

INSTRUCTION MANUAL

Portable Vibrometer: VM-3024S/H

IMV CORPORATION

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Feb 03, 2102	1.0.0	New Issue
Mar 22, 2012	1.0.1	Corrected Figures and phrases. Added optional accessories.
Apr 06, 2012	1.0.2	Added "Preparation" (3-1) Added "How to Fix the Pickup" (10)
Oct 03, 2012	1.0.3	Corrected AC OUT Sensitivity (4-4)
Dec 21, 2012	1.5.0	Added "Password Function" (4-11)

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1. Introduction

We truly appreciate your purchase.

Please read this manual carefully before use and follow the cautions below for your safety.

CAUTION

1. If the subject of the measurement could be hot, rotating, or near the movable parts, assure the safety and fix the pickup for measurement.
Do NOT hold the pickup manually in these cases to avoid any possible accidents; including burning yourself, and entangled cables.
2. Follow the instructions printed on the battery for replacement and disposal of used batteries. Pay attention to the polarity of the battery for installation.

Should you have any inquiries or find a problem during use, please consult our sales office near you or IMV quality assurance department.

1-1. Panel Description

VM-3024 is available in Standard Model or High-End Model. Icons appeared on the display are different in

each model. High-end model has these two icons, , when the machine is turned on.

Standard Model



Japanese

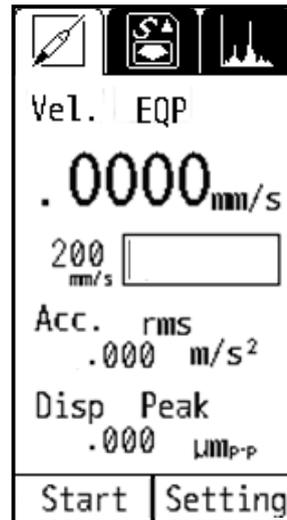


English

High-End Model



Japanese



English

In this manual, panel displays of the standard model, VM-3024S, will be used to explain basic operation in Chapter 3. Additional functions of the high-end model, VM-3024H, will follow in Chapter 5.

1-2. Package Contents
Product and Accessories for the VM-3024S/H

(1) Standard Product and Accessories

	Products	Qty	Model	Note	Figure
Main Unit	SmartVibro	1	VM-3024S/H	—	
	Pickup	1	VP-3024V	Electrodynamic velocity type	
Accessories	Probe	1	—	Handheld probe. φ8mm x 50mm	
	Output Cable	1	—	1.5m cable with a plug at one end. For output to a stroboscope or recorder, etc.	
	Battery	2	—	AA Alkaline batteries	
	Instruction Manual	1	—	With inspection report	
	SD Card	1	—	VM-3024H only	

(2) Optional Accessories

	Products	Qty	Note	Figure
1	Long Pickup Cable	CE-3004-3 (3m) CE-3004-6 (6m) CE-3004-10(10m)	To keep a distance from the subject of measurement.	 (Example)
2	Magnet	MH-201R	To fix the pickup on the subject of measurement.	
3	Cover	PC-3024	Silicone jacket	
4	AC Adapter	PS-3024-S	AC100-240V	
5	Carrying Case	C-3024	To store the SmartVibro and pickup.	

Specifications and appearances of the items above are subject to change without notice.

2. Outline

2-1. SmartVibro

SmartVibro is a portable digital vibrometer designed to measure the displacement, velocity, and acceleration of vibration of various machineries such as machine tools, rolling mills, forge rolling machines, pumps, air blowers, compressors, electric motors, and turbines. Also, vibration frequency is easily analyzed. SmartVibro is suitable for the use in JIS inspection, quality control, and maintenance of your products. It is capable of measuring vibration severity that complies with the mechanical vibration of rotating and reciprocating machinery mentioned in the ISO 2954*.

*ISO2954 is available from ISO website: <http://www.iso.org/iso/home.html>

2-2 Features

- Frequency Range
10 – 1,000 Hz
- Simultaneous Measurement
High-speed processing CPU enabled simultaneous display of acceleration, velocity and displacement of velocity signal coming from the pickup.
- LCD Screen
Various settings like measurement conditions are possible by a touch panel.
- Velocity Pickup
The electrodynamic velocity pickup complies with the ISO 2954. High-sensitive measurement is possible.
- FFT Analysis Function (VM-3024H Only)
Real-time FFT analysis is possible with a minimum condition setting to check vibration frequency components.
- Waveform Data Save (VM-3024H Only)
Waveform can be stored.
Stored data in the SD card can be exported to a personal computer.
- Language
SmartVibro can be operated in Japanese or English by changing the setting.

3. Measurement



Fig 3-1

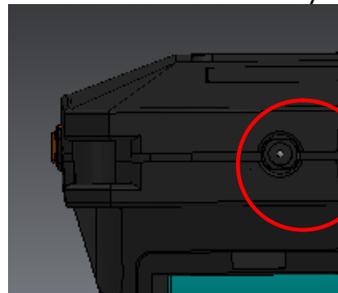
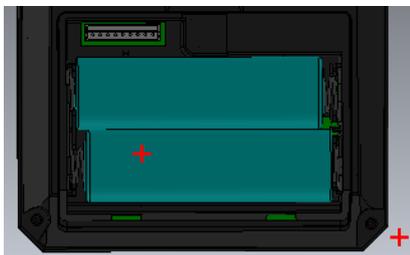
3.1 Before Getting Started

(1) You can select the computing method for velocity, acceleration, and displacement. Refer to the Chapter 4-2 for more details. Initial settings are as follows:

- Acceleration : rms
- Velocity : rms
- Displacement : EQP (Equivalent Peak)

- If you are familiar with our VM-3004, EQP setting for the displacement is highly recommended. Since the measurement data with the VM-3004 is indicated in EQP, you may easily compare the data with the same setting.
- For measurement of the vibration severity, velocity setting needs to be “rms.”

(2) Check the polarity carefully, and set two (2) AA batteries in the battery box. (NiCd or Alkaline)



Power Connector

For the use with the AC adaptor, connect the AC adaptor cable to the power connector in the bottom of the device.

(3) Connect the pickup cable to the pickup connector.

Refer to the following chapters for measurement.

The pickup needs to touch the subject for measurement. For the method to fix the pickup, refer to the page 30.

(4) Language Setting

You can select Japanese or English to be displayed on the screen. Refer to the Chapter 4-9 for details.

3-2. Measurement Screen

Turn on the SmartVibro by sliding an orange switch on the left side of the device. Initial screen (Fig 3-2) will appear.

You can operate the device by using the touch screen and two function buttons.

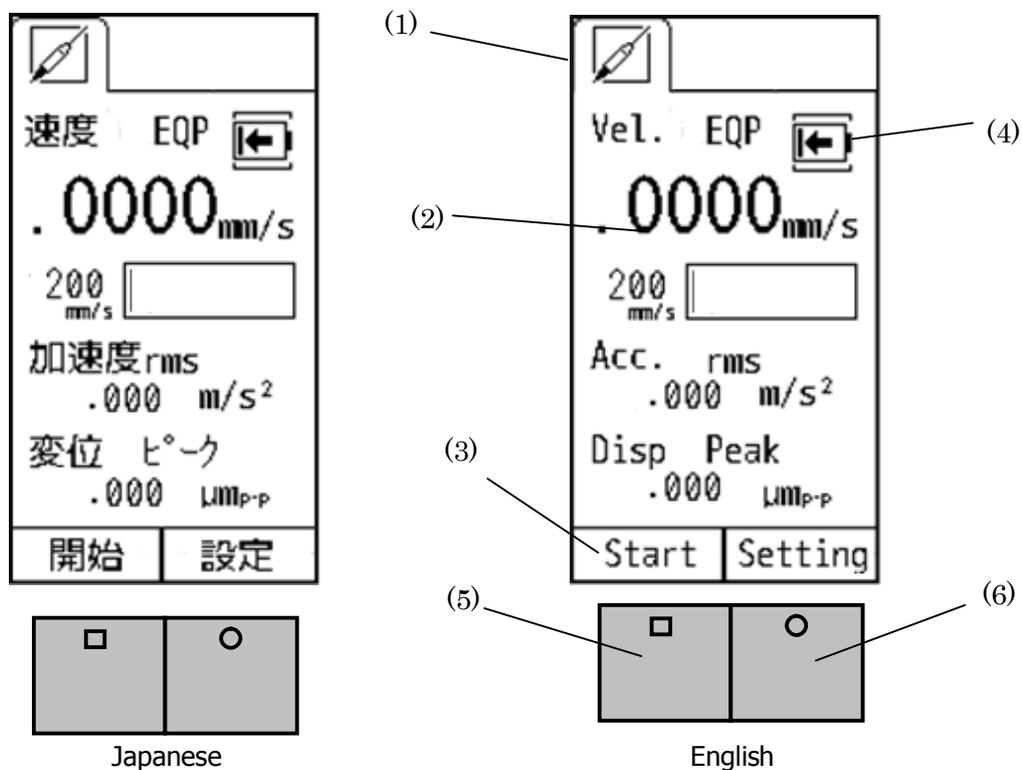


Fig 3-2 Initial Screen

- (1) Standard Measurement Mode
VM3024S is equipped with this mode only.
- (2) Measurement Range Bar
This shows the level of measurement data. The data is not absolute, but rough indication.
- (3) Function Indicator
Valid functions are indicated. In the Fig 3-2, “Start” and “Setting” are operative.
- (4) Battery Indicator
This appears when the battery level is low.
- (5) Function Button (L)
In the measurement mode, you can start or hold measurement when you press this button. In the setting mode, you can check the battery level. (Chapter 4)
- (6) Function Button (R)
In the measurement mode, range display will appear when you press this button. In the FFT mode (available only with the VM-3024H), this button would switch the display from detailed to simple indication of the result, and vice versa. (Chapter 5) As for the range setting, refer to the Chapter 4.

3-3. Operations during Measurement

Touching "Start" on the touch screen or press the function button L in the Figure 3-2 would start measurement. The screen displays measurement status. (Fig 3-3)

Once you press the same function button or touch the "Hold" in the touch screen would hold measurement and the display.

