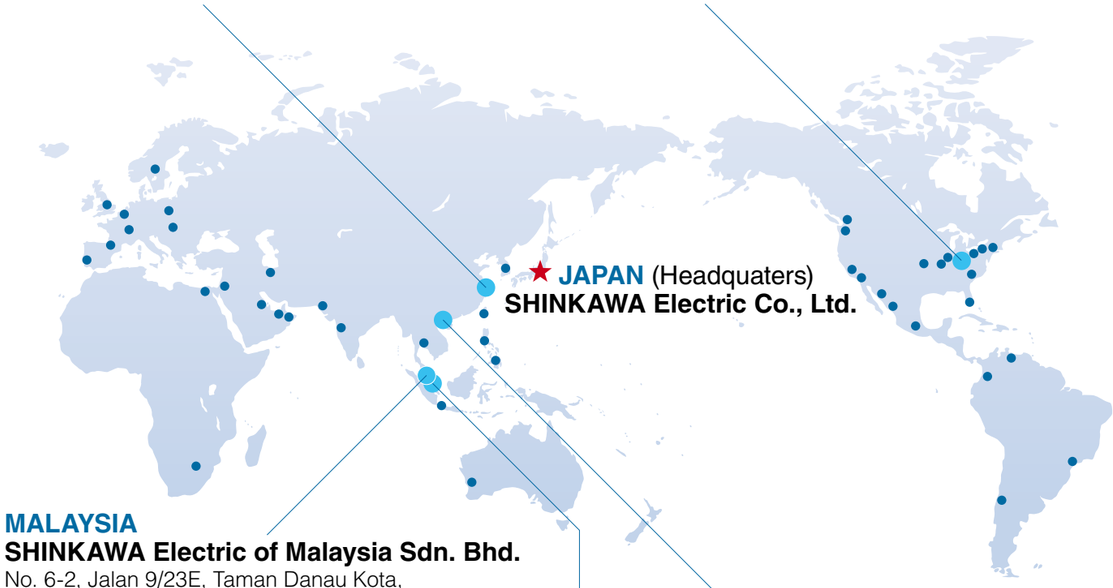

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★ Headquaters ● Subsidiary ● Sales and Service

System Specifications

Maximum number of connections	20 units* (VM-7, DAQpod)	* DP-2000H is composed of 2 systems, therefore counted as two units in this calculation.
Maximum number of measuring points	480 points*	* Actual number of points measurable may be limited due to system configuration.
Number of FFT lines	VM-7 : 800 lines DAQpod : 400 / 800 / 1600 lines	
Short Term / Long Term data saving feature	Short Term data saving period. Short Term data saving interval Long Term data saving period Long Term data saving interval	Can be set to any length between 1 day and 31 days. Trend data : 1 sec Waveform data : 10 sec / 20 sec / 30 sec / 1 min / 2 min / 3 min / 5 min / 10 min 1 yr / 2 yrs / 3 yrs / 4 yrs / 5 yrs 10 min / 20 min / 60 min / 120 min
Alarm data saving feature (Applicable to critical mode only)	Time range of the data to be saved Data saving interval Type of alarm	Trend data : 24 hours of data before and after the alarm occurred. Waveform data : 24 hours of data before and after the alarm occurred. Trend data : Every 1 sec Waveform data : Based on the normal waveform data saving interval. OA amplitude, 1X amplitude / phase, 2X amplitude / phase, rotation speed, process data
	*Alarm high speed acquisition mode : Trend data is captured and saved 20 sec before alarm and 10 sec after alarm in 0.1 sec intervals for more detailed analysis. (Only applicable to the channels connected to DAQpod.)	
Transient data saving function	Data saving period Startup period : From [Specified number of revolutions] to [specified number of revolutions] + N minutes (can be set to any time between 0 - 60 minutes) (Example : 100 rpm to 2,950 rpm + 20 minutes) Shutdown period : From [Specified number of revolutions] to [specified number of revolutions] (Example : 2,950 rpm to 100 rpm) Data saving interval	Δt setting : Trend 1 sec / waveform 10 sec (Fixed) Δrpm setting : From Δ1 rpm to Δ100 rpm (1 rpm increments)
Number of histories	Number of transient histories per measuring point 100 to 1,000 Number of alarm histories per measuring point 100 to 1,000 Number of event histories per hardware item 1,000 to 10,000	
Data display function	Displayable graphs : Trend Plot, Long Term Trend Plot, Bar Graph, Spectrum Plot, Waveform Plot, Orbit & Waveform Plot, Waterfall Plot, Polar Plot, Shaft Centerline Plot, X-Y Plot, S-V Plot, Bode Plot (Optional plots : Cascade Plot, Full Spectrum Plot, Full Waterfall Plot, Full Cascade Plot, Campbell Plot) List view : List of Current Values, List of Alarm Setting Values, Event History, Machine Train (maximum 24)	
Diagnostic functions (*optional)	Imbalance, permanent bends, rotor defects, misalignment, resonance with critical speed, rotor cracks, poor precision of an unsymmetrical shaft gear, contact of sealed parts, oil whirl, oil whipping, steam whirl / seal whirl, cavitations, blade vibration, draft core, surging	
System requirements	OS Other requirements	Microsoft® Windows® XP Professional SP3 (32bit) Microsoft® Windows® 7 (32 / 64 bit) Professional or later Microsoft® Windows Server® 2008 R2 or later Microsoft® SQL Server® 2008 R2 or later Microsoft® .NET Framework3.5 SP1 or later

