



Instruction Manual

Portable Vibrometer

SmartVibro Series

Model: VM-4424S
VM-4424H

Manufacture: **IMV CORPORATION**
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Revision History

Date	Ver.	Details
3 rd Mar, 2012	1.0.0	New Issue.
22 th Mar, 2012	1.0.1	(1) Corrected Figures and phrases. (2) Added optional accessories.
9 th Apr, 2012	1.0.2	(1) Added Preparation (3-1). (2) Added Definitions (10), including H-func.
7 th Aug, 2012	1.0.3	Added Title for BRG and H-func.
30 th Oct, 2012	1.0.4	Corrected Unit Display.
21 th Dec, 2012	1.5.0	Added "Password Function" (4-14).
20 th Feb, 2013	1.5.1	Corrected Parts Name of Long Pickup Cable.
17 th Jan, 2014	1.5.2	Corrected Pick-Up Model Number.
28 th Jan, 2016	1.5.3	Corrected AC Adapter Model Number.
5 th Feb, 2016	2.0.0	Added Sensitivity Setting.
28 th Mar, 2016	2.0.1	(1) Corrected the description of the acceleration measurement range. (2) Corrected the description of the linearity accuracy. (3) Added the language "Chinese". (4) Added the frequency range of velocity and Displacement.
10 th May, 2016	2.1.0	(1) Ver2.00 and overall review. (2) SmartVibro screen and wording were corrected.
18 th 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-4424S)

The standard model (VM-4424S) was discontinued as of 31st March, 2021. 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-4424S/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 safely 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-4424 is available in Standard Model (VM-4424S) or High-End Model (VM-4424H).

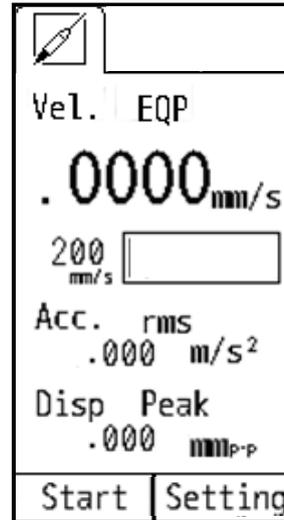
Icons appeared on the display are different in each model. Each screen display example is shown below.

High-end model has these two icons  when the machine is turned on. VM-4424 can be switched freely between Japanese and English.

● Standard Model (VM-4424S)



(Japanese)

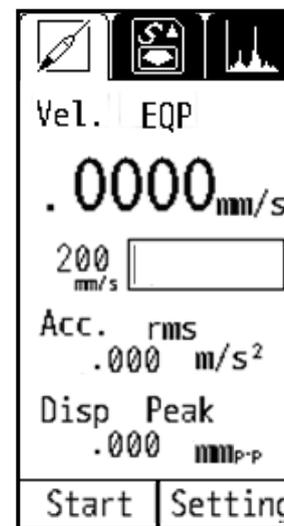


(English)

● High-End Model (VM-4424H)



(Japanese)



(English)

The basic measurement operations will be explained on the screen of the high-end model (VM-4424H) (Section 3). Operation method is the same for the standard model (VM-4424S) as well. Additional functions of the high-end model, VM-4424H, will follow in section 5.



1-2. Package Contents

Product and Accessories for the VM-4424.

(1) Basic Product and Accessories

	Products	Qty	Model	Note	Figure
Main Unit	SmartVibro	1	VM-4424S or VM-4424H		
	Pickup	1	VP-4316	Piezoelectric Acceleration Type	
Accessories	Probe	1	—	Handheld probe (with a nut) φ6×195mm	
	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-4424H only	

(2) Option Accessories

	Products	Model	Note	Figure
1	Long Pickup Cable	LC4 (4m)	To keep a distance from the subject of measurement.	 (Example)
2	Magnet	Plane: MH-201R Curve: MH-203R (Fig is MH-201R)	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 an acceleration meter placing emphasis on analysis, which is equipped with functions of H-function measurement, i.e., envelope processing.

This machine serves various uses in measurement including checking the machines and equipment from various points of view. With SmartVibro, you can not only analyze the bearing, but also measure the acceleration amount and check fluctuation components in low-speed rotating machinery bearings.

2-2. Features

■ Analysis Capability

RMS value of acceleration and H-function measurement enables precise data gathering that benefits your decision-making process.

■ Simultaneous Measurement

High-speed processing CPU enabled simultaneous display of acceleration, velocity and displacement of acceleration signal coming from the pickup.

■ LCD Screen

Various settings like measurement conditions are possible by a touch panel.

■ FFT Analysis Function (Only VM-4424H)

Real-time FFT analysis is possible with a minimum condition setting to check vibration frequency components.

■ Waveform Data Save (Only VM-4424H)

Waveform can be stored.

Stored data in the SD card can be exported to a personal computer.

■ Language

VM-4424 can be switched freely between Japanese and English.

■ Volume Adjust

The volume can be adjusted with the digital volume.



3. Measurement

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

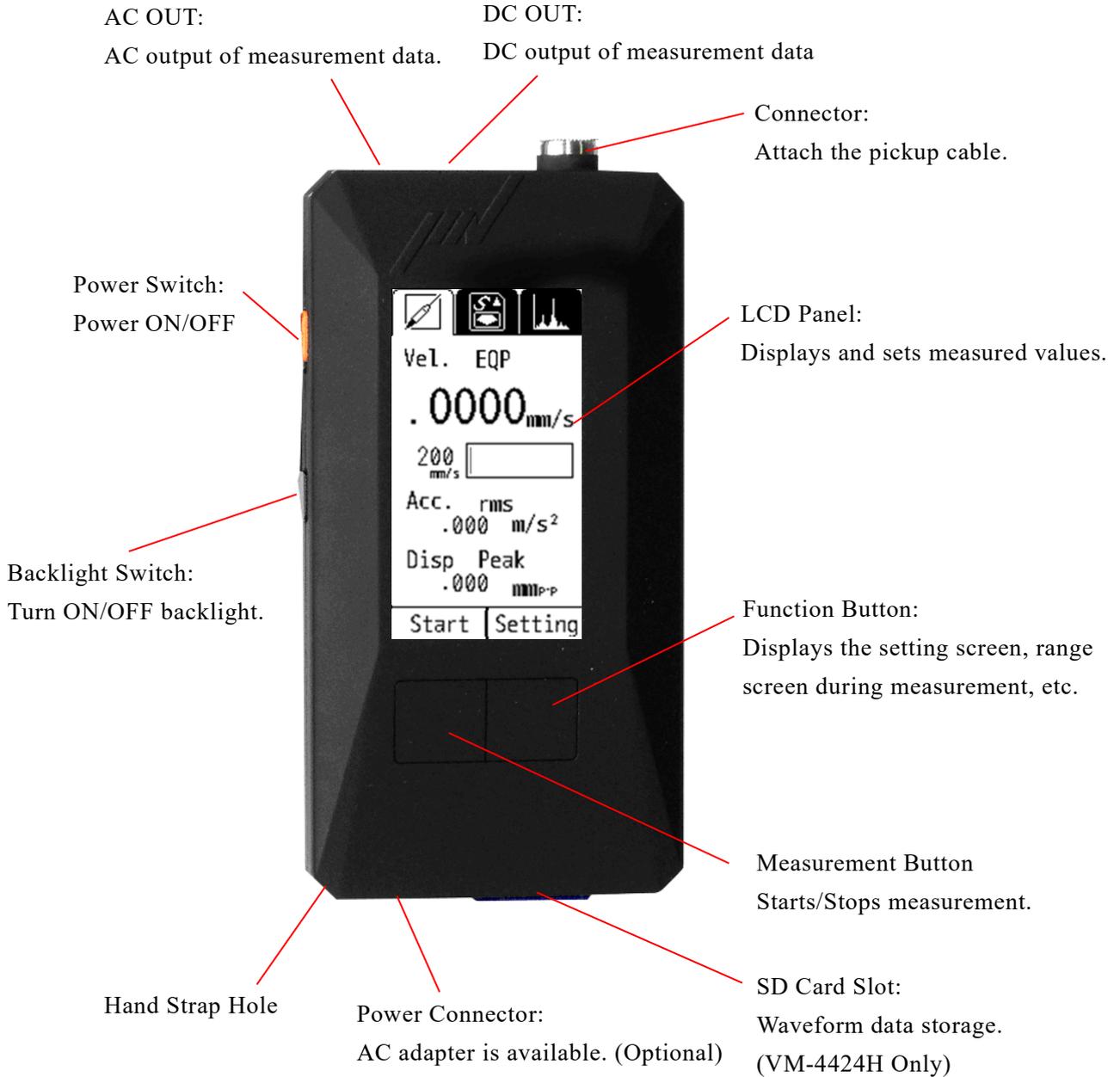


Fig.3-1 Vibrometer Main Unit



3-1. Before Getting Started

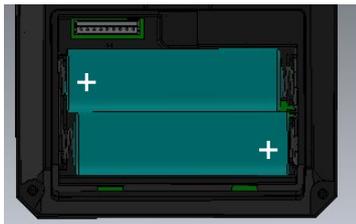
- (1) You can select the computing method for velocity, acceleration, and displacement. Refer to the section 4-2 for more details. Initial settings are as follows:

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

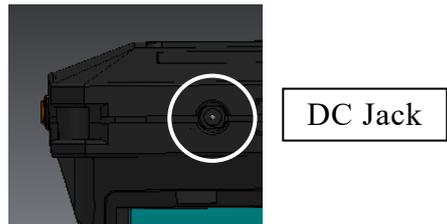
 Caution
For measurement of the vibration severity, make the following settings. (1) Set velocity calculation setting to “rms.” (2) Set the filter settings to “HPF 10Hz” and “LPF 1000Hz” (see Section 4-3)

- (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 adaptor cable to the power connector in the bottom of the device.



(a) Installing AA batteries



(b) Attaching the AC adaptor

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 9 when fixing the pickup.

- (4) Display Language Setting

VM-4424 can switch between Japanese and English as needed. Refer to section 4-7.



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 function buttons.

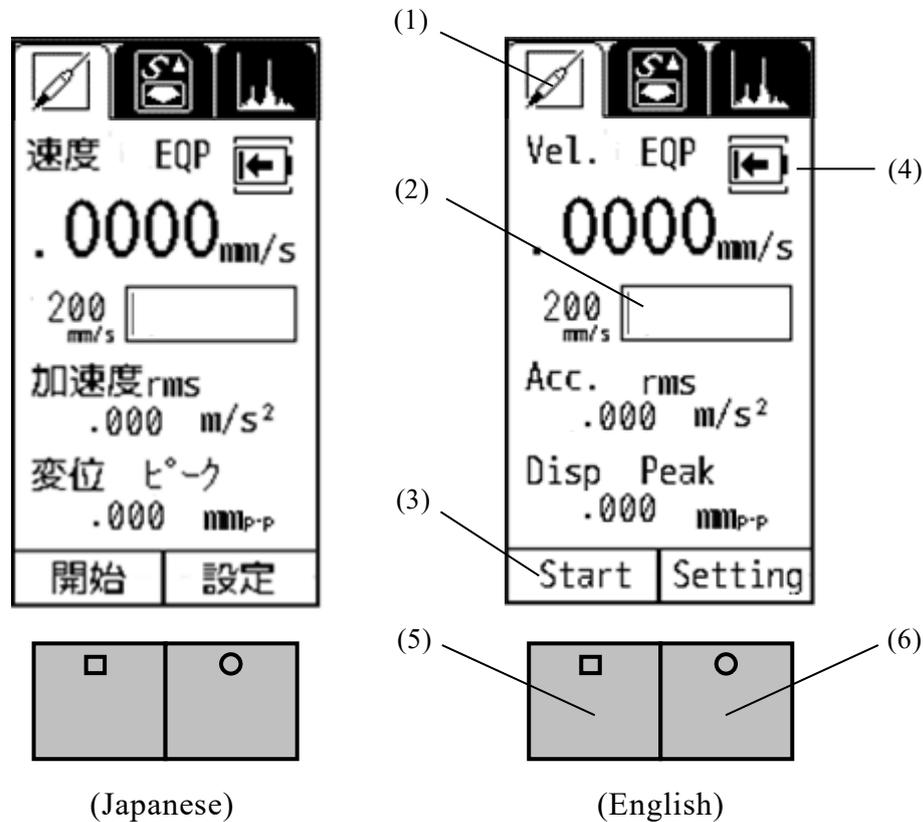


Fig.3-3 Initial Screen

(1) Standard Measurement Mode

VM-4424S 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) 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 4-9.).

(6) Function Button

In the measurement mode, range display will appear when you press this button. In the FFT mode (VM-4424H only), 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 touch “Hold” on the touch screen or press “Function Button” would hold measurement and the display (AC output when stopped is not retained).

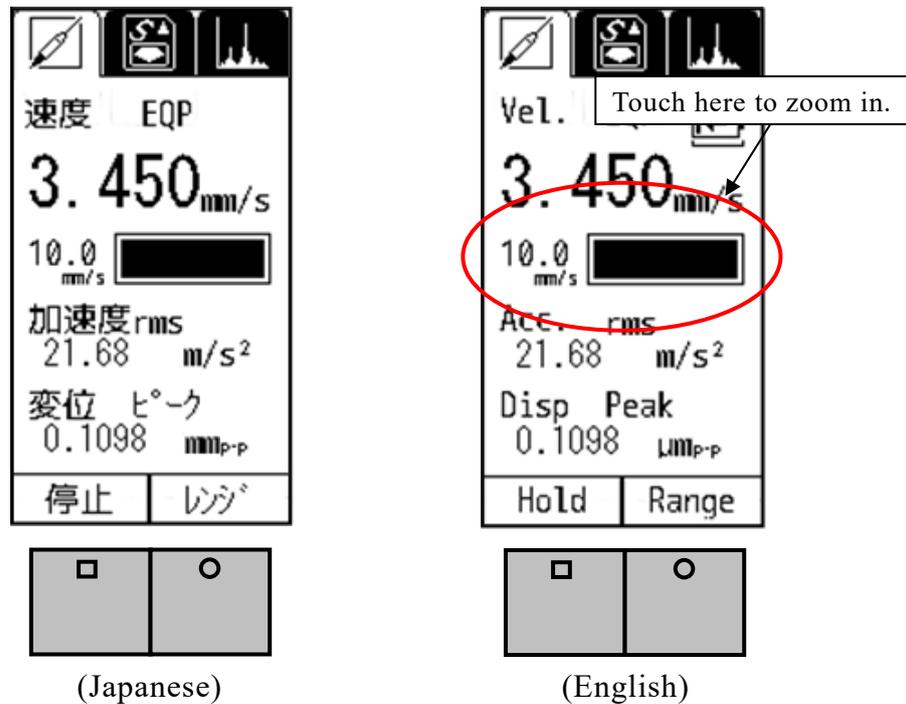


Fig.3-4 Display during Measurement

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).

