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SMS-Rotor Care

Rotor Quality

Dynamic Balance

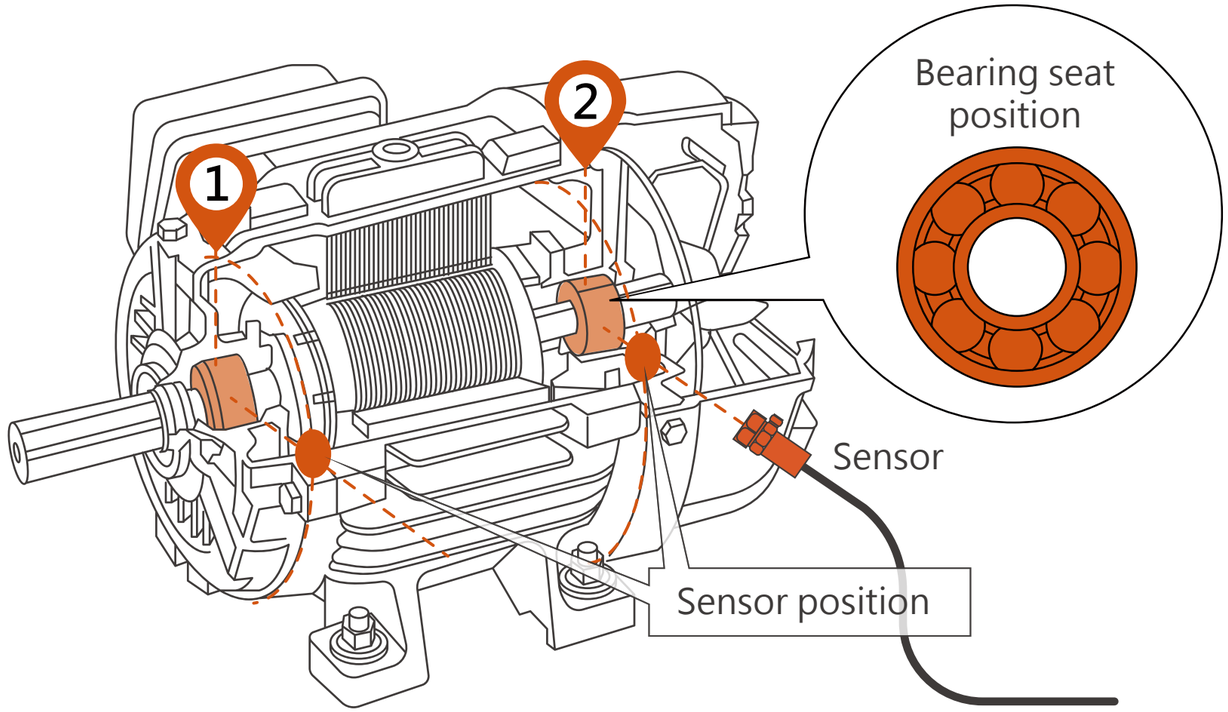
Spectrum Analysis

Vibration Meter

Goodtechnology.com.tw

- It is forbidden to splash water on this instrument.
- Do not touch the switch and power cord when your hands are wet.
- It is forbidden to use any damaged or exposed metal power cords,plugs, and sockets to connect to the instrument.
- It is forbidden to drop the instrument severely.
- It is forbidden to make any unauthorized modification, unauthorized disassembly or repair of this instrument.
- Avoid placing the instrument in a humid computer room environment.
- When the instrument is connected to the power supply, it is forbidden to touch any live parts and to open the case.
- When charging, please turn off the device and prohibit charging while using the instrument.

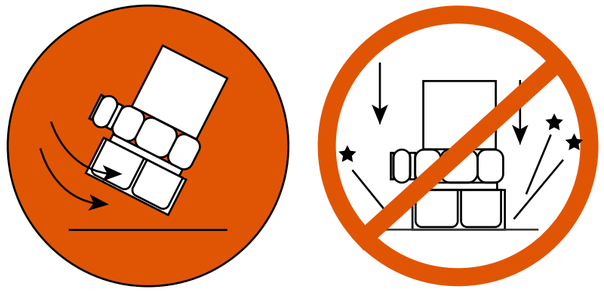
Mount the sensor to where is the nearest to the bearing on motor shell



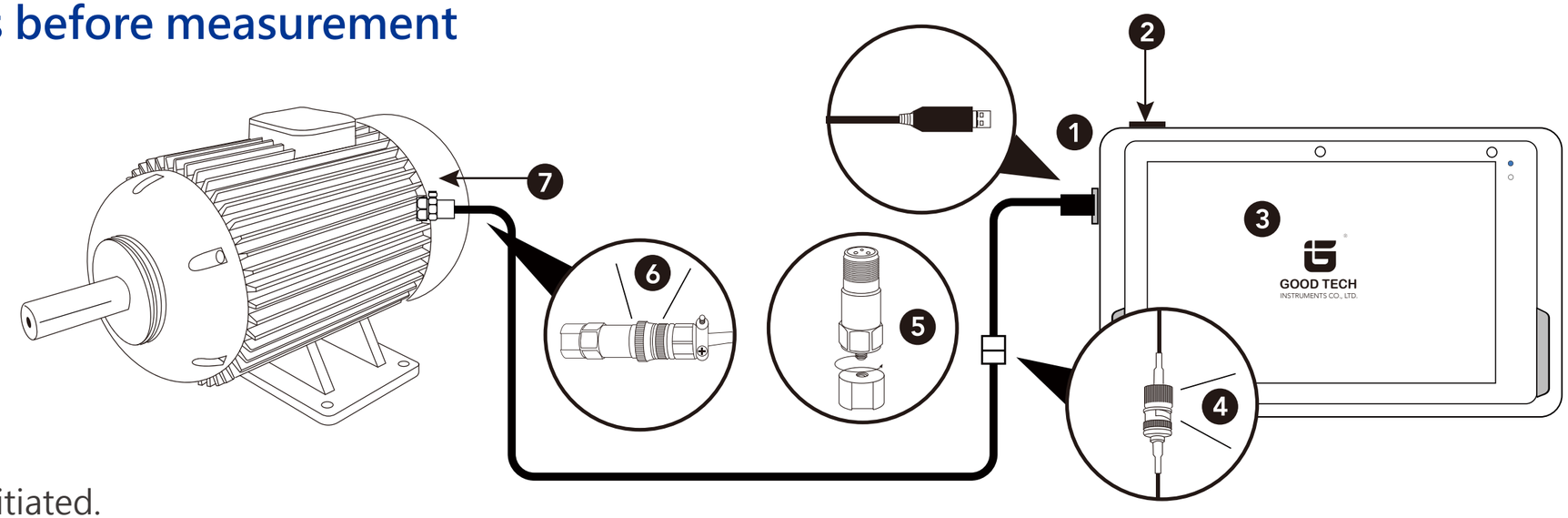
Attention

How to use the probe：When the attachment space is small and the magnetic base cannot be placed, please use the probe. Rotate and remove the magnetic base on the sensor first, and then install the probe, and the probe must be tightly connected to the sensor, otherwise the measured value will be inaccurate.

Caution for sensor mounting：Mount the magnet/sensor assembly to the prepared test surface by gently “rocking” or “sliding”.Do not directly impact the sensor to cause damage to the sensor.



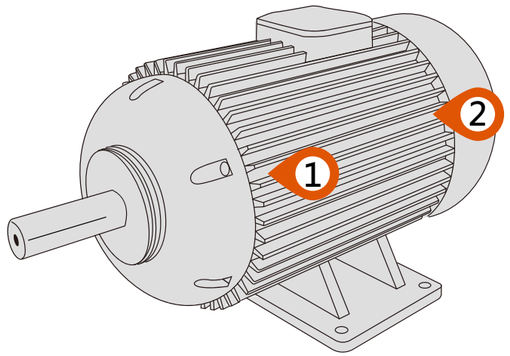
Installation steps before measurement



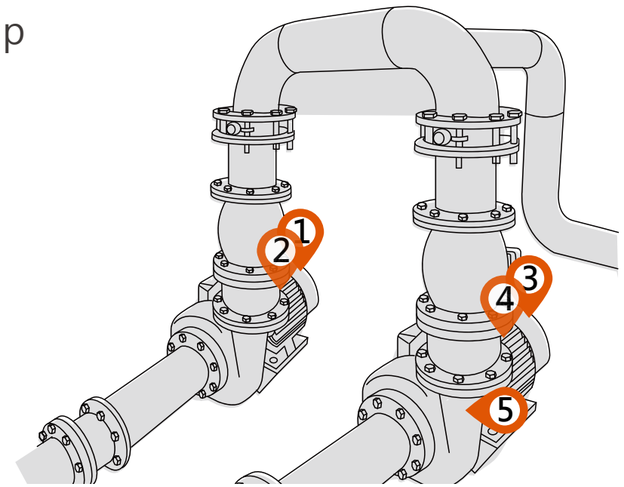
1. Insert the USB jack.
2. Turn on the power.
3. The software has initiated.
4. Lock the vibration signal transmission line to DAQ USB connector cable.
5. The vibration sensor is rotated and locked to the magnetic base.
6. Lock the vibration sensor to the vibration signal transmission line.
7. The vibration sensor is mounted to the motor shell and you can start the measurement.

