Instruction Manual

Portable Vibrometer
SmartVibro Series

Model: VM-3024S
VM-3024H

Manufacture: **IMV CORPORATION**
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Revision History

Date	Rev.	Details
3rd Feb, 2012	1.0.0	New Issue.
22th Mar, 2012	1.0.1	(1) Corrected Figures and phrases. (2) Added optional accessories.
6th Apr, 2012	1.0.2	(1) Added Preparation (3-1). (2) Added “How to Fix the Pickup” (10).
3rd Oct, 2012	1.0.3	Corrected AC OUT Sensitivity (4-4)
21th Dec, 2012	1.5.0	Added “Password Function” (4-11).
20th Feb, 2013	1.5.1	Corrected Cable Model. CE-3004 → CE-3024
28th Jan, 2016	1.5.3	Corrected AC Adapter Model Number.
10th May, 2016	2.0.0	(1) Ver2.00 and overall review. (2) SmartVibro screen and wording were corrected.
18th June, 2021	3.0.0	(1) Ver2.16 or later compatible and overall review. (2) Removed “Chinese” from language (end of support).

⚠ Important Notice

EOL of Standard Model (VM-3024S)

The standard model (VM-3024S) was discontinued as of 30th September, 2014.
Thank you in advance for your understanding.
Please contact us for product maintenance.

⚠ Important Notice

End of support about language display "Chinese"

The support of language display "Chinese" has ended 17th June, 2021.
Thank you in advance for your understanding.

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1. Introduction

Thank you for purchasing Portable Vibrometer “VM-3024S/H”.

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

Safety Precautions

This chapter describes several items which we would like to you observe in order to use the product safety and prevent injury to customers and other persons and damage to property. Please be sure to read this instruction manuals and attached documents before use, and fully understand the contents for use.

After reading this manual, be sure to place it in a location so that you can always refer to it.

● Expressions of safety instructions

Danger	**Calls attention to a procedure, practice, or condition that could possibly cause death or bodily injury.**
Warning	**Calls attention to a procedure, practice, or condition that could possibly cause bodily injury or damage to instrument.**
Caution	**Represent handling precautions or notes on product specifications.**
	Indicates product specification information and actual usage information.

● For safe use

Danger	**In case of the place of objective instrument is high temperature, near rotating shaft and near a moving element, the mounting of pick-up, please go to when the machine is stopped. In such a place, measuring the vibration with pick-up in one’s hand, it causes burn injury and cable engulfment. It is very dangerous, please stop absolutely.**
Warning	**Stop using the instrument, when producing smoke, bad smell or noise. It causes fire or shock hazard. Turn off the power switch and unplug the power cable from outlet as soon as possible, please contact the agency or IMV. To reduce risk of injury, take it to a qualified serviceman when service or repair is required.**
Warning	**Do not substitute parts or modify instrument. It causes bodily injury, fire or shock hazard.**
Warning	**Stop using the instrument, when an object or liquid falls/spills into the instrument. It causes fire or shock hazard. Turn off the power switch and unplug the power cable from outlet as soon as possible, please contact the agency or IMV.**
Caution	**Do not expose the instrument to moisture or dust. If causes fire or shock hazard.**
Caution	**When replacing or disposing of the battery, follow the precautions on the battery. Also, pay attention to the polarity when replacing.**
Caution	**When the product is not used for a long time, turn off the power switch and store it with the battery removed. Storing the battery with the battery inside may cause a malfunction due to liquid leakage.**

1-1. Panel Description

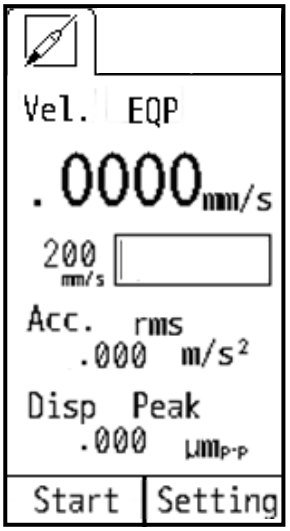
VM-3024 is available in Standard Model (VM-3024S) or High-End Model (VM-3024H). Icons appeared on the display are different in each model. Each screen display example is shown below.

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

VM-3024 can be switched freely between Japanese and English.

●Standard Model (VM-3024S)

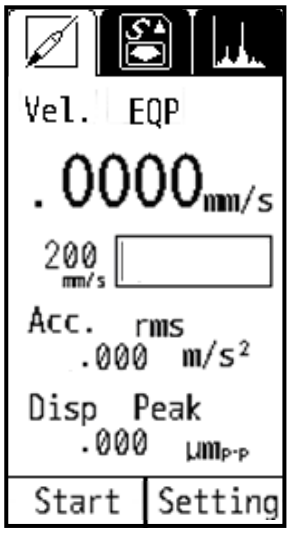
(Japanese)



(English)

●High-End Model (VM-3024H)

(Japanese)



(English)

The basic measurement operations will be explained on the screen of the high-end model (VM-3024H) (Section 3). Operation method is the same for the standard model (VM-3024S) as well. Additional functions of the high-end model, VM-3024H, will follow in section 5.

1-2. Package Contents

Product and Accessories for the VM-3024.

(1) Basic Product and Accessories

	Products	Qty	Model	Note	Figure
Main Unit	SmartVibro	1	VM-3024S or VM-3024H		
Accessories	Pickup	1	VP-3024	Electrodynamic Velocity Type	
	Probe	1	—	Handheld probe ϕ 10×50mm	
	Output Cable	1	—	1.5m cable with a plug at one end. For output to a recorder etc.	
	Battery	1	—	AA Alkaline Batteries	
	Instruction Manuals	1	—	with Inspection Sheet	
	SD Card	1	—	VM-3024H only	

(2) Option Accessories

	Products	Model	Note	Figure
1	Long Pickup Cable	CE-3024-3 (3m) CE-3024-6 (6m) CE-3024-10 (10m)	To keep a distance from the subject of measurement.	 (Example)
2	Magnet	Plane: MH-202R Curve: MH-203R (Fig is MH-202R)	To fix the pickup on the subject of measurement.	
3	Cover	PC-3024	Silicone jacket	
4	AC Adapter	PS-3024-3	100 to 240VAC	
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 Overview

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. Ideal for JIS standard inspection, quality control, and maintenance inspection.

In addition, vibration severity can be measured in accordance with “Instrument for measuring vibration of rotating machines and reciprocating machines (ISO2954 *)” defined by ISO (International Organization for Standardization).

* ISO2954 is available from ISO website.
(https://www.iso.org/home.html)

2-2. Features

■ Frequency Range
10Hz to 1kHz

■ 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.

■ Electrodynamic Velocity Pickup
The electrodynamic velocity pickup complies with the ISO2954.
High-sensitive measurement is possible.

■ FFT Analysis Function (Only VM-3024H)
Real-time FFT analysis is possible with a minimum condition setting to check vibration frequency components.

■ Waveform Data Save (Only VM-3024H)
Waveform can be stored.
Stored data in the SD card can be exported to a personal computer.

■ Language
VM-3024 can be switched freely between Japanese and English.

3. Measurement

The names of each part of the main unit are as shown in Fig.3-1.

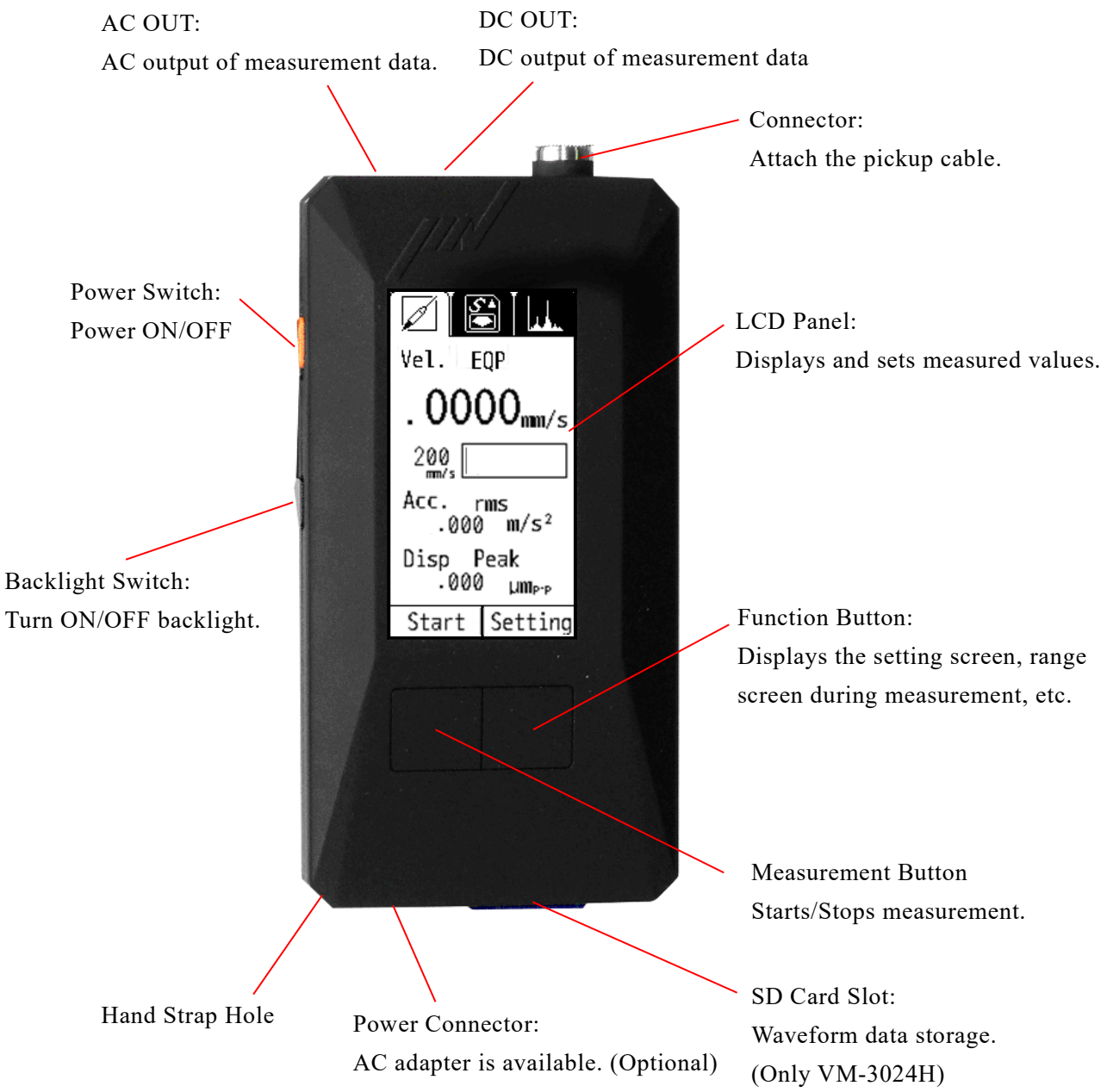


Fig.3-1 Vibrometer Main Unit

3-1. Before Getting Started

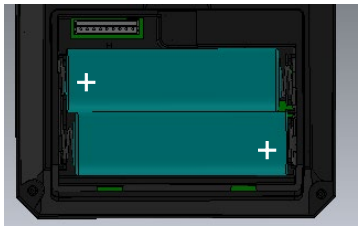
(1) You can select the computing method for velocity, acceleration, and displacement. Refer to section 4-2 for more details. Initial settings are as follows:

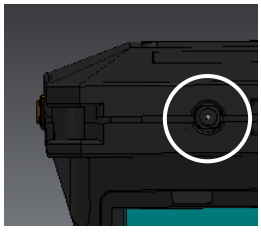
- ■ Acceleration (ACC): rms
- ■ Velocity: rms
- ■ Displacement: EQP

Caution

(1) If you are familiar with our VM-3004 or VM-3304, EQP setting for the displacement is highly recommended. Since the measurement data with the VM-3004 and VM-3304 is indicated in EQP, you may easily compare the data with the same setting.
(2) For measurement of the vibration severity, velocity setting needs to be “rms.”

(2) Check the polarity carefully, and set two AA batteries in the battery box (Ni-Cd or Alkaline) (Fig.3-2).
For the use with the AC adaptor, connect the AC adapter cable to the power connector in the bottom of the device.





(a) Installing AA batteries (b) Attaching the AC adapter

Fig.3-2 Power Supply Method

Caution

Pay attention to the polarity of the battery.

(3) Connect the pickup cable to the pickup connector.
In addition, when measuring, pickup installed or fixed for object. For actual measurement, refer to the following sections.

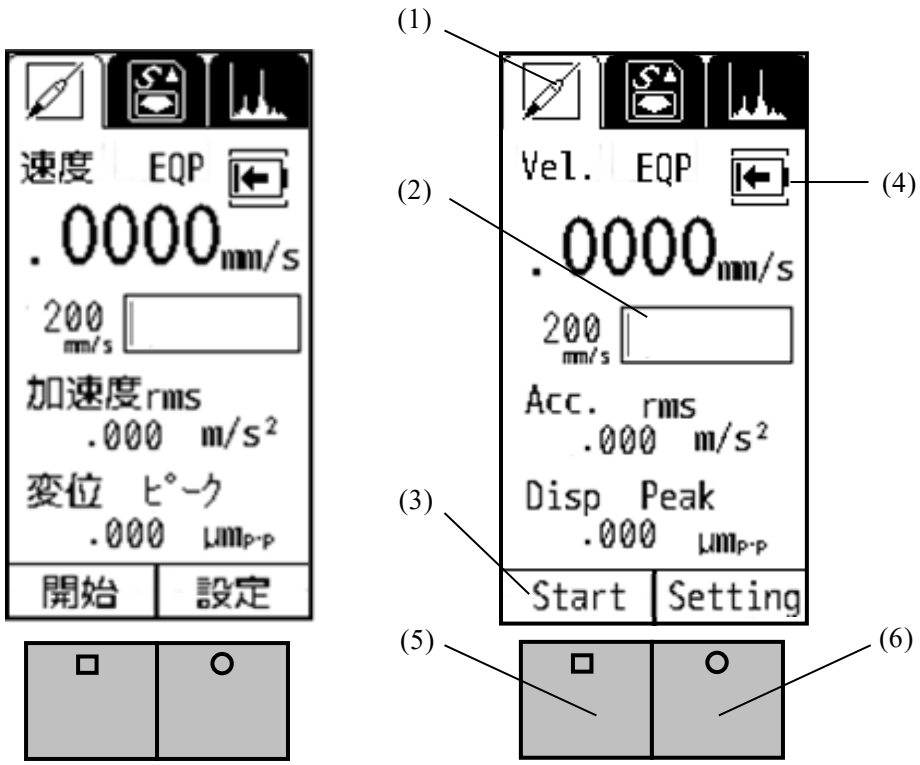
Caution

Refer to section 10 when fixing the pickup.