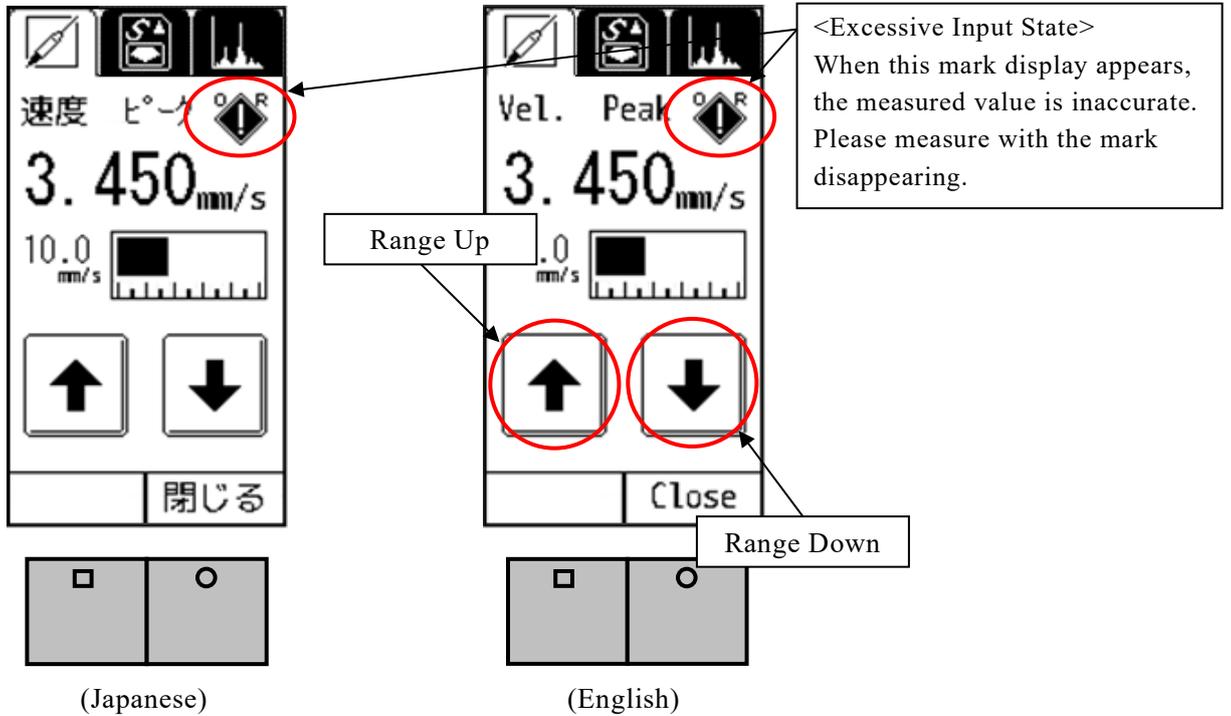


Fig.3-5 Display during Changing the Range

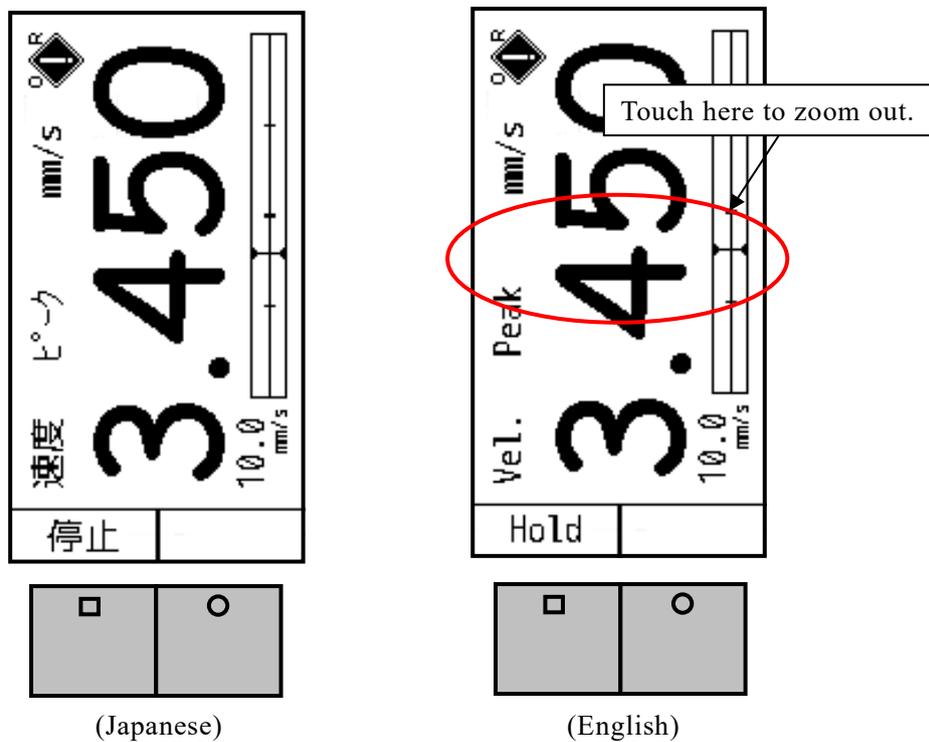


Fig.3-6 Enlarged



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 press “Function Button” when “setting” is indicated in the function indicator (Fig 4-2).

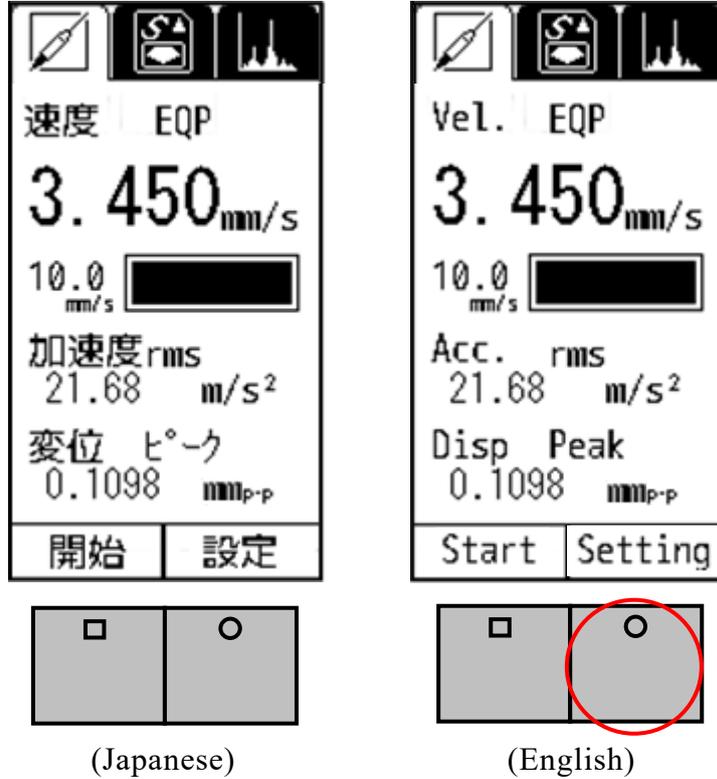


Fig.4-1 “Setting” in the Function Indicator

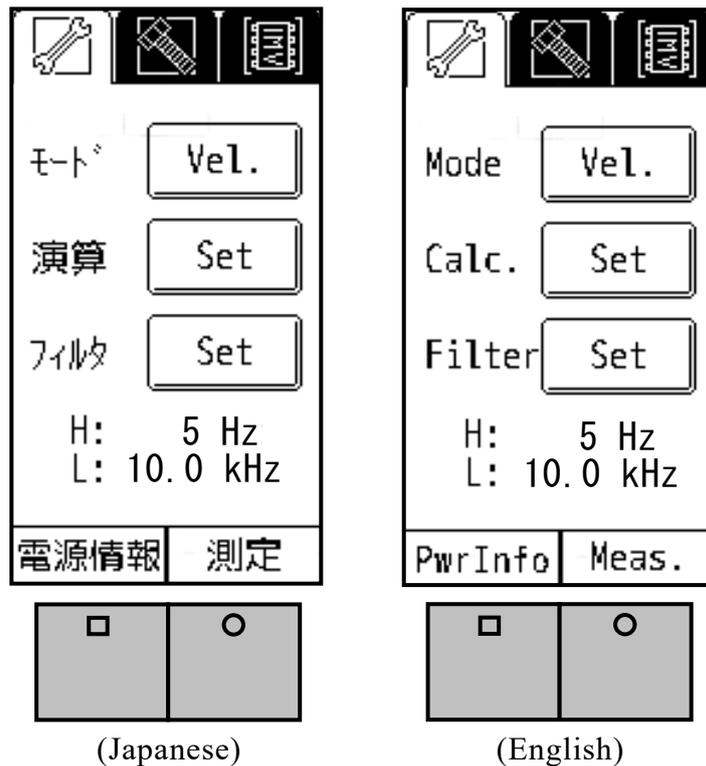


Fig.4-2 Mode and Calculation Setting Screen



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

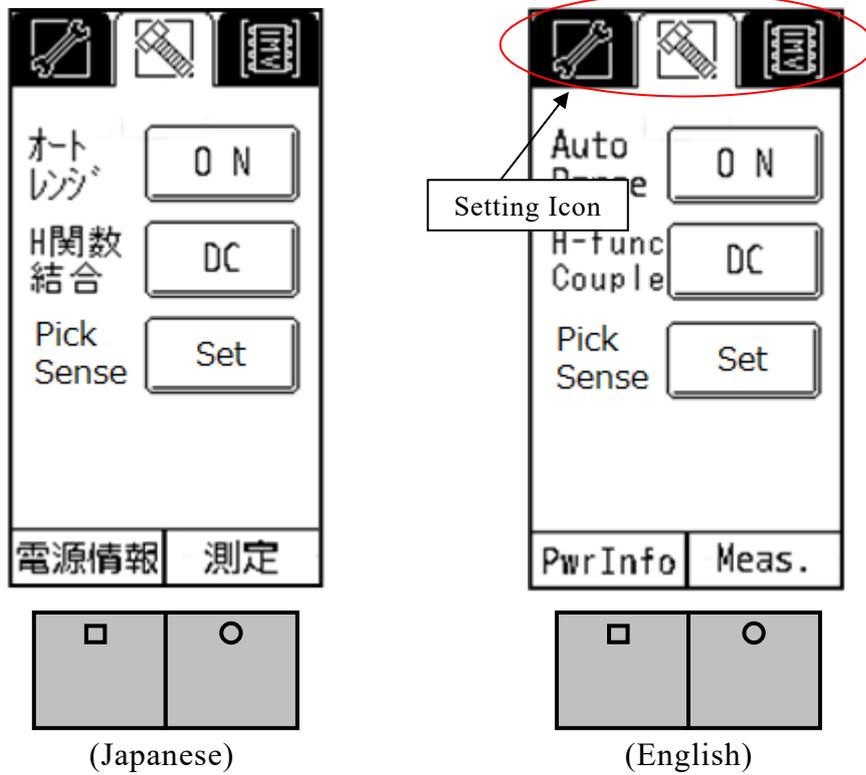
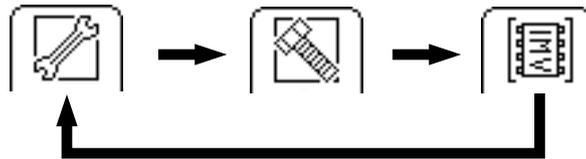


Fig.4-3 Switching the setting screen

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.