Suggested Measuring Point

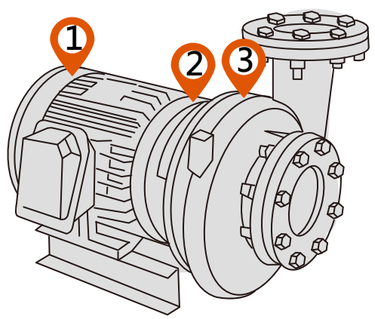
Motor

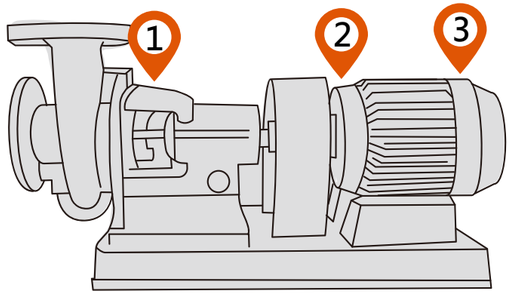


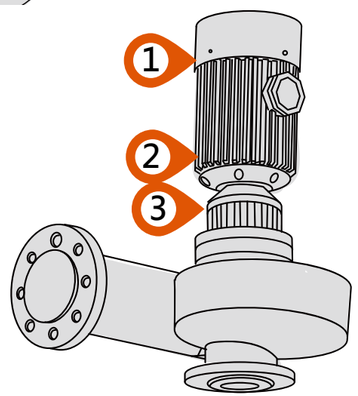
Scroll Pump



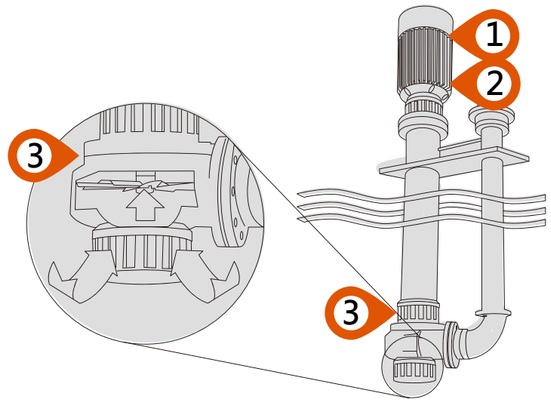
Scroll Pump



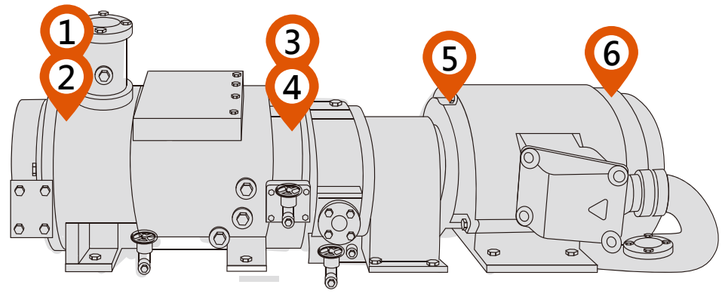




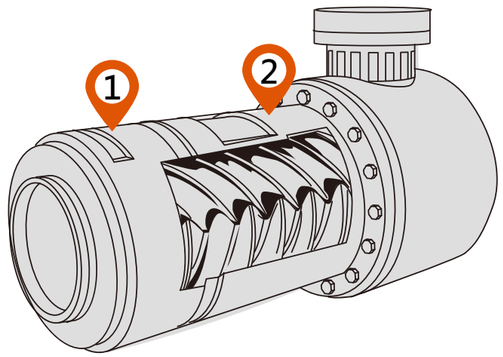
Water Pump



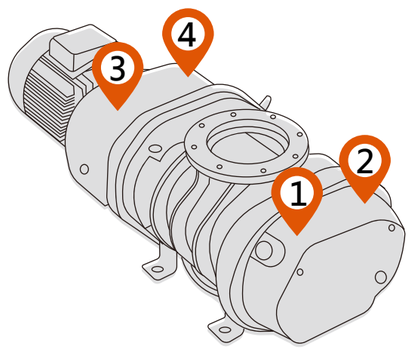
Air compressor



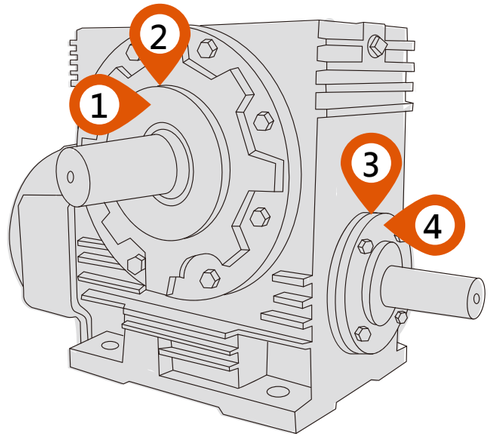
Vacuum pump



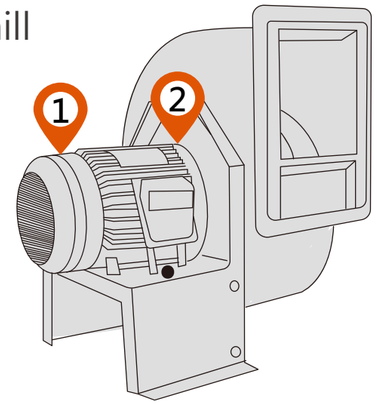
Dry pump

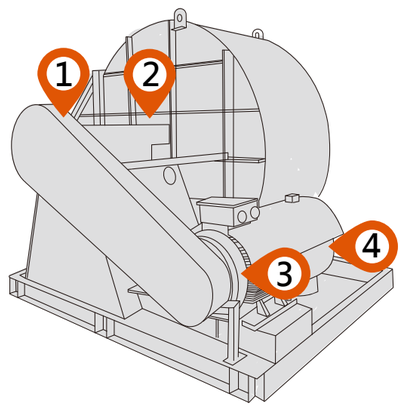


Gearbox

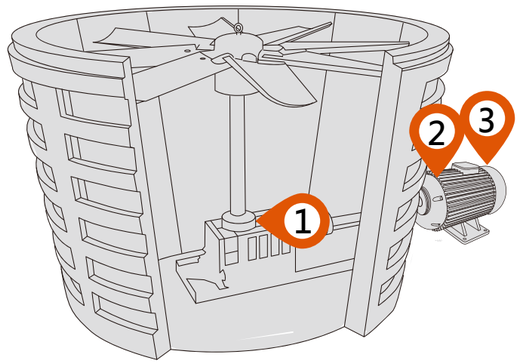


Exhaust Windmill

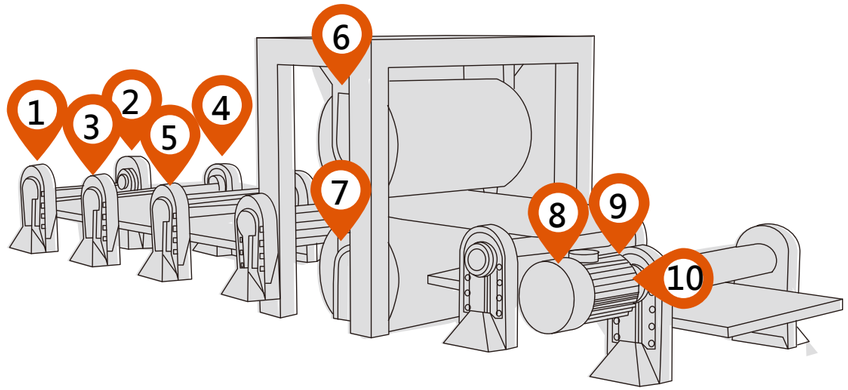




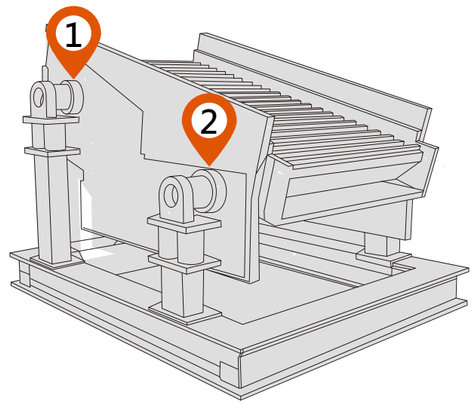
Cooling Tower



Roll-to-roll equipment



Roll to Roll Conveyor Belt



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SMS-Rotor Care

Software name

Diagnosing rotors quality according to ISO 10816 stan-dard.

Diagnosing rotors G level based on ISO 1940 dynamic balance.

Rotor Quality

Dynamic Balance

Spectrum Analysis

Vibration Meter

Back to window

Shut down table

A built-in precise vibration meter.

Spectrum analysis on Frequency do-main(FFT) and Time domain.

Guide

Suggested Measuring Point

Function Description

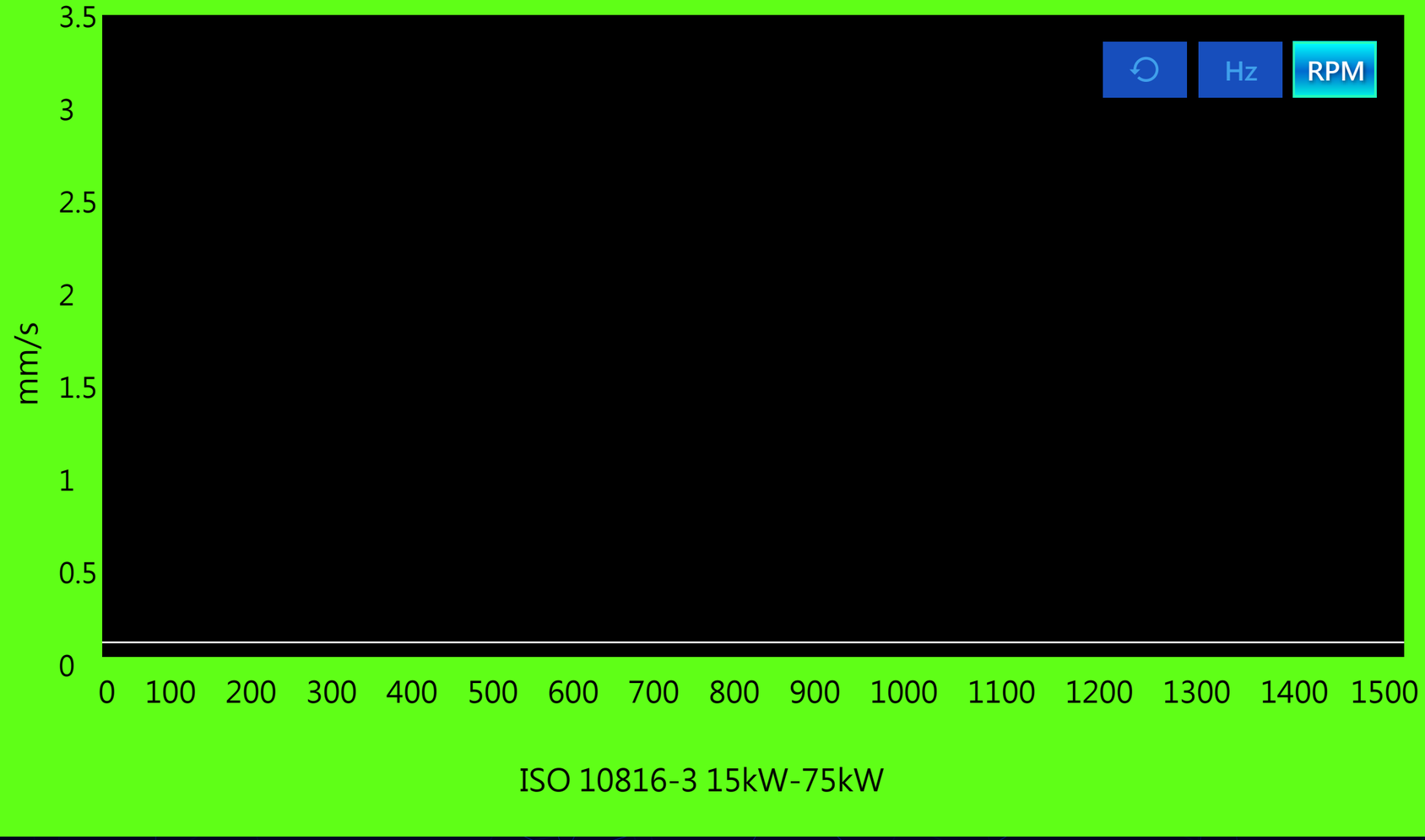
Back

Measuring time：28 s

Rotor Quality

Vibration Value :

Good



Measuring time：28 s

Rotor Quality

Vibration Value :

Good

Hz

RPM

3.5

3

2.5

2

1.5

1

0.5

0

mm/s

1300

1400

1500

ISO 10816-3 15kW-75kW

Setting

Choose the applicable specification

ISO 10816-3 15kW-75kW

Bandpass Filters

Hz ~ Hz

Cancel

OK

Diagnosing rotors quality according to ISO 10816 standard.