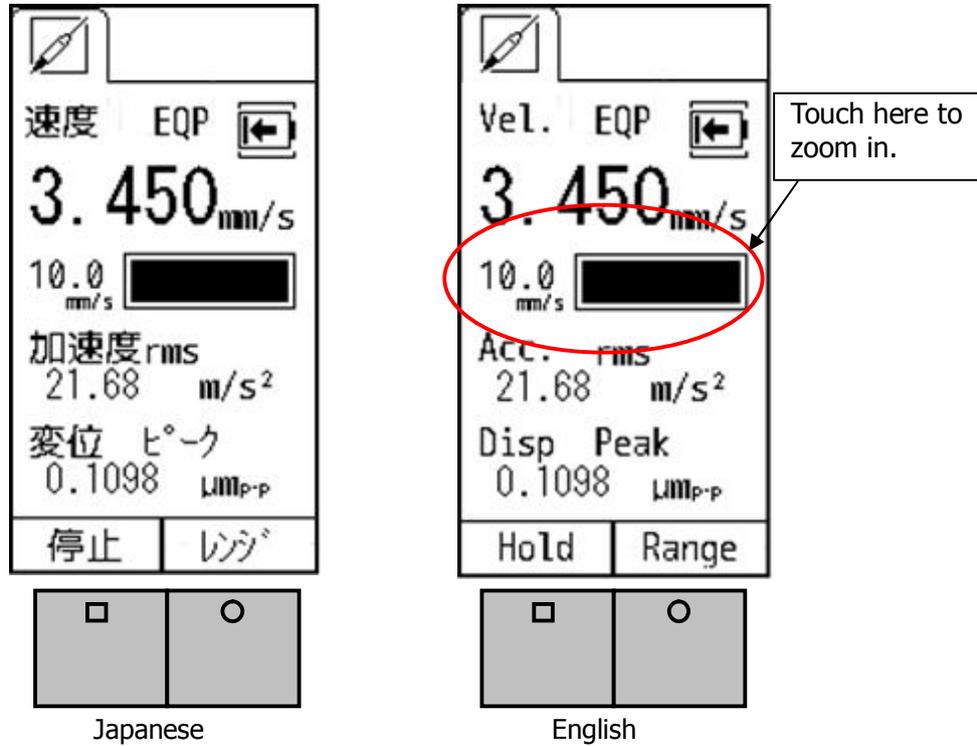


Fig 3-3 Display during Measurement

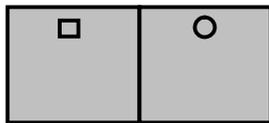
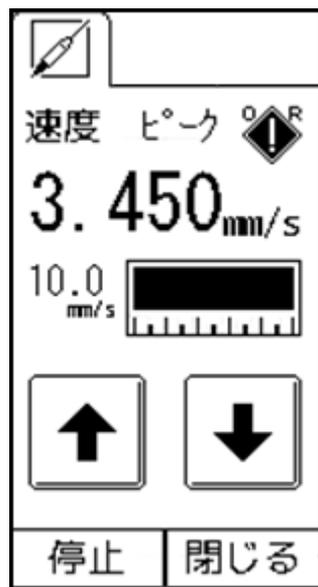
How to Change the Range

When the Auto Range function is OFF (as described in Chapter 4), the range key will be activated during measurement. (Fig 3-3) Touching "Range" on the touch screen or pressing the function button R will show the range setting display. You may adjust the range accordingly.

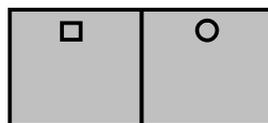
The icon, , will appear on the upper right corner of the screen when the value is over the range. (Fig 3-4)

How to Zoom In

Touch the range bar area on the screen to zoom in the image. To zoom out, touch the same area again. (Fig 3-5)

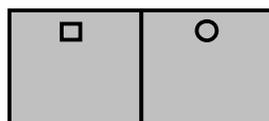
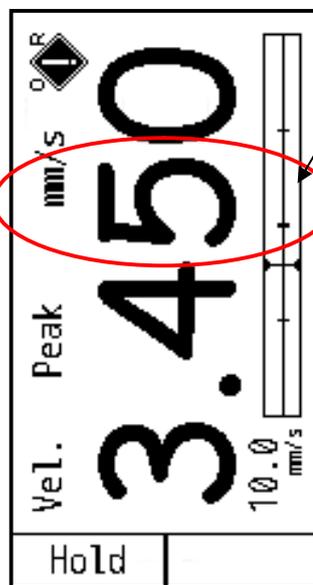
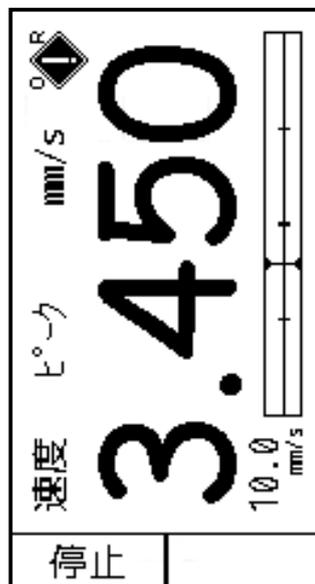


Japanese

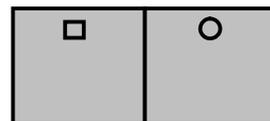


English

Fig 3-4 Display during Changing the Range



Japanese

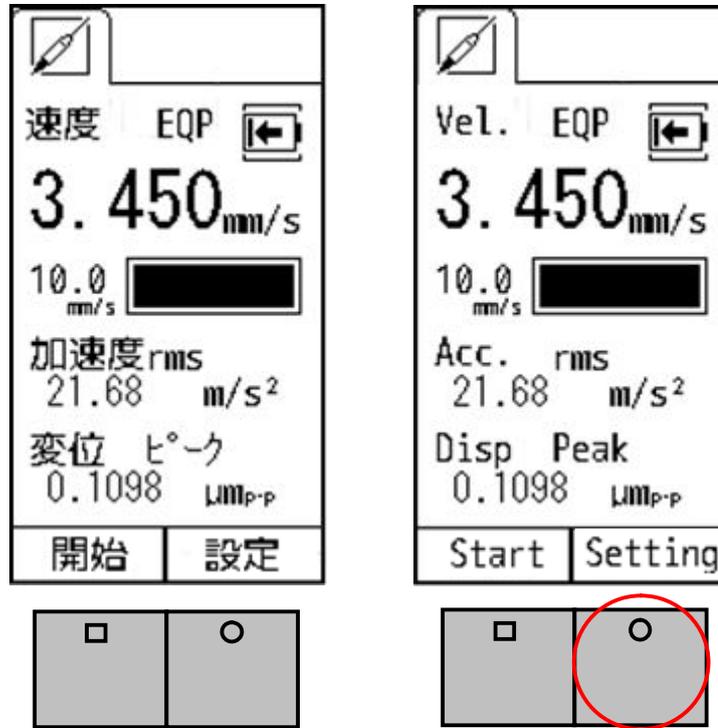


English

Fig 3-5 Enlarged

4. Setting

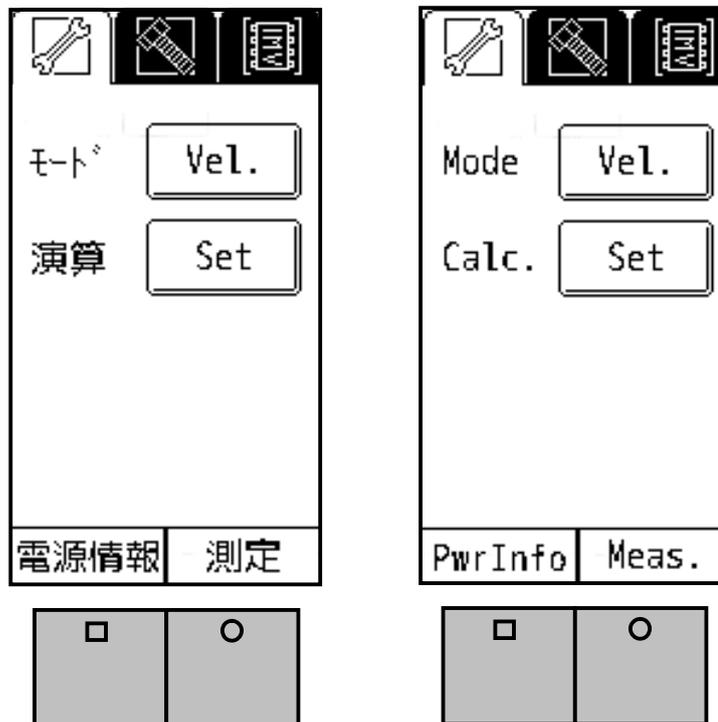
As shown in the Fig 4-1, the setting screen will appear when you press the function button R when "setting" is indicated in the function indicator. (Fig 4-2)



Japanese

English

Fig 4-1 "Setting" in the Function Indicator



Japanese

English

Fig 4-2 Mode and Calculation Setting Screen

4-1. Mode Setting

When “Vel.” Is selected for the Mode (Fig 4-2), the physical amount is shown at the top of the measurement screen. Also, the enlarged screen will show the physical amount accordingly.

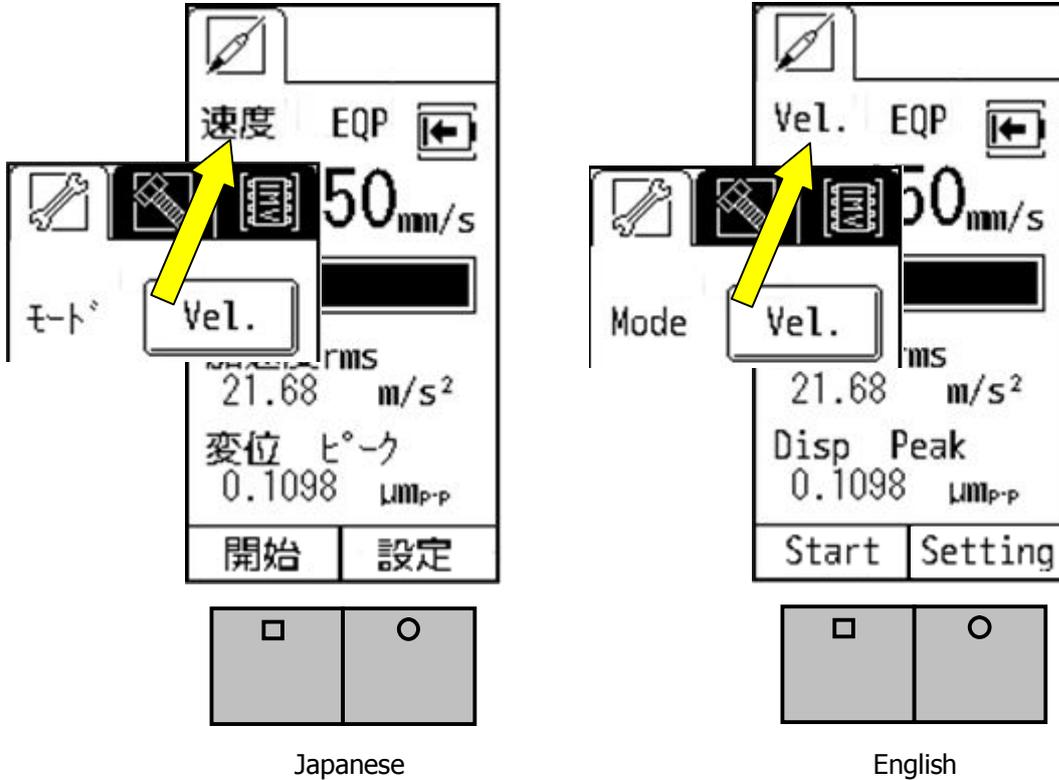
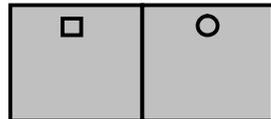
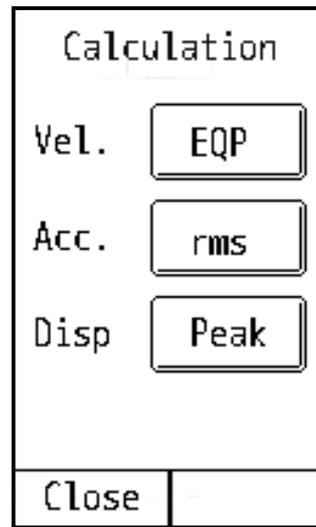