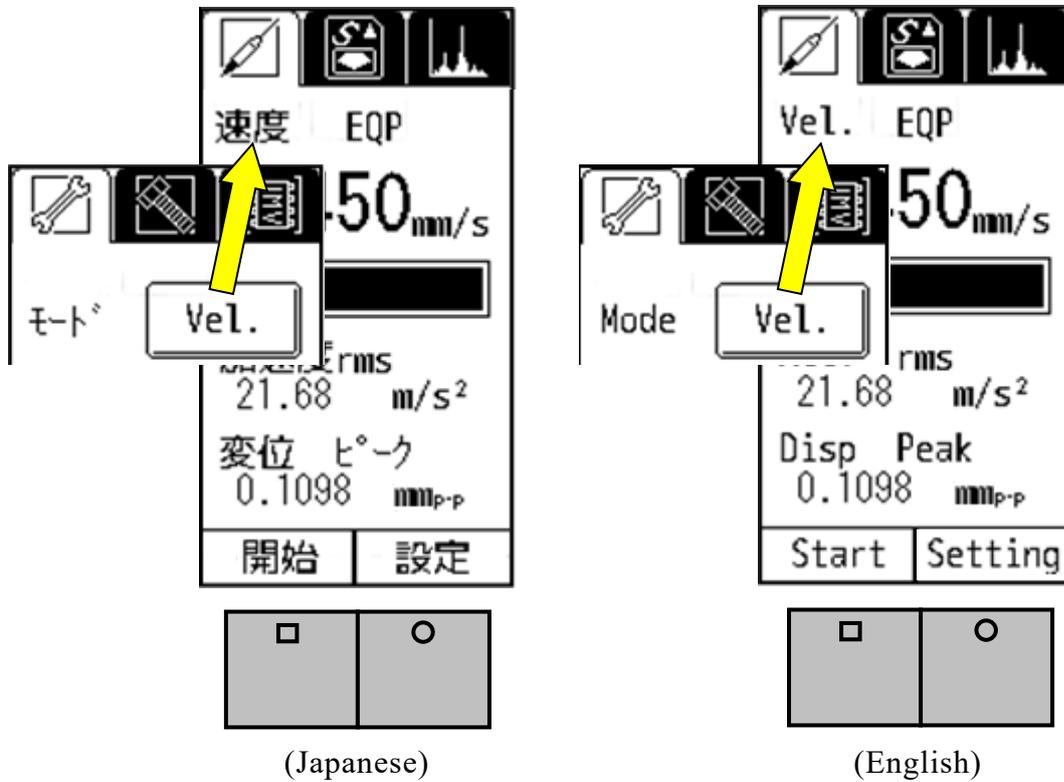
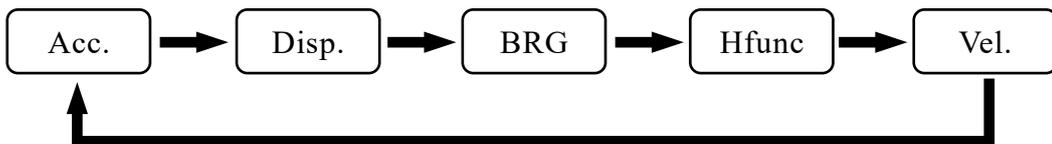


Fig.4-4 Mode Setting

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



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

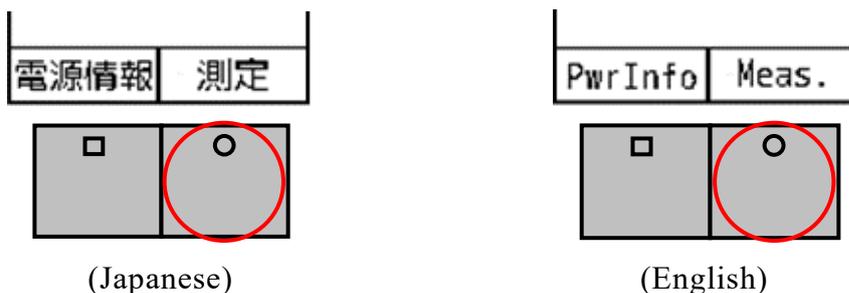


Fig.4-5 How to return to the Measurement Screen



Refer below for explanation of BRG and Hfunc.

- BRG (Bearing)

In BRG mode, processing is performed with a filter fixed in the 1kHz to 10kHz band.

In VM-4416, the range in this mode was A to E, and the unit was dimensionless.

However, VM-4424 displays the acceleration with the original physical quantity. There are 6 ranges as well as acceleration.

Unlike normal measurement, “BRG” is displayed on the measurement screen and all acceleration values are displayed (velocity and displacement are not displayed).

- Hfunc (H-function)

By enveloping the vibration amount and its fluctuation waveform at 2kHz to 15kHz, the band that cannot be captured directly by BRG is also covered.

Unlike normal measurement, “Hfunc” is displayed on the measurement screen and all acceleration values are displayed (velocity and displacement are not displayed).

DC output changes as follows according to the switching between AC and DC in section 4-4-2 (AC output terminal always outputs only the fluctuation component).

(1) AC

Equivalent to “ENV” of VM-4416.

With this setting, only the fluctuation component (envelope waveform) of H-function is rectified, and display and DC output are performed.

H-function is suitable for measuring a high component of 2kHz to 15kHz due to a vibration source at a low period (1kHz or less).

It is possible to listen to sound that is converted the band signal that cannot be heard to 1kHz or less signal.

(2) DC

Rectifies the 2kHz to 15kHz component, and displays and outputs the level and the fluctuation component (envelope) of 1kHz or less.

This is called H-function.



About H-function, refer to also the definitions in section 10.



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.

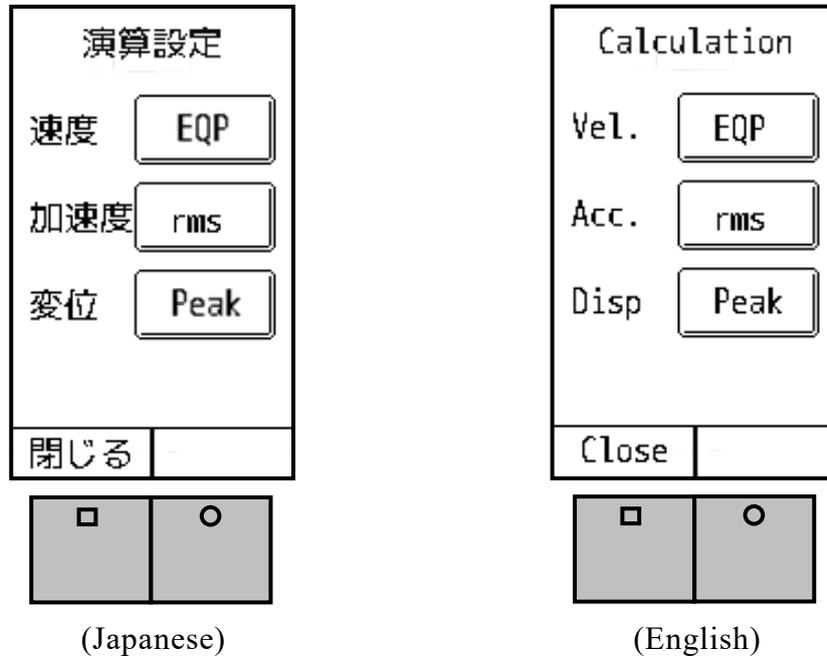


Fig.4-6 Calculation Setting

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

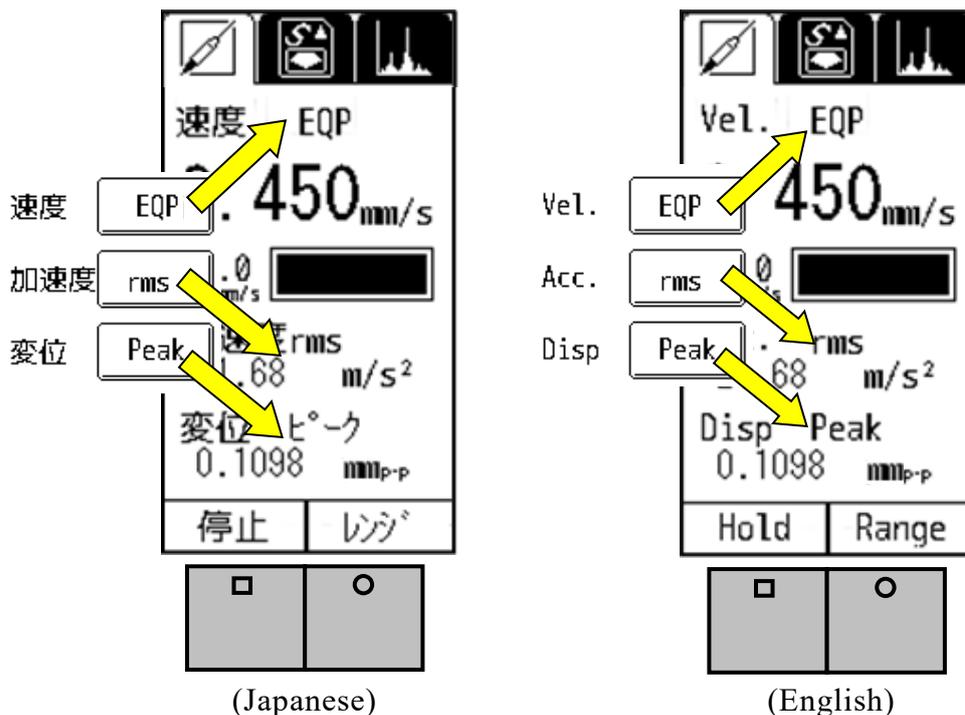
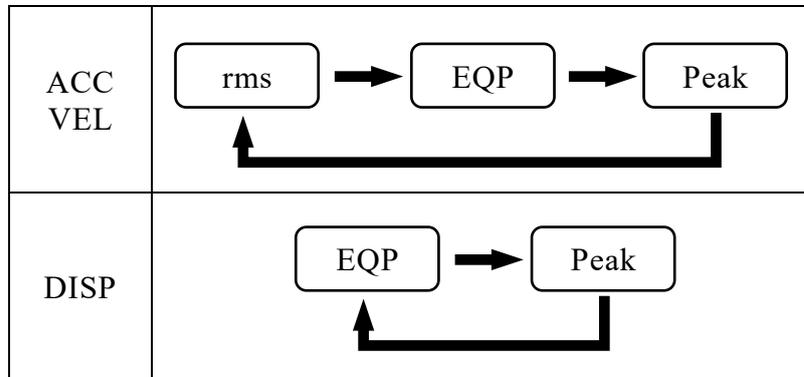


Fig.4-7 Example of the Setting Screen



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



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.



4-3. Filter

Change the settings of high-pass (HPF) and low-pass filters (LPF).

Pressing “Set” would bring you to the screen indicated in Fig.4-8.

By touching the triangles on the screen (▲ or ▼), you can change the frequency of each filter.

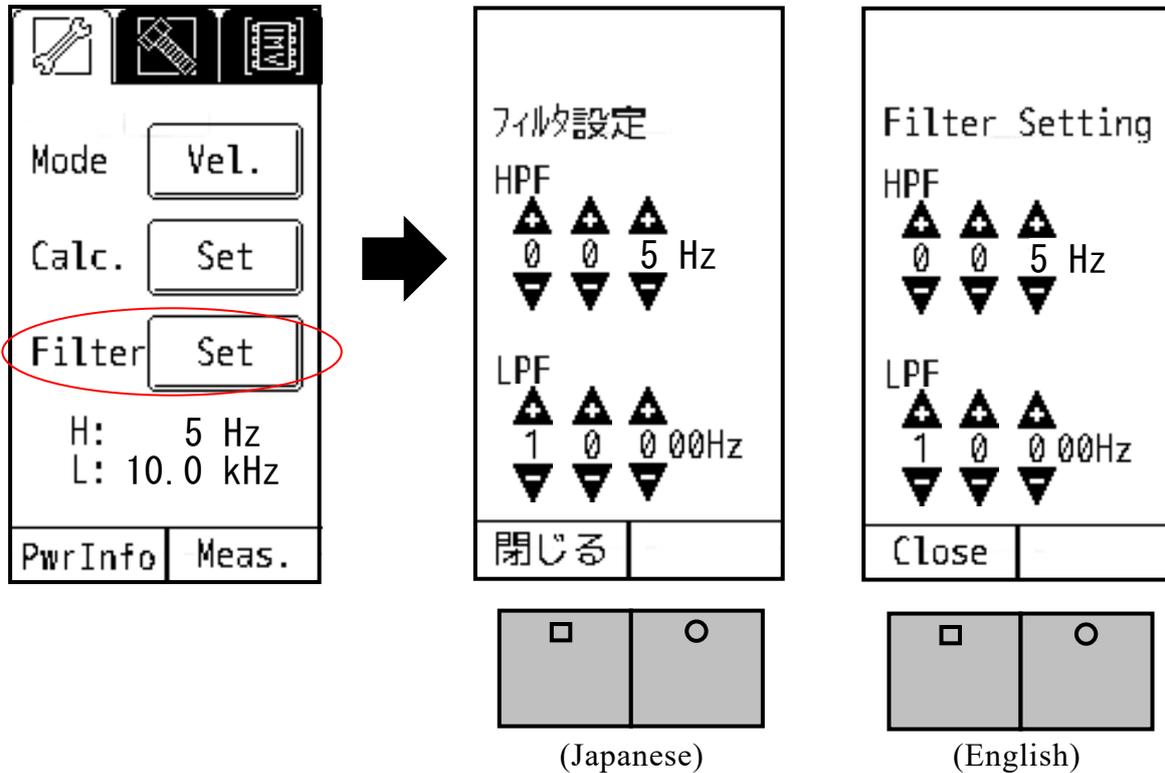


Fig.4-8 Example of Filter Setting

The range of filter is as follows:

Filter	Minimum Setting	Maximum Setting	Setting Step
HPF	5Hz	999Hz	1Hz
LPF	100Hz	10000Hz	100Hz

Caution

About Filter Setting

- (1) 「Set “LPF setting value” larger than “HPF setting value”.
If “LPF setting value” is smaller than “HPF setting value”, the filter setting screen cannot be closed. Be sure to set “LPF setting value > HPF setting value”.
- (2) Please refer to “Appendix” for filter characteristics.



4-4. Setting of Auto Range, H-function Coupling, and Pickup Sensitivity

To set Auto Range, H-function Coupling and Pickup Sensitivity, select  tab on the setting screen.