Setting

Start measuring

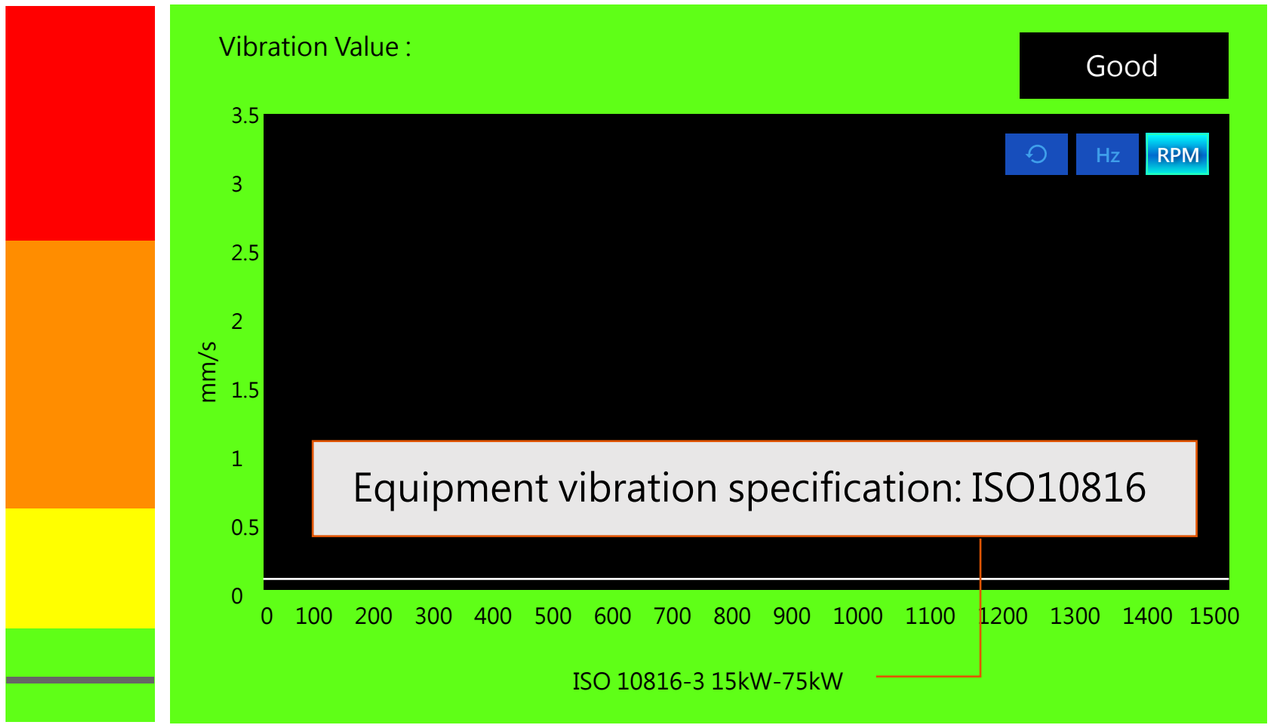
Save file

Screen photo

Function Description

Suggested Measuring point

Return to the main screen



<

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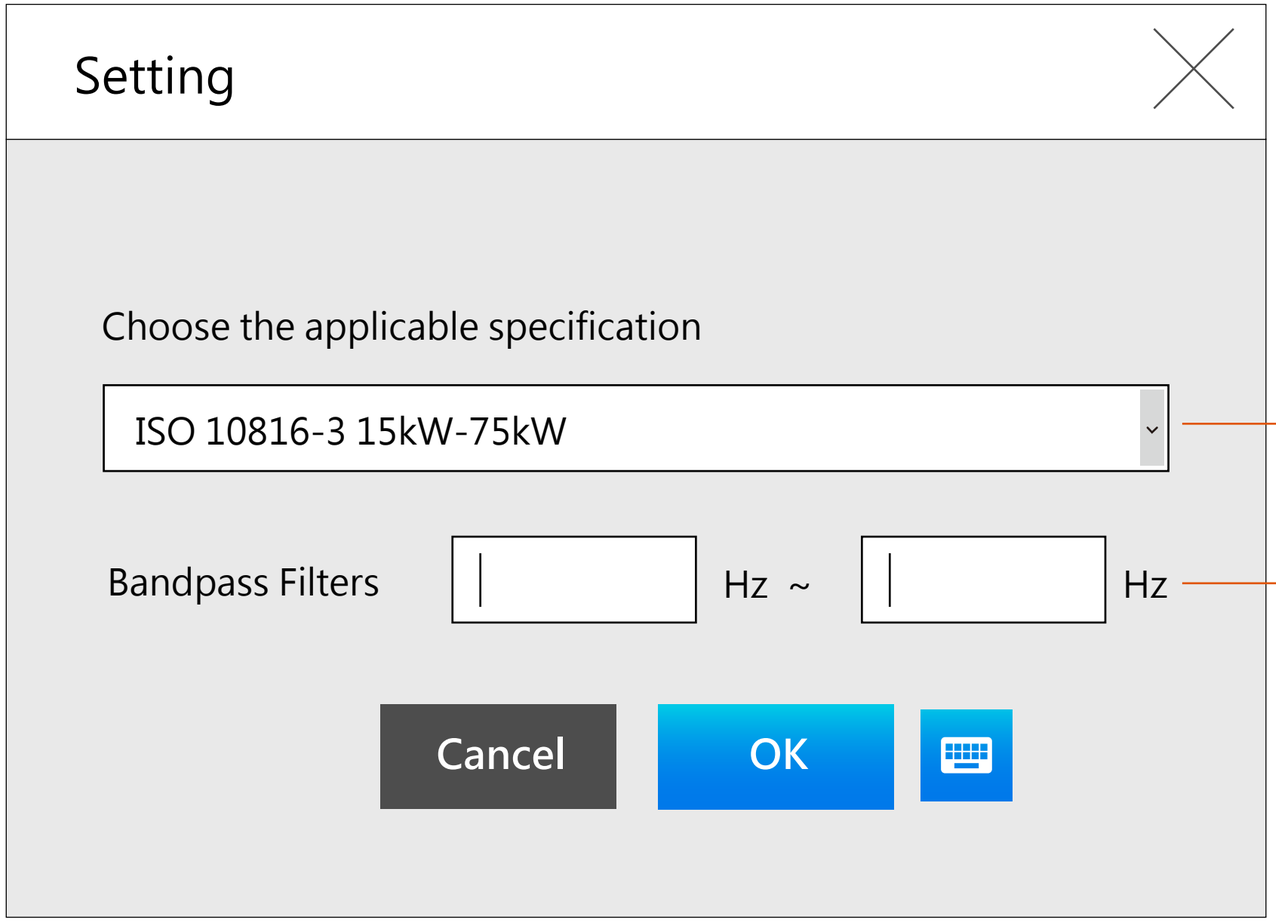
Back



ISO 10816 standard Index

Filter range 10 Hz – 1000 Hz

It's an advanced function: filter the structural low frequency driven from reciprocating air compressor, dry pump, compound rotor system, etc.

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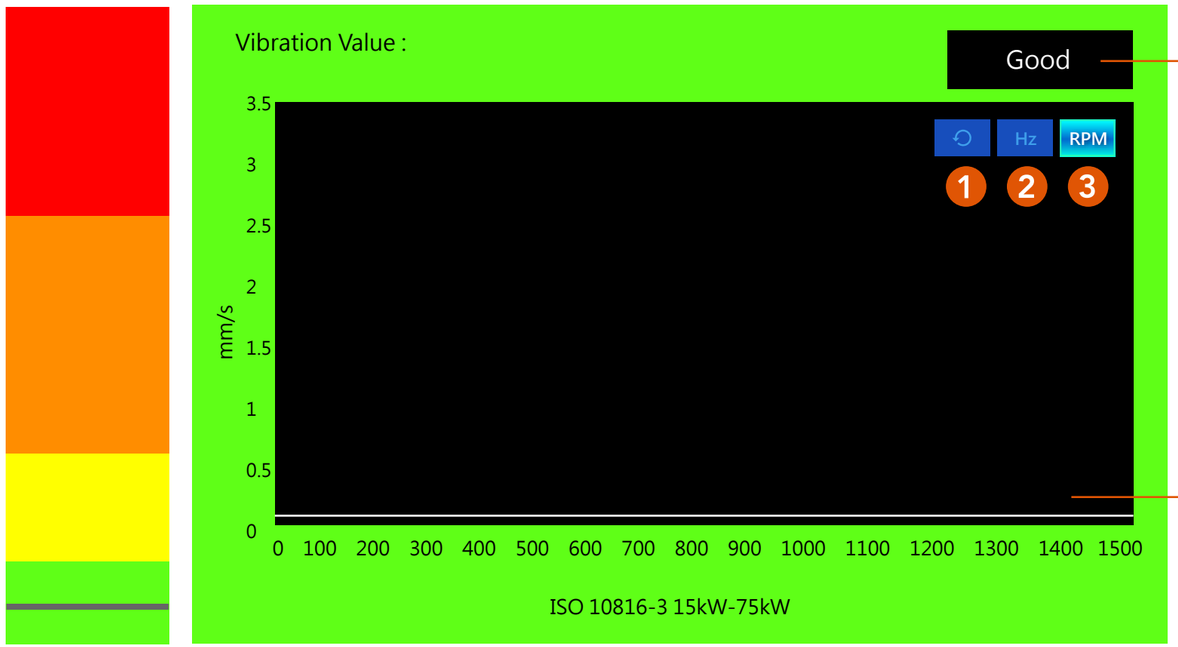
Rotor Quality Function Description