Fig 4-3 Mode Setting

As you touch the button (Vel.) by “Mode” on the screen, the subject of setting will change from velocity, to acceleration, and then to displacement in the mode setting.

4-2. Calculation Setting

You can set how to indicate the physical amount of measurement results in calculation setting. As you touch “Set” in the Fig 4-2, the Fig 4-4 will appear.



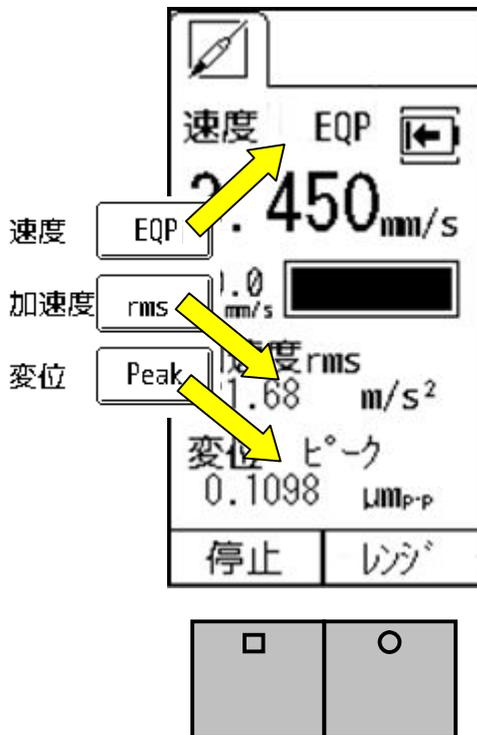
Japanese



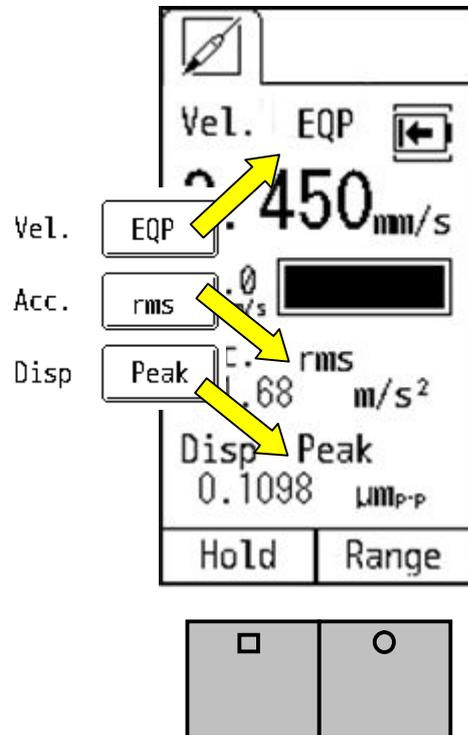
English

Fig 4-4 Calculation Setting

The calculation method selected in the Fig 4-4 will be displayed on the screen.



Japanese



English

Fig 4-5 Example of the Setting Screen

The calculation method also will be changed as you touch the button on the screen in the following order:

Velocity: "rms" "EQP" "Peak"

Acceleration: "rms" "EQP" "Peak"

Displacement: "EQP" "Peak"

Below is a brief description of each calculation method.

rms: Root mean square. This is the square root of the mean of the squares of the time-series data gathered from measurement. ISO standard sets RMS as evaluation criteria of the vibration velocity, which is also known as vibration severity.

EQP: EQP is a value gained by "rms" times root 2 ($\sqrt{2}$). This formula is suitable to use for measurement of sine vibration generated by rotational machines, for example.

Peak: The maximum value of the time-series data.

[Note] Refer to the Chapter 11 for more detailed definitions.

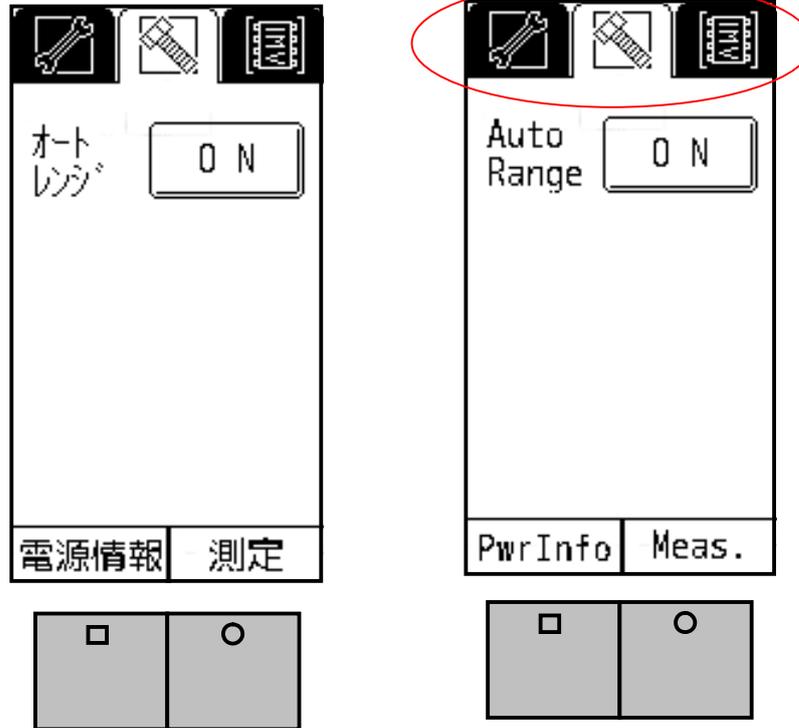
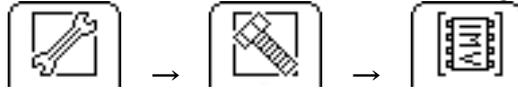
[Note] Settings of the VM-3004

For the users of the VM-3004, using the same setting with the VM-3024 is recommended instead of "Peak" setting. Below is the recommended setting of the VM-3024.

Model	VM-3004	VM-3024
Velocity	rms	←
	EQP	←
Acceleration	rms	←
	EQP	←
Displacement	EQP	←
	—	—

4-3. Auto Range

In the setting section, the menu will be switched in the following order as you touch the icon:



Japanese

English

Fig 4-6 Auto Range Setting Page

Auto Range ON: Range will be adjusted automatically during measurement. “Range” will not be indicated on the measurement display, namely in this case the function button R is not effective.

You can switch between ON and OFF by touching the Auto Range button on the screen.

4-4. Sensitivity Setting of AC and DC Output

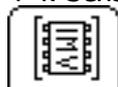
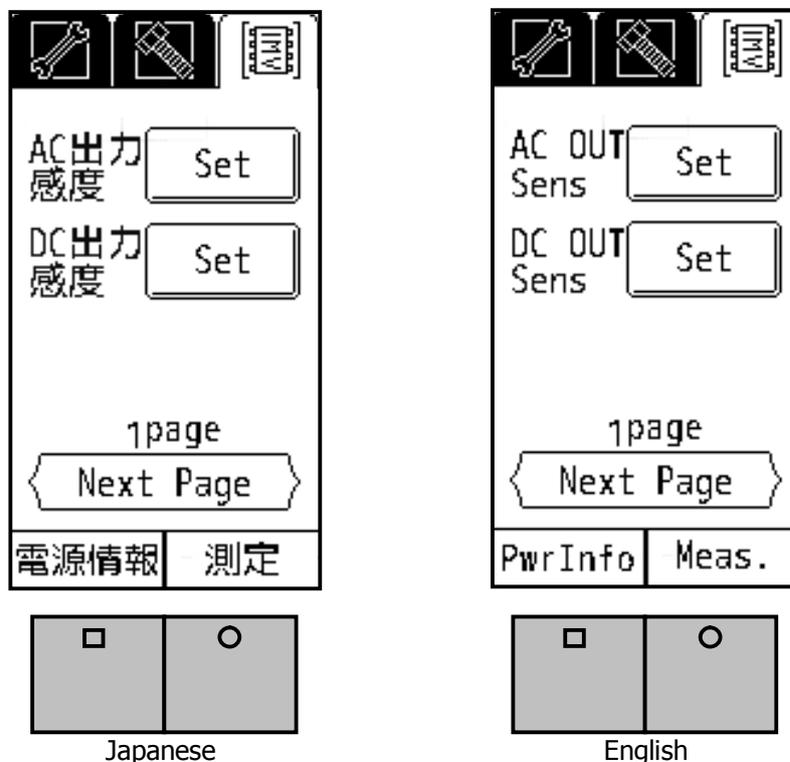


Fig 4-7 will appear as this icon is selected.



Japanese

English

Fig 4-7 AC and DC Output Sensitivity Setting Page

This function set the full-scale value to the AC Output Voltage(1V). Display in the Fig 4-8 will appear once you press "Set."

You can set the level of velocity, acceleration, and displacement per 1V. In the Fig 4-8, each level is set as follows:

Velocity: 1V is equivalent to 200mm/s.