* Windows, Windows Server, SQL Server, Microsoft, and Microsoft .NET are registered trademarks of Microsoft Corporation in the United States and other countries.

Hardware Specifications

For DAQpod

Number of inputs (number of channels)	AP-2000H* (19" rack)	: Maximum number of vibration channels = [48 ch - (number of phase marker channels)] x 2 Number of phase marker channels = [0, 4, 8, 12, 16 ch] x 2
	AP-2000D* (19" rack)	: Maximum number of vibration channels = 48 ch - (number of phase marker channels) Number of phase marker channels = 0, 4, 8, 12, 16 ch
	DP-2000 (24 ch box)	: Maximum number of vibration channels = 24 ch - (number of phase marker channels) Number of phase marker channels = 0, 4, 8 ch
	* DAQpod AP-2000H : two 48-channel systems incorporated. DAQpod AP-2000D : one 48-channel system incorporated.	
Number of frequency analysis lines	400 / 800 / 1600 lines	
Trend data	Rotation speed, OA amplitude, GAP, 0.5X amplitude / phase, 1X amplitude / phase, 2X amplitude / phase, Not-1X amplitude, nX1 to nX4 amplitude/phase, Smax amplitude, Σ8X or higher amplitude, IR / OR / BS vibration.	
Data collection interval	Trend data collection interval Every 1 sec (every 0.1 sec during alarm high speed acquisition mode*) * With DAQpod, effective period of alarm high speed acquisition mode is 20 sec before alarm, 10 sec after alarm. Waveform data collection interval During normal operation : Every 10 / 20 / 30 sec, 1 / 2 / 3 / 5 / 10 min During transient : Δt setting : Trend every 1 sec (fixed) : Waveform every 10 sec (fixed) : Δrpm setting : From Δ1 rpm to Δ100 rpm (1 rpm increments) The actual intervals that can be used to collect data will be limited depending on the number of channels and system requirements.	
Network Interface	Ethernet 100 Base-T	
Power supply voltage	AP-2000H / D (19" rack) : 85 - 264 VAC DP-2000 (24 ch box) : DC 24 V ±10%	
Dimensions	AP-2000H / D (19" rack) : 482 (W) x 132.5 (H) x 444 (D) mm DP-2000 (24 ch box) : 96 (W) x 224 (H) x 165 (D) mm	

For VM-7 (Analysis board installed)

Number of inputs (number of channels)	Phase marker channels : 4 ch, vibration channels : 44 ch
Number of frequency analysis lines	800 lines
Trend data	Rotation speed, OA amplitude, GAP, 0.5X amplitude / phase, 1X amplitude / phase, 2X amplitude / phase, Not-1X amplitude. nX1 to nX4 amplitude / phase, Smax amplitude.
Data collection interval	Trend data collection interval Every 1 sec (Process data : Every 10 sec) Waveform data collection interval During normal operation : Every 10 / 20 / 30 sec, 1 / 2 / 3 / 5 / 10 min During transient : Δt setting : Trend every 1 sec (fixed) : Waveform every 10 sec (fixed) : Δrpm setting : From Δ1 rpm to Δ100 rpm (1 rpm increments) The actual intervals that can be used to collect data will be limited depending on the number of channels and the system requirements.
Network Interface	Ethernet 100 Base-T
Power supply voltage	Supports redundant power supply with VM-75 □B Power Supply Module (85-264 VAC, 24 VDC ± 10%, 110 VDC ± 10%) * Module for 24 VDC is under development.