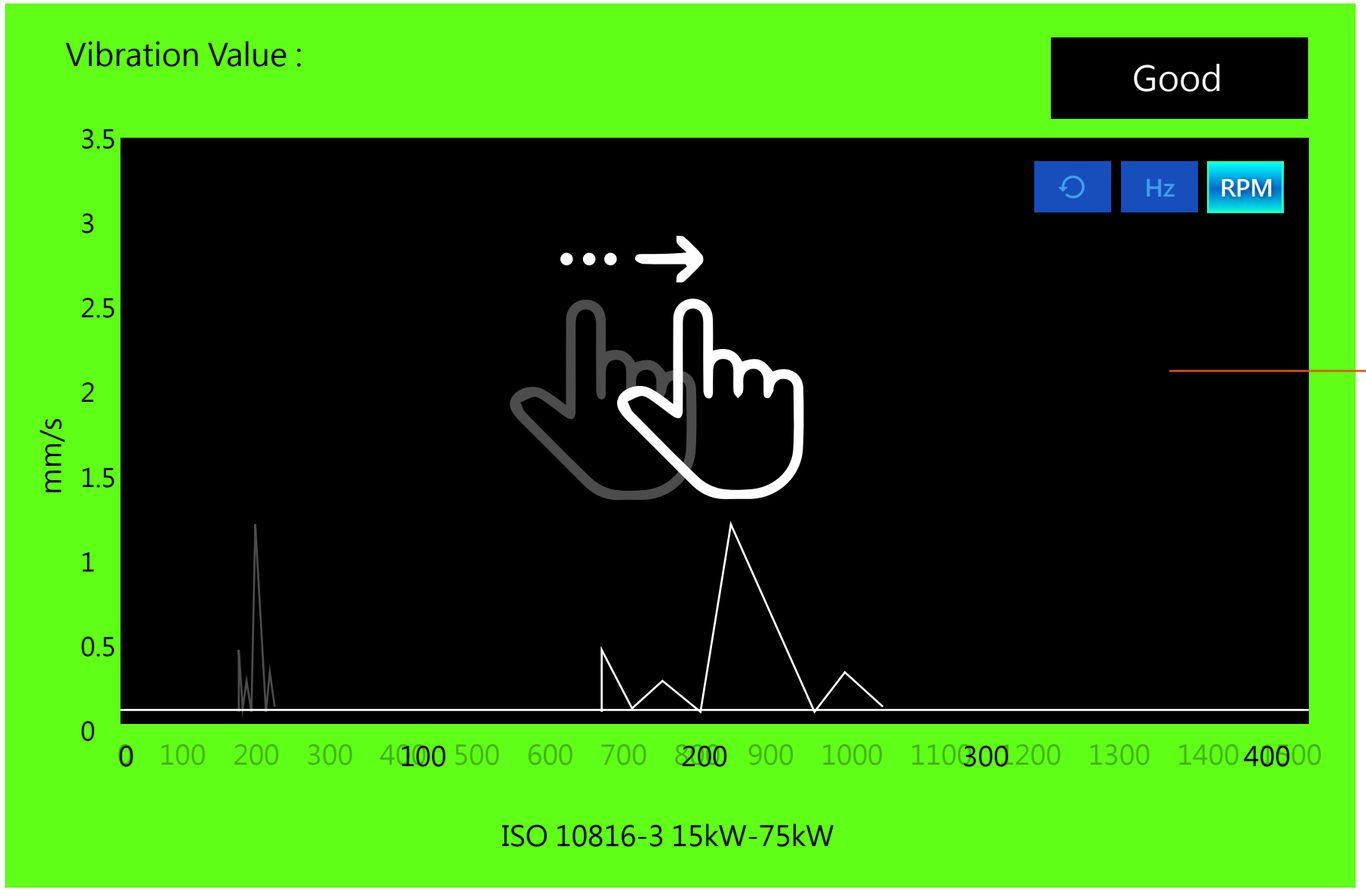
Device status：Good / Satisfactory
Unsatisfactory / Unacceptable

1. Restore after zoom in
2. Select Hz unit
3. Select RPM(CPM) unit

FFT chart

- Good：New machinery, excellent vibration quality, no specific deadline.
- Satisfactory：Acceptable vibration value, the machine can be used for a long time, there is no specific time limit.
- Unsatisfactory：Machine hasn't been used for a while. Maintenance or repair is needed.
- Unacceptable：Immediate repair is recommended.

Rotor Quality Function Description



Swipe your finger from left to right on the chart to zoom in on the chart.

Restore after zoom in.

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Flexible & Rigid

According to the ISO specification, the equipment of different wattages and the nature of the base (flexible or rigid base) are divided into four groups to define the normal, alert, and dangerous vibration values of the equipment.The types of mechanical assembly supporting the rotor are divided into : flexible structure (Flexible), rigid structure (Rigid).

Flexible：
1. Usually fixed on the shock mount. There are rubber or springs under the motor base.
2. The motor equipment is assembled from flexible bearings, structural supports and foundations.

Rigid：
Rigid structure: For the entire system (Rotor + base), the lowest natural frequency must exceed the mechanical working speed (working frequency)25% or more, making it a rigid structure.

Measuring time : 28 s

Dynamic Balance

G1

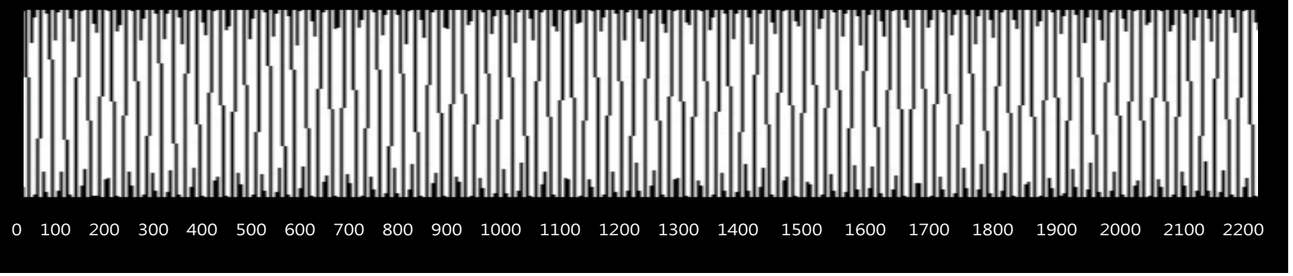
Audio and video drives, Grinding machine drives

The current G level ： **G1**

Value : **0.9**

RPM ： 3600(Auto)

Speed amplitude



No Spec.

Measuring time : 28 s

Dynamic Balance

G0.4 G1 G1600 G4000

Setting

Please find your rotor equipment

G0.4 Spindles,Dics,and armatures of precision grinders,Gy

Please enter the device speed value

RPM

Cancel OK

The current G

500(Auto)

Speed ampli

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200

lo Spec.

Measuring time : 28 s

Dynamic Balance

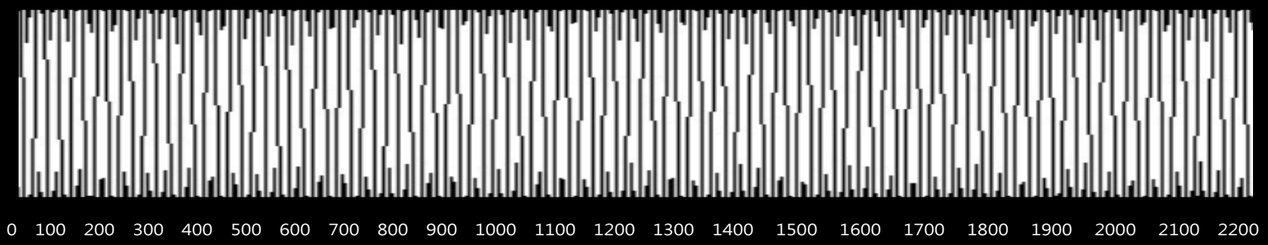
G40

Cars: wheels, wheel rims, wheel sets, drive shafts

Crankshaft drives, inherently balanced, elastically mounted

The current G level ： **G630**　　Value : **420**　　RPM ： **3600**

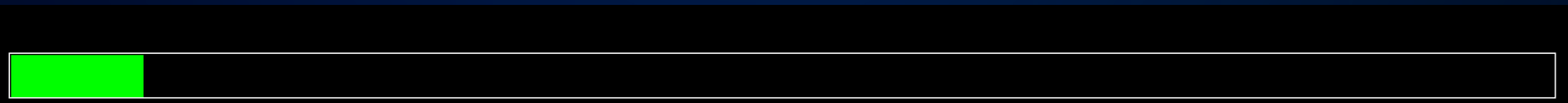
Speed amplitude



Fail

Measuring time : 28 s

Dynamic Balance



G1

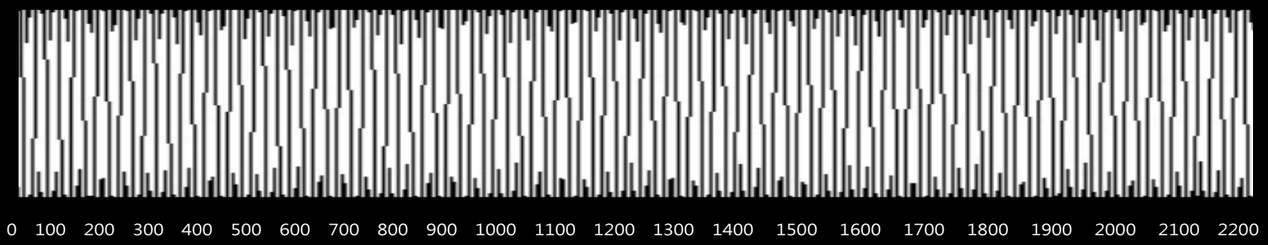
Audio and video drives, Grinding machine drives

The current G level ： **G1**

Value : **0.8**

RPM ： **3600**

Speed amplitude



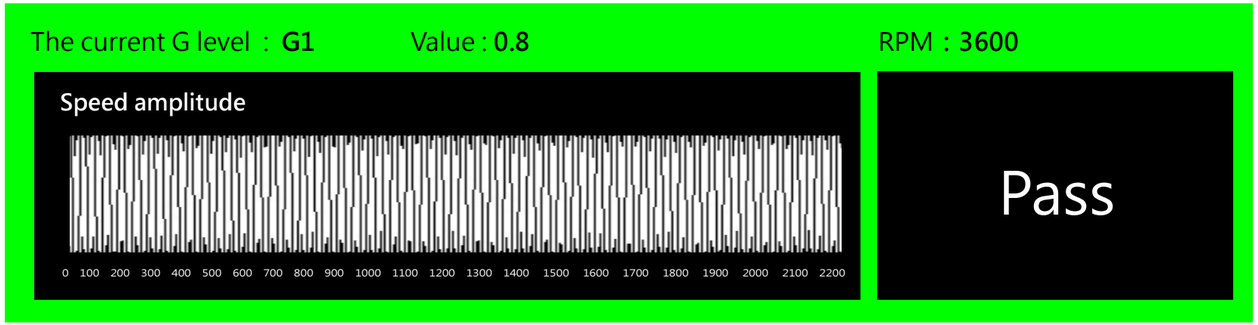
Pass

Diagnosing rotors G level based on ISO 1940 dynamic balance.