Acceleration: 1V is equivalent to 100m/s².

Displacement: 1V is equivalent to 500μm.

The physical amount of output signal of AC OUT is equivalent to the physical amount designated in the mode setting. You can select the value by pressing the button. The value will be switched as follows:

Velocity: 200 → 20 → 2

Acceleration: 100 → 10 → 1

Displacement: 500 → 50 → 5

AC出力感度	
速度 mm/s	200
加速度 m/s ²	100
変位 μm	500
単位/V	
閉じる	



Japanese

AC OUT Sens	
Vel. mm/s	200
Acc. m/s ²	100
Disp μm	500
unit/V	
Close	

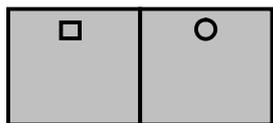


English

Fig 4-8 AC Output Sensitivity Setting Page

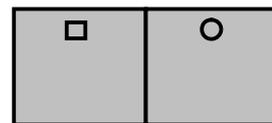
This function set the full-scale value to the DC Output Voltage(1V). Display in the Fig 4-9 will appear once you press "Set."

DC出力感度	
速度 mm/s	200
加速度 m/s ²	100
変位 μm _{P-P}	1000
単位/V	
閉じる	



Japanese

DC OUT Sens	
Vel. mm/s	200
Acc. m/s ²	100
Disp μm _{P-P}	1000
unit/V	
Close	



English

Fig 4-9 DC Output Sensitivity Setting Page

Setting method is the same as AC sensitivity setting. The setting values are as following.

Velocity: 200 → 20 → 2
Acceleration: 100 → 10 → 1
Displacement: 500 → 50 → 5

4-5. Battery Setting

You can go to the next page by touching the "Next Page" indication on the screen. You can go back to page 1 by touching "Next Page" in page 3. Fig 4-10 shows page 2.

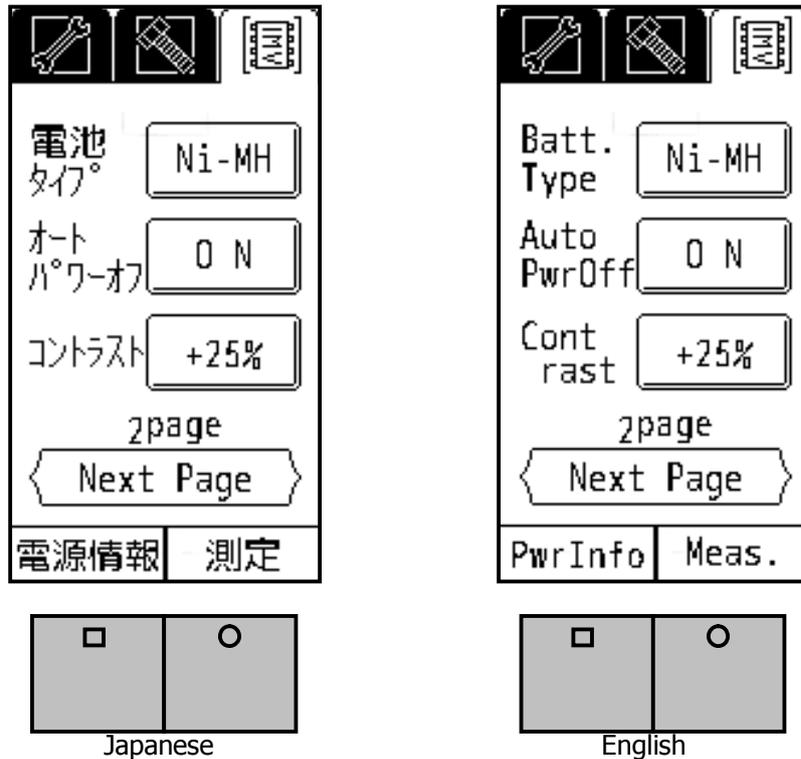


Fig 4-10 Battery, Auto Power, Contrast Setting Page

You can select the battery type, Ni-MH (rechargeable Ni-Cd battery) or LR6/R6 (alkaline battery). Since battery life indication depends on this battery type setting, the correct battery type needs to be selected. If other types of battery is used, the battery life may not be indicated correctly.

4-6. Auto Power OFF

Auto Pwr OFF: ON

The device will be turned off automatically in 30 minutes.

4-7. Contrast

You can adjust the contrast of the screen from -50% to +50% at +25% intervals.

4-8. Language Setting

On page 3, you can select language and check the version.

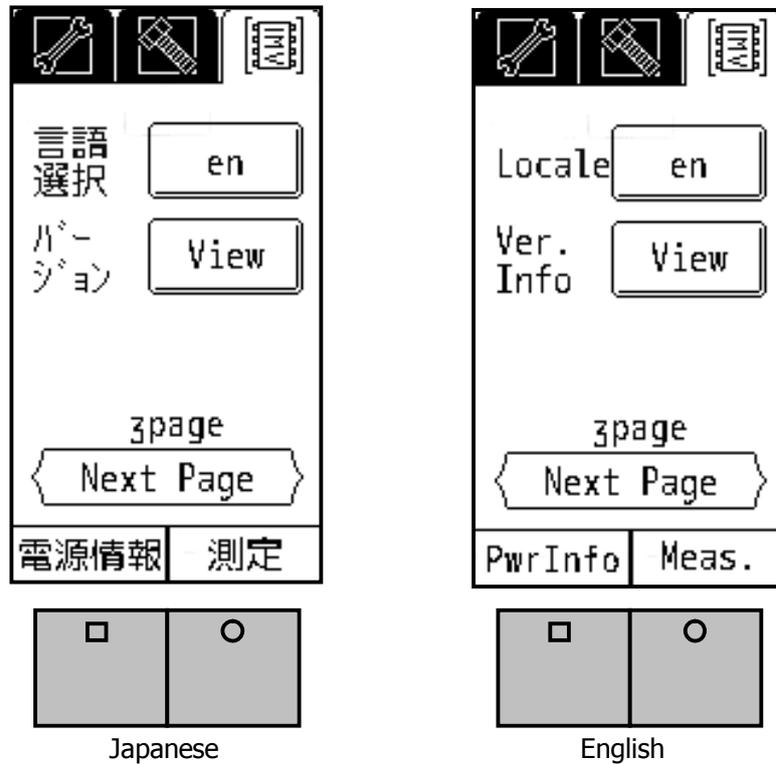


Fig 4-11 Language Setting and Version Information

Select "en" for English. Once you restart the device, the display will be changed into English. To choose Japanese, select "jp" and restart the device.

4-9. Version Information

Firmware version will be displayed as you press the View button in the Fig 4-11.

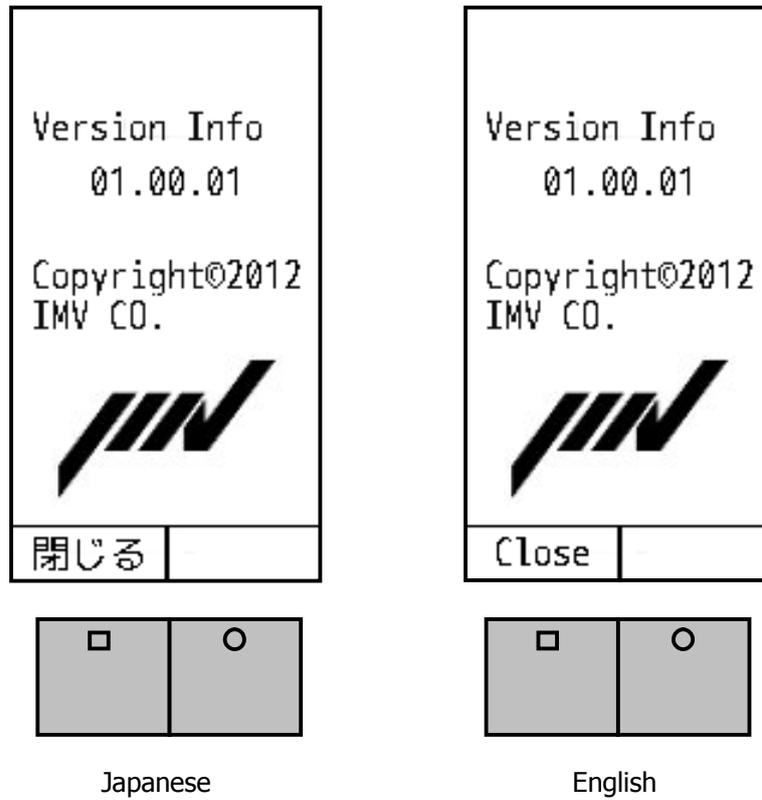


Fig 4-12 Version Information

4-10. Battery Indicator

Battery indicator will appear when you press the function button L below "Pwr Info" indication.