(4) Display Language Setting
VM-3024 can switch between Japanese and English as needed. Refer to section 4-6.

3-2. Measurement Screen

Turn on the SmartVibro by sliding an orange switch on the left side of the device, initial screen (Fig.3-3) will appear. Operate the device by using the touch screen and two buttons.



(Japanese) (English)

Fig.3-3 Initial Screen

(1) Standard Measurement Mode
VM-3024S 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 Fig.3-3, “Start” and “Setting” are operative.

(4) Battery Indicator
This appears when the battery level is low.

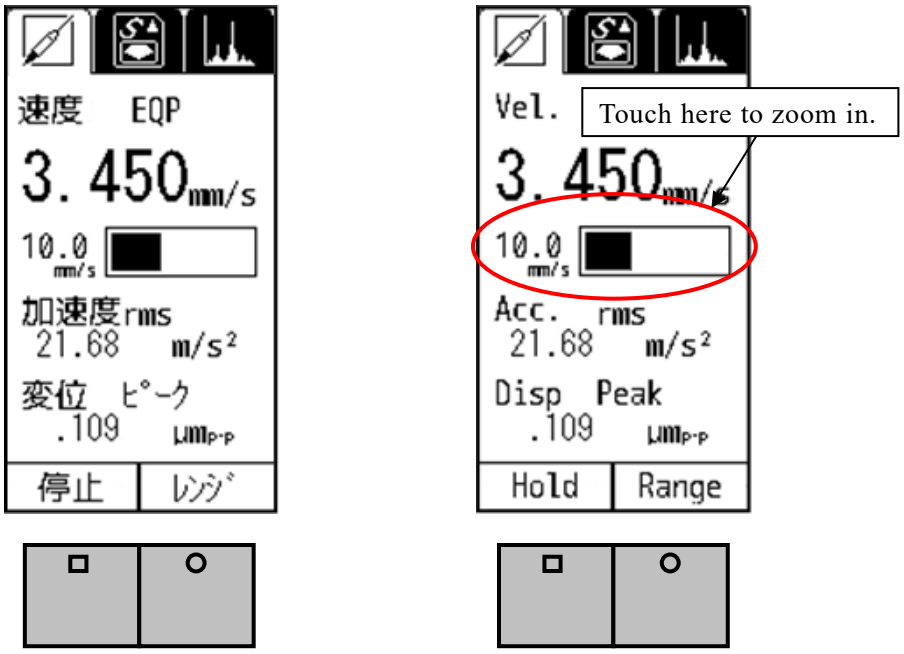
(5) Measurement Button
In the measurement mode, you can start or hold measurement when you press this button.
In the setting mode, you can check the battery level (refer to section 4-8).

(6) Function Button
In the measurement mode, range display will appear when you press this button.
In the FFT mode (only VM-3024H), this button would switch the display from detailed to simple indication of the result, and vice versa (refer to section 5-1).

3-3. Operations during Measurement

Touching “Start” on the touch screen or press “Measurement Button” in Fig.3-3 would start measurement. The screen displays measurement status (Fig.3-4).

Once you touch “Hold” on the touch screen or press “Function Button” would hold measurement and the display (AC output when stopped is not retained).



(Japanese) (English)

Fig.3-4 Display during Measurement

⚠ Caution

(1) How to change the Range

When the Auto Range function is “OFF” (refer to section 4-4.), the range key will be activated during measurement (Fig 3-4).

Touching “Range” on the touch screen or pressing “Function Button” 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.3-5).

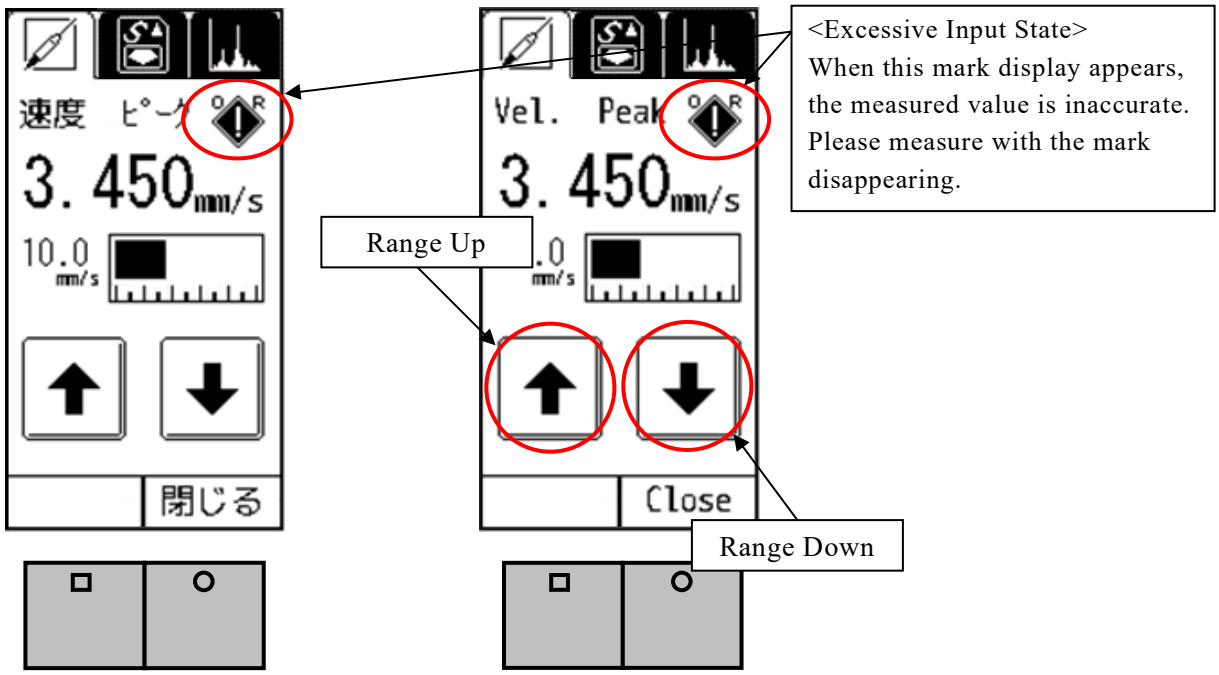
(2) About Excessive Input State (Measurement Impossible State)

When is displayed on the upper right of the screen, regardless of main unit version, input speed value exceeds the hardware range (amplifier gain), and the waveform is distorted and unsuitableness state.

In this case, do not use it as a measurement value because it is not possible to measure accurately.

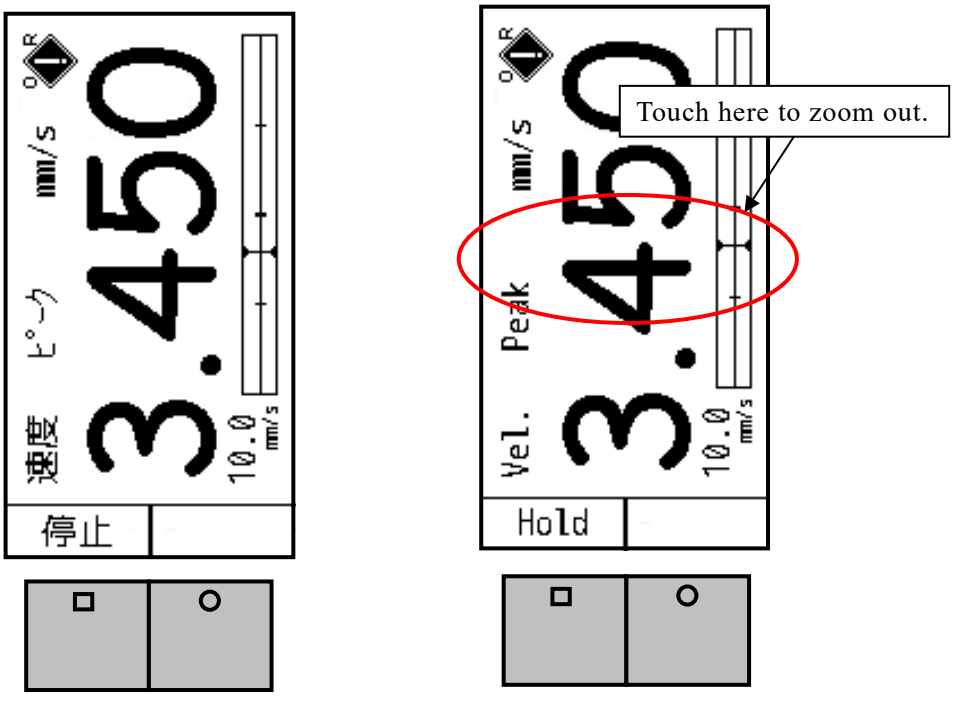
How to Zoom In

Touch the range bar area on the screen to zoom in the image (Fig.3-4). To zoom out, touch the same area again (Fig.3-6).



(Japanese) (English)

Fig.3-5 Display during Changing the Range



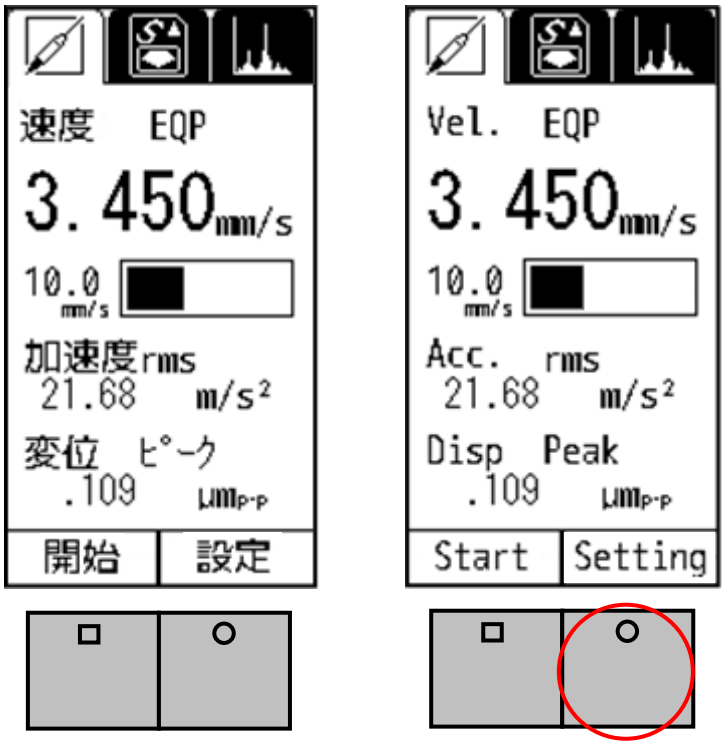
(Japanese) (English)

Fig.3-6 Enlarged

4. Setting

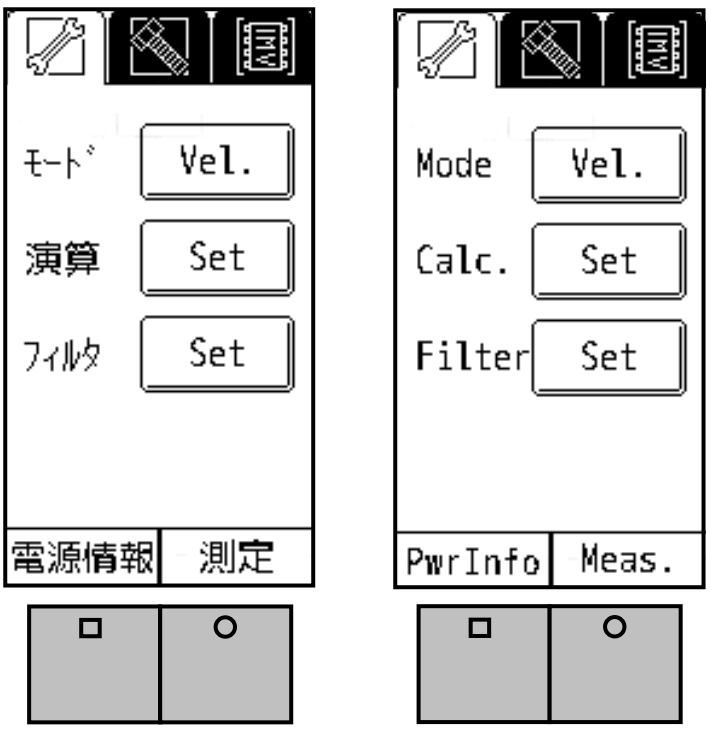
This section explains how to make various settings such as measurement mode.

As shown in Fig.4-1, the setting screen will appear when pressing “Function Button” or touching "Setting" on the touch screen when “setting” is indicated in the function indicator (Fig.4-2).



