

Vibration Analysis Program SX-A1VA



This program adds vibration measurement functions to the RIONOTE Multifunction Measurement System.

All essential vibration measurement functions are provided, enabling equipment diagnosis and trend management for industrial machinery. The program also supports detailed diagnosis including FFT analysis and envelope processing, and ISO absolute value evaluation can also be performed. Because up to four accelerometers can be connected to the RIONOTE, simultaneous measurement in two horizontal directions and one vertical direction or other measurements of multiple planes can be easily realized.

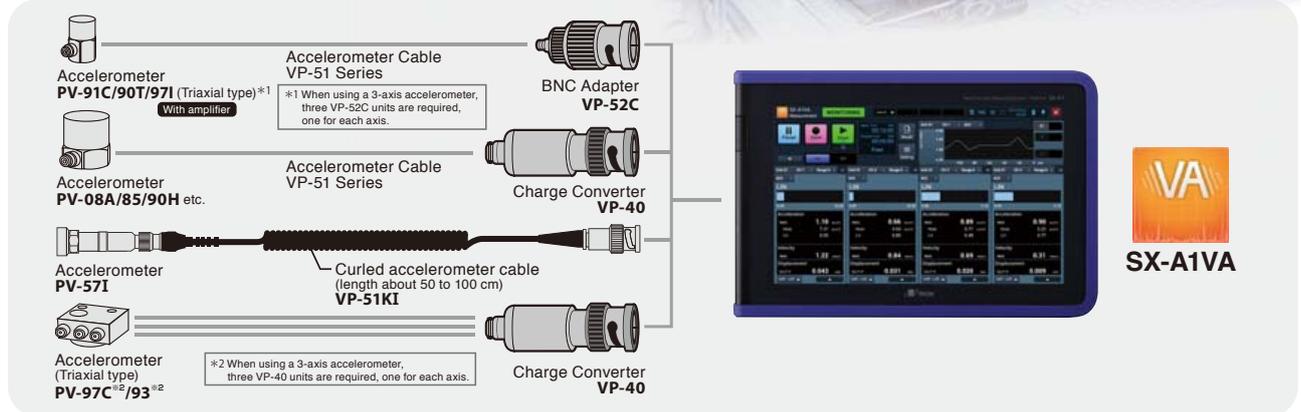
Monitoring of vibration sound (acceleration) possible

Vibration meter mode

- Measurement simultaneously for vibration acceleration, velocity, and displacement
- Auto store function continuously records vibration values and tacho data in 100 ms intervals
- Calculation of average vibration quantity values for a specified measurement period (to facilitate reading of representative values for measurement data with considerable fluctuation)
- Separate filter settings (HPF, LPF) for acceleration, velocity, and displacement are supported



Connection examples



Simple diagnosis

By periodically measuring the vibration magnitude and comparing the results to a reference value, the equipment condition (normal or potential problem) can be diagnosed.

The example at right shows the screen in absolute measurement mode for four channels. Because the danger state is indicated by purple-red, caution by yellow, and good by green, the display of measurement results lets the operator assess the state of vibration at a glance.



■ Absolute value evaluation mode (absolute value evaluation function)

ISO 10816 series (Evaluation of machine vibration by measurements on non-rotating parts).

According to ISO 10816-1:1995 / Amd. 1:2009, evaluation criteria for mechanical vibration over a specified range are to be decided by agreement between the supplier and the user of the machine, and boundary values for evaluation are to be determined in consideration of the measurement position and the support rigidity of the machine etc.

- Reference value
 - A/B 0.71 to 4.5 mm/s (rms)
 - B/C 1.8 to 9.3 mm/s (rms)
 - C/D 4.5 to 14.7 mm/s (rms)

Representative zone boundary value

| Vibration acceleration rms value | Range of representative zone boundary value | | |
|----------------------------------|---|--|--|
| 0.28 | Zone boundary value A/B 0.71 to 4.5 | Zone boundary value B/C 1.8 to 9.3 | Zone boundary value C/D 4.5 to 14.7 |
| 0.45 | | | |
| 0.71 | | | |
| 1.12 | | | |
| 1.8 | | | |
| 2.8 | Zone boundary value B/C 1.8 to 9.3 | Zone boundary value C/D 4.5 to 14.7 | Zone boundary value C/D 4.5 to 14.7 |
| 4.5 | | | |
| 7.1 | | | |
| 9.3 | | | |
| 11.2 | | | |
| 14.7 | Zone boundary value C/D 4.5 to 14.7 | Zone boundary value C/D 4.5 to 14.7 | Zone boundary value C/D 4.5 to 14.7 |
| 18 | | | |
| 28 | | | |
| 45 | | | |
| 45 | | | |

■ Standard mode (evaluation function)

Two threshold values (upper and lower) each are set for acceleration, velocity, and displacement to perform evaluation.