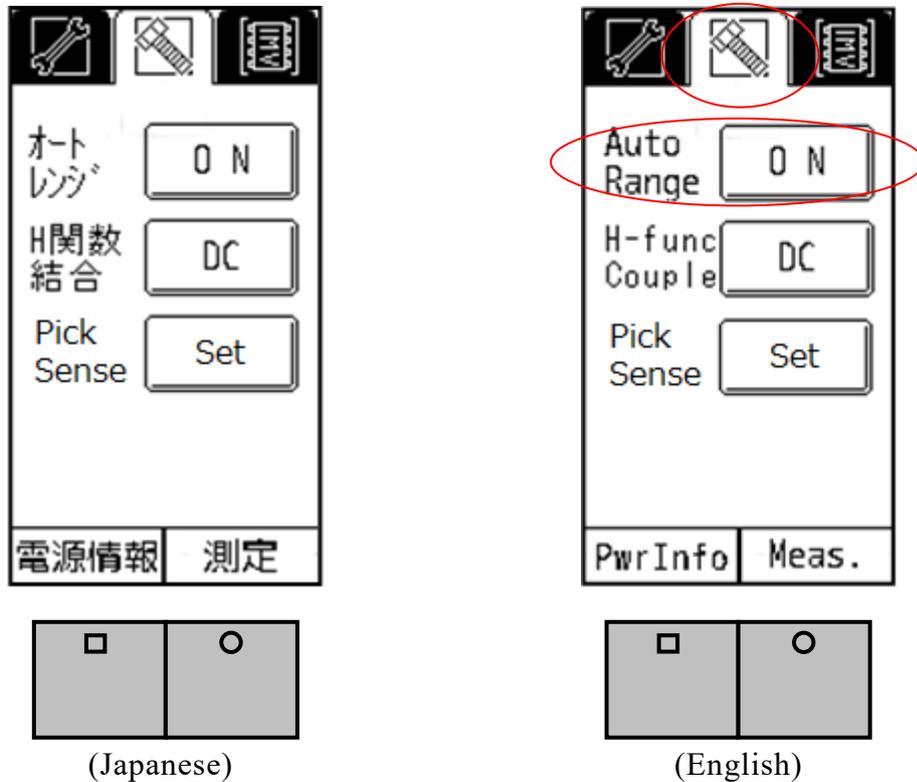


Fig.4-9 Setting Page of Auto Range, H-function Coupling, and Pickup Sensitivity

4-4-1. Setting of Auto Range

When auto range is "ON", range will be adjusted automatically during measurement (Fig.4-9). "Range" will not be indicated on the measurement display. In this case, "Function Button" is not effective (Fig.4-10).

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

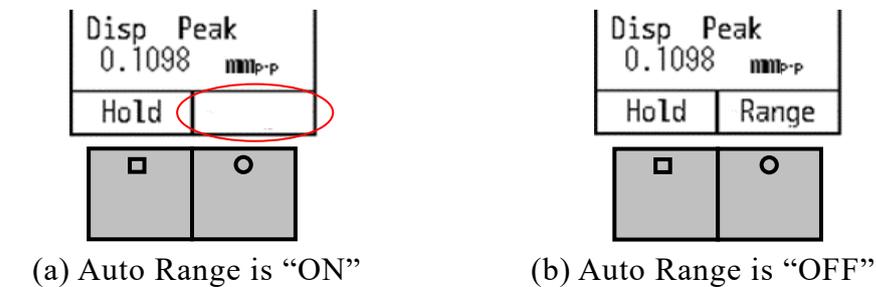


Fig.4-10 Measuring Screen of Auto Range "ON" and "OFF"



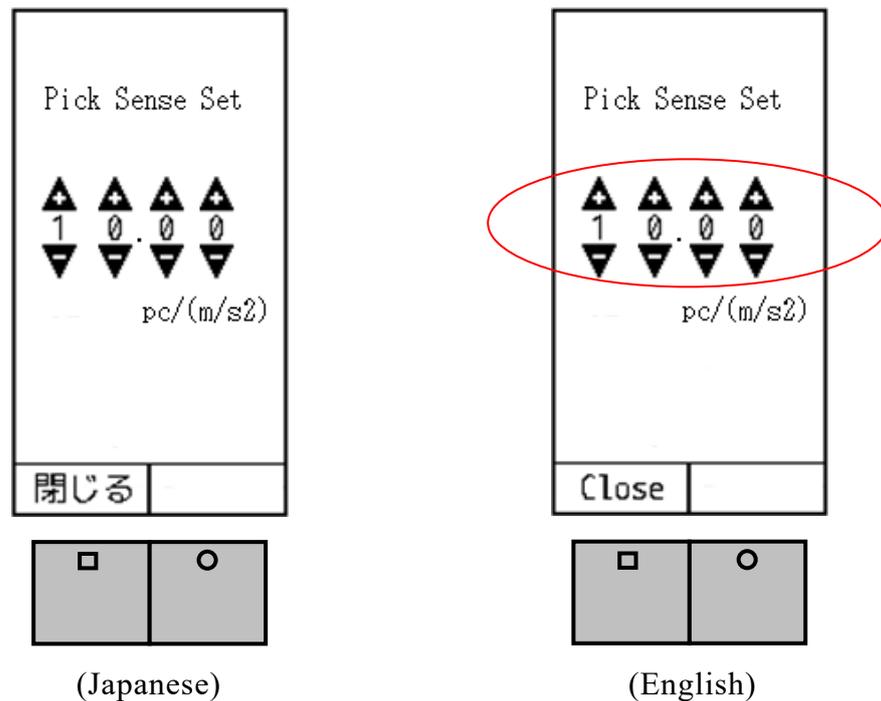
4-4-2. Setting of H-function Coupling

Select the coupling of the H-function from AC and DC. Touching “DC” of H-function coupling in Fig.4-9 switches between “DC” and “AC”.

The ACOUT output always outputs only the fluctuation component, but the displayed value and the DC output differ depending on this setting (refer to section 4-1).

4-4-3. Setting of Pickup Sensitivity

When “Set” button of “Pick Sense” in Fig.4-9 is pressed, the pickup sensitivity input screen as shown below is displayed (Fig.4-11).



(Japanese) (English)
Fig.4-11 Setting Screen of Pickup Sensitivity

The number displayed by default is the sensitivity of the pickup calibrated at the time of shipment. Sensitivity can be changed as necessary in the following cases.

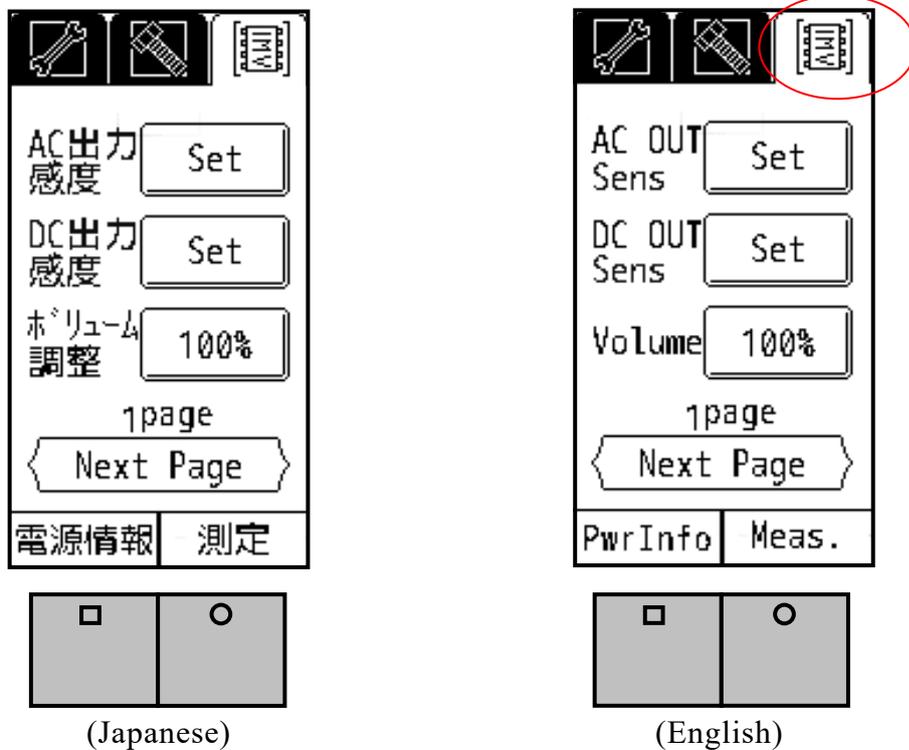
- a) Replacing the pickup due to failure
- b) Switching between multiple pickups
- c) Changing sensitivity by re-vibration calibration

 Caution
(1) If the sensitivity is not set correctly, correct measurement results cannot be obtained. Enter the sensitivity of the pickup to be used (pC/(m/s ²)).
(2) There is no change in normal use. Do not change it unnecessarily.
(3) Please do not use any connection other than the dedicated pickup (VP-4316) as it may cause measurement failure or malfunction.



4-5. Sensitivity Setting of AC and DC Output and Volume Adjustment

To set the sensitivity of AC Output and DC Output, select the  tab on the setting screen (Fig.4-12).



(Japanese)

(English)

Fig.4-12 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.

4-5-1. Sensitivity Setting of AC and DC Output

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. mmo-p	75 → 7.5 → 0.75 → 0.075

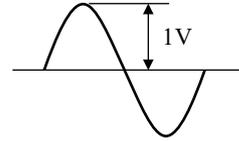
Fig.4-13 AC Output Sensitivity Setting



The AC output sensitivity specifies the full scale for the ACOUT voltage value. Touching the “Set” button will display Fig.4-14.

For each of velocity, acceleration, and displacement, set the value of voltage 1V. In the example shown in Fig.4-14, the settings are as follows.

- Velocity: “1V” is equivalent “1500mm/s EQP”
- Acceleration: “1V” is equivalent “450m/s² EQP”
- Displacement: “1V” is equivalent “75mmo-p”



AC出力感度	
速度 mm/s	1500
加速度 m/s ²	450
変位 mm	75
単位/V	
閉じる	



(Japanese)

AC OUT Sens	
Vel. mm/s	1500
Acc. m/s ²	450
Disp mm	75
unit/V	
Close	



(English)

Fig.4-14 AC Output Sensitivity Setting Page

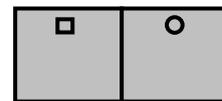
On the other hand, DC output sensitivity specifies the full scale for the DCOUT voltage value. Touching the “Set” button will display Fig.4-15.

DC出力感度	
速度 mm/s	1500
加速度 m/s ²	450
変位 mm _{p-p}	150
単位/V	
閉じる	



(Japanese)

DC OUT Sens	
Vel. mm/s	1500
Acc. m/s ²	450
Disp mm _{p-p}	150
unit/V	
Close	



(English)

Fig.4-15 DC Output Sensitivity Setting Page



The setting method is the same as AC output sensitivity. The value is switched as shown in Fig.4-16 by pressing the button with the number displayed.

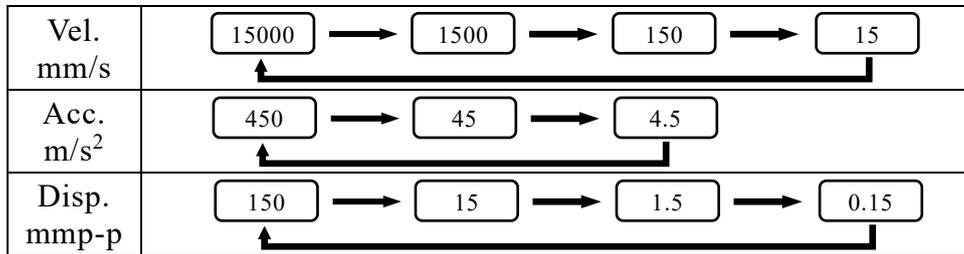


Fig.4-16 DC Output Sensitivity Setting



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 100mm/s,
 AC Output Sensitivity is set “150”.
 DC Output Sensitivity is set “150”.

4-5-2. Volume Adjustment

If you insert an earphone into the ACOUT jack, you can hear the vibration sound during measurement.

This volume can be changed with “Volume” in Fig.4-12. It can be set in increments of 10% from 10 to 100%.

4-6. Setting of Battery Type, Auto Power Off, and Contrast

Touch “Next Page” on the setting screen shown in Fig.4-12 to move to the second page (Fig.4-17 on the next page).

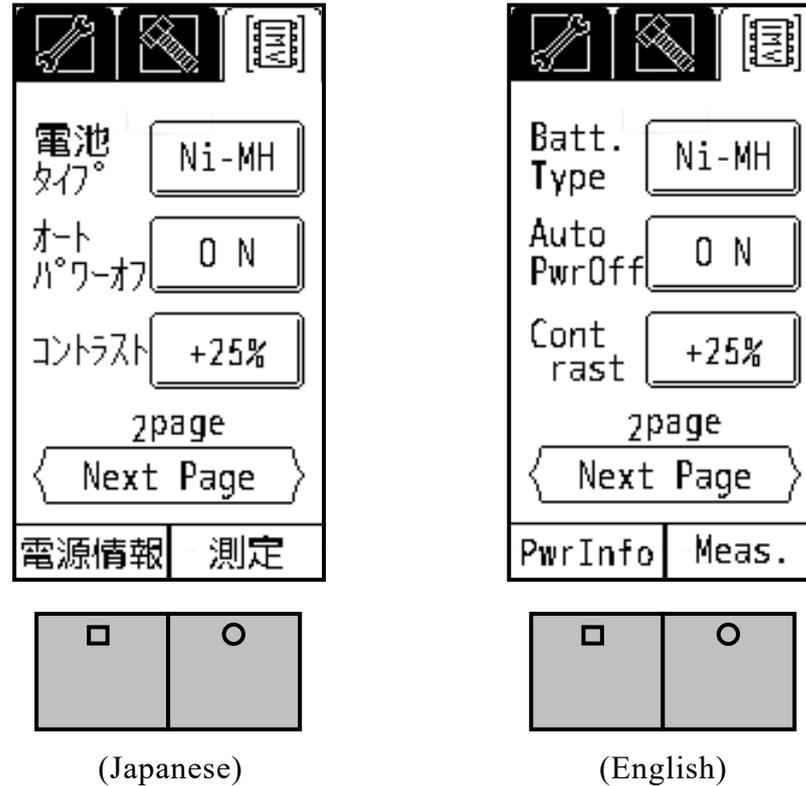


Fig.4-17 Setting Screen of Battery Type, Auto Power Off, and Contrast

4-6-1. 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.

4-6-2. 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.

4-6-3. Setting of Contrast

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



4-7. Language Setting

Touch “Next Page” on the setting screen shown in Fig.4-17 to move to the third page (Fig.4-18).