- Setting
- Start measuring
- Save file
- Screen photo
- Function Description
- Suggested Measuring point
- Return to the main screen

G1

Audio and video drives, Grinding machine drives



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Dynamic Balance Function Description

Severity bar and signals; Green for pass, Red for fail.

The diagnostic G level, value figure.

The current G level ： **G1** Value : **0.8**

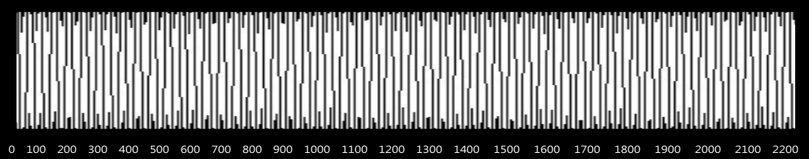
G1

Audio and video drives, Grinding machine drives

The current G level ： **G1** Value : **0.8** RPM : **3600**

The display of G level set, RPM set

Speed amplitude



Pass

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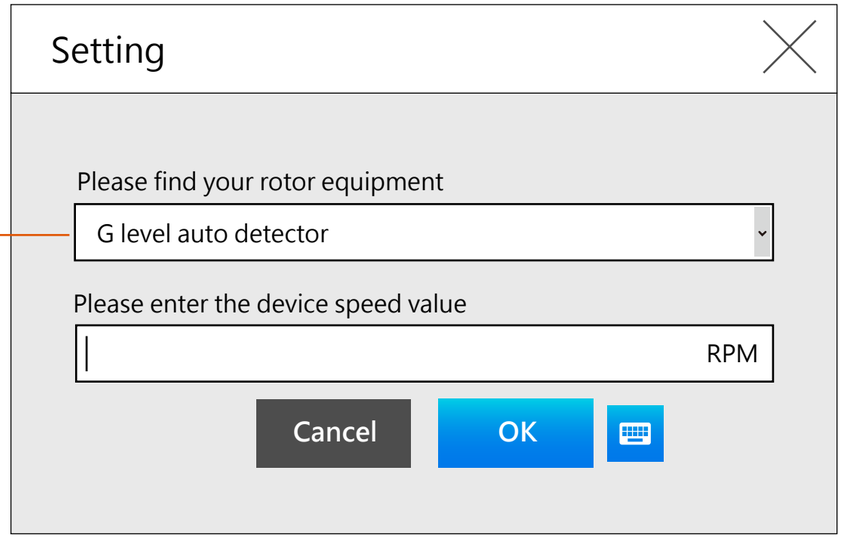
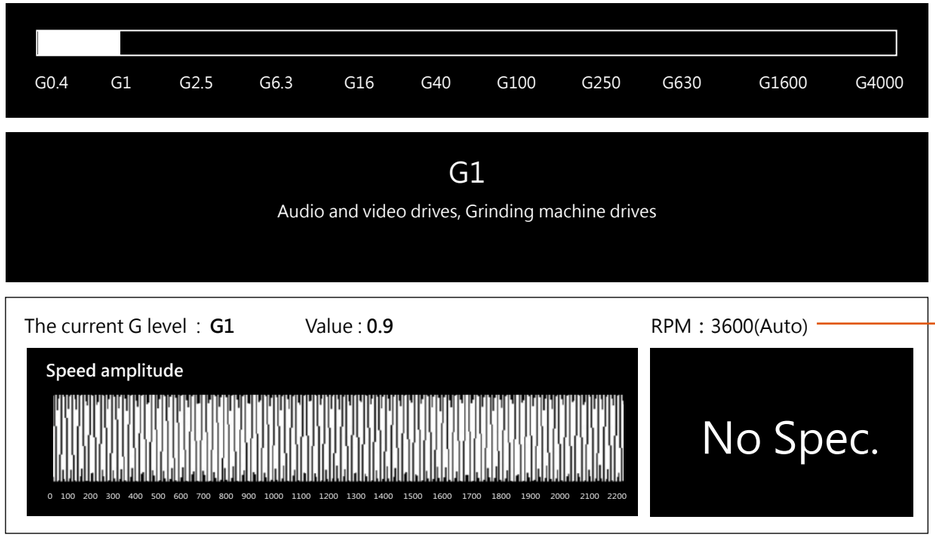
Dynamic Balance Function Description

If user doesn't enter RPM figure, the system will automatically detect the speed and marked (Auto) at the end.





If user can't find the target measured object in the menu, or user has no idea what G level his object is, please select G level auto detector instead. The color criticality will be disabled and result to be shown only in white.

Guidance for balance quality grades for rotors in a constant (rigid) state

G 0.4：Gyroscopes, Spindles and drives of high-precision systems

G 1：Audio and video drives, Grinding machine drives

G 2.5：Compressors, Computer drives, Electric motors and generators (of at least 80 mm shaft height), of maximum rated ; speeds above 950 r/min,Gas turbines and steam turbines, Machine-tool drives, Textile machines

G 6.3：Aircraft gas turbines, Centrifuges (separators, decanters) ; Electric motors and generators (of at least 80 mm shaft height), of maximum rated ; speeds up to 950 r/min ; Electric motors of shaft heights smaller than 80 mm ; Fans, Gears, Machinery, general, Machine-tools, Paper machines, Process plant machines, Pumps, Turbo-chargers, Water turbines

Guidance for balance quality grades for rotors in a constant (rigid) state

G 40：Cars: wheels, wheel rims, wheel sets, drive shafts, Crankshaft drives, inherently balanced, elastically mounted

G 100：Complete reciprocating engines for cars, trucks and locomotives

G 250：Crankshaft drives, inherently unbalanced, rigidly mounted

G 630：Crankshaft drives, inherently unbalanced, elastically mounted

G 1600：Crankshaft drives for large slow marine diesel engines (piston speed below 9 m/s), inherently balanced

G 4000：Crankshaft drives for large slow marine diesel engines (piston speed below 9 m/s), inherently unbalanced

Measuring time : 28 s

Spectrum Analysis

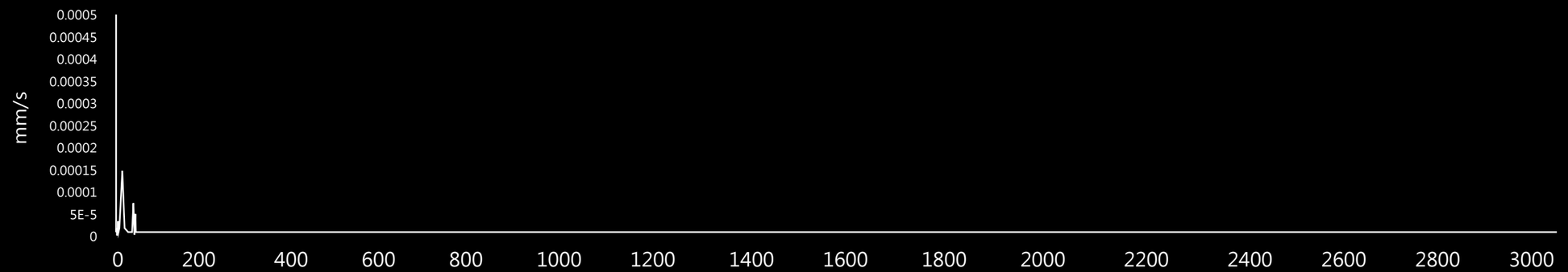
Maximun Peak : 30 RPM

Vibration Value：0.00015 mm/s RMS

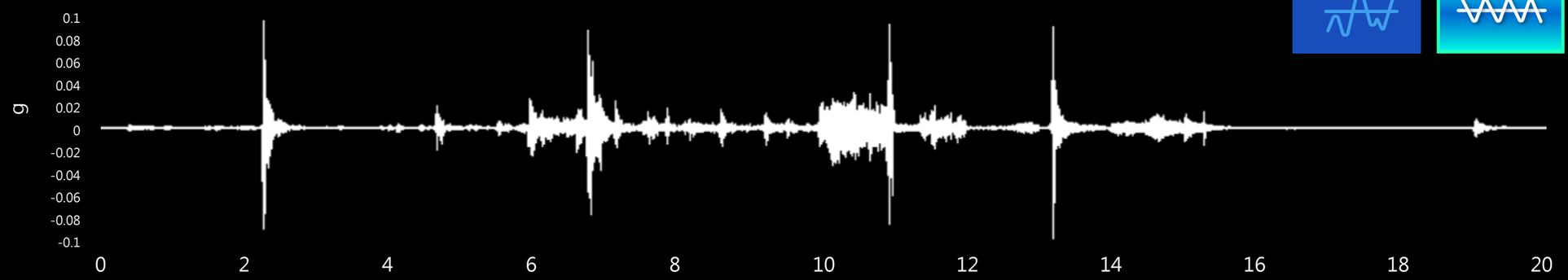
Hz

RPM

Frequency-domain (FFT)