(Japanese) (English)

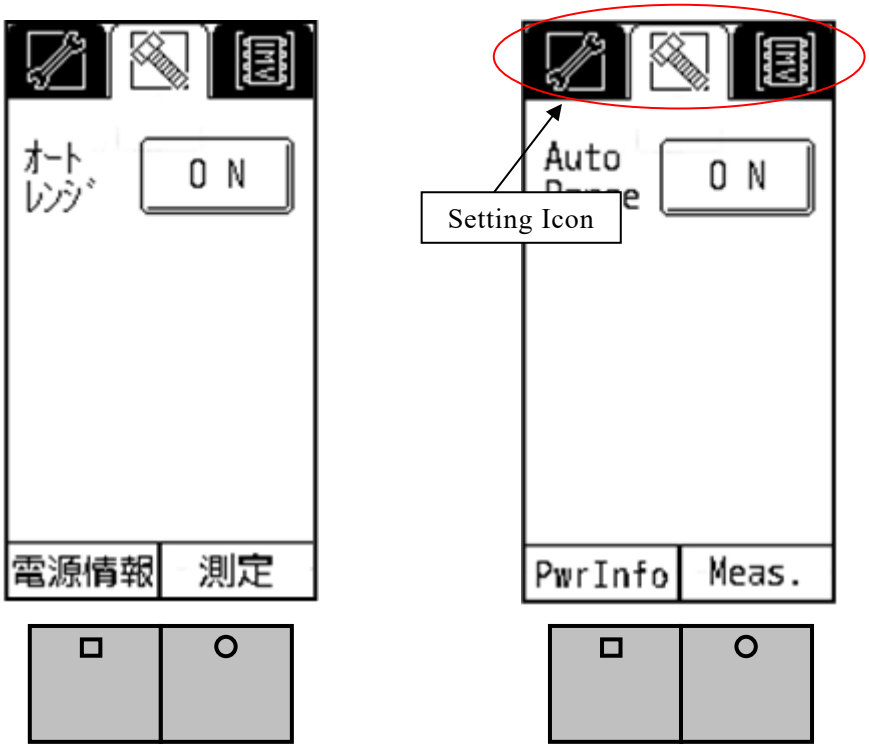
Fig.4-1 “Setting” in the Function Indicator



(Japanese) (English)

Fig.4-2 Mode and Calculation Setting Screen

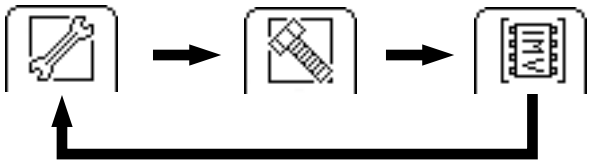
The setting screen can be switched by touching the icon at the top of the screen (Fig.4-3).



(Japanese) (English)

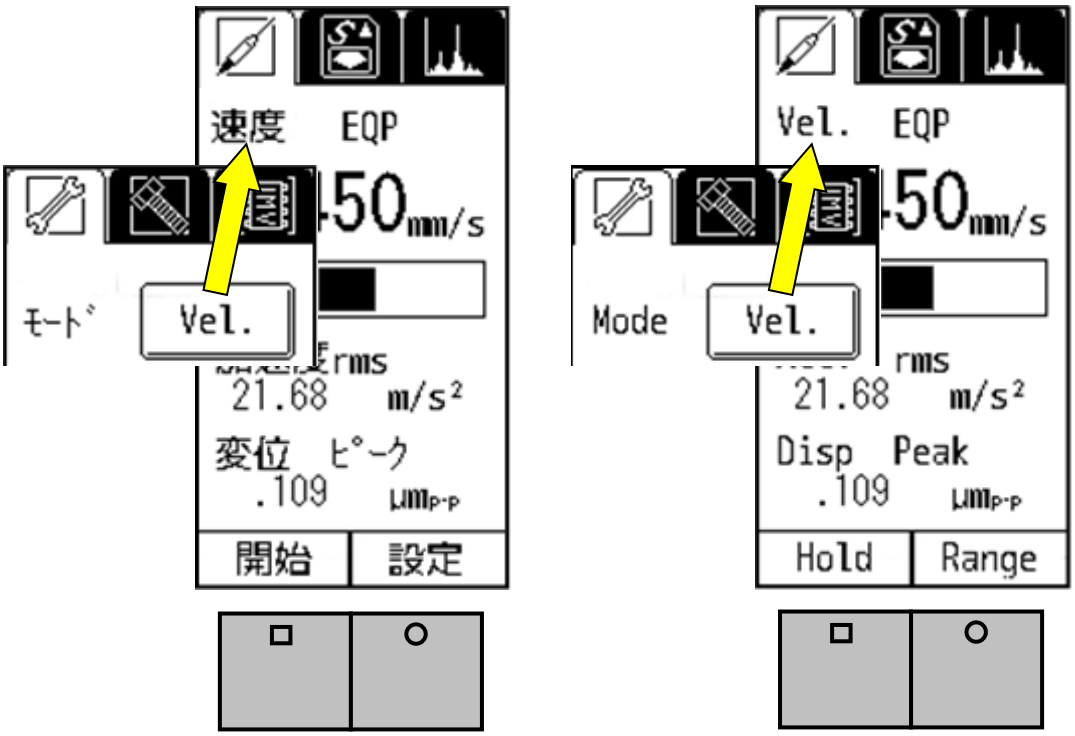
Fig.4-3 Switching the setting screen

Switching is in the following order.



4-1. Mode Setting

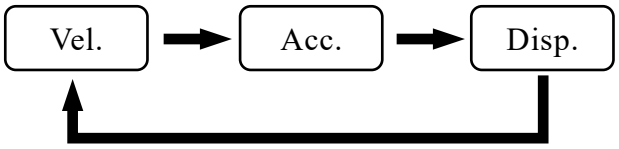
When “Vel.” is selected for the Mode (Fig.4-4), the physical amount is shown at the top of the measurement screen. Also, the enlarged screen will show the physical amount accordingly.



(Japanese) (English)

Fig.4-4 Mode Setting

In “Mode”, the setting mode changes in the following order each time the button is touched.



After setting mode, press “Measurement Button” button or touch "Meas." on the touch screen, return to the measurement screen (Fig.4-5).

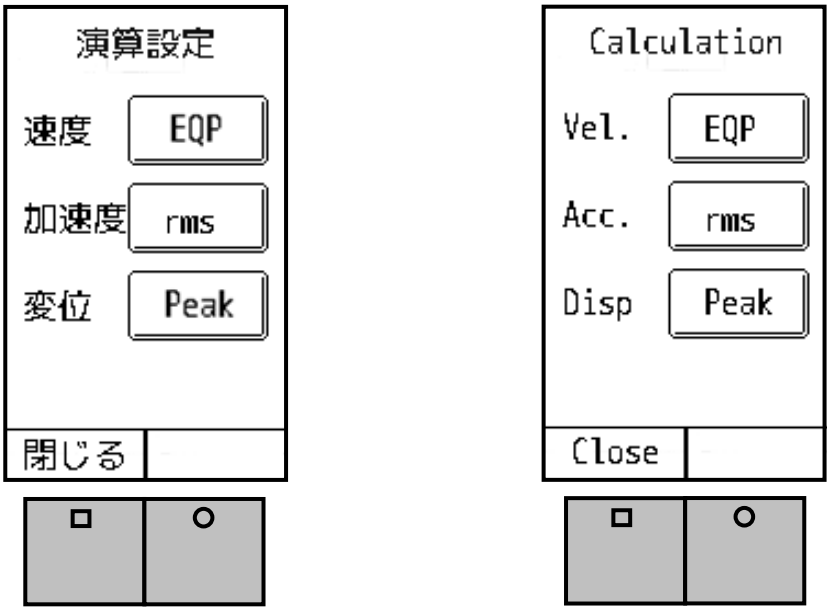
(Japanese) (English)

Fig.4-5 How to return to the Measurement Screen

4-2. Calculation Setting

You can set how to indicate the physical amount of measurement results in calculation setting “Calc.”.

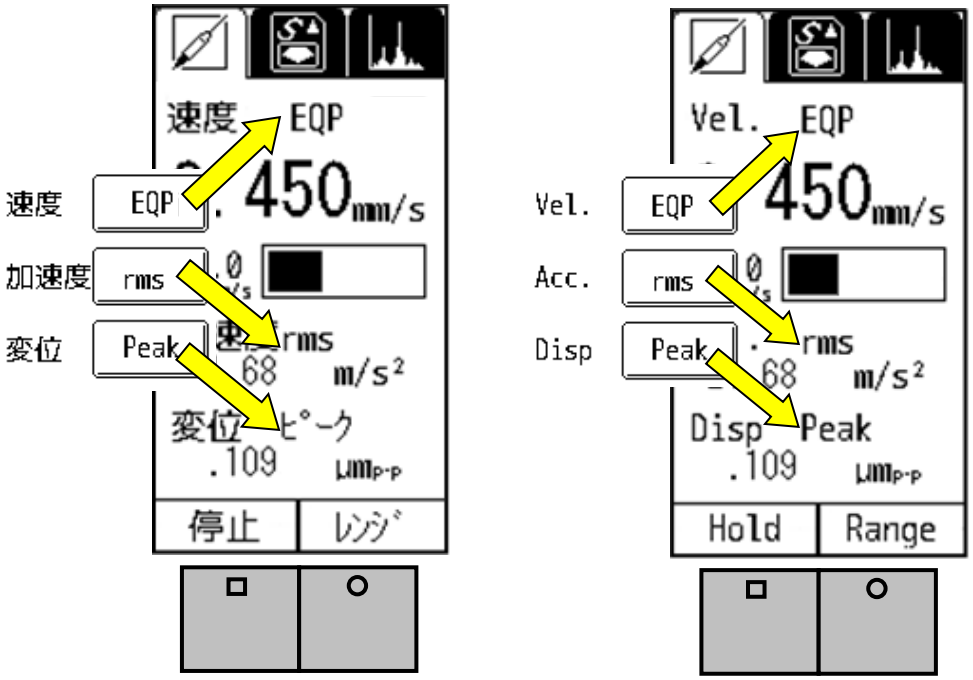
As you touch “Set” in Fig.4-2, Fig.4-6 will appear.



(Japanese) (English)

Fig.4-6 Calculation Setting

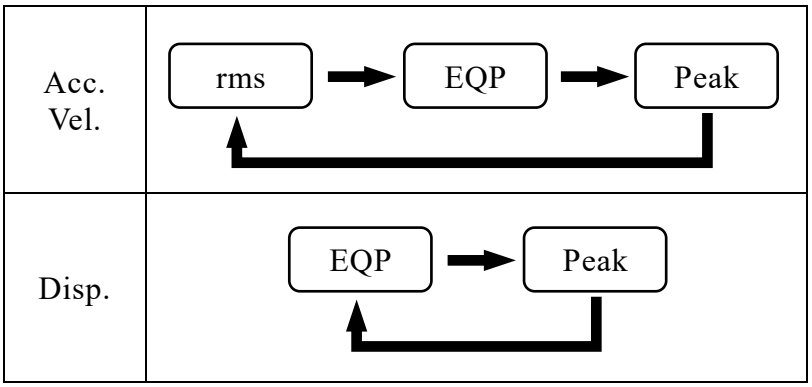
The calculation method selected in Fig.4-6 will be displayed on the screen (Fig.4-7).



(Japanese) (English)

Fig.4-7 Example of the Setting Screen

Calculation settings change each time the button is touched.
Switching is in the following method.



(1) A brief Description of each Calculation Method

rms: "rms" is "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"$\times\sqrt{2}$. 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.

For detailed explanation, refer to the definitions in Section 10.

(2) Setting of VM-3004 and VM-3304

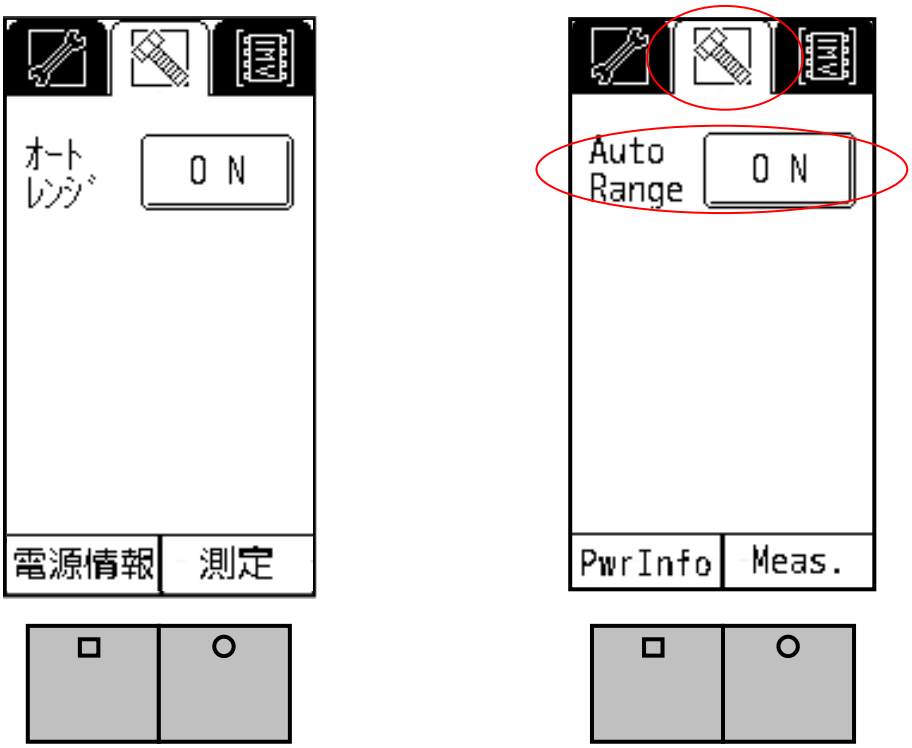
When had used VM-3004 and VM-3304 in past, should not use "Peak" setting, but use the same setting as VM-3004 or VM-3304.

Recommended settings for VM-3024 are as shown in the table below.

Model	VM-3004 VM-3304	VM-3024S VM-3024H
Acc.	rms	rms
	EQP	EQP
Vel.	rms	rms
	EQP	EQP
Disp.	EQP	EQP
	—	Peak

4-3. Setting of Auto Range

To set Auto Range, select  tab on the setting screen (Fig.4-8).



(Japanese) (English)

Fig.4-8 Setting Page of Auto Range

When auto range is "ON", range will be adjusted automatically during measurement (Fig.4-8). “Range” will not be indicated on the measurement display. In this case, “Function Button” is not effective (Fig.4-9).