Detailed diagnosis (FFT analysis and envelope processing)

The FFT analysis function and envelope processing function (acceleration envelope processing) can be used to determine abnormal conditions and to assess failure stage and location. Three examples for analysis using patterns to analyze vibration causes are shown below.

Bearing fault

The bearing fault manifests itself by large acceleration. Envelope analysis reveals peaks at regular intervals, as shown in the illustration. When the dimensions of the bearing parts, number of rolling elements, number of shaft revolutions etc. are known, the faulty part can be determined from the primary frequency of the series of peaks.



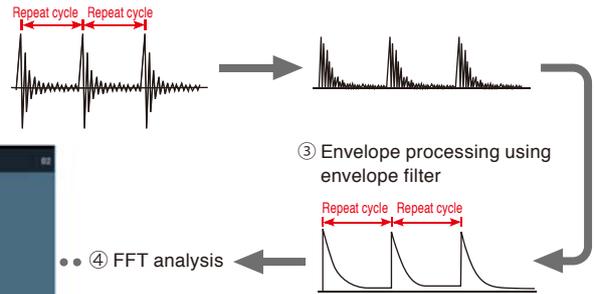
Time waveform



FFT spectrum

Envelope processing

- ① Shock waveform due to bearing fault
- ② Absolute waveform value



For failure diagnosis of bearings, envelope processing is used because it is necessary to know the repetition period of the shock waveform.

Misalignment

In the case of misalignment, a large frequency component that is an integer multiple of the number of revolutions appears in the axial direction. The multiplication factor of the vibration component depends on the type of bearing.



FFT spectrum

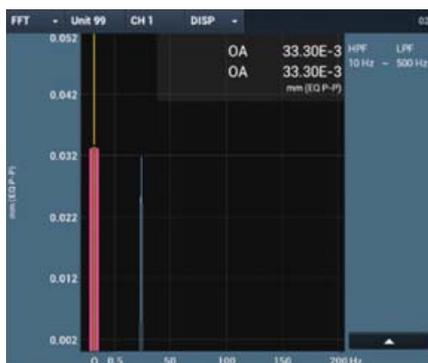
What is misalignment?

Misalignment refers to a state where the rotation center line of two rotary axes that are joined by a coupling is not in a straight line. This can be due to core deviation, face shift or a combination of these or similar conditions. When misalignment occurs, face runout can cause an increase in the thrust load acting on the bearing, which shortens the service life of the bearing.

| | |
|--------------------------------|--|
| Core deviation | |
| Face runout | |
| Core deviation and face runout | |

Unbalance

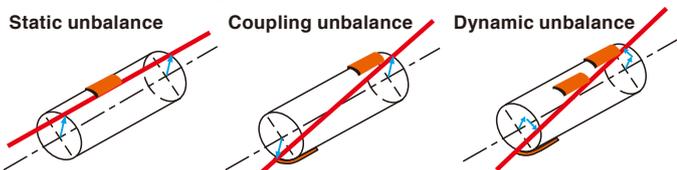
Unbalance is a condition that occurs in the rotary direction. It is characterized by an increase only in the vibration component that is equal to the number of revolutions. Other vibration frequency components will show almost no change. The vibration amplitude is proportional to the degree of unbalance. When the rotation frequency increases, the amplitude increases by the square of the number of revolutions.



FFT spectrum

What is unbalance?

Unbalance occurs when the center of gravity of a rotating body is displaced from the center. Different types of unbalance include static unbalance, coupling unbalance, and dynamic unbalance. When unbalance occurs, the load acting on the bearing in the circumferential direction increases, which shortens the service life of the bearing.

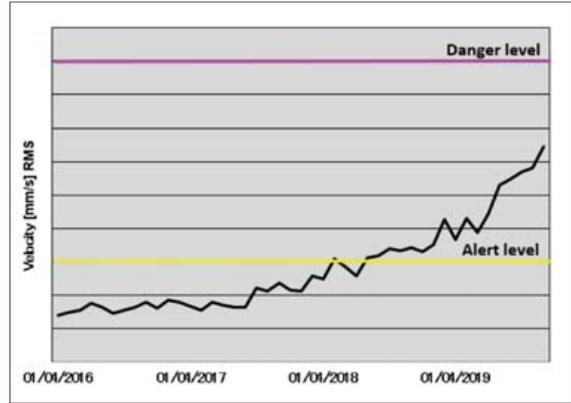


Trend management (relative value evaluation)

SX-A1VA program can store the data tagged with information of the measurement point and can output the data all together for each measuring object. By using spreadsheet software such as Excel enables trend management of the machinery condition. In order to assess changes in the vibration of rotating machinery or similar which can indicate problems and possible causes, it is necessary to effectively accumulate and manage measurement data. Reference values can then be determined based on these data for example to set caution and danger threshold values.