Time-domain



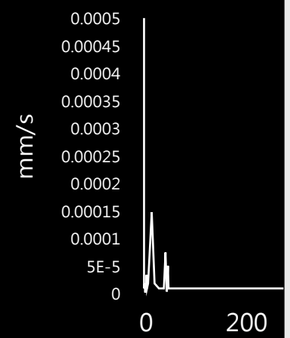
Maximun Peak : 30

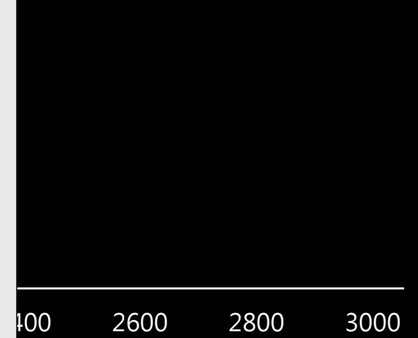
Vibration Value : 0

Hz

RPM

Frequency-domain





Time-domain

Setting

Physical quantity: Acceleration

View: Peak to Peak

Metric System: mm/s

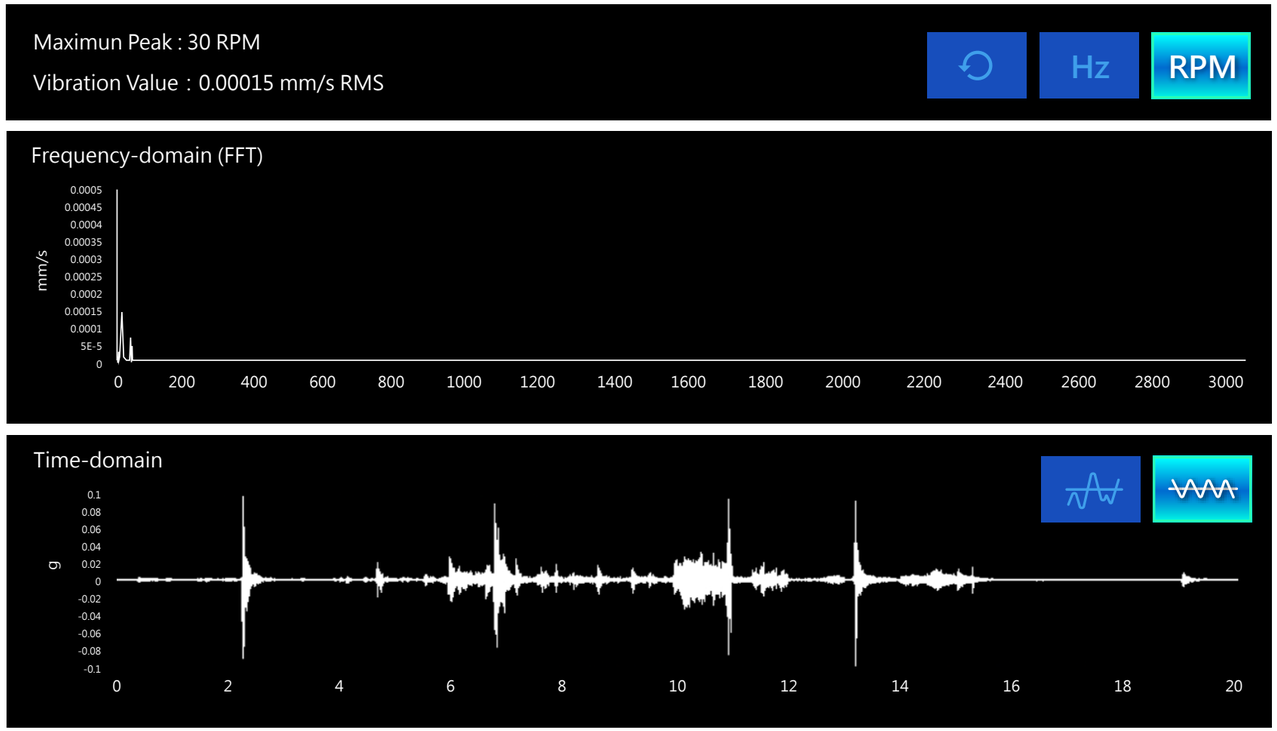
Frequency Range (1~3000Hz): Hz ~ Hz

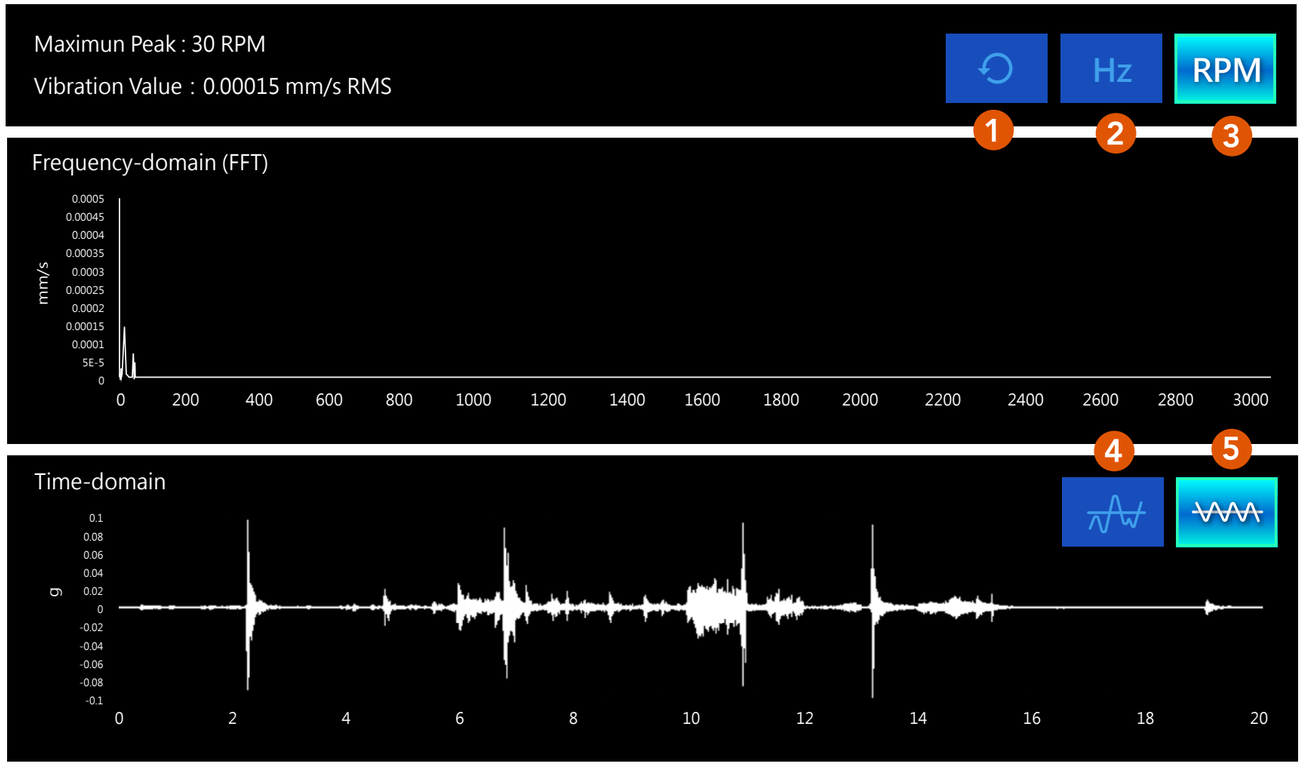
Cancel

OK

Spectrum analysis on Frequency domain (FFT) and Time domain.

- Setting
- Start measuring
- Save file
- Screen photo
- Function Description
- Suggested Measuring point
- Return to the main screen





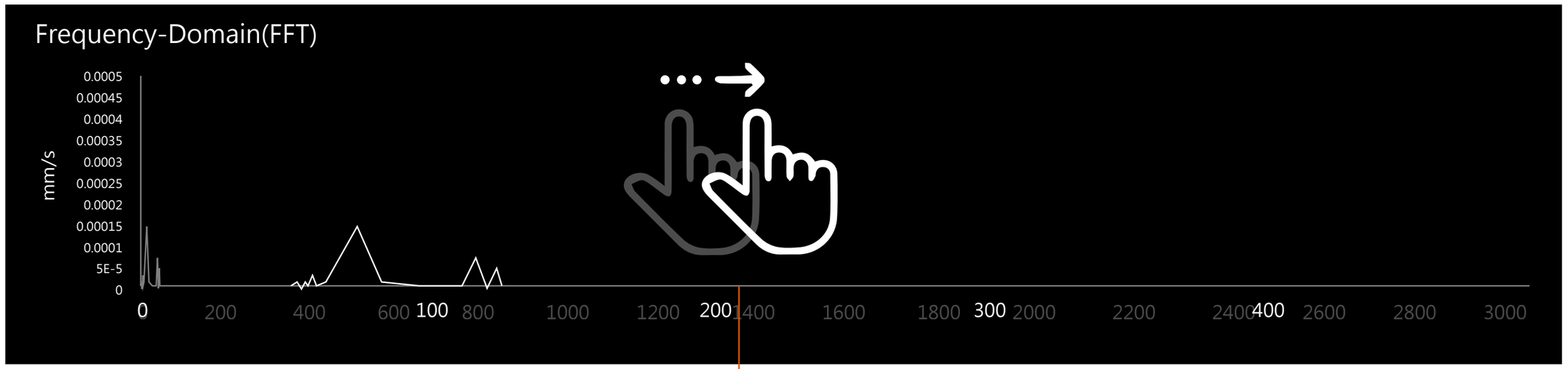
1. Restore after zoom in
2. Select Hz unit
3. Select RPM(CPM) unit
4. Using timing：unsteady signal analysis
5. Using timing: steady signal analysis

Spectrum characteristics

Spectrum Analysis Function Description

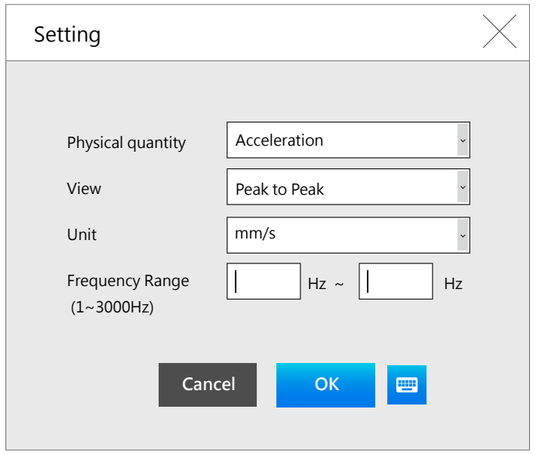
Maximun Peak : 30 RPM

Vibration Value：0.00015 mm/s RMS



Swipe your finger from left to right on the chart to zoom in on the chart.

Restore after zoom in.