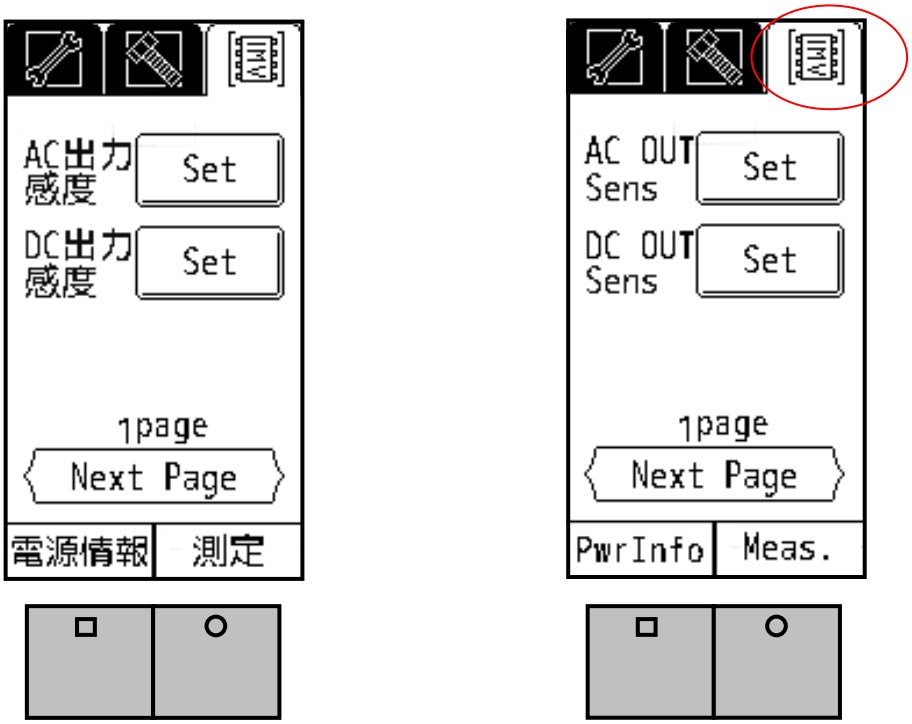
You can switch between “ON” and “OFF” by touching Auto Range button on the screen.

(a) Auto Range is “ON” (b) Auto Range is “OFF”

Fig.4-9 Measuring Screen of Auto Range “ON” and “OFF”

4-4. Sensitivity Setting of AC and DC Output

To set the sensitivity of AC Output and DC Output, select the tab on the setting screen (Fig.4-10).



(Japanese) (English)

Fig.4-10 AC and DC Output Sensitivity Setting Page

Touch “Next Page” on the setting screen shown in Fig.4-12 to move to the second page.
There are 4 pages in total, and every time you touch “Next Page”, the screen is change as follow.

“1page” → “2page” → “3page” → “4page” → “1page”→ …

For the contents on “2page” and after, refer to section 4-6 and after.

The physical amount of output signal of ACOUT is equivalent to the physical amount designated in the mode setting, and select the value by pressing the button. The value will switch as follows:

Vel. mm/s	15000 → 1500 → 150 → 15
Acc. m/s^2	450 → 45 → 4.5
Disp. µmo-p	75 → 7.5 → 0.75 → 0.075

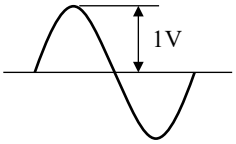
Fig.4-11 AC Output Sensitivity Setting

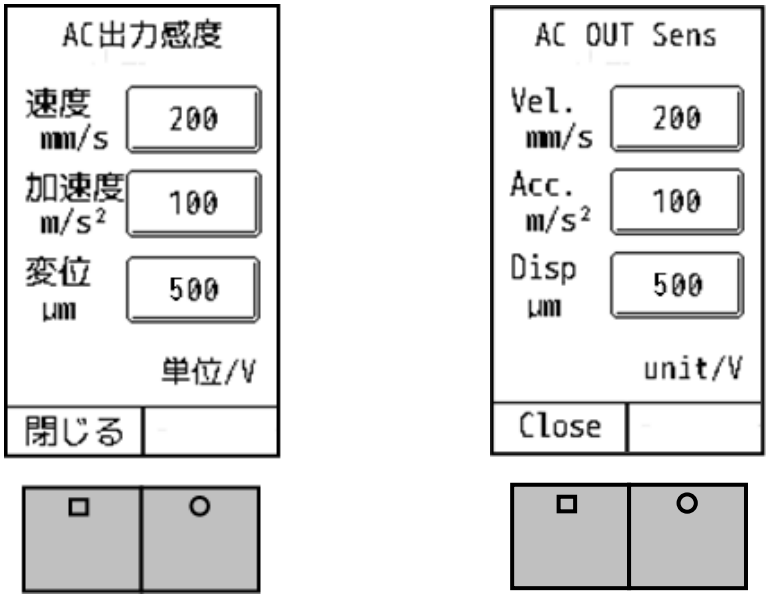
AC output sensitivity specifies the full scale for the ACOUT voltage value. Touching the "Set" button will display Fig.4-12.

For each of velocity, acceleration, and displacement, set the value of voltage 1V.

In the example shown in Fig.4-12, the settings are as follows.

Vel.: "1V" is equivalent "200mm/s EQP"
Acc.: "1V" is equivalent "100m/s^2 EQP"
Disp.: "1V" is equivalent "500µmo-p"

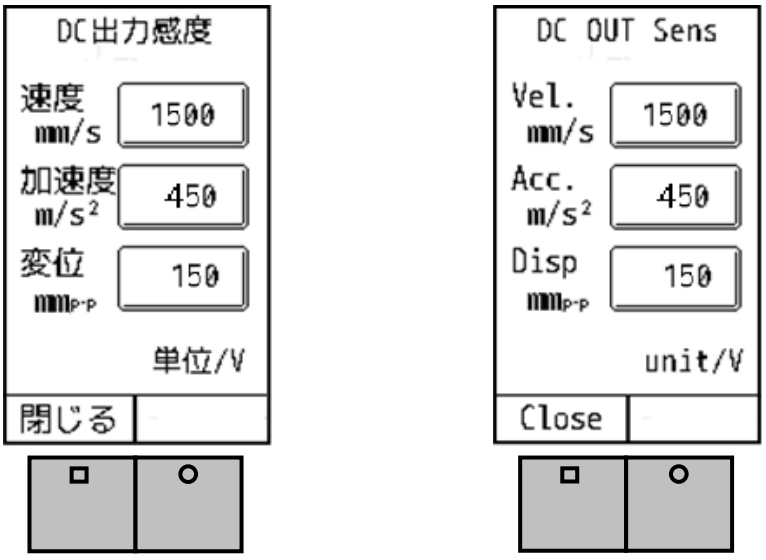




(Japanese) (English)

Fig.4-12 AC Output Sensitivity Setting Page

On the other hand, DC output sensitivity specifies the full scale for the DCOUT voltage value. Touching the "Set" button will display Fig.4-13.



(Japanese) (English)

Fig.4-13 DC Output Sensitivity Setting Page

The setting method is the same as AC output sensitivity. The value is switched as shown in Fig.4-14 by pressing the button with the number displayed.

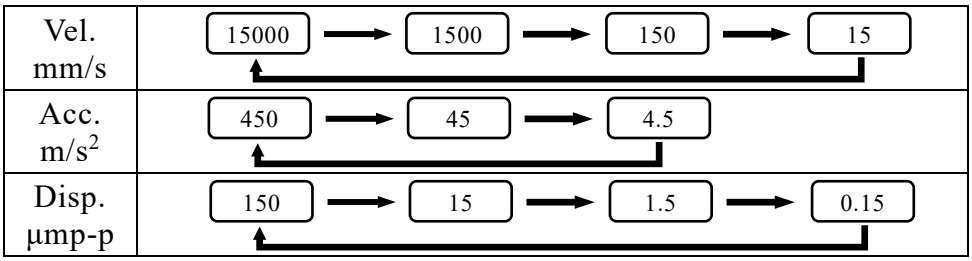


Fig.4-14 DC Output Sensitivity Setting

Caution

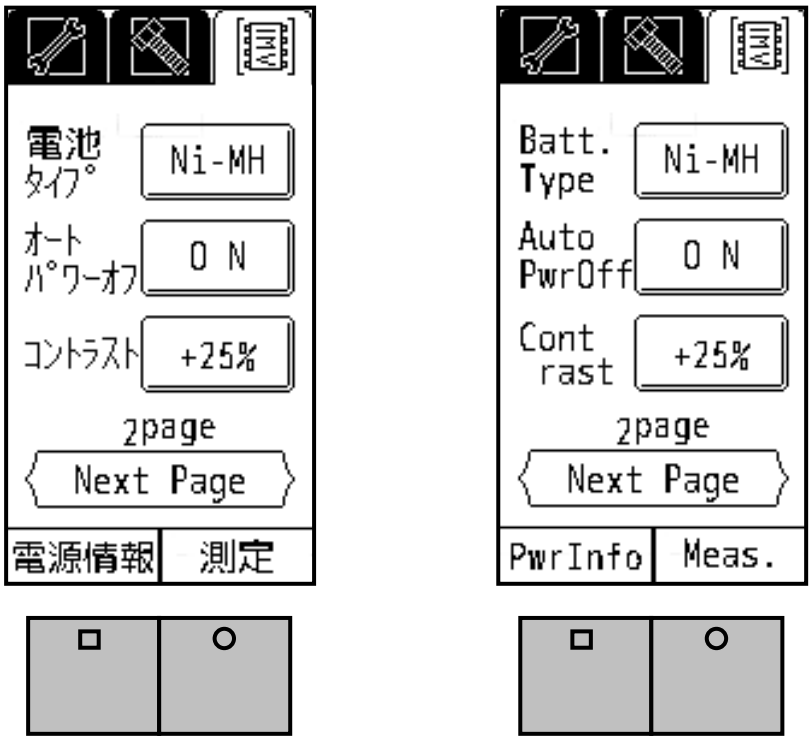
Cautions when using AC output and DC output

(1) **When performing measurement using AC output and DC output, be sure to set Auto Range to "OFF".**
If Auto Range is set to "ON", the vibration value fluctuates greatly immediately after when the measurement range switched. At this time, AC output and DC output fluctuate greatly, and correct measurement results cannot be obtained.

(2) Be sure to set the sensitivity of AC output and DC output above the selected range.
Ex.
When set to the range of velocity 6mm/s,
AC Output Sensitivity is set "20".
DC Output Sensitivity is set "20".

4-5. Setting of Battery Type, Auto Power Off, and Contrast

Touch "Next Page" on the setting screen shown in Fig.4-10 to move to the second page (Fig.4-15 on the next page).



(Japanese) (English)

Fig.4-15 Setting Screen of Battery Type, Auto Power Off, and Contrast

4-5-1. Setting of Battery Type

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 are used, the battery life may not be indicated correctly.

4-5-2. Setting of Auto Power Off Function

When “Auto Power Off” is set to “ON”, the power is automatically turned off approximately 10 minutes after the last operation.

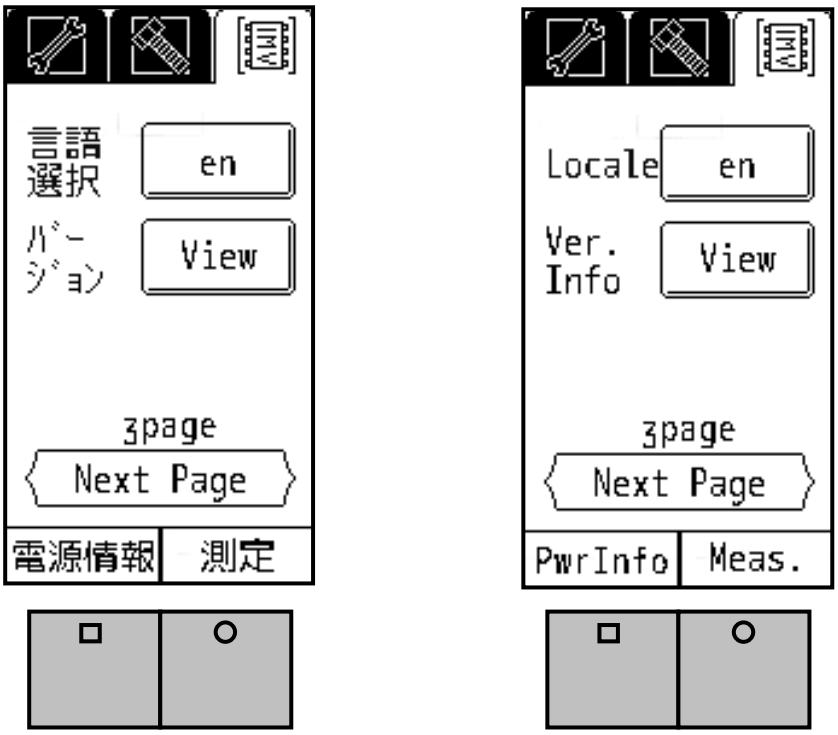
⚠
(1) When the backlight is on, it will turn off approximately 8 minutes after the last operation. If any operation is performed while the light is off, the backlight will turn on again. (2) To turn the power on again after the power is turned off by auto power off, turn the power switch off and then on again.

4-5-3. Setting of Contrast

Adjust the contrast of the screen from -50% to +50% at +/-25% intervals.

4-6. Language Setting

Touch “Next Page” on the setting screen shown in Fig.4-15 to move to the third page (Fig.4-16).



(Japanese) (English)

Fig.4-16 Language Setting and Version Information

4-6-1. Language Setting

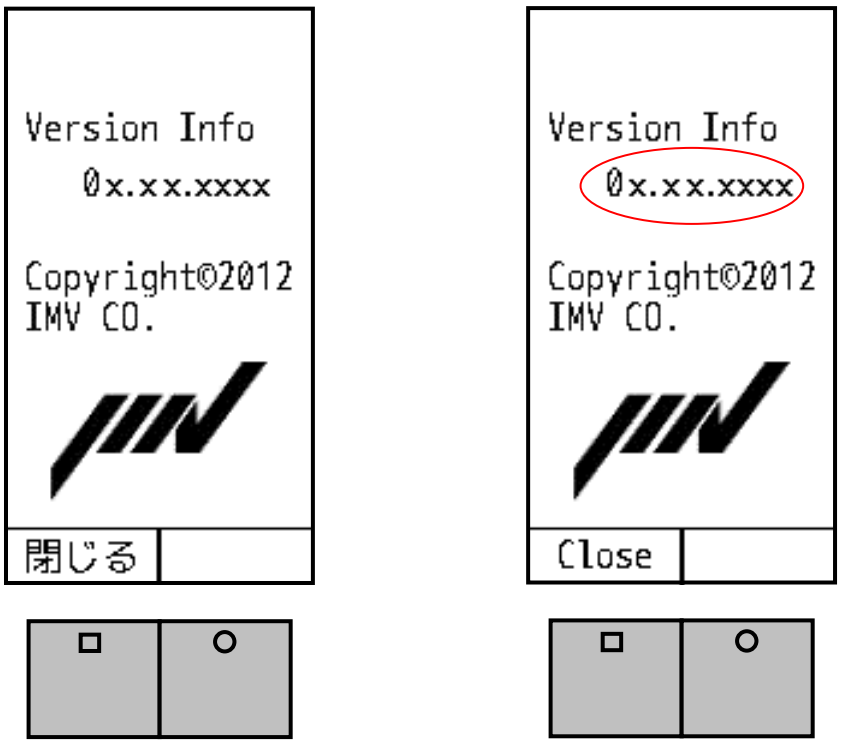
Select “en” for English. Once you restart the device, the display will be changed into English.