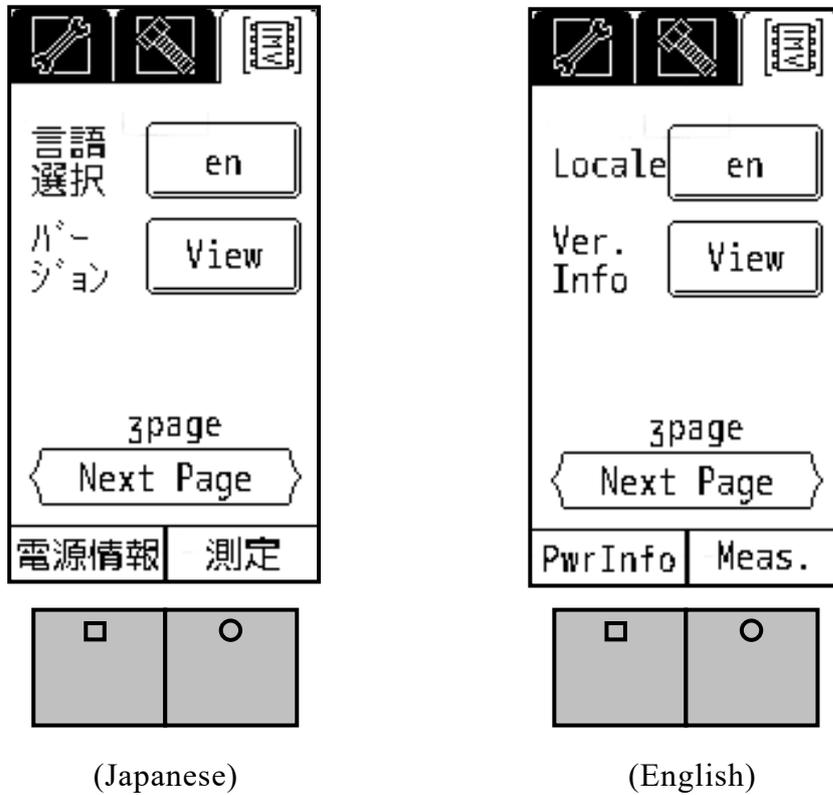


Fig.4-18 Language Setting and Version Information

4-7-1. Language Setting

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

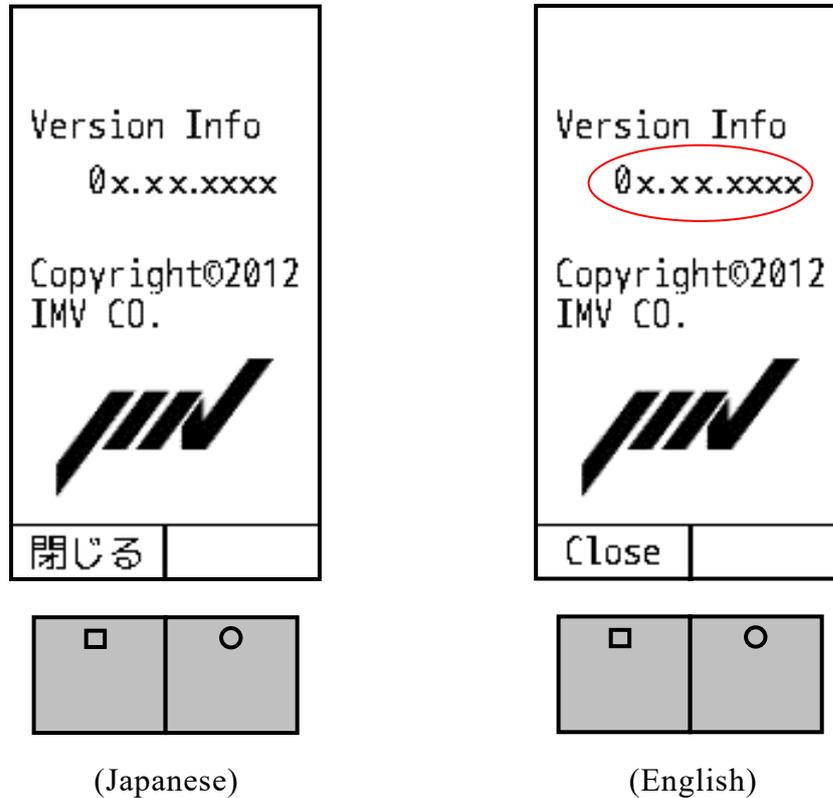
To choose Japanese, select “jp”, and restart the device.



4-7-2. Version Information

You can check the firmware version.

Touch the “View” button next to the version in Fig.4-18 to display the version information (Fig.4-19).



Example of Version Display
02.16.2021

Fig.4-19 Display of Version

If you contact us about the product, we may check the version of holding VM-4424S/H. Please check the version in advance with this function.

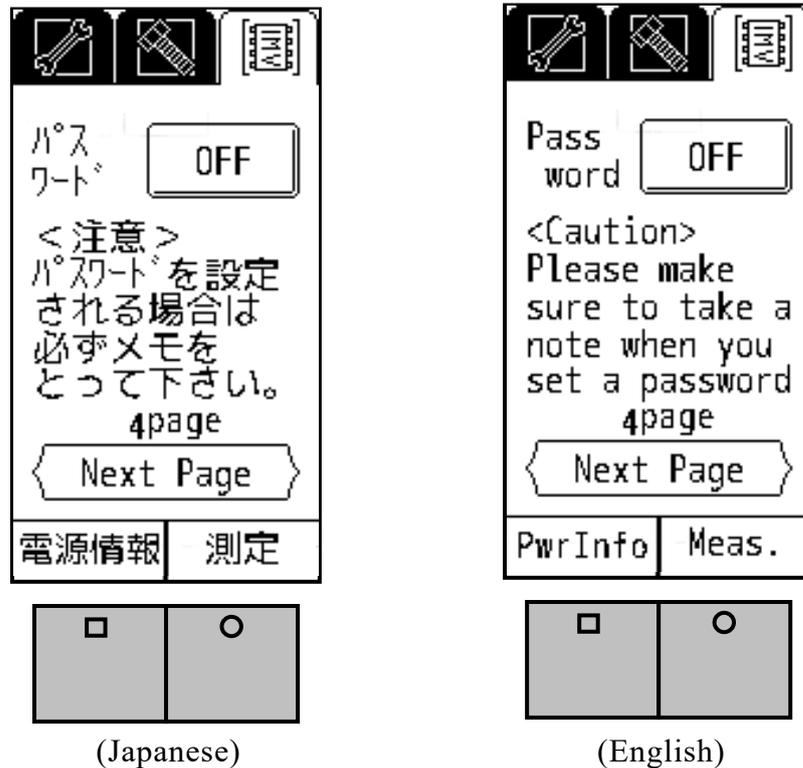


4-8. Password Function

4-8-1. Password Setting

Touch “Next Page” on the setting screen shown in Fig.4-18 to move to the forth page (Fig.4-20).

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”).

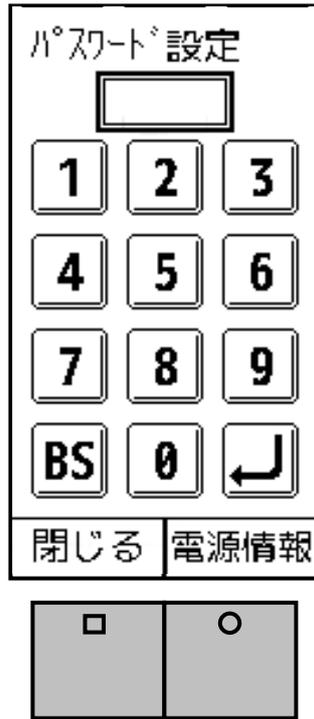


(Japanese) (English)

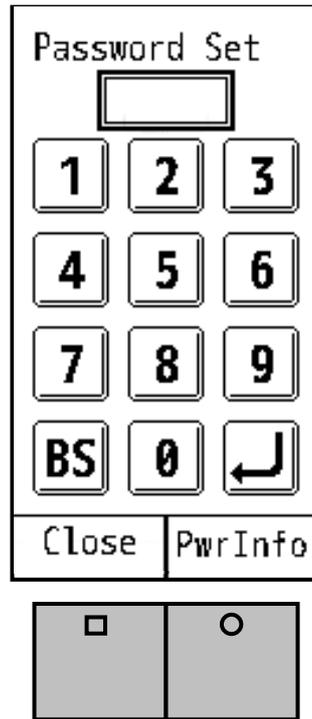
Fig.4-20 Password Setting (Password “OFF”)

Push the “OFF” button on Fig.4-20, then Fig.4-21 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 4-20 (see Fig.4-22).

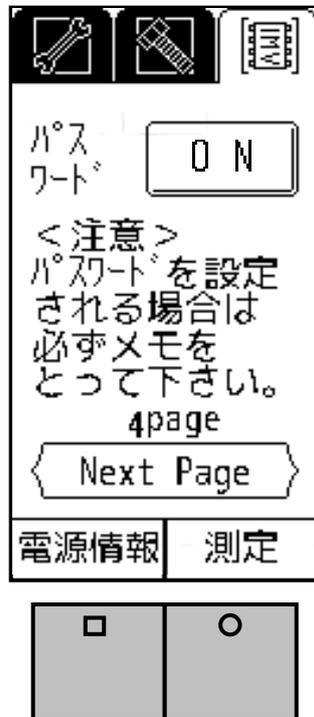


(Japanese)



(English)

Fig.4-21 Password Input



(Japanese)



(English)

Fig.4-22 Password Setting (Password "ON")



4-8-2. Password Input

While password is set, if you press the “Setting” button, Fig 4-23 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.

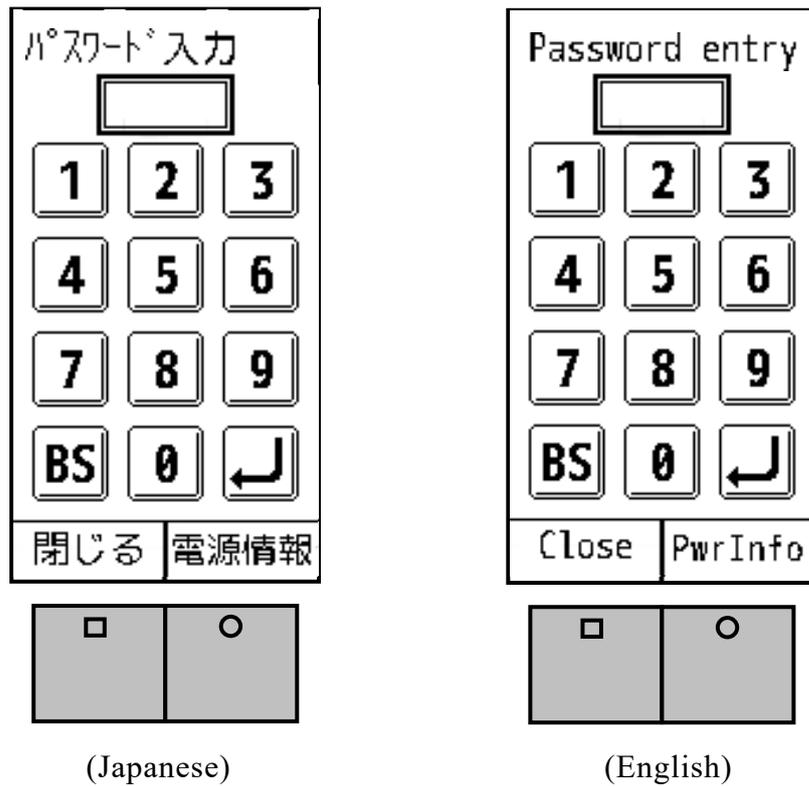


Fig.4-23 Password Input

! 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.**



4-9. Battery Indicator

When “PwrInfo” is displayed, press the button or touch the screen to check the power information (Fig.4-24 and Fig.4-25).

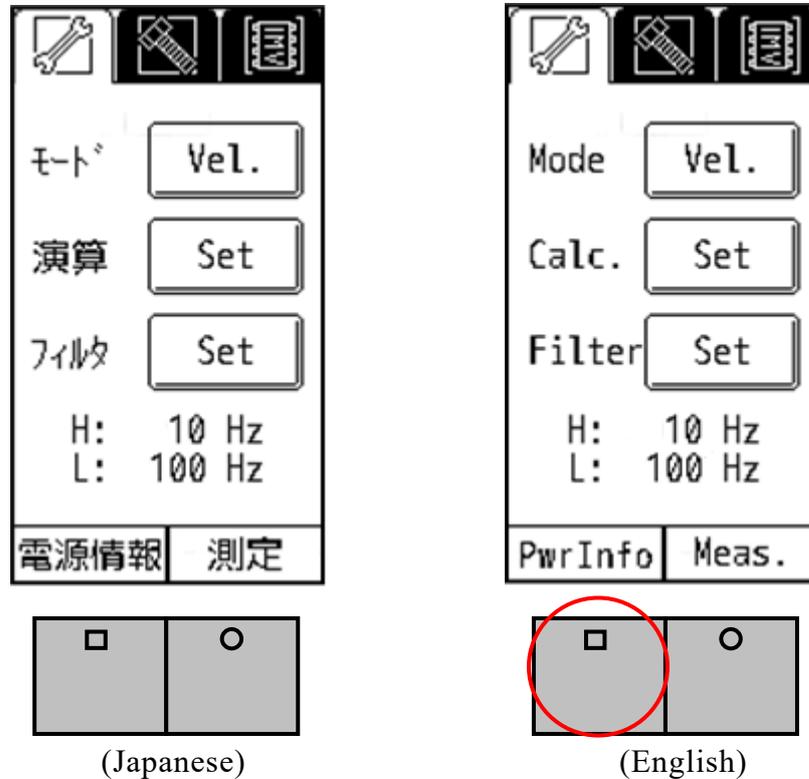


Fig.4-24 “PwrInfo” Indication

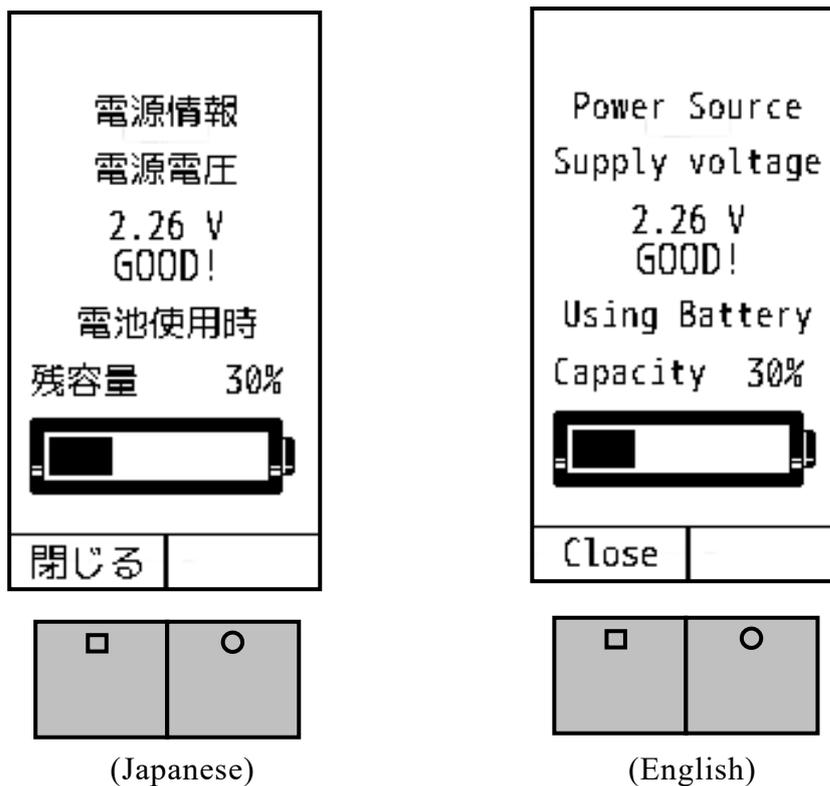


Fig.4-25 Battery Information



5. FFT and Data Save

VM-4424H 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).