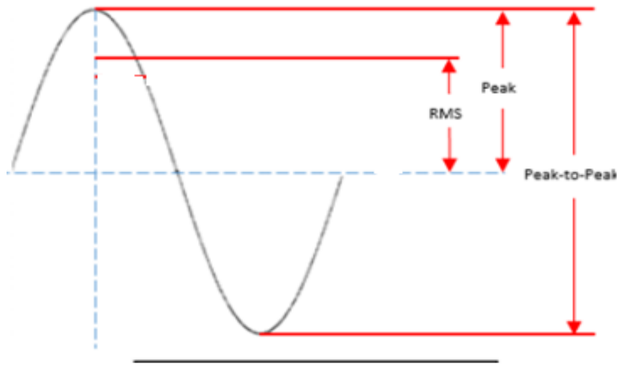


Physical quantity：select the physical quantity.

View：Select amplitude characteristics.

Unit：Metric / Imperial units.

Frequency range：Type in the start frequency range / End frequency range interval.

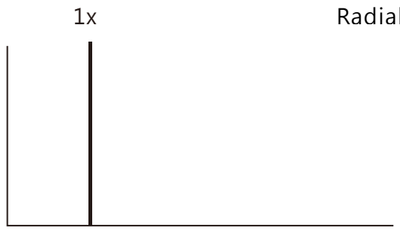


Amplitude：Peak to Peak > 0 to Peak > RMS

Babbitt Bearing / Mega Structure：Displacement Peak to Peak

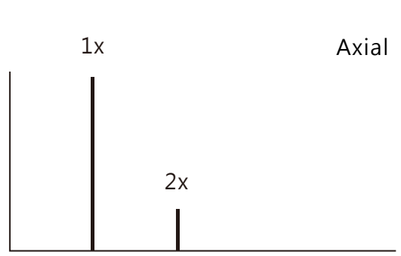
Motor / Pump / Rotating Equipment：Velocity RMS

Equipment above 500Hz frequency ：Acceleration RMS



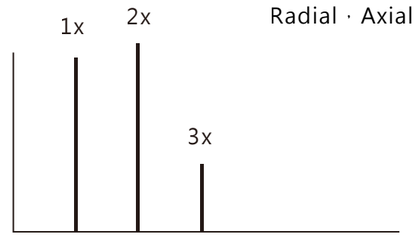
Poorly balanced vibration characteristics

- Vibration spectrum mainly occurs at double speed.
- The direction of vibration usually occurs in the radial direction.
- The axial amplitude is very small, much smaller than 1/3 of the radial.
- No matter in the radial or axial direction, there is almost no vibration of 2 times, 3 times, 4 times or other doubled frequencies.



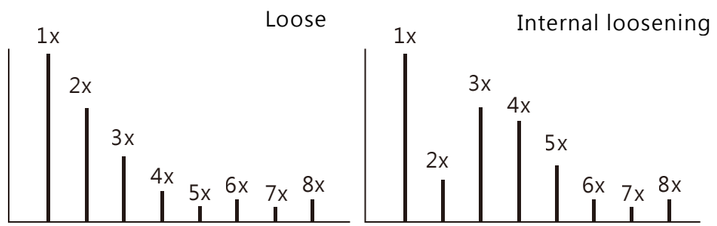
Vibration characteristics of shaft bending

- The bending at the center of the shaft will cause vibration of 1 times the speed frequency, and the vibration direction mainly occurs in the axial direction.
- The bending near the coupling causes the vibration of 2 times the speed frequency, and the vibration direction also occurs in the axial direction.



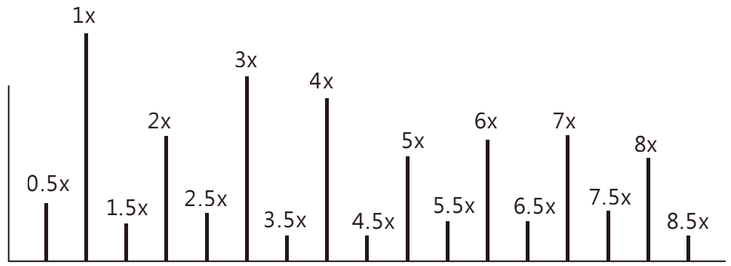
Vibration characteristics of poor alignment

- The vibration frequency mainly occurs at 1, 2, or 3 times the speed.
- Because most of the misalignment is a mixed misalignment (angle + parallel), the vibration direction comes from both radial and axial directions.



Vibration characteristics of mechanical looseness

Regardless of external looseness or internal looseness, the frequency spectrum will show obvious 1x, 2x, 3x...7x, 8x or higher speed frequencies, and the radial and axial directions have the same characteristics. The spectrum of external and internal loosening is usually slightly different.



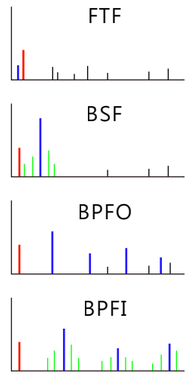
Vibration characteristics of shaft friction

- When the rotating parts rub against the fixed parts, the frequency spectrum is similar to looseness.
- Usually excites the sub-harmonic frequency (1/2, 1/3, 1/4...) of an integer fraction of the rotation speed.

The damage characteristics of the four components of the bearing can be classified as follows:

	Main wave frequency	Harmonics	Sidebands
FTF	Lowest	No	No
BSF	Second lowest	No	Yes
BPFO	Second highest	Yes	No
BPFI	Highest	Yes	Yes

Sometimes when the bearing is damaged, its characteristics are not 100% the same as the above table. It depends on the severity of the bearing damage and whether there is a load change at the damaged point.



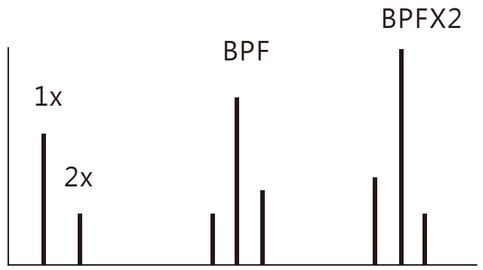
Damaged rolling bearings

Damage frequency of bearing rolling element (BSF)
BSF=1/2 xRPM x Pd/Bb x (1-Bd/Pd x cosø)2)

Damage frequency of bearing inner ring track (BPFI)
BSFI=1/2 xRPM x N x (1-Bd/Pd x cosø)

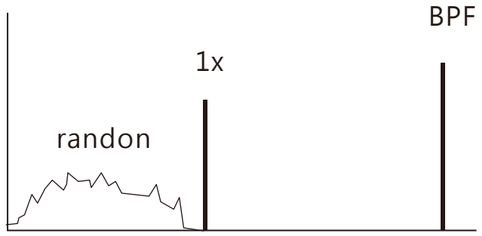
Damage frequency of bearing outer ring track (BPFO)
BSFO=1/2 xRPM x N x (1+Bd/Pd x cosø)

Bearing retainer damage frequency (FTF)
FTF=1/2 xRPM x (1xBd/Pd x cosø)



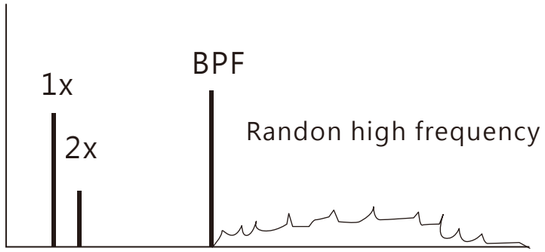
Blade vibration

- Blade frequency (BPF) = number of blades x speed, which is the natural frequency of pumps, windmills and compressors.
- However, if the design is improper, the diffuser is worn, the pipeline is steeply bent, the turbulence is obstructed, or the shaft is eccentric, all will cause high BPF



Fluid turbulence

- When the air enters and exits the windmill, sudden changes in pressure or speed will cause turbulence.
- Spoilers usually produce random, low-frequency vibrations, ranging from about 1 to 30 Hz.



Pitting

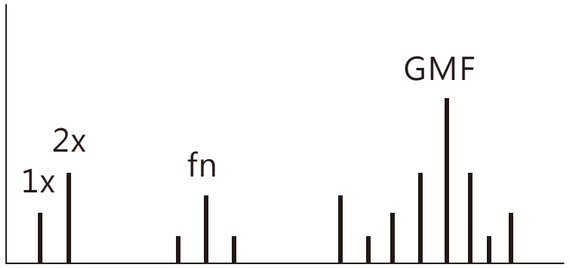
· When the pump inlet pressure is insufficient, pitting corrosion (cavitation) is easy to occur.

· Pitting corrosion usually produces random, high-frequency and wide-band vibration, which will cause corrosion inside the pump.

Gear vibration (normal)

· Gear meshing frequency (GMF) = gear x speed.

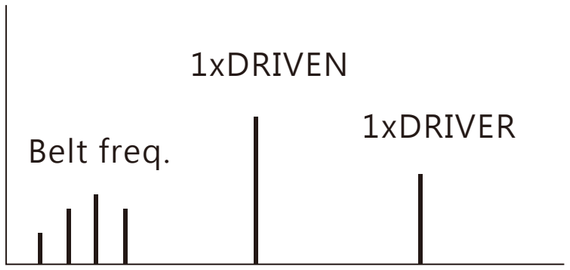
· GMF is the natural frequency of the gear mechanism, and its size represents the amount of load, not wear.



Gear vibration (abnormal)

· The frequency spectrum characteristic when the gear is worn, eccentric or the two shafts are not parallel is: the natural frequency of the gear will be excited fn.

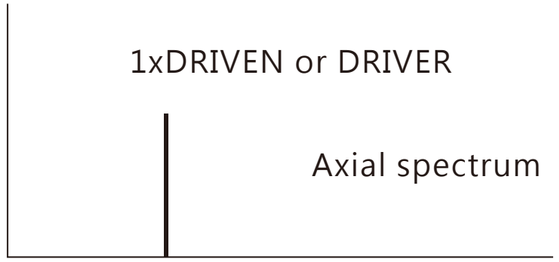
· GMF becomes larger, and with the increase in side wave wear of the worn gear speed, side wave will also increase and increase. When eccentric or two shafts are not parallel, there will be 2 times GMF.



Belts and pulleys (1)

· Belt frequency = 3.14x pulley diameter x speed/belt length

· When the belt is worn, loose, or fitted incorrectly, the belt frequency of 1x, 2x, 3x, 4x is often caused.

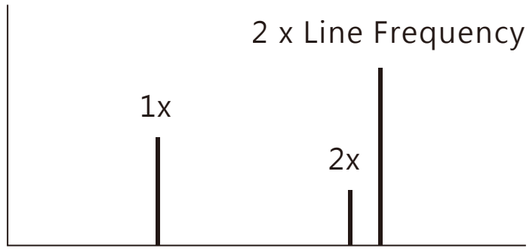


Belts and pulleys (2)

- When the pulley is out of alignment, it will appear at 1x speed. High vibration shaft is especially obvious.
- The rotational speed frequency of the driven part will be found on the frequency spectrum of the transmission part.