To choose Japanese, select “jp”, and restart the device.

4-6-2. Version Information

You can check the firmware version.

Touch the “View” button next to the version in Fig.4-16 to display the version information (Fig.4-17).



(Japanese) (English)

Example of version display

02.16.2021

Fig.4-17 Display of Version

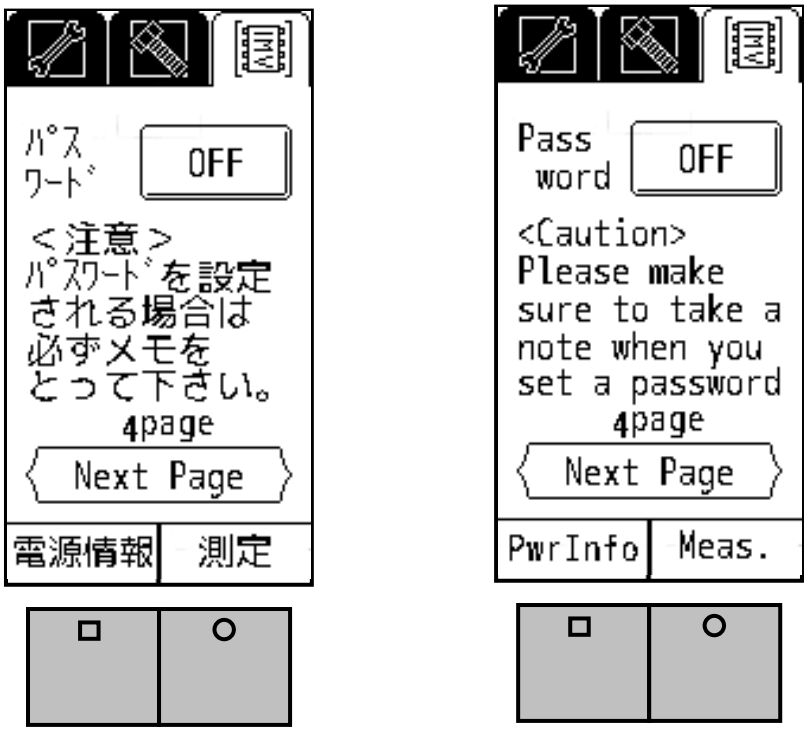
If you contact us about the product, we may check the version of holding VM-3024S/H. Please check the version in advance with this function.

4-7. Password Function

4-7-1. Password Setting

Touch “Next Page” on the setting screen shown in Fig.4-16 to move to the forth page (Fig.4-18).

Password lock can be set so that only the administrator can change the settings. Note that the password is not set when shipped from the factory ("OFF").



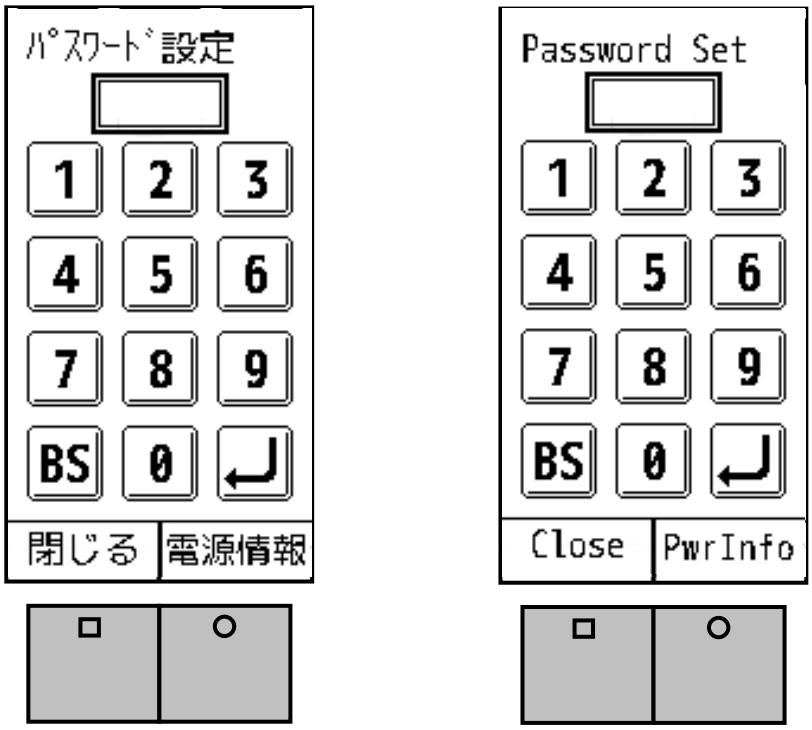
(Japanese) (English)

Fig.4-18 Password Setting (Password “OFF”)

Push the “OFF” button on Fig.4-18, then Fig.4-19 is showed to input 4 digits password number.

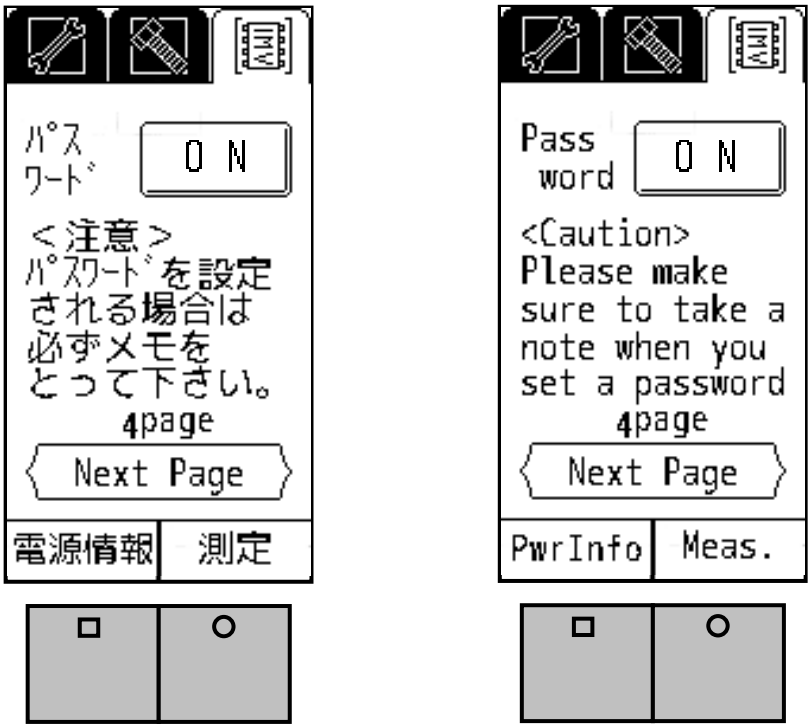
Input 4 digits number, and push the return button (↵), then the password number is set.

In case of “password is being set”, “OFF” becomes to “ON” in Fig 4-18 (see Fig.4-20).



(Japanese) (English)

Fig.4-19 Password Input



(Japanese) (English)

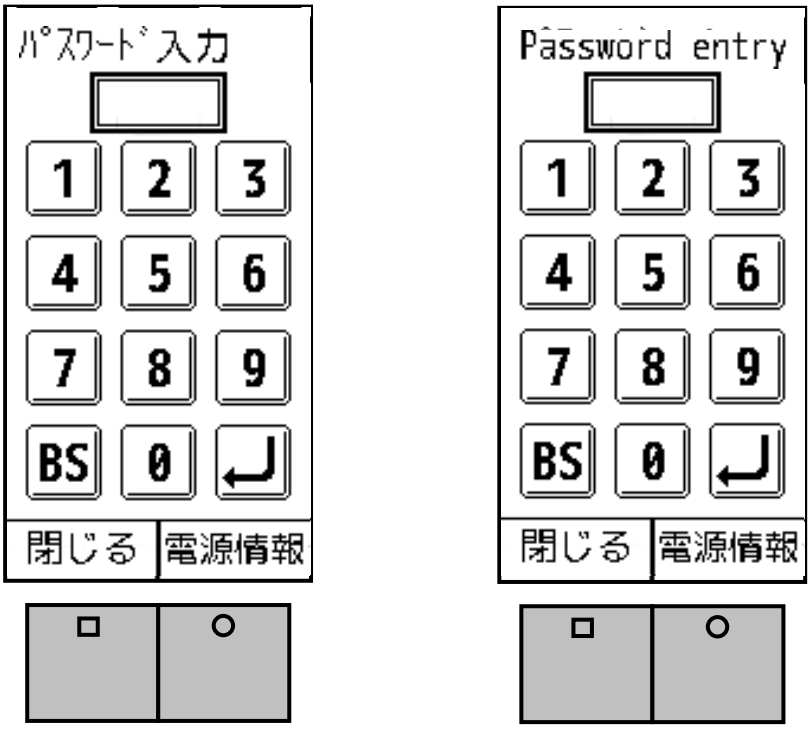
Fig.4-20 Password Setting (Password “ON”)

4-7-2. Password Input

While password is set, if you press the “Setting” button, Fig 4-21 will show “Password entry”.

Please input 4 digits number, and press the return button (↵). If password is correct, the setting page will be displayed.

If password is not correct, then the “Password entry” is required again. In such a case, please confirm your password and input it correctly.



(Japanese) (English)

Fig.4-21 Password Input

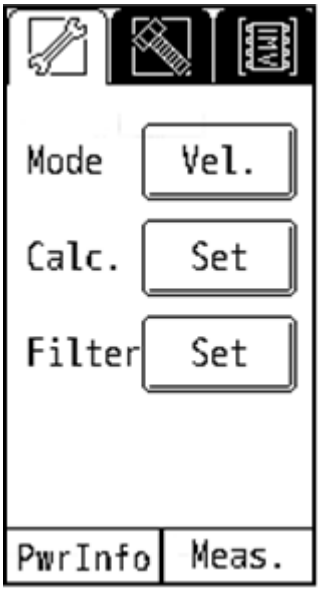
Caution

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.

4-8. Battery Indicator

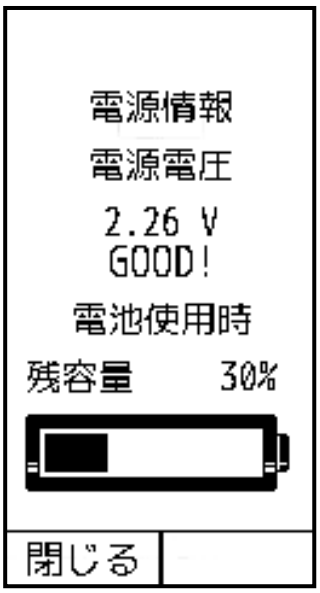
When “PwrInfo” is displayed, press “Measurement Button” or touch “PwrInfo” on the touch screen to check the power information (Fig.4-22 and Fig.4-23).

(Japanese)

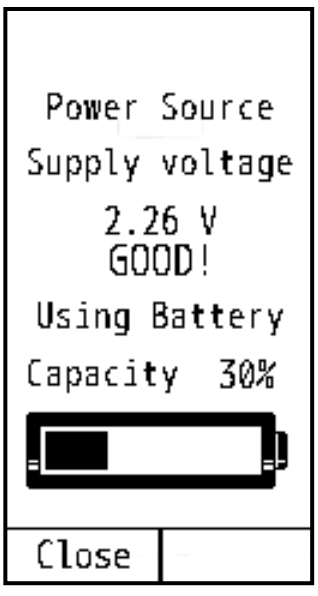


(English)

Fig.4-22 “Pwr Info” Indication



(Japanese)



(English)

Fig.4-23 Battery Information

5. FFT and Data Save

VM-3024H is equipped with FFT and waveform saving functions. These functions are described below.

FFT: FFT Mode is activated when this tab is selected.

Data Save: Data Save Mode is activated when this tab is selected. Waveform data will be stored in the SD card as plain text.

Caution

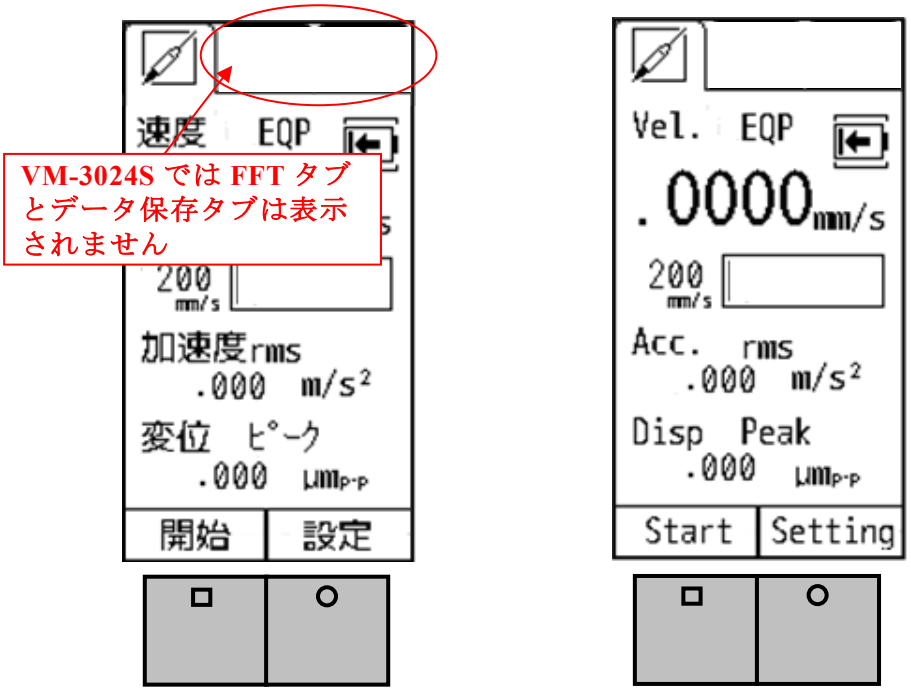
Only waveform data can be saved to SD (FFT results and measurement values (OA values) displayed on the screen cannot be saved).