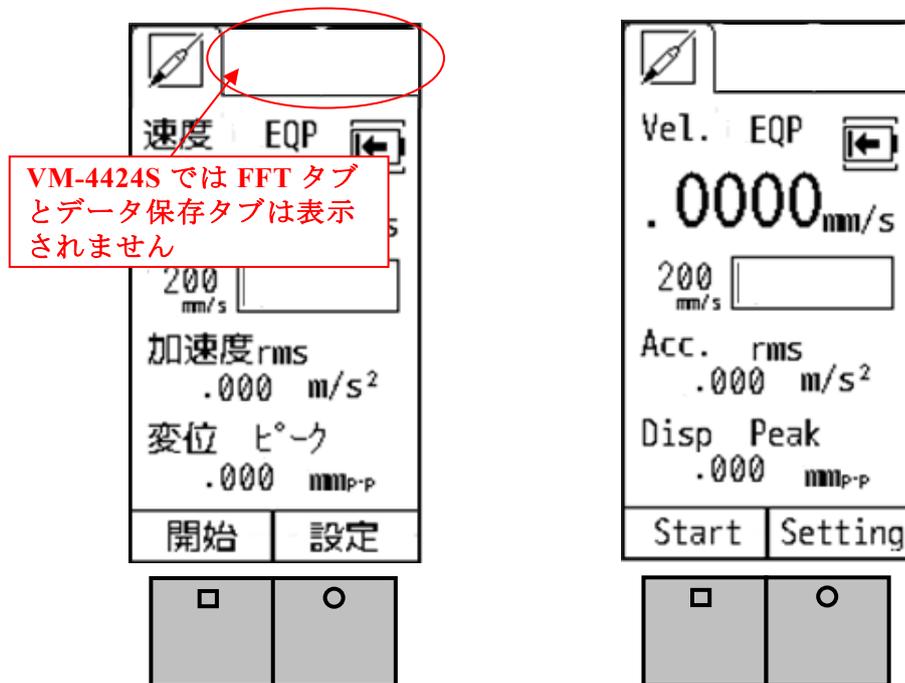


About FFT Function and Waveform Saving

Only VM-4424H 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-4424S (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-4424S



5-1. FFT

5-1-1. FFT Indication

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

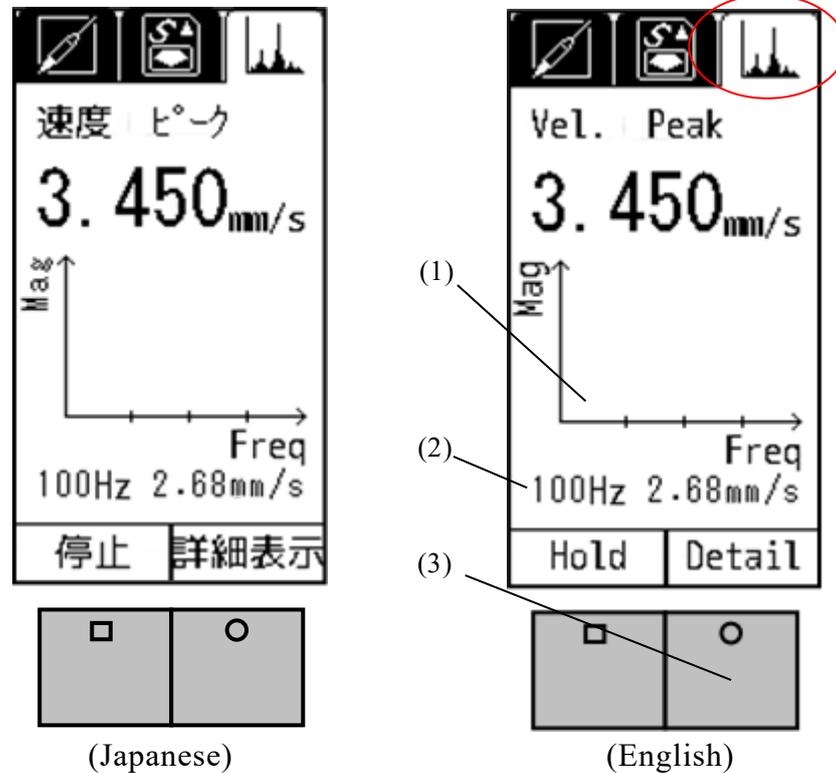


Fig.5-2 FFT Menu

(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 the function button (Fig.5-3).

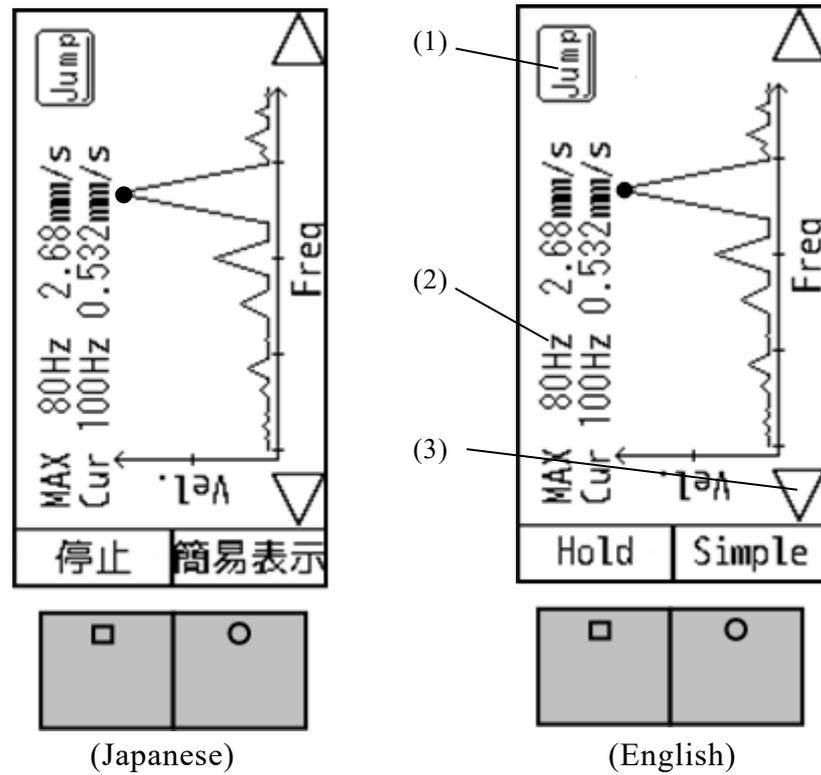


Fig.5-3 Detail of FFT

- (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-4424H, “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 6.25Hz, 12.5Hz, and 25Hz.

Select the FFT frequency from “Low”, “Mid”, and “High”.

The frequency axis range is specified, but it is set as follows according to the measurement mode.

Physical quantity	Low	Mid	High
Acceleration	5Hz to 1kHz	50Hz to 5kHz	1kHz to 10kHz
Velocity	10Hz to 1kHz		
Displacement	10Hz to 150Hz		
Bearing	1kHz to 10kHz		
H-function	5Hz to 1kHz		

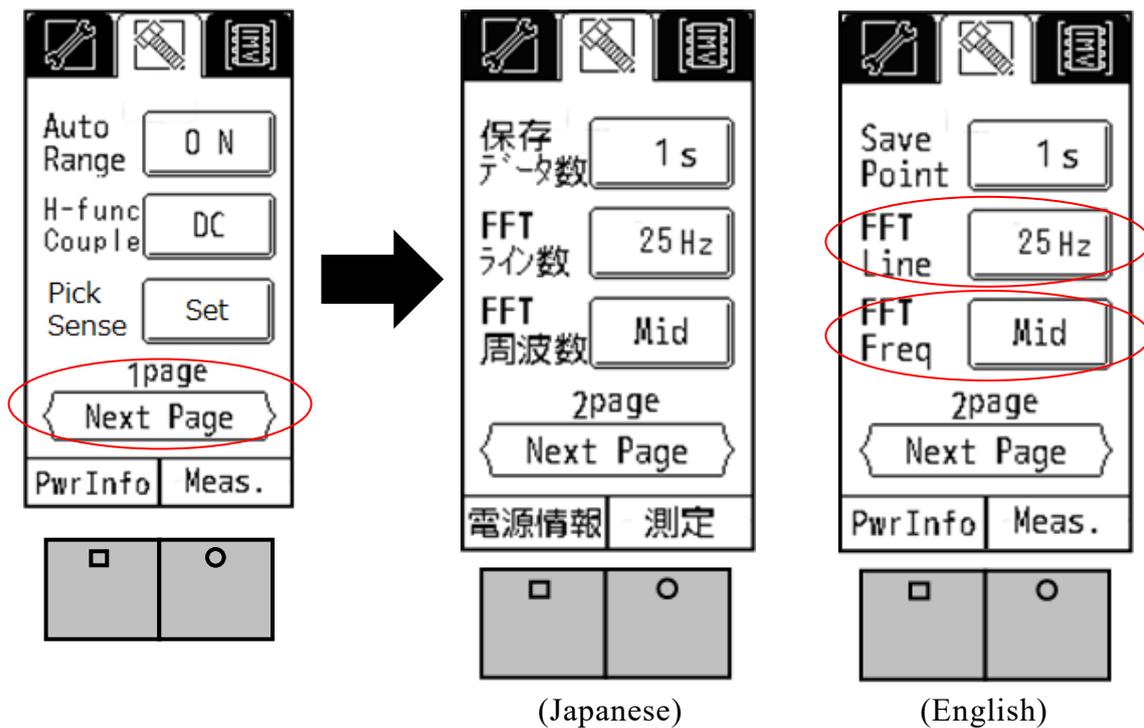


Fig.5-4 Setting of FFT Parameter

“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.