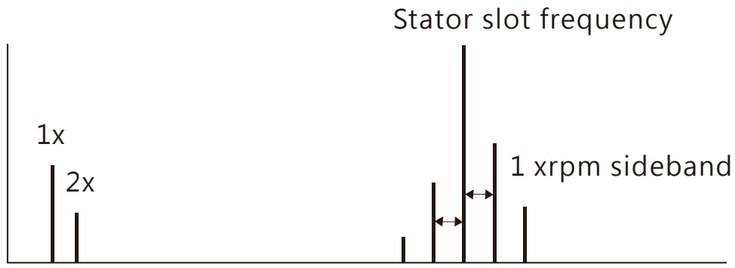
Belts and pulleys (3)

- When the pulley has an eccentricity problem, its vibration frequency spectrum characteristics are the same as the problem of poor balance. The vibration mainly occurs in the radial double frequency.



Motor stator eccentric

- Stator eccentricity will produce uneven air gap and cause vibration.
- Uneven air gap will generate local heating and bend the motor shaft, so the vibration will increase with the operating time and will cause high vibration at 2 times the line frequency (120 or 100 Hz).

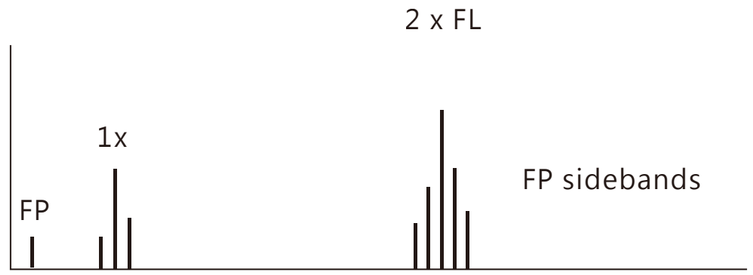


Motor stator abnormal

Stator slot frequency = number of stator slots x speed

When the stator slot is abnormal, it will produce high-frequency vibration of the stator slot

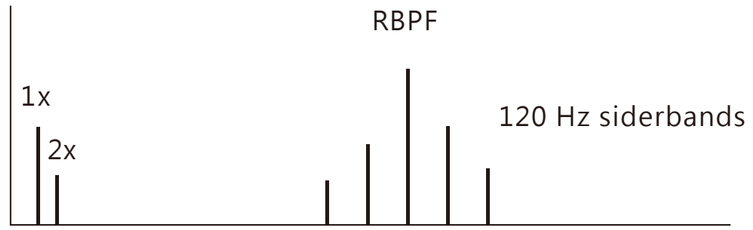
The stator slot frequency is accompanied by the side wave of the motor speed



Motor rotor eccentric

· Rotor eccentricity will produce 2 times the line frequency, accompanied by the pole pass frequency (FP = P x hysteresis frequency).

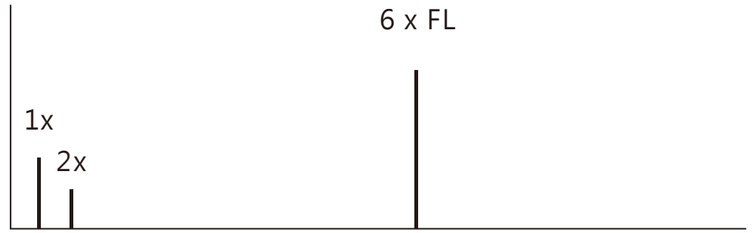
· FP will appear in the low frequency range (about 0.3~2.0 Hz)



Loose motor rotor bar

· Rotor bar passing frequency (RBPF) = number of rotor bars x speed

· When the rotor rod is loose, it will produce RBPF and 2xRBPF, accompanied by 2x FL (120 or 100Hz) side wave.



DC motor abnormal

· Damaged field windings, poor SCR, and loose couplings will produce high vibrations of 6 times the line frequency (360 or 300 Hz).

< > Back

RT MAX AVG

123456.1234

m/s^2 RMS







MAX AVG

4

Setting

Physical quantity: Acceleration

View: RMS

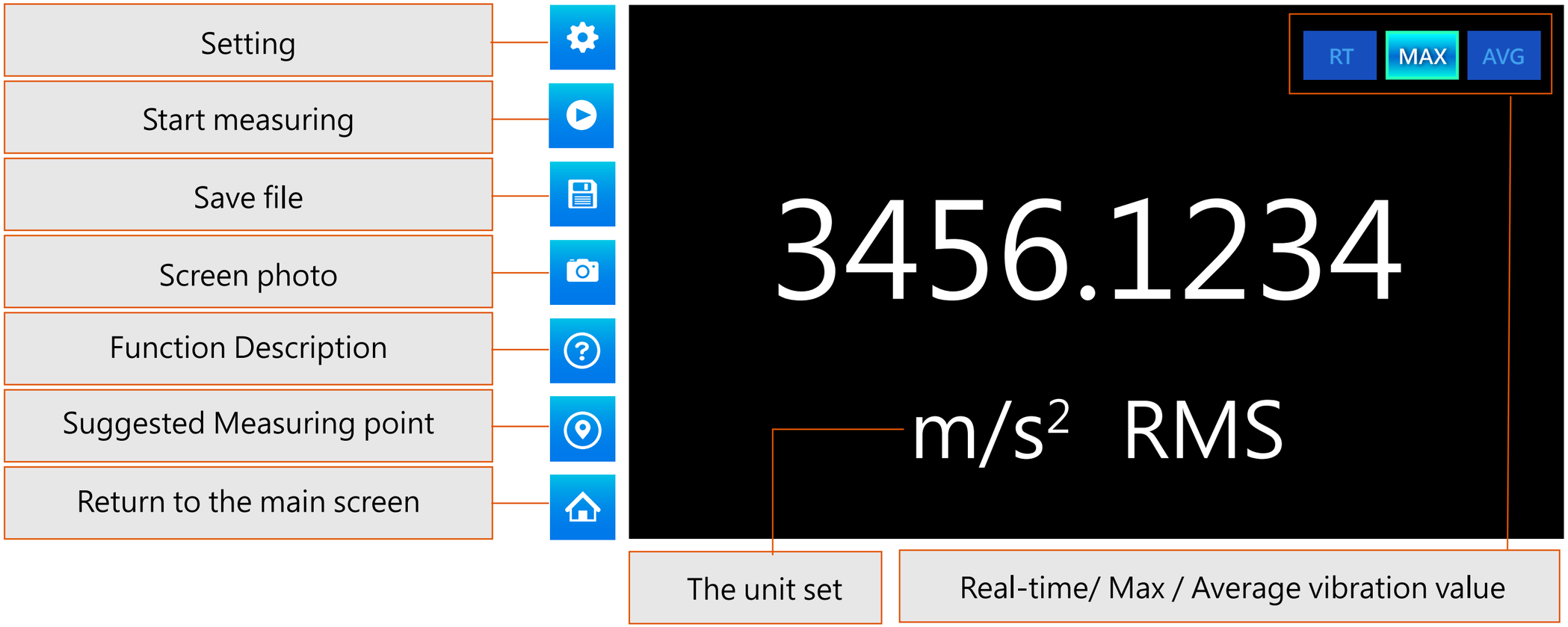
Unit: g

Filter: None

Hz

Cancel OK

A built-in precise vibration meter.



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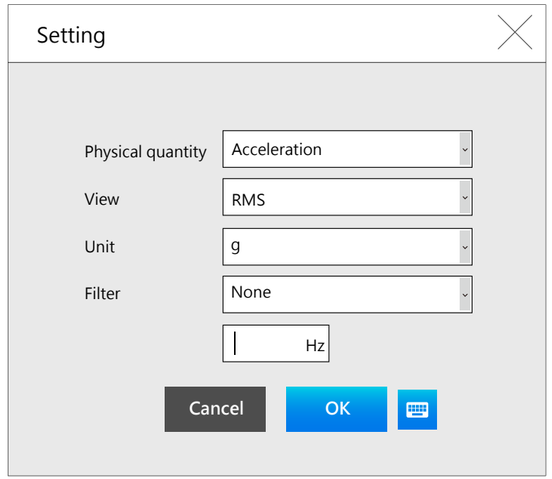
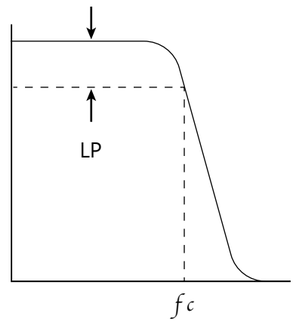
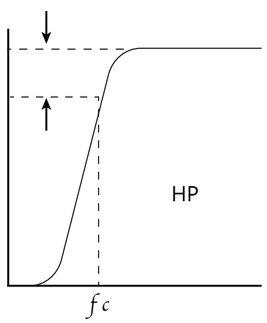




Low-pass filter frequency



High-pass filter frequency

Physical quantity：select the physical quantity.

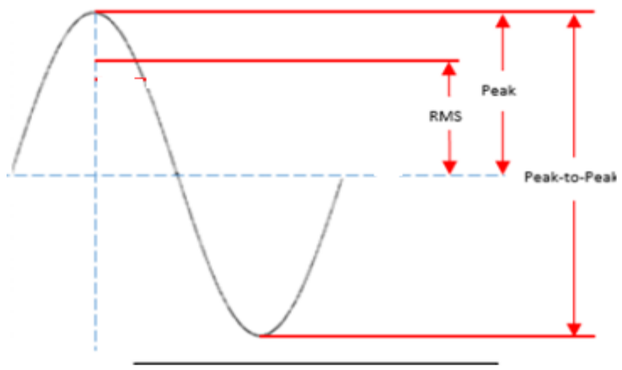
View：Select amplitude characteristics.

Unit：Metric / Imperial units.

Filter：

Low-pass filter(LPF) allows low-frequency signals to pass, but attenuates (or reduces) the passage of signals with frequencies higher than the cut off frequency.

High-pass filter(HPF) allows high-frequency signals to pass, but attenuates (or reduces) signals with frequencies lower than the cut off frequency.



Amplitude：Peak to Peak > 0 to Peak > RMS

Babbitt Bearing / Mega Structure：Displacement Peak to Peak

Motor / Pump / Rotating Equipment：Velocity RMS

Equipment above 500Hz frequency ：Acceleration RMS