About FFT Function and Waveform Saving

Only VM-3024H supports the FFT function and waveform data storage function.

The FFT tab and Data Save tab are not displayed on the initial screen of VM-3024S (Fig.5-1).

You can also insert SD card into the SD slot, but these functions will not be enabled even if you insert SD card.



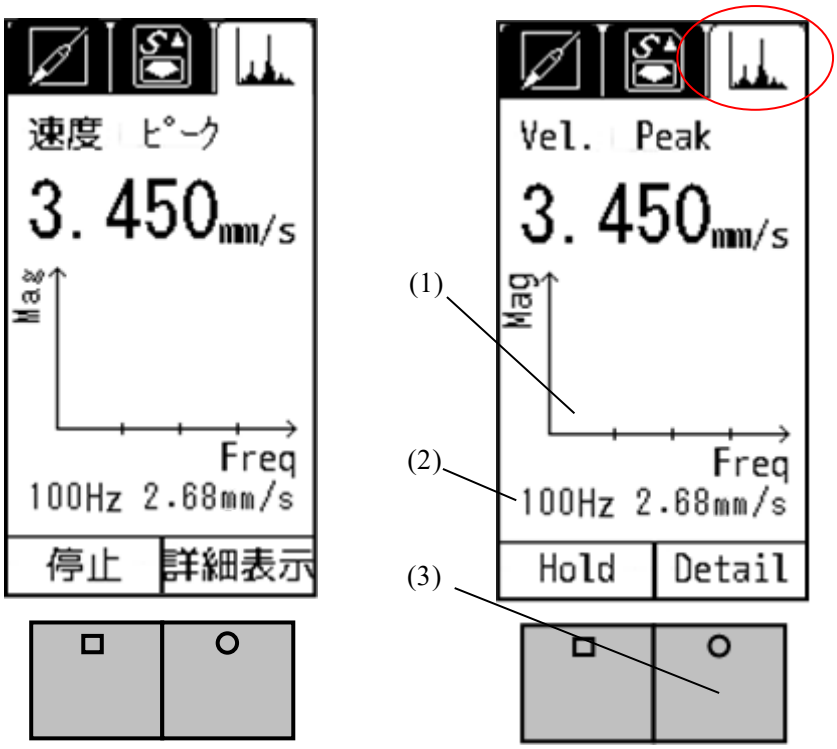
(Japanese) (English)

Fig.5-1 Initial Screen of VM-3024S

5-1. FFT

5-1-1. FFT Indication

Selecting FFT tab  will show the screen Fig.5-2.



(Japanese) (English)

Fig.5-2 FFT Menu

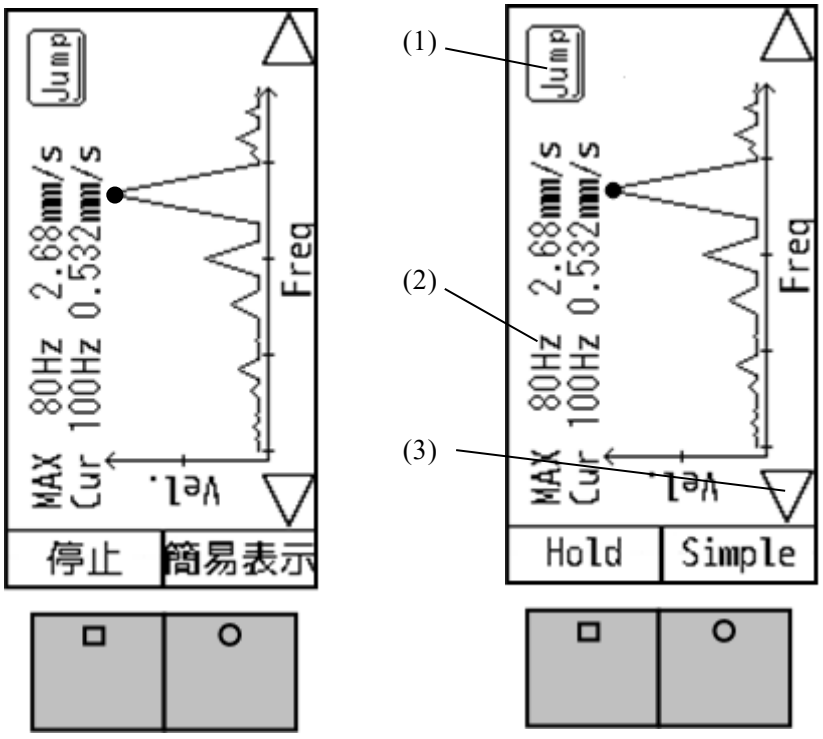
(1) FFT Graph

Y-axis shows the physical amount of the measurement result indicated above the graph (Velocity in Fig 5-2).

X-axis indicates frequency.

(2) Maximum frequency and its value.

(3) Details will appear as you press “Function Button” (Fig.5-3).



(Japanese) (English)

Fig.5-3 Detail of 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.

Regarding the Range when using FFT

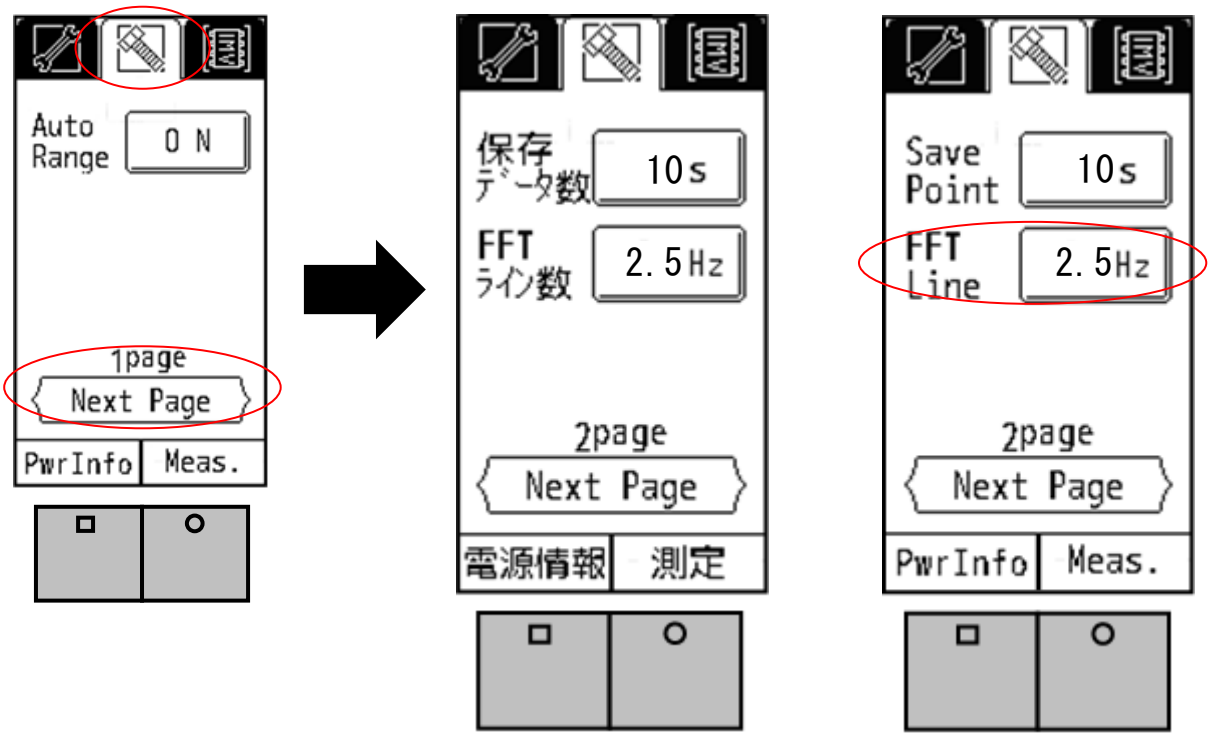
When "Auto Range" is set to "OFF", the range cannot be changed on the FFT display screen.

To change the range, return to the measurement mode screen and make settings (refer to section 3-3).

5-1-2. FFT Setting

On VM-3024H, “Next Page” is displayed on Auto Range setting screen. When “Next Page” is touched, the setting screen for “Save Point” and “FFT Line” is displayed (Fig.5-4).

“FFT Line” shows a frequency resolution. You can select from 2.5Hz, 5Hz, and 10Hz.



(Japanese) (English)

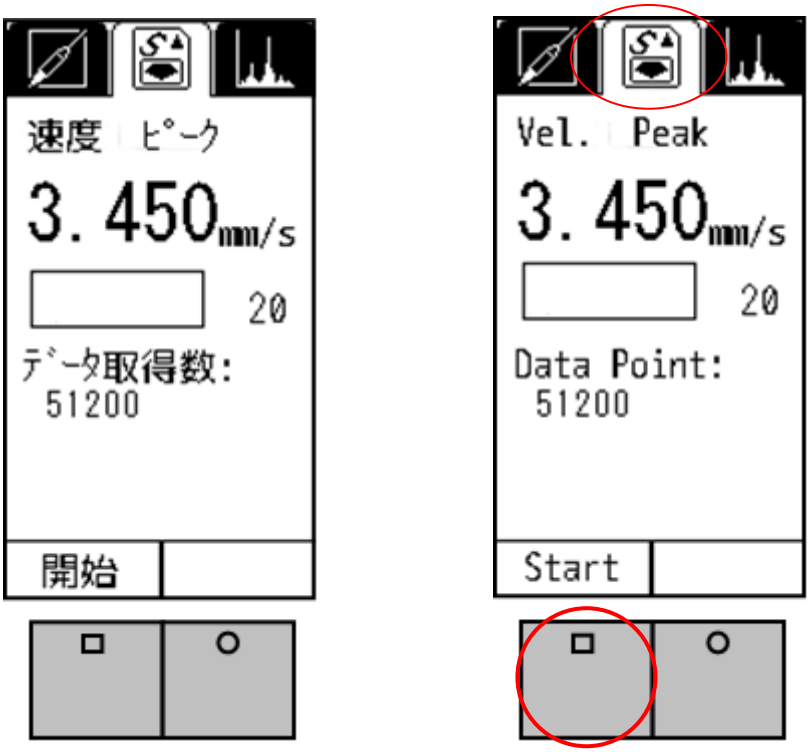
Fig.5-4 Setting of FFT Parameter

“Save Point” does not affect the FFT calculation.

5-2. Data Save

5-2-1. Waveform Data Save

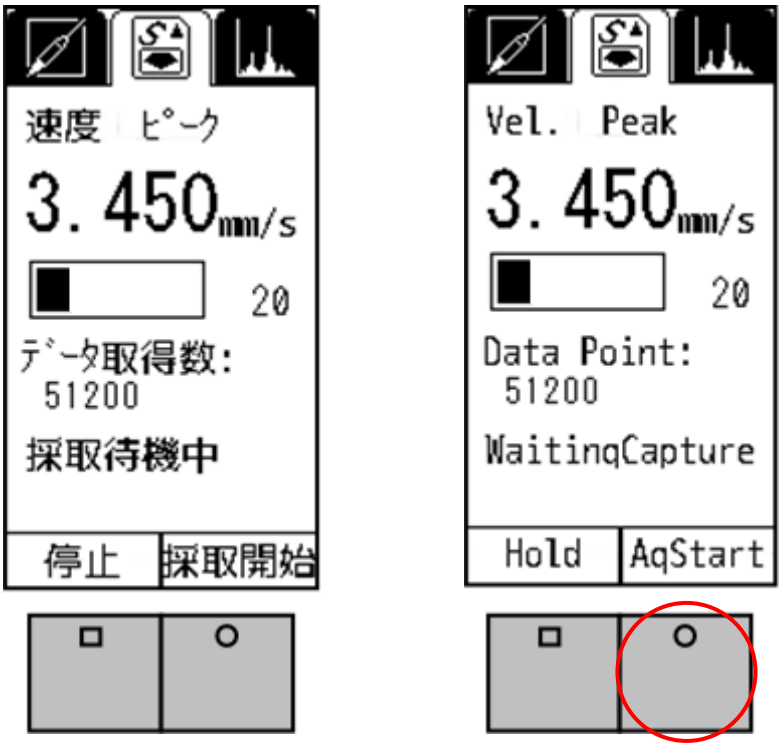
Selecting Data Save tab  will show the screen Fig.5-5.



(Japanese) (English)

Fig.5-5 Waveform Data Gathering Start

Pressing “Measurement Button” or touching “Start” in Fig.5-5 starts gathering the data.



(Japanese) (English)

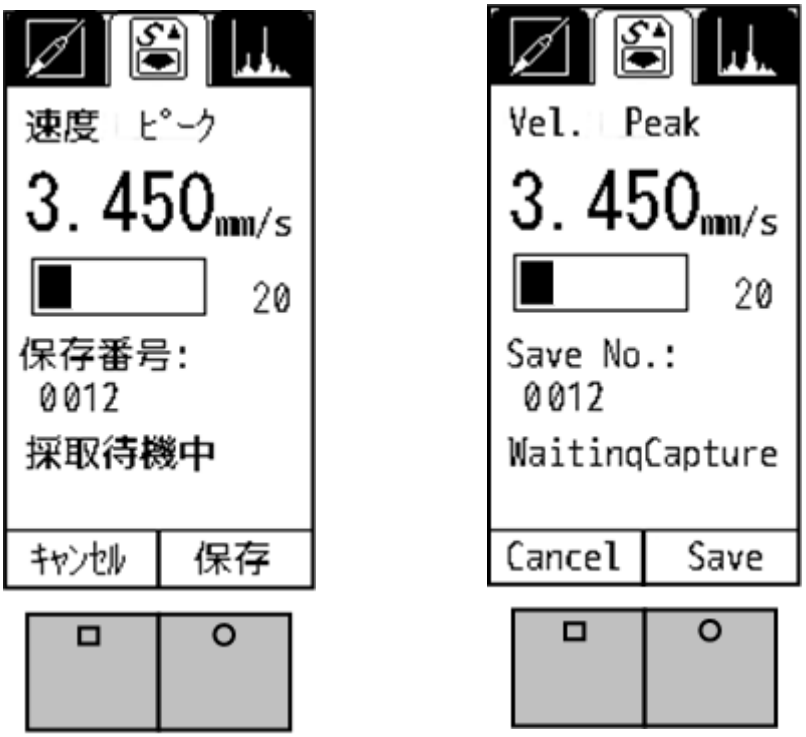
Fig.5-6 Waveform Data Gathering

In Fig.5-6, when press “Function Button” or touch “AqStart” on the touch screen, data acquisition actually starts.