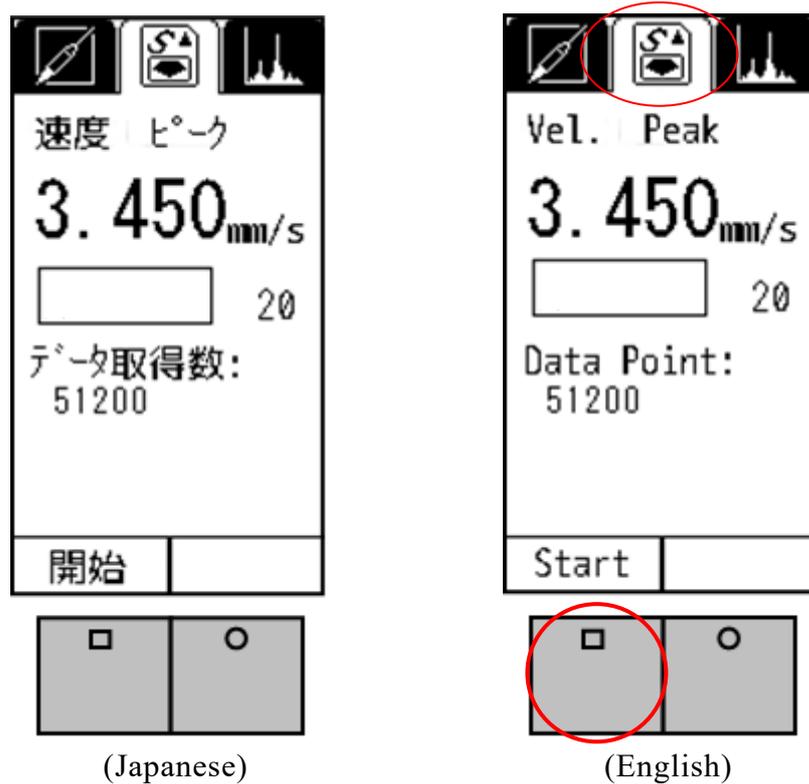


Fig.5-5 Waveform Data Gathering Start

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

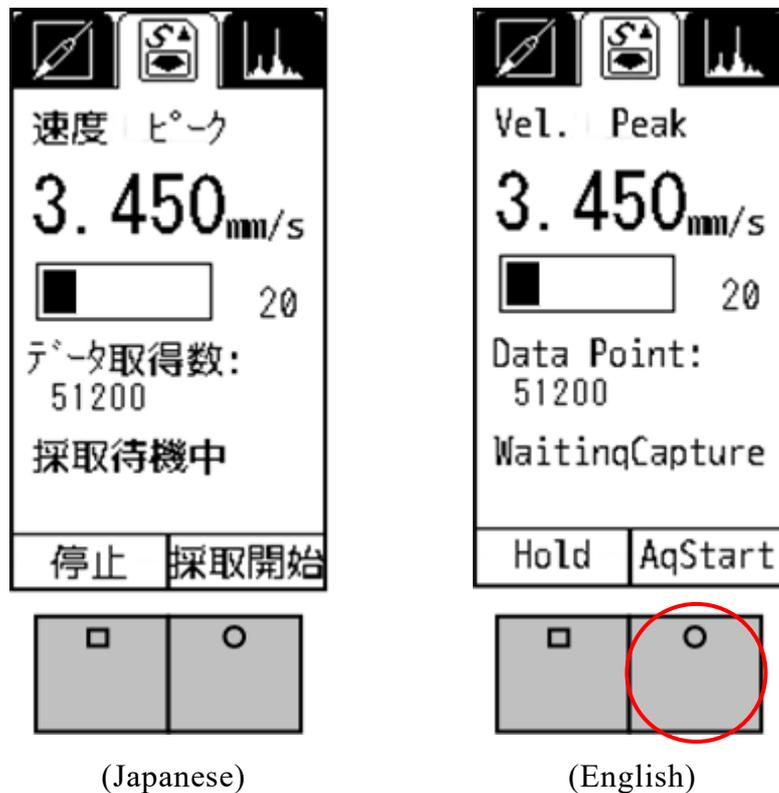


Fig.5-6 Waveform Data Gathering

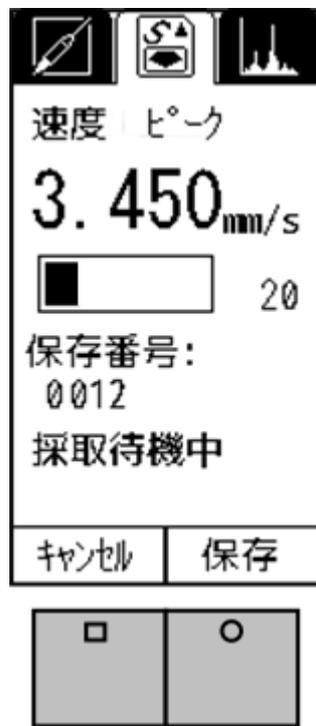


In Fig.5-6, when press “Function Button” or touch “AqStart” on the touch screen, data acquisition actually starts.

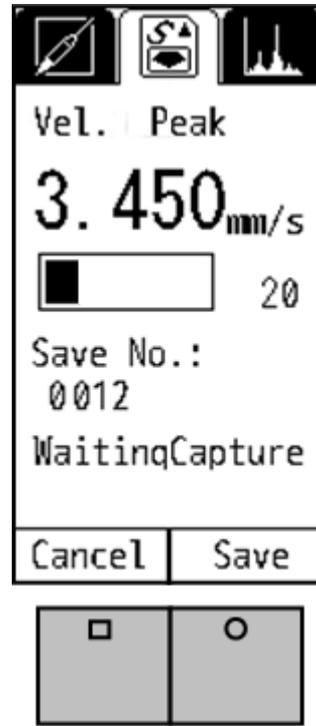
When data acquisition is complete, the screen shown in Fig.5-7 appears. Press “Function Button” or touch “Save” on the touch screen to save the data to SD. Saving to SD is numbered in order starting from “0000” and saved to the SD card (Fig.5-8).

⚠ 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

名前	サイズ	種類
0000.CSV	1,350 KB	Microsoft Office Ex...
0001.CSV	271 KB	Microsoft Office Ex...

2	0.001 022		
3	-0.001 61		
4	-0.01 261		
5	-0.02567		
6	-0.03239		
7	-0.02894		
8	-0.01 886		
9	-0.01 007		
10	-0.01 03		

Fig.5-8 Example of Waveform Data



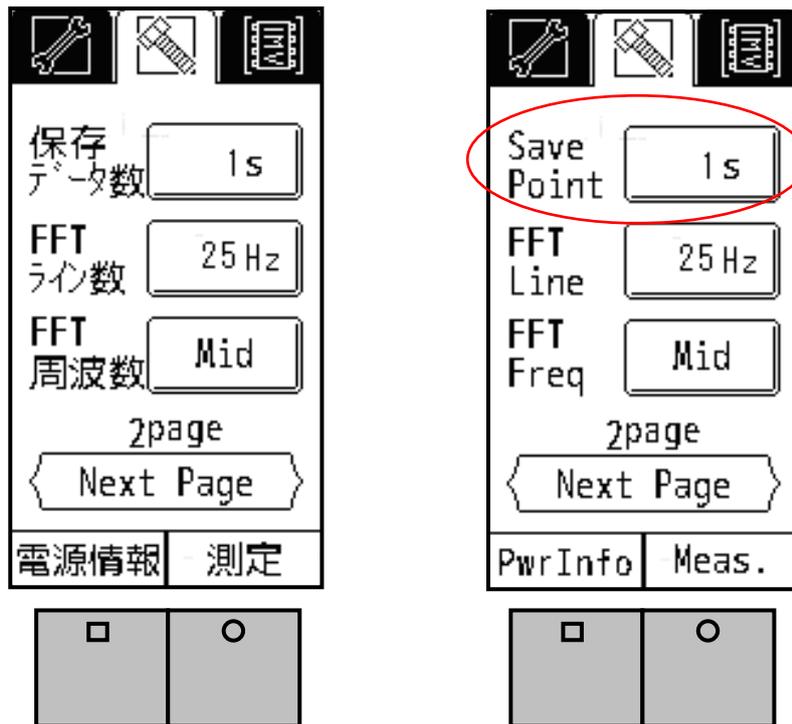
Caution

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-4424H. 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.



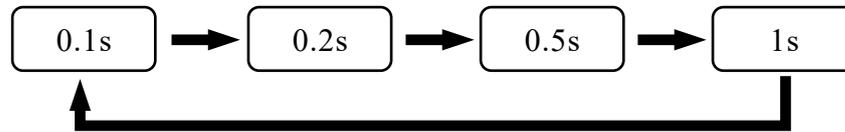
(Japanese)

(English)

Fig.5-9 Parameter Setting of Data Save



The time that can be specified is “0.1s”, “0.2s”, “0.5s” and “1s”. The time changes each time you touch.



The number of data acquisitions is 51,200 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
0.1s	5,120
0.2s	10,240
0.5s	25,600
1.0s	51,200



6. Specifications

6-1. SmartVibro

Sampling Frequency	51.2kHz
Frequency Range	Acceleration (ACC), Velocity (VEL) and Displacement (DISP): Depends on the filter setting (*1) Setting Range of HPF: 5 to 999Hz 1Hz Step (*) Setting Range of LPF: 100 to 10,000Hz 100Hz Step (*) * Factory Default is “HPF: 5Hz” and “LPF: 10,000Hz”. Bearing (BRG): 1kHz to 10kHz H-function (Hfunc): 3Hz to 1kHz (Envelope processing by 2k to 15kHz BPF)
Frequency Characteristics (Acceleration) (*2)	±5% (10Hz to 5kHz) -30/+50% (5Hz to 10Hz, 5kHz to 10kHz)
Measurement Range (Full Scale) (*3)	ACC: 6-range (300、100、30、10、3、1m/s ²) and Auto VEL: 6-range (1000、300、100、30、10、3mm/s) and Auto DISP: 6-range (10、3、1、0.3、0.1、0.03mmp-p) and Auto BRG: 6-range (1000、300、100、30、10、3m/s ²) and Auto Hfunc: 6-range (1000、300、100、30、10、3m/s ²) and Auto
Indication	EQP (ACC, VEL, DISP) PEAK (ACC, VEL, DISP) rms (ACC, VEL)
Accuracy	Sensitivity Error: ±5% at 1kHz Range Changeover Error: ±2% at 1kHz Linearity: ±1% at 1kHz full scale
Output	AC OUT : 0 to ±1V with a load above 10kΩ DC OUT : 0 to +1V with a load above 10kΩ
FFT (Only VM-4424H)	Δf: 6.25Hz, 12.5Hz, 25Hz
Waveform Save (Only VM-4424H)	SD Card Data Saving: 0.1s, 0.2s, 0.5s, 1s (Sampling Frequency: 51.2kHz)
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×H158×D32.5mm (refer to section 6-3) Approximately 230g (standard configuration battery is installed)

(*1) The upper limit frequency of velocity and displacement is limited by acceleration of 450m/s².

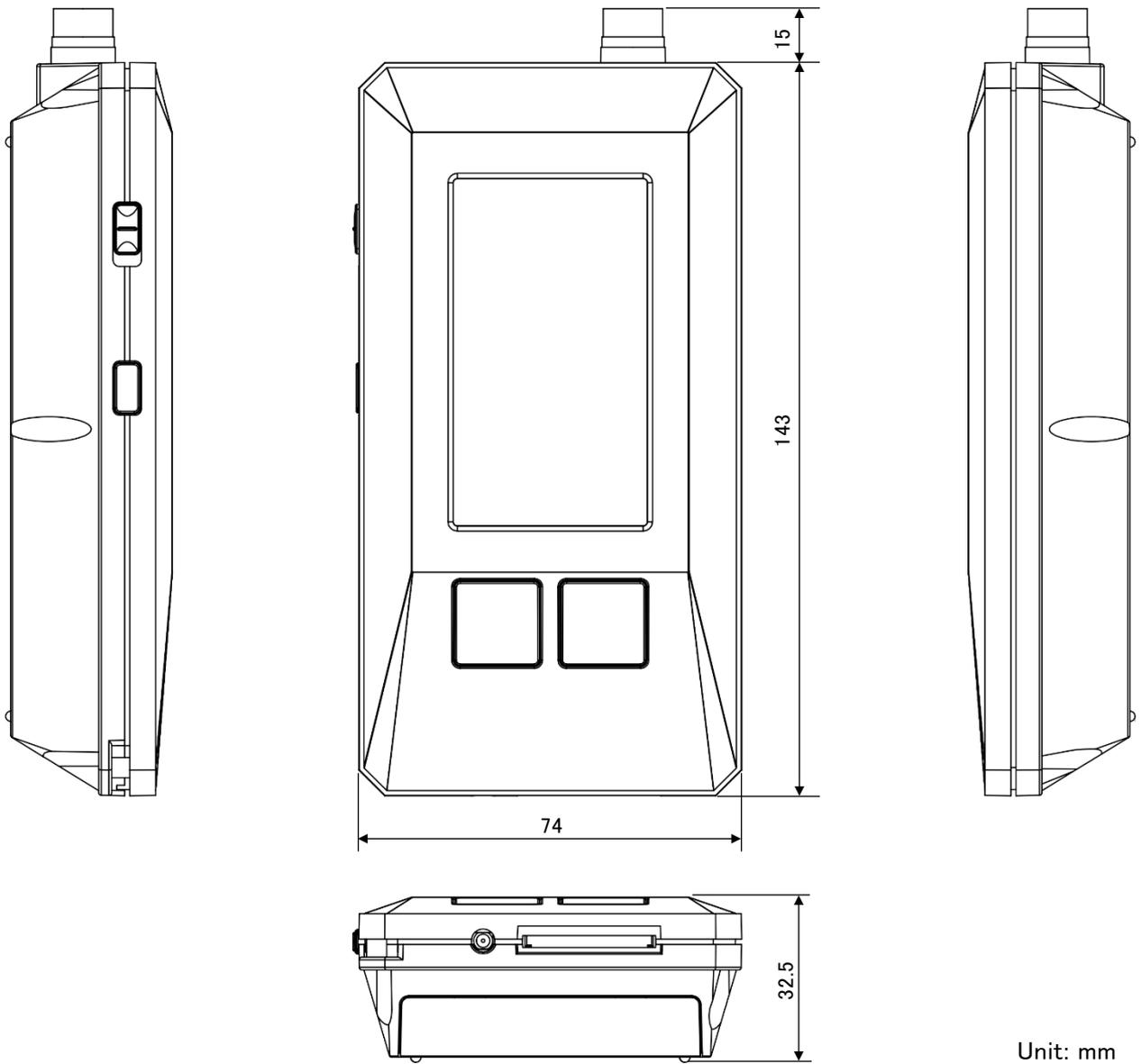
(*2) This is a characteristic when HPF: 5Hz and LPF: 10000Hz are set.

For the characteristics of other filter settings, refer to appendix of this document.

(*3) The upper limit of velocity and displacement measurement range is limited by the maximum input acceleration of each range.