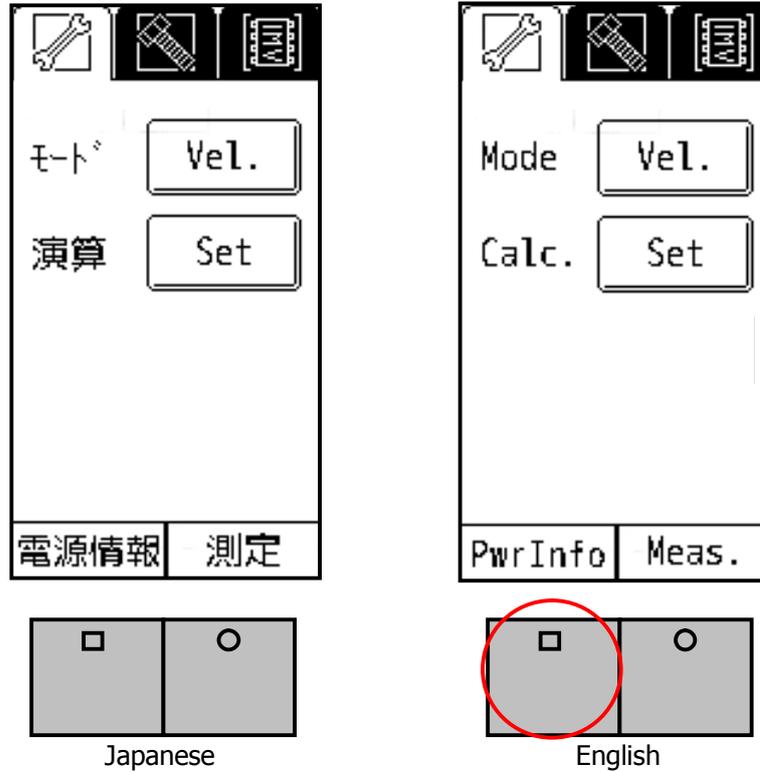


Fig 4-13 Pwr Info Indication

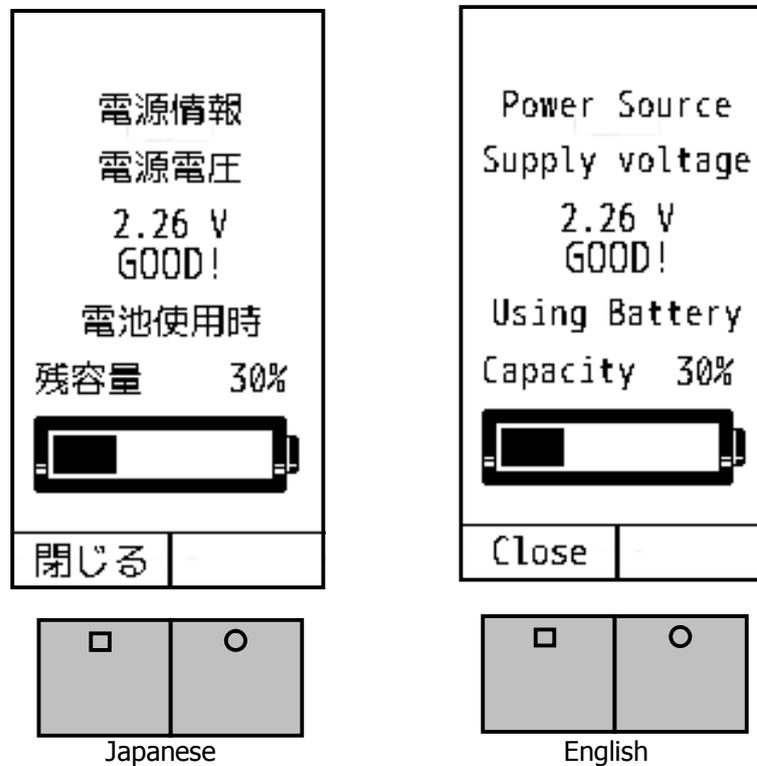


Fig 4-14 Battery Information

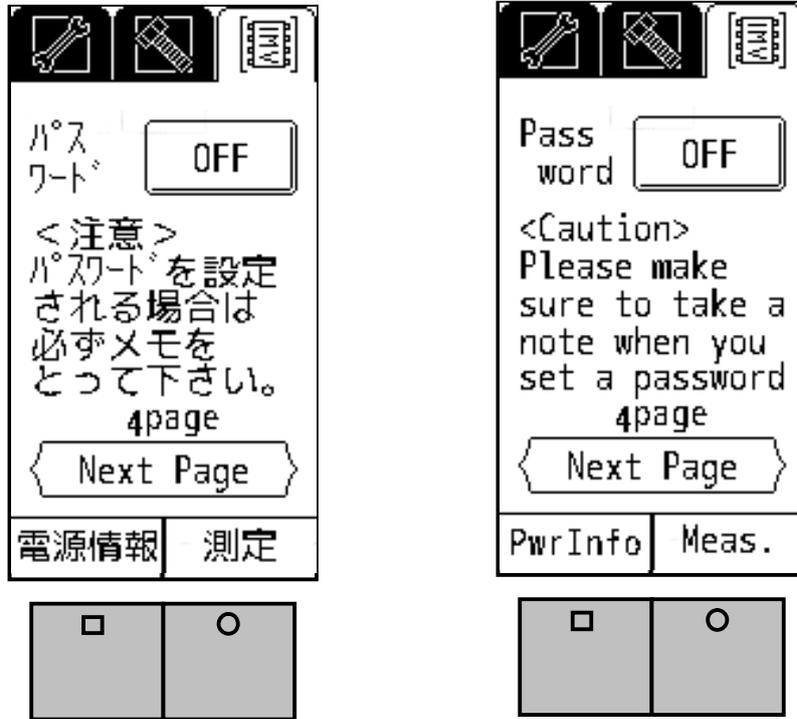
4-11. Password Function

4-11-1. Password Set

You can set the password not to change the setting parameters. Default password is not set.



tab's 4th page shows "Password setting".

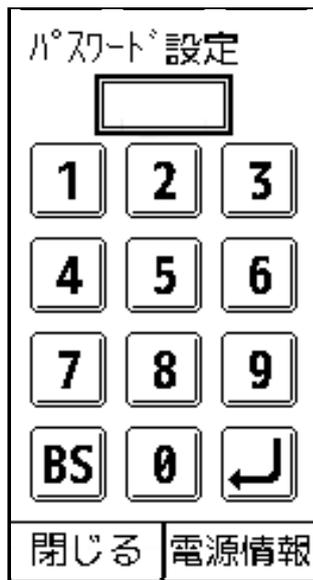


Japanese

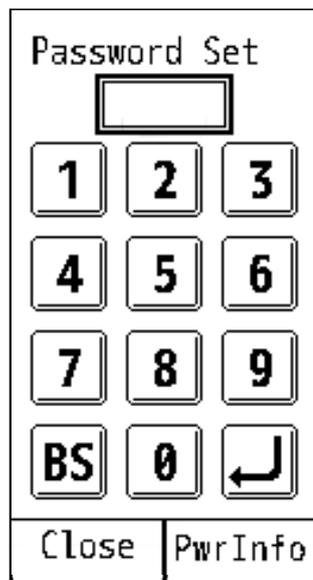
English

Fig 4-15 Password setting (password off)

Push the "OFF" button on Fig 4-15, then Fig 4-16 is showed to input 4 digits password number. Input 4 digits number, and push the "Return" button, then the password number is set. In case of " password is being set ", "OFF" becomes to "ON" in Fig 4-15 (see Fig 4-17).

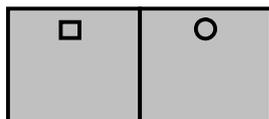
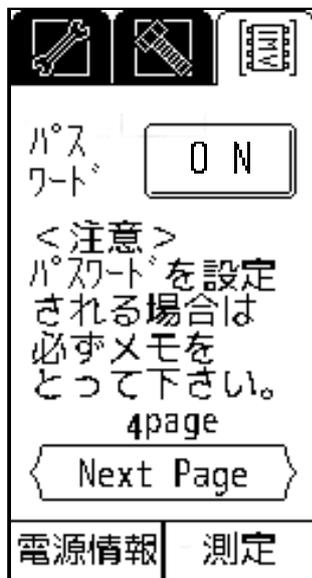


Japanese

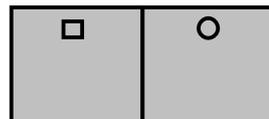
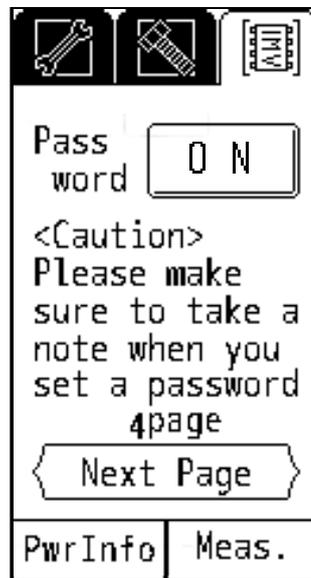


English

Fig 4-16 Password input



Japanese



English

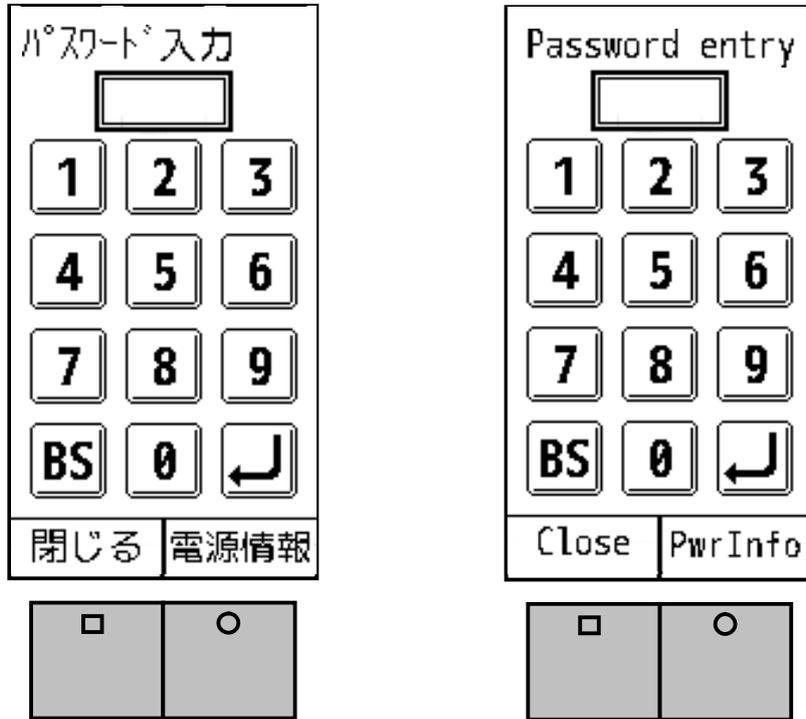
Fig 4-17 Password setting (password on)

4-11-2. Password Input

While password is set, if you press the "Setting" button, Fig 4-18 will show "Password entry". Please input 4 digits number, and press the "return" button.

If password is correct, then the setting page will be displayed, and if not correct, then the "Password entry" is required again.

In such a case, please confirm your password and input it correctly.



Japanese

English

Fig 4-18 Password Input

**Note) Please make sure to take a note when you set a password.
If you have forgotten your password,
you would not change the setting parameters.**

5. The High-End Model; VM-3024H

VM-3024H is equipped with the FFT and waveform saving functions. (Note: Sections from here is not relevant to the VM-3024S functions). FFT and data save functions are equipped only with the high-end model.



FFT: FFT Mode

Equipped only with the VM-3024H.



Data Save: Data Save Mode

Waveform data will be stored in the SD card as plain text.

5-1. FFT

5-1-1. FFT Indication



Selecting the <FFT> tab will show the screen shown in Fig 5-1.