When a caution threshold is exceeded, monitoring should be strengthened, and when the danger threshold is reached, detailed diagnosis will normally be performed. With many common types of vibration acceleration, values that are about 2 to 3 times above normal are considered caution indicators and a further increase by a factor of 2 to 3 will indicate a danger state. For a given piece of machinery, vibration measurement location, measurement direction, and measurement period are determined, and a graph in which measured values are entered in a time series is created (trend management graph).

| | Measurement point | Measurement value |
|----|----------------------|-------------------|
| 1 | Area | Area A |
| 2 | Machine | Machine 001 |
| 3 | Point | Point A-1 |
| 8 | ACC Unit | m/s ² |
| 9 | ACC RMS/EQ | RMS |
| 10 | VEL Unit | mm/s |
| 11 | VEL RMS/EQ | RMS |
| 12 | DISP Unit | um |
| 13 | DISP RMS/EQ | EQ P-P |
| 15 | DateTime | Project Name |
| 16 | 8/4/2017 12:56:05.9 | project_0000 |
| 17 | 9/4/2017 12:57:40.0 | project_0001 |
| 18 | 10/4/2017 12:58:46.2 | project_0002 |
| 19 | 11/4/2017 12:59:53.5 | project_0003 |
| 20 | 12/4/2017 13:01:07.0 | project_0004 |
| 21 | 1/4/2018 13:02:12.9 | project_0005 |
| 22 | 2/4/2018 13:02:49.0 | project_0006 |
| 23 | 3/4/2018 13:03:40.0 | project_0007 |



Trend management graph

Evaluation

Specifications

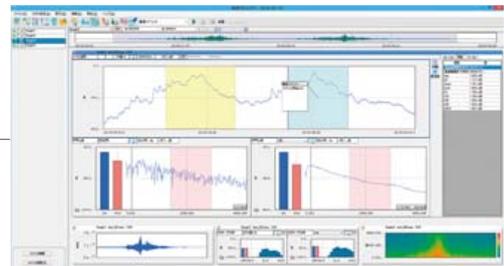
| | |
|--|--|
| Number of input channels | Max. 2 (with SA-A1B2) Max. 4 (with SA-A1B4) (Number of logical channels: Using one signal input, settings for analysis of multiple vibration quantities such as acceleration, velocity, displacement, acceleration envelope etc. can be made.) |
| Vibration frequency range (using PV-57I) | Acceleration: 0.02 to 141.4 m/s ² (rms) Velocity: 0.2 to 141.4 mm/s (rms, at 159.15 Hz) Displacement: 0.02 to 40.0 mm (EQ peak-peak, at 15.915 Hz) |
| Measurement frequency range (Electrical characteristics) | Acceleration: 1 Hz to 20 kHz Velocity: 3 Hz to 3 kHz Displacement: 3 Hz to 500 Hz Acceleration envelope: 1 kHz to 20 kHz |
| Filters | High-pass filter: 1 Hz, 3 Hz, 5 Hz, 10 Hz, 1 kHz Low-pass filter: 500 Hz, 1 kHz, 5 kHz, 10 kHz, 20 kHz |
| Vibration meter mode | Acceleration: rms, EQ 0-peak, Waveform peak, Crest factor Velocity: rms, EQ 0-peak Displacement: rms, EQ 0-peak, EQ peak-peak |
| Sampling frequency | 51.2 kHz |
| Store functions | Instantaneous value store, Auto store, Average value store |
| Threshold evaluation function | Allows setting a threshold value for a vibration quantity, with on-screen indication when the vibration quantity exceeds the threshold during measurement |
| ISO absolute value evaluation function | Evaluation of instantaneous value or average value can be performed based on ISO 10816-1:1995/Amd.1:2009 |

| | |
|------------------------------|--|
| FFT analysis mode | Power spectrum Time waveform of 1 frame |
| Frequency range | 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz |
| Number of analysis lines | 200, 400, 800, 1 600, 3 200 (Number of sampling points: 512, 1024, 2048, 4096, 8192) |
| Time window functions | Rectangular, Hanning, Flat-top |
| Average processing functions | Linear average, Exponential average, Maximum value hold (MAX) |
| Display functions | Display units: Acceleration: m/s ² , G, in/s ² ; Velocity: mm/s, in/s; Displacement: mm, um, mil |
| Waveform recording | Recording of vibration waveform during measurement |
| Sampling frequency | Vibration meter mode: 51.2 kHz (fixed) FFT analysis mode: Frequency range x 2.56 |
| Quantization bit rate | 24 bit (fixed) |
| Trigger measurement | Trigger modes: Free, Single, Repeat Trigger source: Vibration meter mode: Vibration quantity, Time, External, Tacho pulse FFT analysis mode: Waveform, Time, External, Tacho pulse |

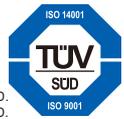
Option

Waveform Analysis Software AS-70

Waveform processing software for display and analysis of waveform data collected with SX-A1VA



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3-20-41, Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan
Tel: +81-42-359-7888 Fax: +81-42-359-7442