When data acquisition is complete, the screen shown in Fig.5-7 appears. Press “Function Button” or touch “Save” on the touch screen to save the data to SD. Saving to SD is numbered in order starting from “0000” and saved to SD card (Fig.5-8).

⚠ Caution

(1) To cancel during waveform acquisition, press “Measurement Button” or touch “Stop” on the touch screen.
(2) To cancel saving of the acquired waveform, press “Measurement Button” or touch “Cancel” on the touch screen.



(Japanese) (English)

Fig.5-7 Completed Data Gathering

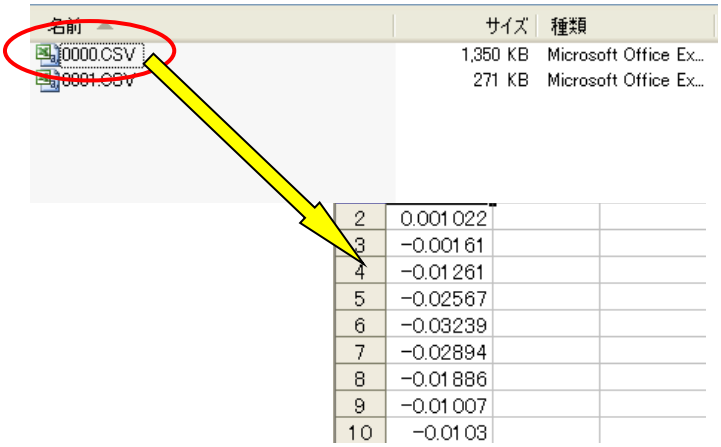


Fig.5-8 Example of Waveform Data

Caution

Precautions when Saving Waveform Data

(1) Waveform data is the physical amount displayed at the top in measurement mode. Display the physical amount you want to collect at the top of the measurement mode, and then save the waveform data.

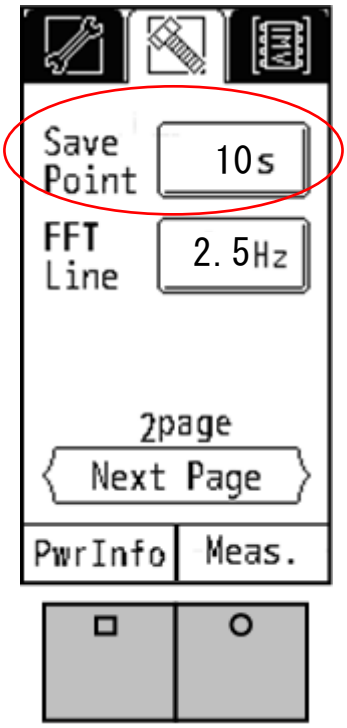
(2) The range setting is not relevant when saving waveform data.

(3) If you move to waveform data save with a large amount of waveform data stored in SD, it may take some time before waveform acquisition can be started. To smooth the waveform data save, delete the waveform data in the SD as appropriate. Note that deletion of data in SD cannot be performed with VM-3024H. After removing SD card, make a backup of the necessary data and delete it with a PC.

5-2-2. Setting of Waveform Data Save

Fig.5-9 is the display of data save setting.

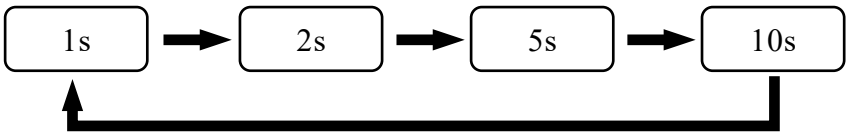
(Japanese)



(English)

Fig.5-9 Parameter Setting of Data Save

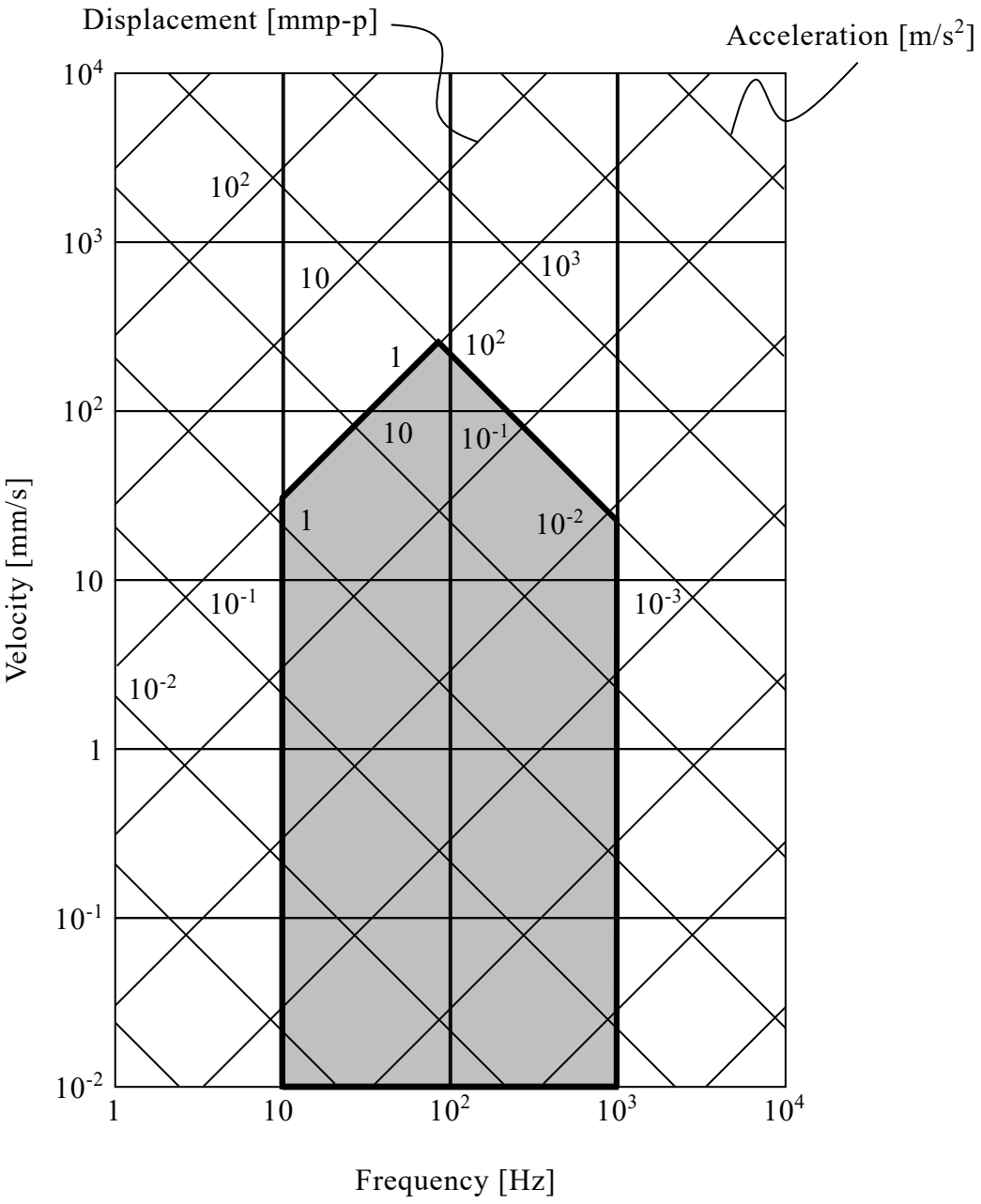
The time that can be specified is “1s”, “2s”, “5s” and “10s”. The time changes each time you touch.



The number of data acquisitions is 10,240 per second and is proportional to the save point, so calculate the time axis based on this (see the table below).

Save Point	Data Acquisitions
1s	10,240
2s	20,480
5s	51,200
10s	102,400

6. Conversion Table



7. Specifications

7-1. SmartVibro

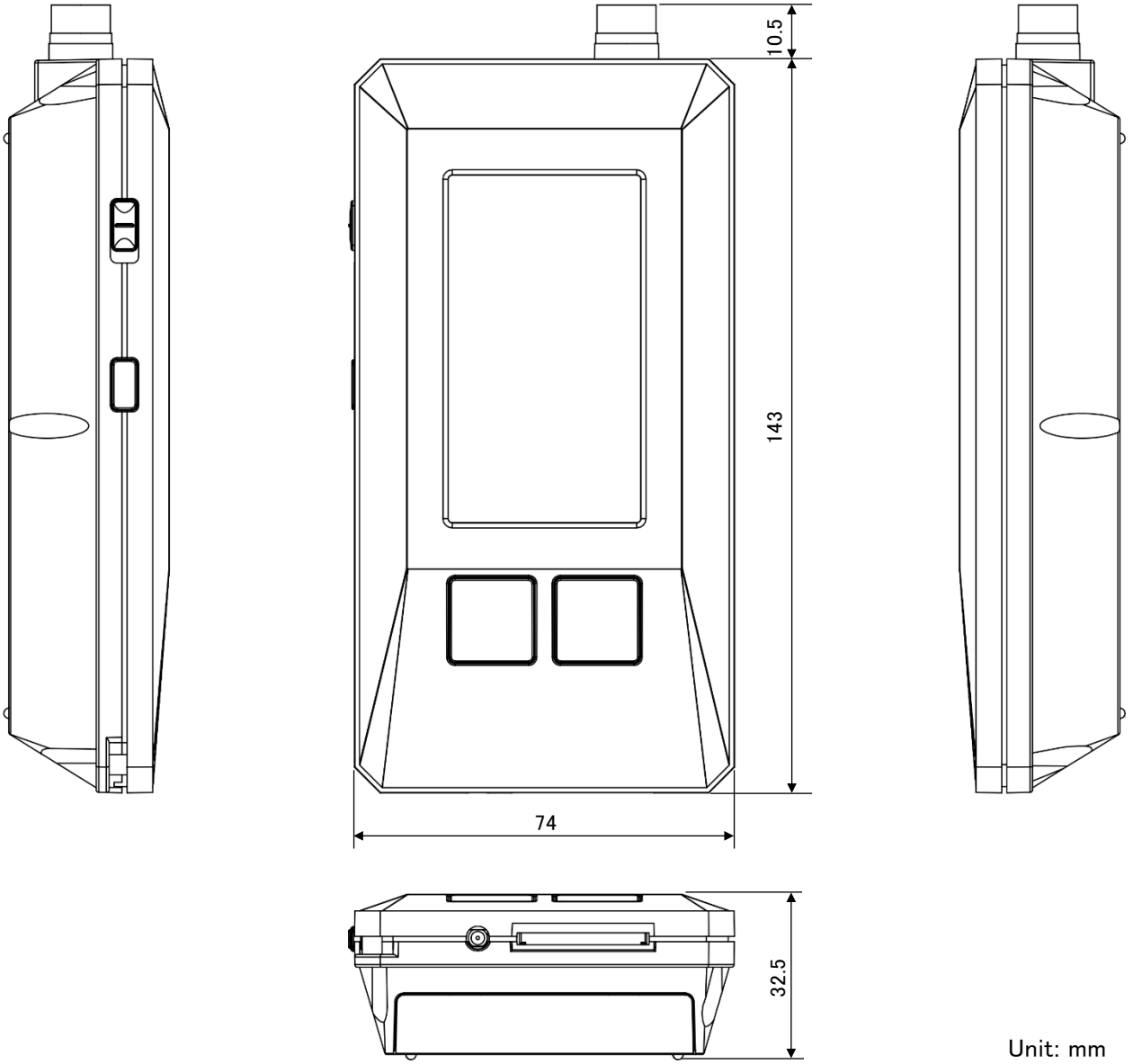
Sampling Frequency	20.48kHz
Frequency Range	10Hz to 1kHz
Frequency Characteristics (Velocity)	+/-5% (20 to 500Hz) +5% to -15% (10Hz to 1kHz)
Measurement Range (Full Scale) (*)	ACC: 6-range (100、30、10、3、1、0.3m/s^2) and Auto VEL: 6-range (200、60、20、6、2、0.6mm/s) and Auto DISP: 6-range (1000、300、100、30、10、3μmp-p) and Auto
Indication	EQP (ACC, VEL, DISP) PEAK (ACC, VEL, DISP) rms (ACC, VEL)
Accuracy	Sensitivity Error: +/-5% at 80Hz Range Changeover Error: +/-2% at 80Hz Linearity: +/-0.5% 80Hz full scale
Output	ACOUT : 0 to +/-1V with a load above 10kΩ DCOUT : 0 to +1V with a load above 10kΩ
FFT (Only VM-3024H)	⊿f: 2.5Hz, 5Hz, 10Hz
Waveform Save (Only VM-3024H)	SD Card Data Saving: 1s, 2s, 5s, 10s (Sampling Frequency: 10.24kHz)
Language	Japanese or English
Power Supply	AA×2pcs (Approx. 20hrs in continuous run) Alarm: Icon in the screen
Ambient Conditions	Use Range: 0 to 50°C, 95%RH or less Accuracy Assured: 5 to 35°C, 85%RH or less Storage range: -10 to 60°C, 95%RH or less However, there should not be condensation
Dimensions and Weight	W74×H153.5×D32.5mm (refer to section 7-3) Approximately 230g (standard configuration battery is installed)

(*) The upper of measurement range is refer to "6. Conversion Table".