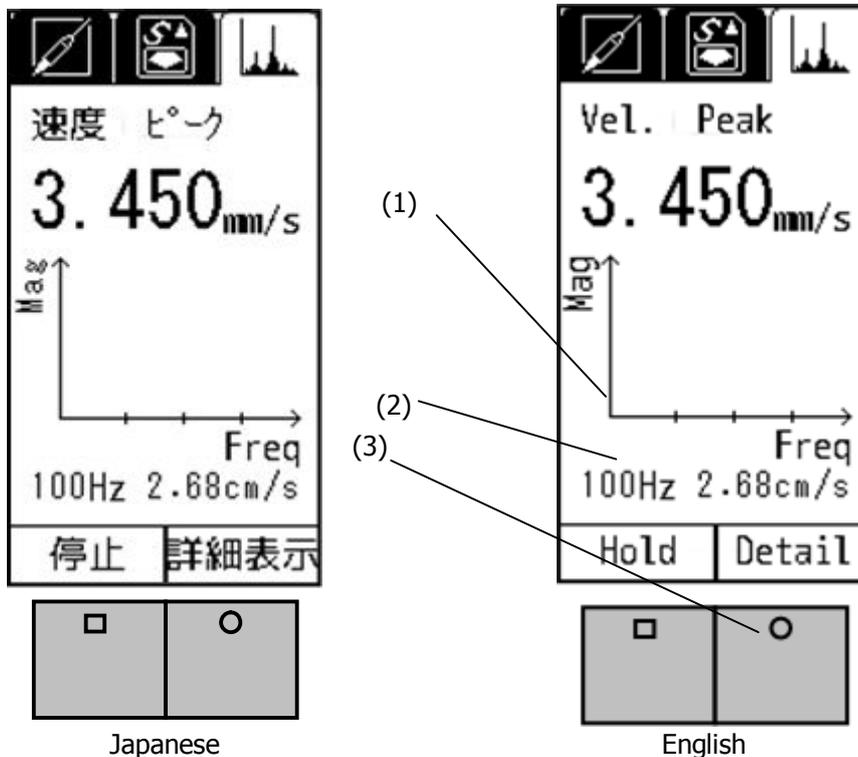


Fig 5-1 FFT Menu

(1) FFT Graph

Y-axis shows the physical amount of the measurement result indicated above the graph.
(Velocity in Fig 5-1)

X-axis indicates frequency.

(2) Maximum frequency and its value.

(3) Details will appear as you press the function button R. (Fig 5-2)

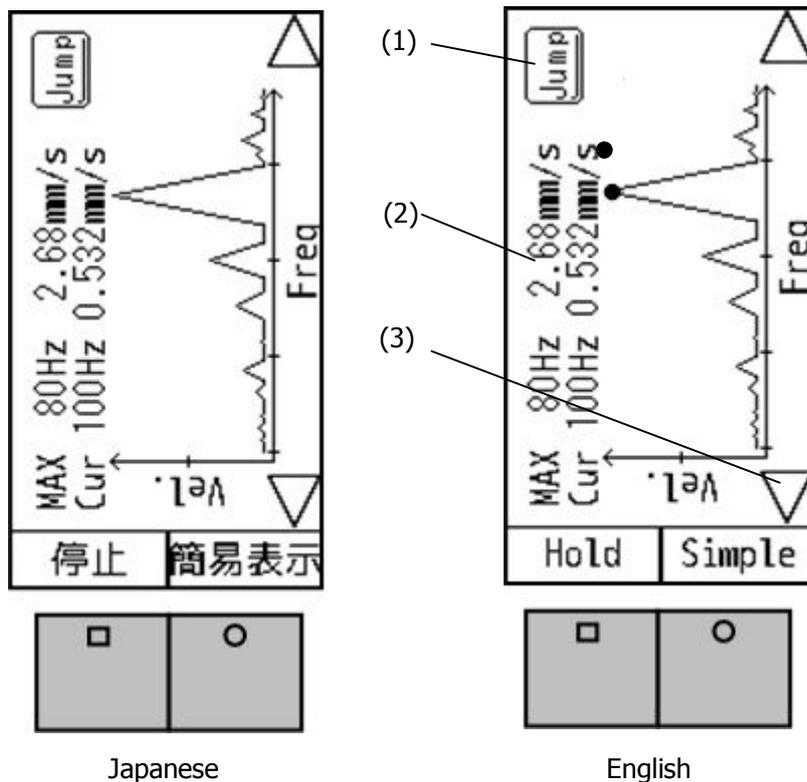


Fig 5-2 Details of the FFT

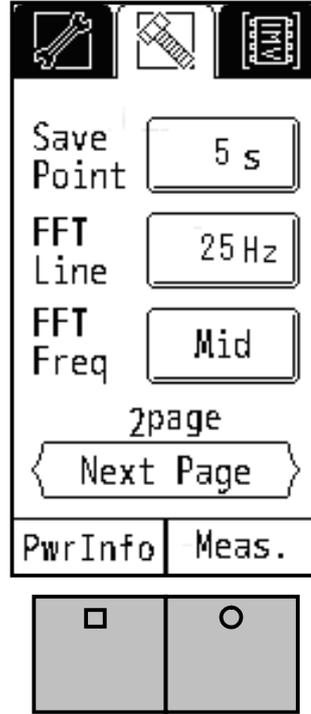
- (1) The cursor, indicated as a black dot on the screen, will move from one peak to another peak.
 - (2) MAX: Maximum value of the gathered data.
Cur: Value pointed by the cursor.
 - (3) Slide the cursor.
- Frequency range of the FFT is 10Hz – 1000Hz.

5-1-2. FFT Setting

Fig 5-3 is the FFT setting page. FFT Line shows a frequency resolution. You can select from 25Hz, 12.5Hz, and 6.25Hz. This specifies the range of frequency axis; however, with the SmartVibro, VM-3024S/H, this setting does not affect the display range. Hence, you may not need to change the FFT setting from the default setting.



Japanese



English

Fig 5-3 FFT Parameter Setting

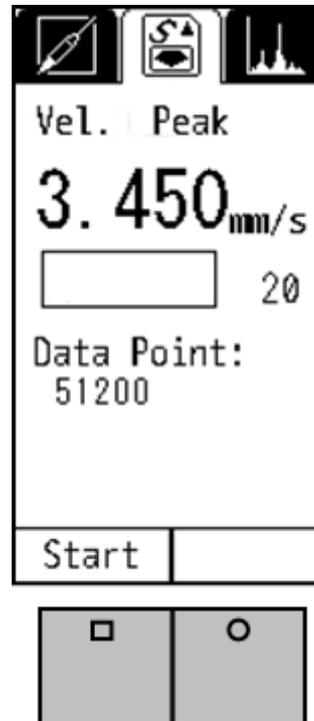
5-2 Waveform Save

5-2-1. Waveform Data Save

Fig 5-4 is shown when you select <Waveform Save> icon  in the measurement mode.



Japanese



English

Fig 5-4 Data Gathering Start

Once you press "Start" on the screen or button in Fig 5-4, Fig 5-5 will appear.

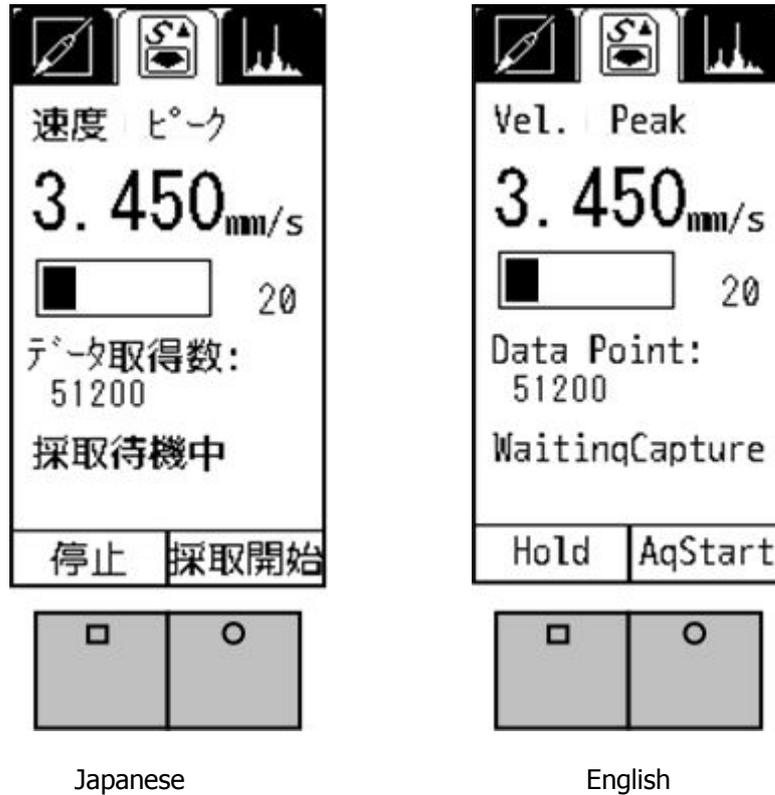
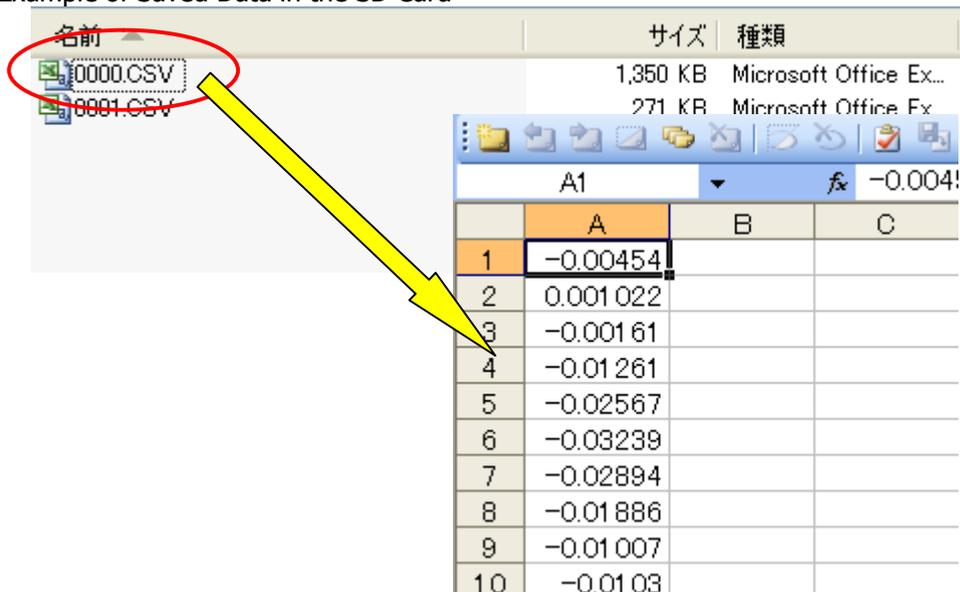


Fig 5-5 Data Gathering

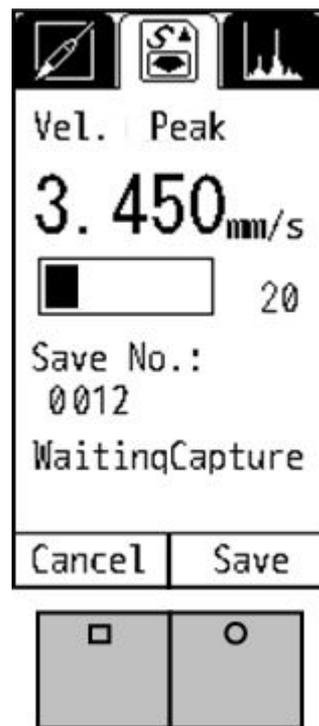
Pressing/Touching "Aq Start" in Fig 5-5 starts gathering the data. Once it is completed, Fig 5-6 appears. Press/Touch "Save" to save the data in a SD card. Data will be numbered automatically in series starting from 0000.