6-2. Outer Dimensions of SmartVibro



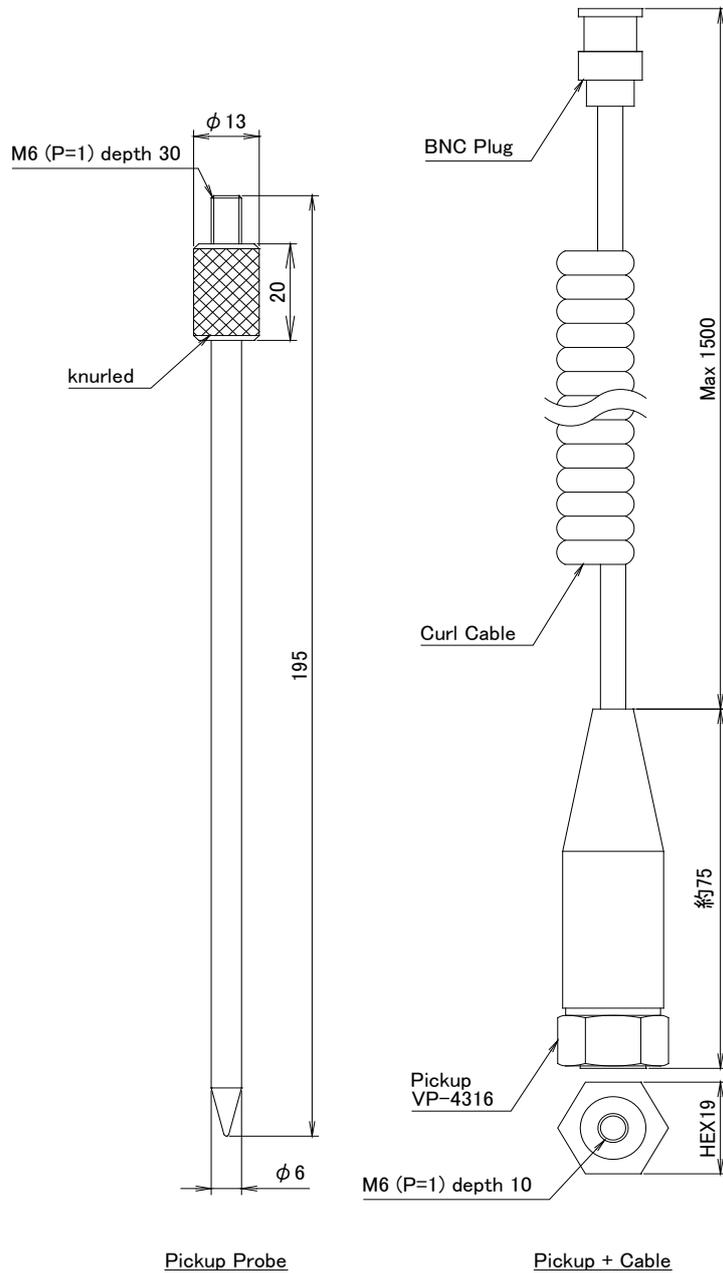
Unit: mm



6-3. Pickup

Detecting Method	Piezoelectric Acceleration Type	
Detection Direction	1 direction	
Sensitivity	9pC/(m/s ²)	
Ambient Conditions	-10 to 50°C (No freezing or condensation)	
Case Material	Aluminum	
Cable Connection	1.5m Curl Cable	
Connector	BNC	
Structure	Dust and Splash Proof	
Dimensions and Weight	Dimensions refer to section 6-4. Weight: Pickup: Approx. 40g	Probe: Approx. 70g

6-4. Outer Dimensions of Pickup and Probe





7. 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”.

8. 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.



9. 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.9-1).

Piezoelectric accelerometers are suitable for high frequency and high accelerometers. So it is necessary to fix by (1) screws or (2) instant adhesives for accurate measurement. Since this product normally uses a detector probe, the influence of the probe on the characteristics is large, but it is possible to fully grasp the increase and decrease and tendency of relative vibration for the same measurement object. Furthermore, by listening vibration sound, the function can be complemented.

- (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 (1000m/s^2). Please handle with care.

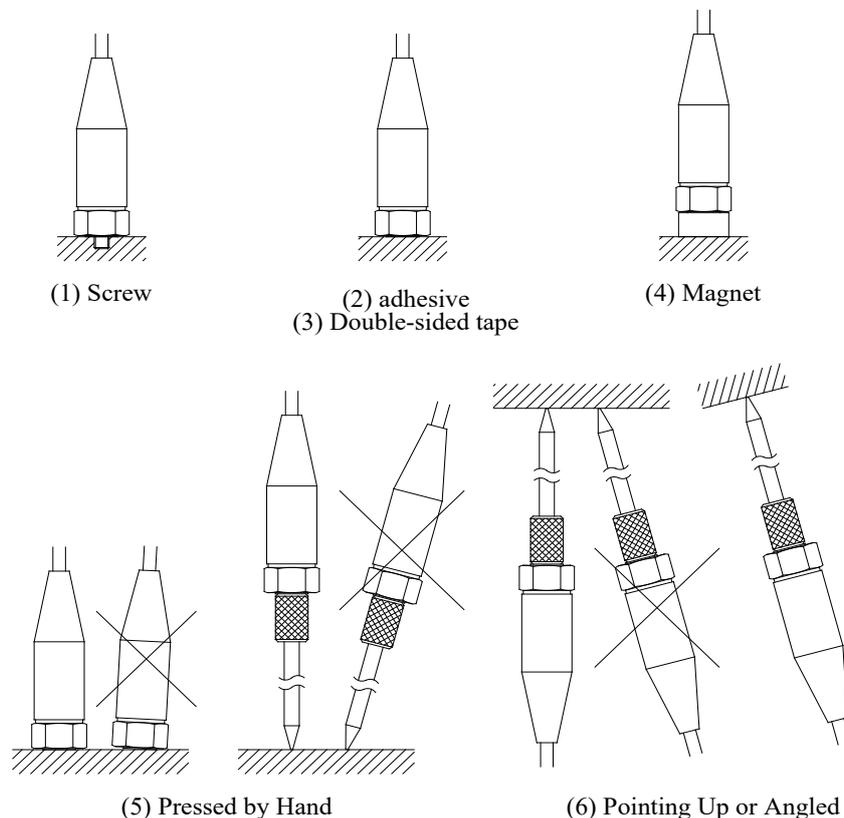


Fig.9-1 How to Fix the pickup

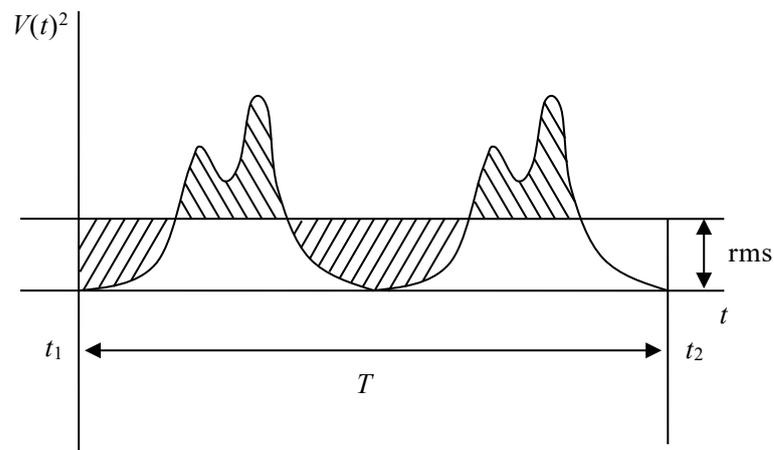


10. Definitions

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.

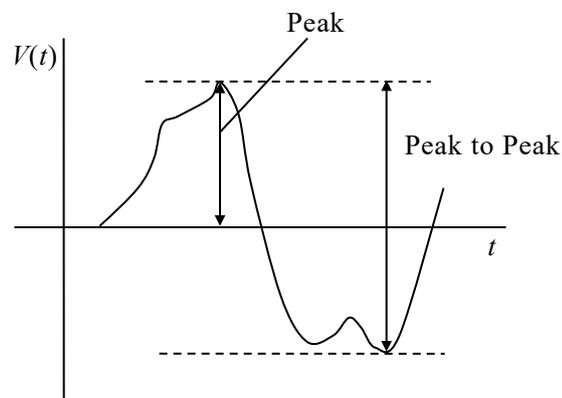


EQP: Equivalent peak. Giving that a measuring data set is sinusoidal, EQP is calculated Peak by following formula.

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

$rms \times \sqrt{2}$ 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.





Envelope Waveform: Envelope waveform means the peak trajectory of the vibration waveform. For example, vibration due to rolling bearing deterioration occurs in DC to 1kHz band due to rotation, and is modulated by the natural frequency (2k to 15kHz) of the bearing and transmitted to the bearing housing. This vibration is detected, the absolute value is taken, and the peak locus of the high-frequency vibration waveform of 2k to 15kHz can be obtained by 1kHz low-pass filter processing.

H-function: When a 2k to 15kHz signal passes through a 1kHz filter in envelope processing, it is rectified to become a direct current component, and a waveform in which an envelope waveform of DC to 1kHz is superimposed on it. This waveform is called H-function, and indicates the magnitude and amount of fluctuation in the high frequency range.

A waveform obtained by removing DC component from H-function and extracting only the fluctuation component from DC to 1kHz is output from ACOUT in VM-4424 in the same way VM-4416. For the indicator and DCOUT, you can switch between H-function and the fluctuation component (below fig.10-1 and refer to section 4-4-2).

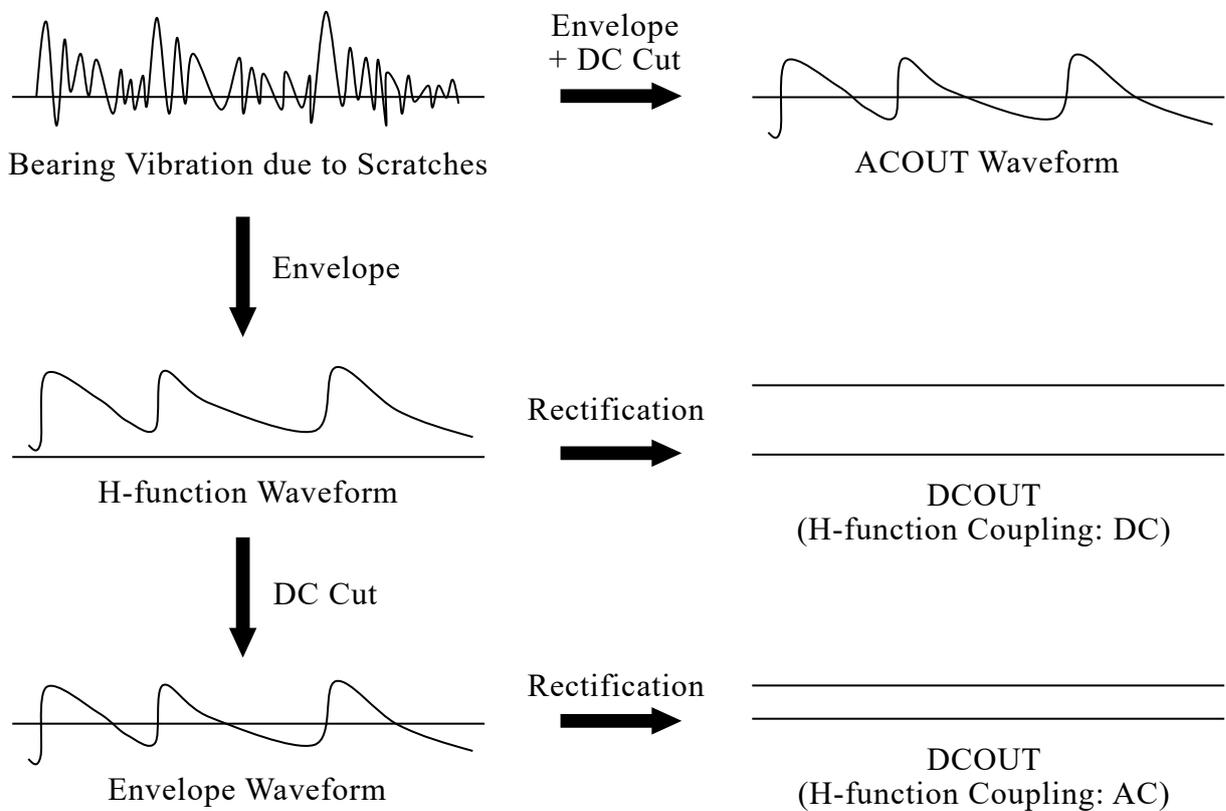


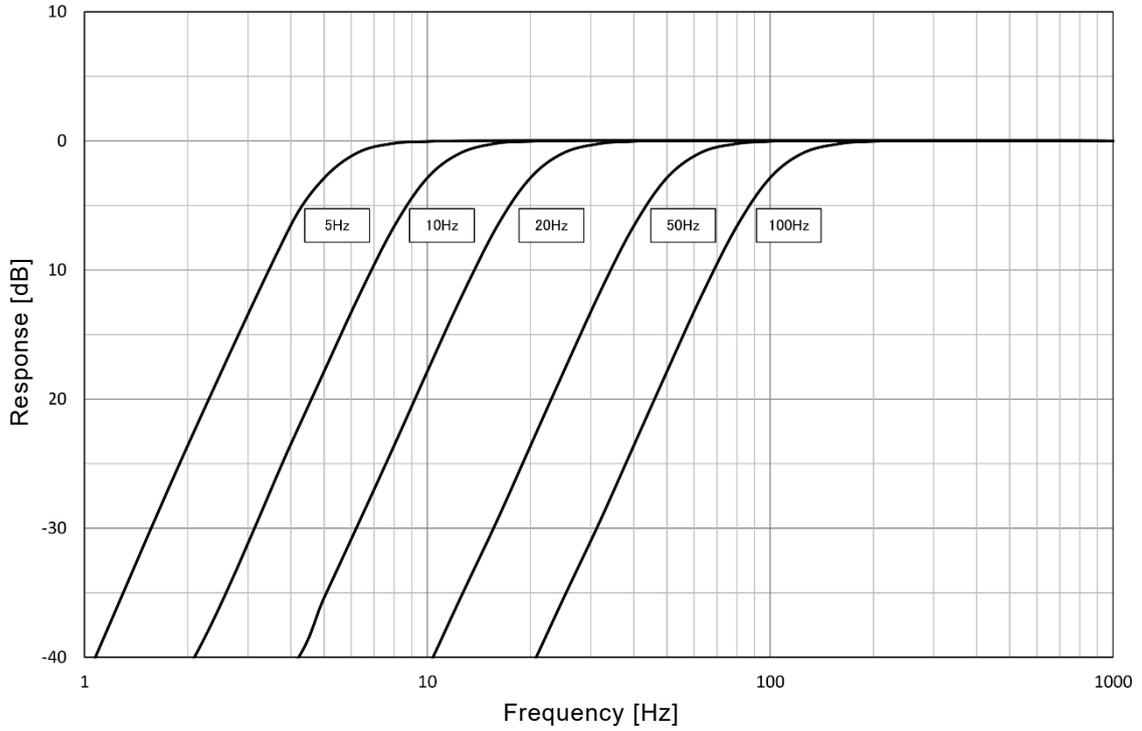
Fig.10-1 Waveform Process of H-function



Appendix Filter Characteristic

The filter characteristics (typical values) for VM-4424S/H are as follows.

(1) High Pass Filter (HPF) Characteristic (Acceleration (ACC) Typical Value)



(2) Low Pass Filter (LPF) Characteristic (Acceleration (ACC) Typical Value)