7-2. Pickup

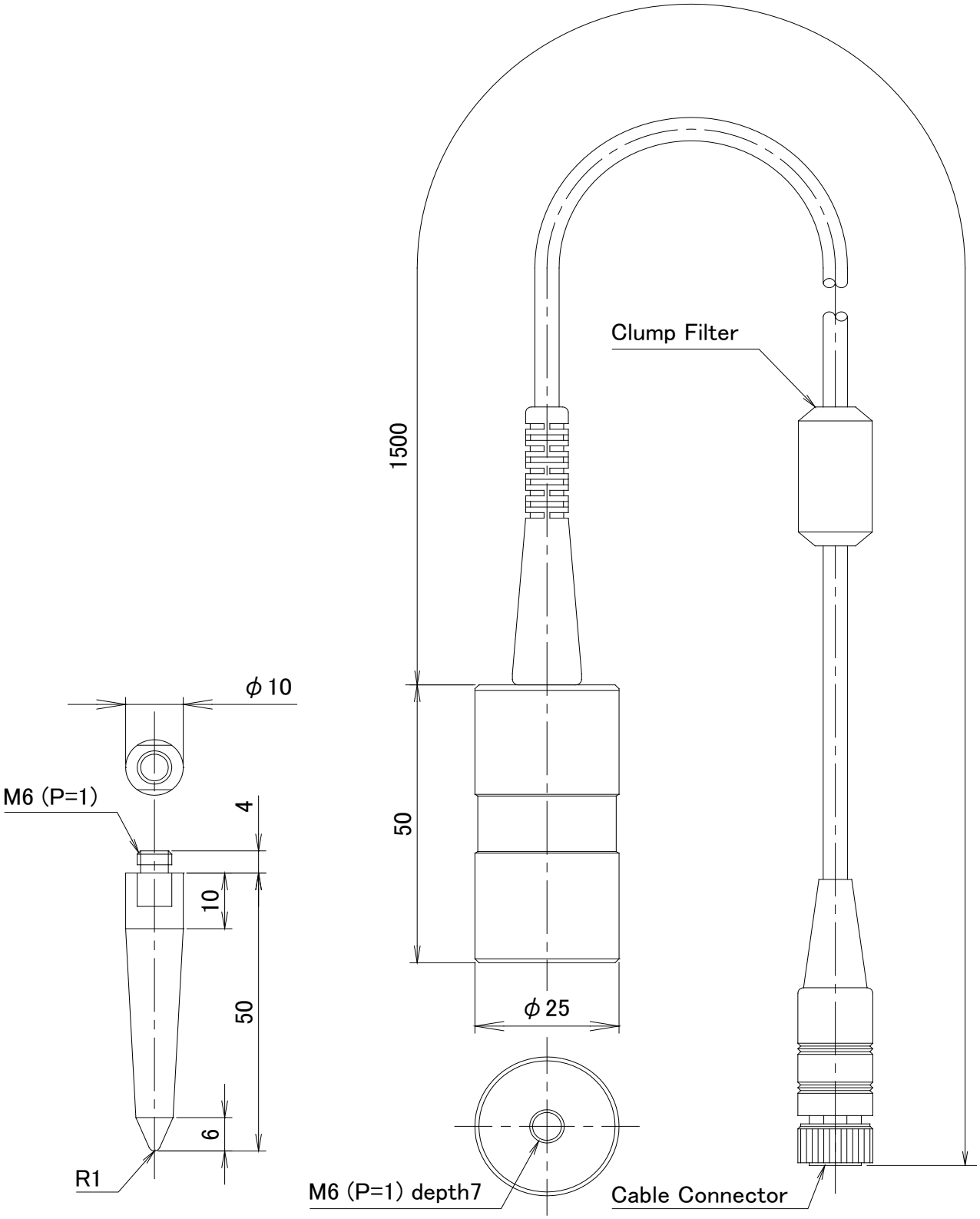
Detecting Method	Electrodynamic Velocity
Detection Direction	1 direction
Sensitivity	4mV/(mm/s) Nominal
Natural Frequency	14Hz
Frequency Range	10Hz to 1kHz
Max Measurable Displacement	1000μmp-p
Max Tolerable Acceleration	100m/s^2
Ambient Conditions	-10 to 50°C (No freezing or condensation)
Case Material	SUS
Weight	Pickup: Approx. 140g Probe: Approx. 20g
Fixing Screw	M6 (P=1), Depth 7mm Female
Cable	Pull-out Directly φ4, 1.5m
Connector	6Pin Connector
Structure	Dust and Splash Proof
Dimension	Refer to Section 7-4

7-3. Outer Dimensions of SmartVibro



Unit: mm

7-4. Outer Dimensions of Pickup and Probe



Pickup Probe

Pickup + Cable

8. Troubleshooting

(1) In case of over range

When the over range icon  appeared during use, modify the range setting as explained in Fig.3-5. Over range will be adjusted automatically in the auto range setting.

If the over range icon  is frequently lit in Auto Range "ON", use manual range (Auto Range is set "OFF").

(2) The screen is not displayed

The following causes are considered. Check the following (A) to (D).

(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.

(3) AC output and DC output waveforms are greatly disturbed

If "Auto Range" is set to "ON", the vibration value fluctuates greatly immediately after when the measurement range switched. At this time, AC output and DC output fluctuate greatly, and correct measurement results cannot be obtained.

When performing measurement using AC output and DC output, be sure to set "Auto Range" to "OFF".

9. Precautions

(1) Turn off and remove batteries when not in use for long period of time.

(2) Avoid high temperature or humidity to protect LCD screen. Store the equipment in dry place under 35°C. Do not leave the machine under direct sunlight or in a car.

(3) 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.

(4) Avoid strong shock. The screen is made of glass.

(5) Do not disassemble the equipment. You can open only the battery box cover.

(6) When disposing of the product, please dispose of it as industrial waste.

10. How to Fix the Pickup and Frequency Characteristics

When a vibration pickup is attached to a vibrating body, a single vibration system is formed at the contact area, and the natural frequency of that system is determined. This is called the contact resonance frequency.

The contact resonance frequency varies depending on the fixing method and contact state between the base of the vibration pickup and the surface of the vibrating body, and particularly affects the high frequency characteristics.

Pickup fixing methods include (1) Screw mounting, (2) Instant adhesive, (3) Double-sided adhesive tape (thin and strong material), (4) Magnet, and (5) pressed by hand (Fig.10-1).

The contact resonance frequency by these methods is above 2kHz and has not almost affect, but contact resonance frequency about (5-2) pressed by hand (using contact pins), this becomes around 1.5kHz shown Fig.10-2 (next page). And it is careful for the indicated value becomes large at 500Hz or more.

(1) Consider the fixing method if necessary.
(2) If the tip contact surface of the detector probe is inclined, correct measurement cannot be performed.
(3) The pickup may be damaged by a strong impact (100m/s^2). Please handle with care.

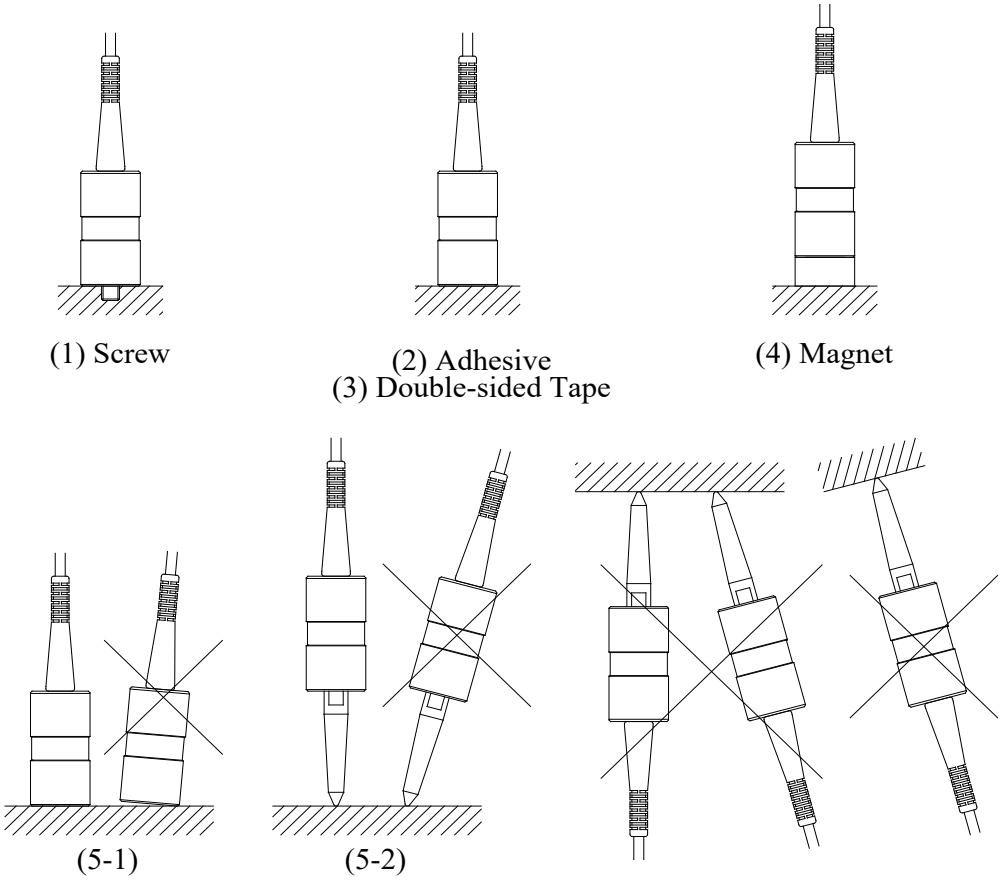


Fig.10-1 How to Fix the pickup

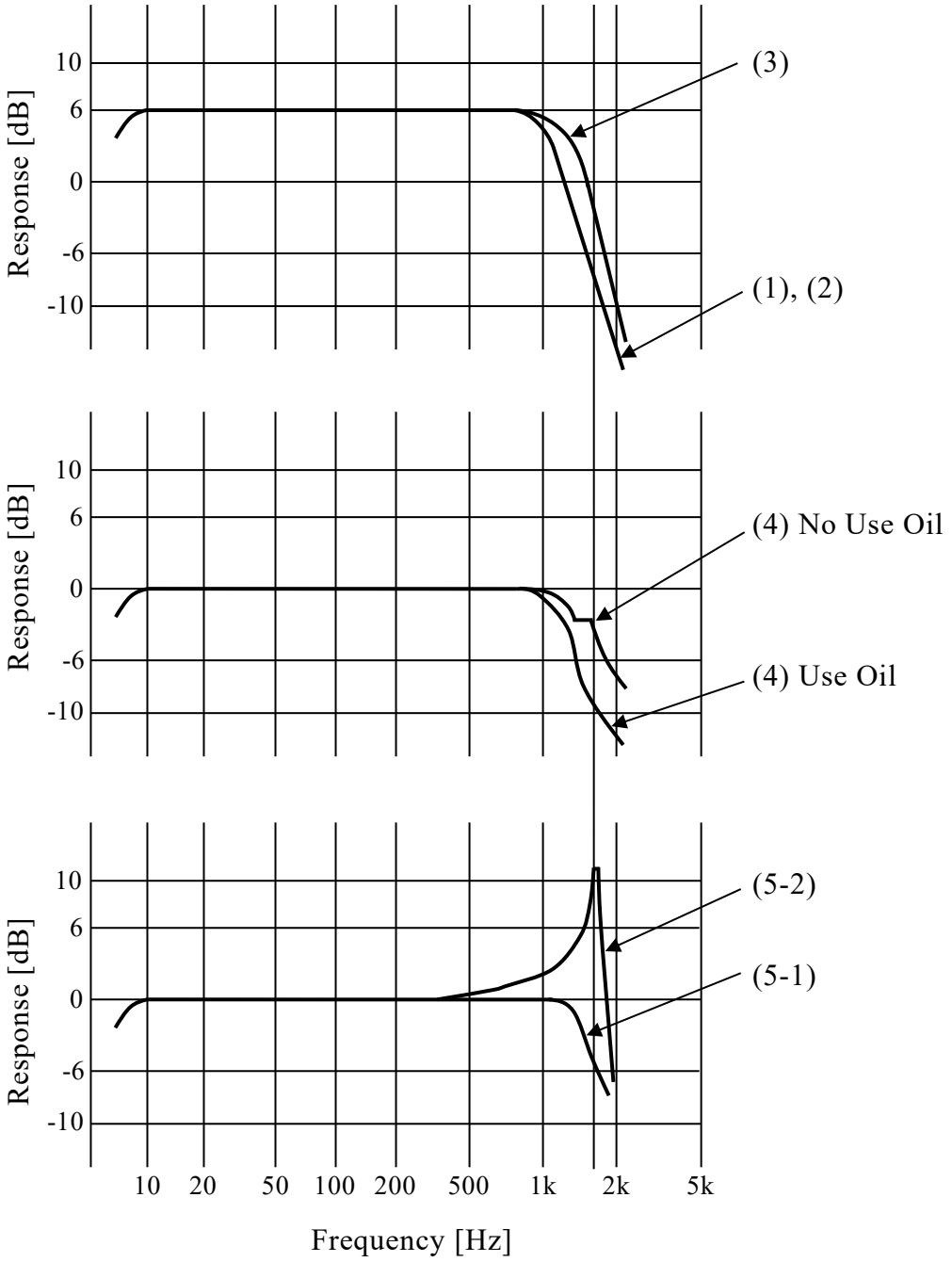


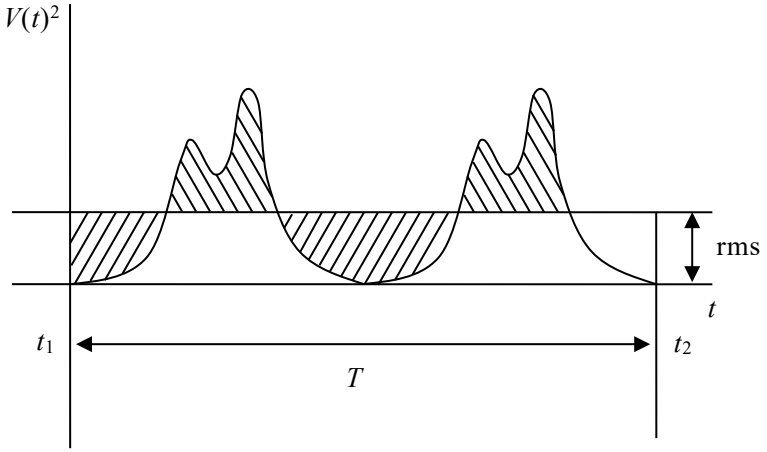
Fig.10-2 Contact Resonance Response of Pickup

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,⋯, x_n, namely

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

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.

$$\text{rms}\times\sqrt{2}$$

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

Peak: Maximum value in the time-domain data.