Example of Saved Data in the SD Card





Japanese



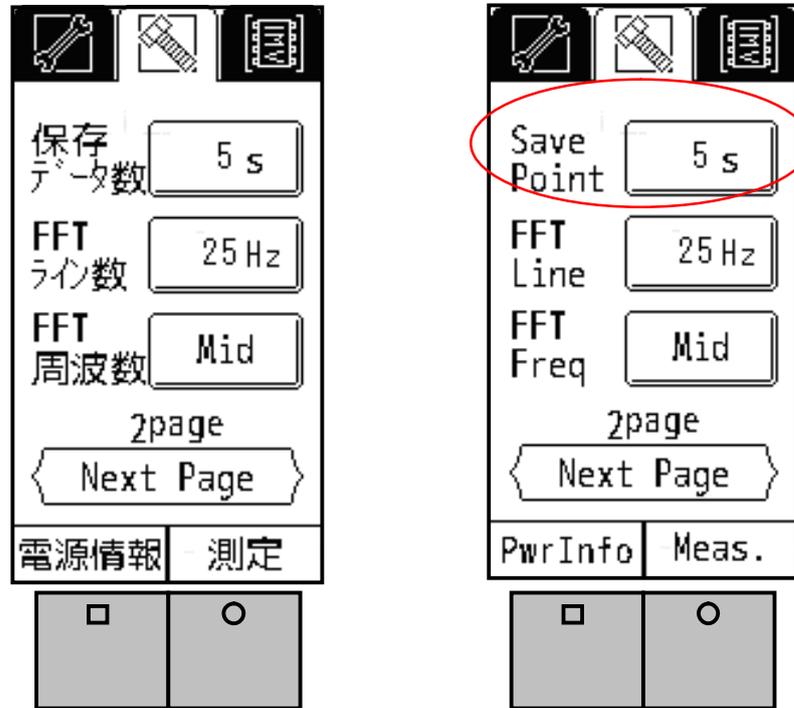
English

Fig 5-6 Completed Data Gathering

5-2-2. Data Save Settings



Fig 5-7 is the display of data save setting. Select this icon:
Go to page 2, and set the save points.



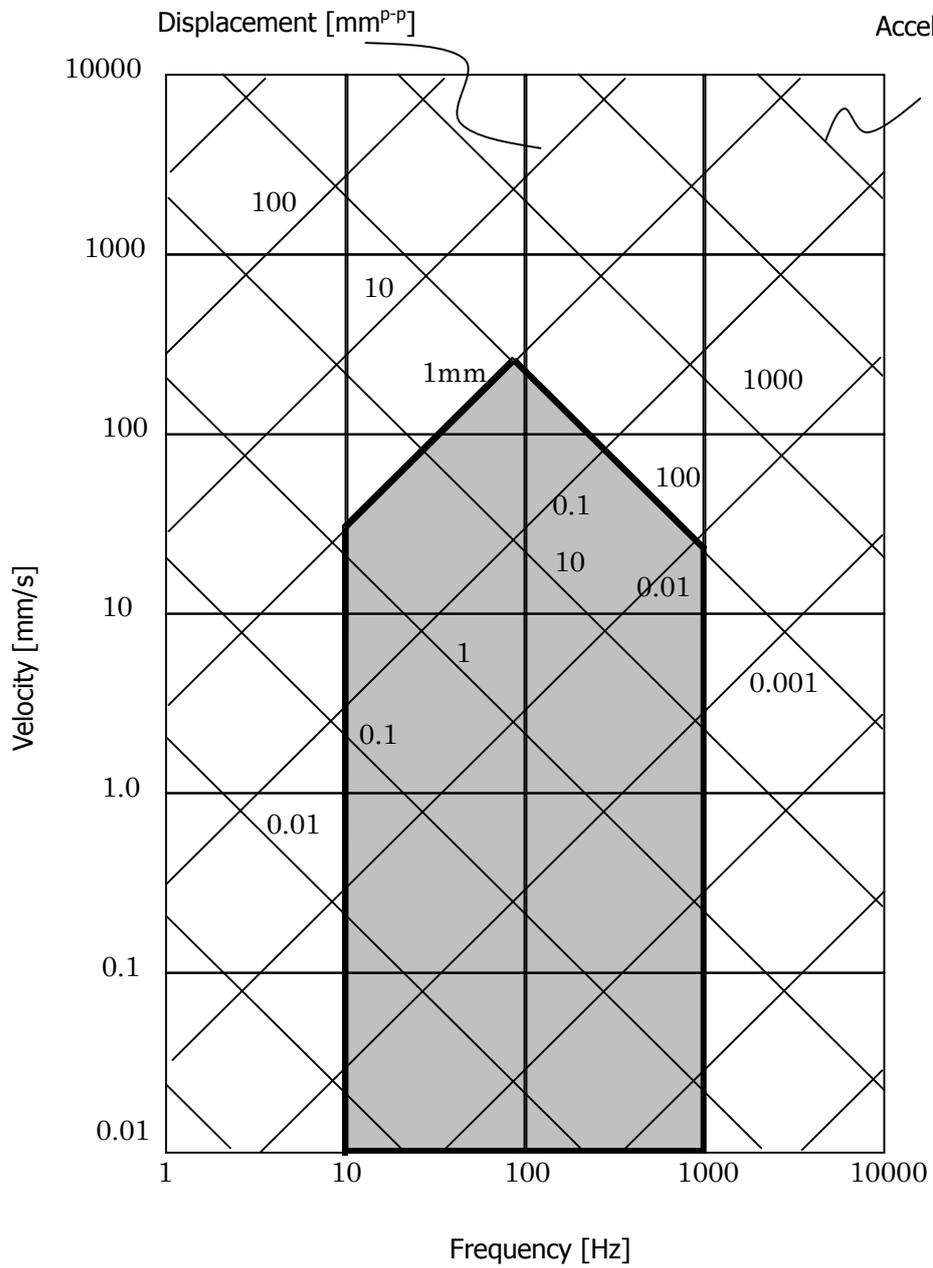
Japanese

English

Fig 5-7 Parameter Setting of Data Save

Select the time to save the data. You can select from 10s, 5s, 2s, or 1s.

6. Conversion Table



7. Specifications
7-1. SmartVibro

Sampling Frequency	20480Hz
Frequency Range	10Hz to 1000Hz
Accuracy	±5% (20 to 500Hz) +5% to -15% (10 to 1000Hz)
Measuring Range	Acceleration: 6-range (100, 30, 10, 3, 1, 0.3m/s ²), Auto Velocity: 6-range (200, 60, 20, 6, 2, 0.6mm/s), Auto Displacement: 6-range (1000, 300, 100, 30, 10, 3μmp-p), Auto
Indication	EQP: Acceleration, Velocity, Displacement PEAK: Acceleration, Velocity, Displacement rms: Acceleration, Velocity
Accuracy	Sensitivity Error: +/-5% (80Hz) Range Changeover Error: +/-2% (80Hz) Linearity: +/- 0.5% (80Hz)
Output	AC OUT: 0 to +/-1V with a load over 10kΩ DC OUT: 0 to +1V with a load over 10kΩ
FFT (VM-3024H Only)	Δf: 2.5Hz, 5Hz, 10Hz
Data Save (VM-3024H Only)	SD Card Data Saving: 1s, 2s, 5s, 10s
Language	Japanese and English
Power	AA x 2pcs (Approx. 20hrs in continuous run) Alarm: Icon in the screen
Ambient Conditions	Use: 0 to +50C; 95%RH or less, without condensation Accuracy Assured: +5 to +35C; 85%RH or less, without condensation Save: -10 to +60C; 95%RH or less, without condensation
Dimensions & Weight	74(W) x 32.5(D) x 148(H)mm 230g (with batteries)

7-2. Pickup

Detection Method	Electrodynamic Velocity
Detection Direction	1 direction
Sensitivity	4.0 [mV/(mm/s)]
Natural Frequency	14Hz
Frequency Range	10 to 1000Hz
Max Measurable Disp.	1000μm _{p-p}
Max Tolerable Accel.	100 m/s ²
Ambient Temperature	-10 to +50C
Material (Case)	SUS
Weight	Pickup: Approx. 140g Probe: Approx. 20g
Fixing Screw	M6, P=1, Depth 5, Female
Cable	Pull-out, directly, φ4, 1.5m
Connector	6P
Structure	Dust proof

8. Troubleshooting

(1) Over range

When the over range icon, , appeared during use, modify the range setting as explained in Figure 3-4. Over range will be adjusted automatically in the auto range setting.

(2) No display

Possible causes are following:

(A) Battery voltage is below 2.0V.

(B) Polarity of the battery is wrong.

(C) Pickup cable is not properly connected to the equipment.

(D) AC adaptor is broken (if AC adapter is used), or not properly connected to the equipment.

When no problem was found in the 4 items above, (A) to (D), turn off and restart the machine.

9. Precautions

1. Turn off and remove batteries when not in use for long period of time.
2. Keep the machine away from organic solvent like ketone or thinner to protect the body made of ABS resin. For cleaning, use soft clothes. You may use a small amount of alcohol.
3. Do not disassemble the equipment. You can open only the battery box cover.
4. Avoid strong shock. The screen is made of glass.
5. Avoid high temperature or humidity to protect LCD screen. Store the equipment in dry place under 35C. Do not leave the machine under direct sunlight or in a car.

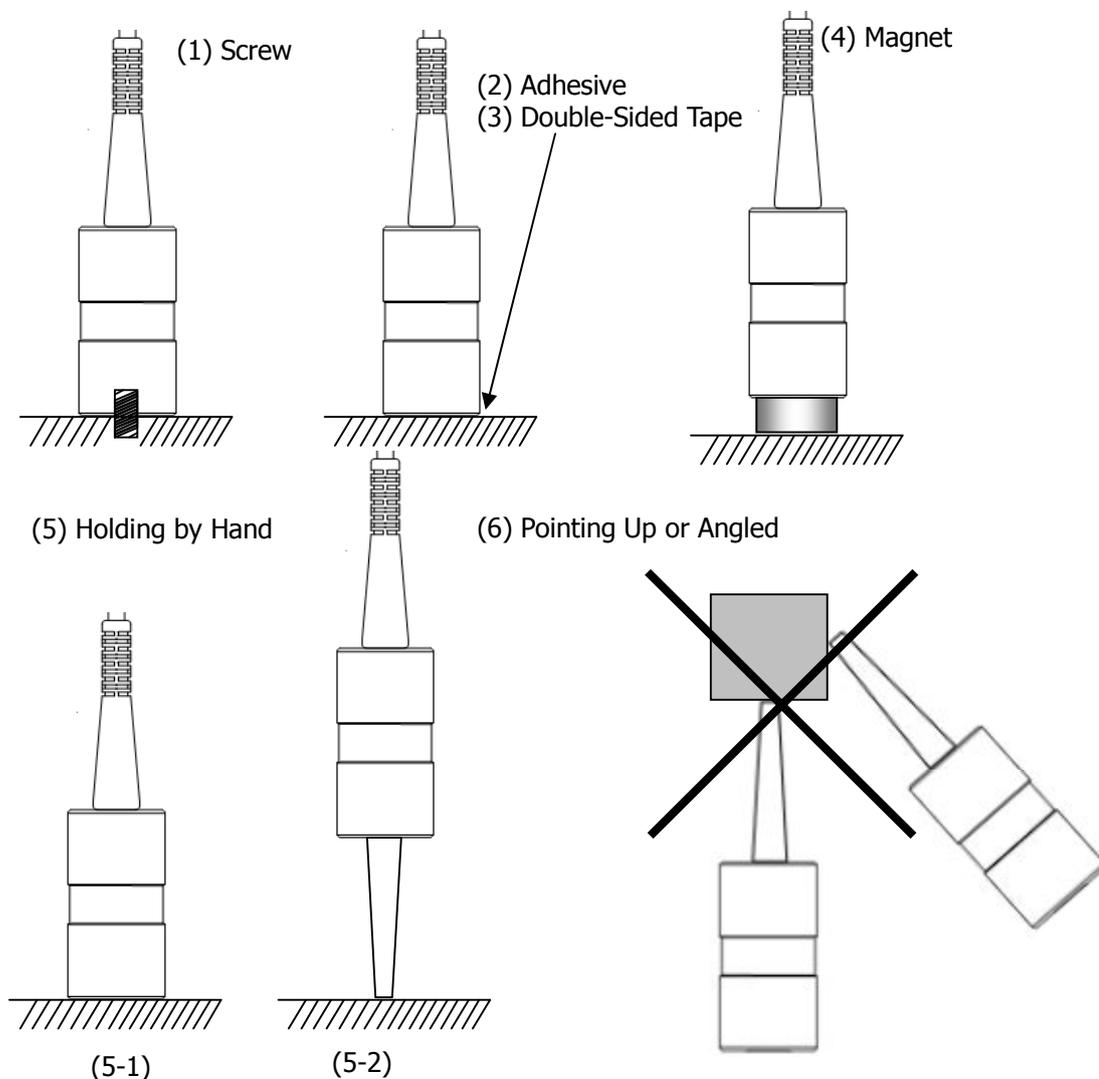
10. How to Fix the Pickup and Frequency

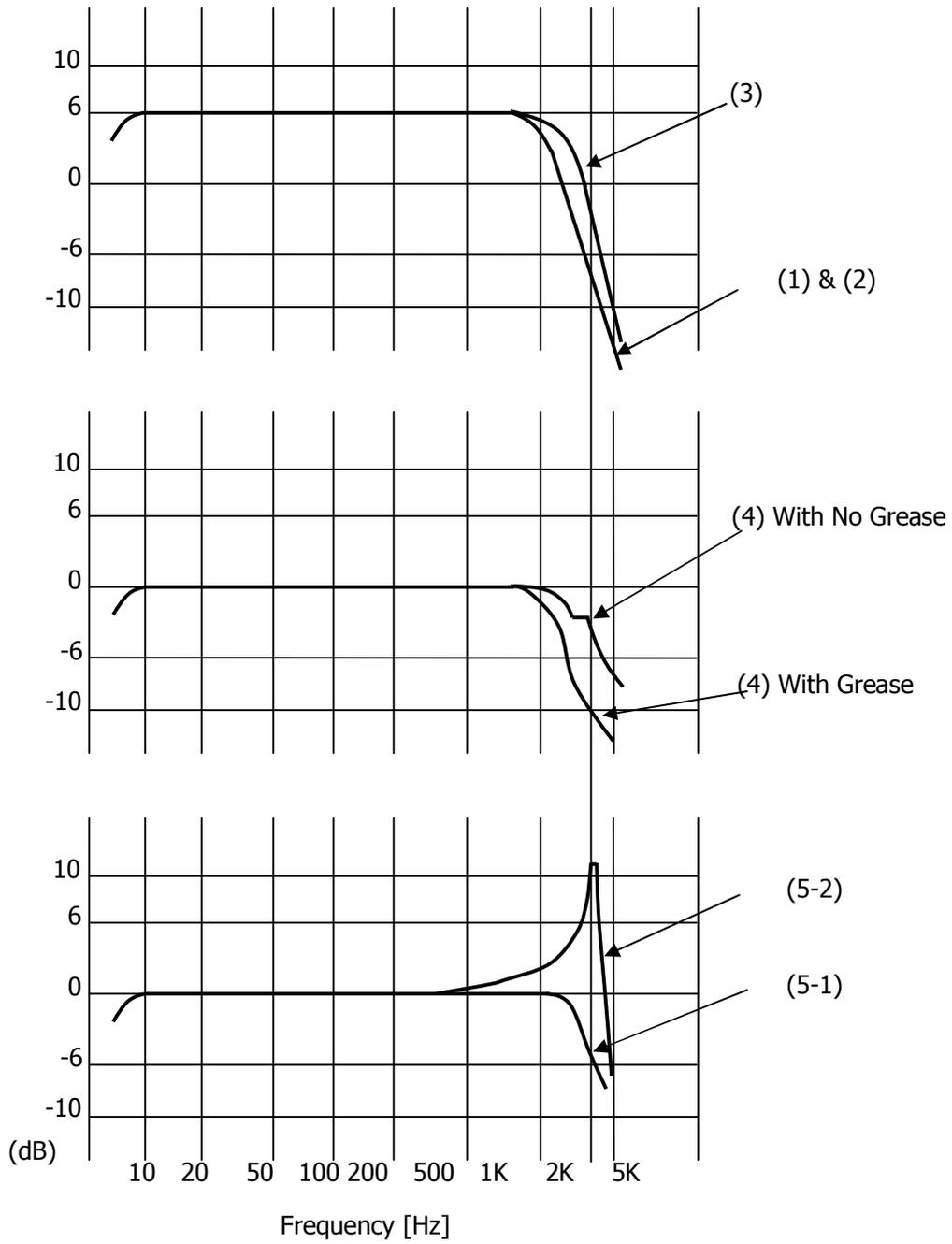
Mounting a pickup on a vibrating object create a vibrating system with its own resonant frequency, called Mounted Resonant Frequency.

This frequency vary with mounting method and state, and for high frequency characteristics, it is much influenceable.

You can fix the pickup onto the subject of measurement by (1) a screw, (2) instant adhesive, (3) double-sided tape, (4) a magnet, or (5) holding the pickup manually during measurement. These five methods do not have any problem in terms of mounted resonant frequency since it is over 2kHz. (5-2) However, the contact resonance frequency could be nearly 1.5kHz if when a contact pin is used for fixing. In this case, you need to be careful since the reading will become large when frequency goes over 500Hz. Also, please note that the probe needs to be pointed down straight to the subject of the measurement. (6)

★Handle the pickup with care. Pickup can be damaged by the shock around 100m/s^2 .



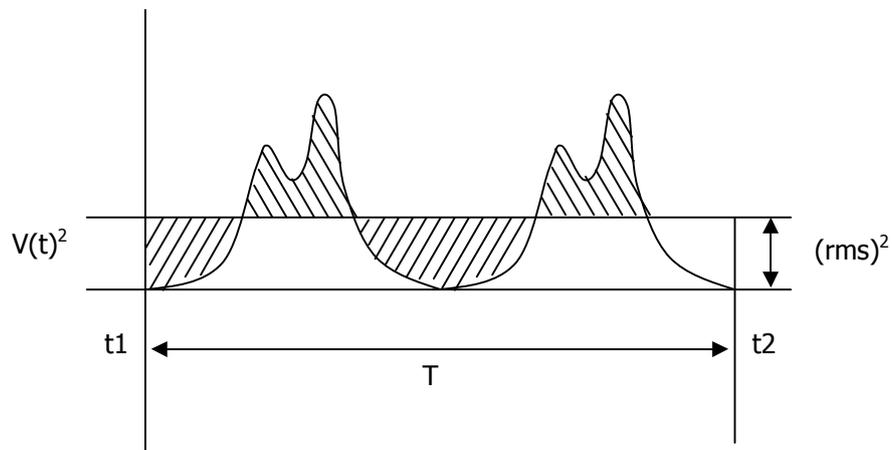


11. Definitions

rms : Root mean square. This is the square root of mean of the values x_i^2 , for a set of measuring data x_1, x_2, \dots, x_n , namely

$$rms = \sqrt{\frac{x_1^2 + x_2^2 + \dots + x_n^2}{n}}$$

ISO standard sets RMS of vibration velocity as evaluation criteria of the vibration velocity, which is also known as vibration severity.



EQP: Equivalent peak. Giving that a measuring data set is sinusoidal, EQP is calculated Peak by following formula.

$(rms) \times \sqrt{2}$ is the formula with SmartVibro since the peak would be $rms \times \sqrt{2}$ in sine wave.

Peak: Maximum value in the time-domain data.

