

# Vibration Analyzer / Function Extension Program VA-14 / VX-14S

**Instruction Manual** 

**Operation Guide** 

# Organization of the VA-14 Instruction Manual

There are two types of instruction manuals for the Vibration Analyzer VA-14.

# **Quick Start Guide**

This manual describes the basic handling of the Vibration Analyzer VA-14.

# Operation Guide (This Document)

This manual explains how to handle the Vibration Analyzer VA-14, how to connect and use peripheral devices, and how to manage the use of an SD card.

You can download the Instruction Manual from our website:



https://svmanual.rion.co.jp/va-14\_e/

# Organization of This Manual

This manual explains the functions and operation methods of the Vibration Analyzer VA-14 and the optional program VX-14S.

If the unit is used together with other equipment to configure a measurement system, consult the documentation of all other components as well.

In addition, safety precautions are described on page 6 onwards. Be sure to read this section carefully.

The manual consists of the chapters listed below.

# **General Operation**

Product Outline

Gives an overview of the unit.

Controls and Features

Briefly identifies and explains the keys, connectors, and other parts of the unit.

Preparations

Describes how to prepare the unit for use, including information on making connections, power-up, and inserting the SD card.

Reading the Common Display

Describes the common display screen contents.

Indicator Lamp

Describes the indicator lamp.

Setting Menu

Describes various items that appear on the setting menu screen.

Analysis Functions

Describes the types of analysis that can be performed by this unit.

Measurement in Vibration Meter (VM) Mode

Describes the display screen contents and operation steps in vibration meter (VM) mode.

Measurement in Time Waveform (TIME) Mode

Describes the display screen contents and operation steps in time waveform (TIME) mode.

· Measurement in FFT Analysis Mode

Describes the display screen contents and operation steps in FFT analysis mode.

Data File Structure

Describes the structure of data files stored on the SD card.

· Saving the Screen as a BMP File

Describes how to save the currently displayed screen as a BMP file.

Recalling Stored Data

Describes how to recall data that were saved from the various measurement screens, and how to view recalled data.

Serial Interface

Describes communication with a computer using the device's built-in serial interface.

# **Advanced Operation**

Trigger Functions

Describes the use of trigger signals and the relationship between triggering and various measurements.

Overlapping Display

Describes how to use the overlapping function in FFT analysis mode.

Setup Files and Initialization

Describes how to use setup files and lists the default settings for various items.

Operation Lock / Key Lock

Provides the operation lock and key lock of the unit.

Function Key

Describes how to assign functions to the Fn key on the unit.

Calibration

Describes how to calibrate the device.

Optional Program

Describes optional programs.

Typical Measurements

Describes measurements for quality inspection of products and precision diagnosis of rotating machinery.

Examples of Settings for Typical Measurements

Provides examples of settings for typical measurements.

Specifications

Lists the technical specifications.

Technical Data

Provides technical data, including frequency characteristics and residual noise when a sensor is connected.

# Safety Precautions / Precautions for Use

# Safety precautions

The precautions shown here are intended to help you use the product safely and correctly, and to prevent harm and damage to you and other people. Incidents that could occur as a result of incorrect handling are divided into two categories: "WARNING" and "CAUTION". Make sure to follow the contents of all these categories because they are serious matters related to safety.

# **Examples of pictorial indications**

Specific prohibitions may be displayed in the illustrations.



Display	Meaning
<b>⚠ WARNING</b>	Indicates a possibility of death or serious injury due to incorrect handling.
<b>⚠</b> CAUTION	Indicates a possibility of personal injury or property damage due to incorrect handling.
Important	Failure to observe the precautions indicated by this may result in damage to the unit.
■ Note	Denotes special information that is helpful in utilizing the capabilities of the unit but that is not directly related to safety.

## Handling of the batteries

# **MARNING**



If electrolyte leaking from the batteries gets into your eyes, rinse with water without rubbing and immediately seek medical attention.

Failing to do so may result in blindness.

If electrolyte leaking from the batteries gets on your skin or clothes, wash it off immediately with water.

## Handling of this product

# **MARNING**



Never disassemble, repair, or modify the product.

Doing so may cause a fire, electric shock, or an accident.



Do not connect the power cable or remove the main unit with wet hands.

Doing so may cause electric shock or injury.



Do not immerse the main unit in water or splash water on it.

The unit is not waterproof, so immersing it in water or splashing it with water may cause electric shock or malfunction.



Do not use the unit for purposes other than for what it is originally intended.

Keep the product away from heat sources such as fire and stoves.

Failure to do so may cause a fire, electric shock, or malfunction.



### Do not use the unit if any abnormality such as damage is discovered.

Continuing to use the unit regardless of an abnormality may cause electric shock or fire. In such circumstances, please contact your dealer.

Do not use the unit if there is something wrong with it, such as it becomes abnormally hot.

Doing so may result in a malfunction or fire.

Do not use or connect to the power supply in a humid place such as a bathroom or in a place where it may get wet.

Doing so may cause electric shock or malfunction.

Do not use, store, or leave the product in a hot place such as in a place exposed to fire, direct sunlight, or inside a car on a hot day.

Doing so may cause a fire, battery breakage, or overheating.

### When disposing of the product, it should not be incinerated.

Doing so may cause a fire or the batteries to explode. When disposing of the product, follow the regulations of your country or local municipality.

### Do not use the power cable connected to the optional AC adapter with a voltage other than 100 VAC.

The power cable connected to the AC adapter is a 100 VAC compatible cable that conforms to electrical safety standards. We cannot guarantee the safety of the unit if it is used with a voltage other than 100 VAC. Use a power cable that is compliant with the laws and electrical safety standards of your location.

When making measurements on exposed rotating parts or power train parts of machinery, do not use the shoulder strap.

If the strap gets caught in the machine, it could lead to a dangerous accident.



If there is dust on the external power supply port, wipe it off before connecting the AC adapter.

Failure to do so may result in electric shock, short circuit, or fire.

Wipe off any water on the main unit and the external power supply port before connecting to the power supply. Failure to do so may result in electric shock, short circuit, or fire.

If there is a problem with the unit during use, turn off the power and disconnect the AC cable and remove the batteries.

In such circumstances, please contact your dealer.

### Always turn off the power after use.

Turn off the power and remove the batteries if you intend to store the product for a long time without using it. Leaving the batteries inside the unit may cause electrolyte to leak. Remove the AC adapter.

Always hold the plug or connector when disconnecting a cord or cable.

Do not apply excessive force, such as holding the cord or cable and pulling it out.

When making measurements on exposed rotating parts or power train parts of machinery, proceed with utmost care to ensure that the accelerometer or accelerometer cable does not get caught in the machine.

# **A**Caution



Do not use or store the product within the reach of children or pets.

Doing so may result in electric shock, injury, or accidental ingestion.

Do not store the unit in places in which it will be subject to water, dust, high temperatures, and high humidity, or in direct sunlight. Do not use or store the unit in places where it may be adversely affected by salt, sulfur, chemicals, gases, etc.

The operating temperature for this unit is  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  and the humidity range is 10% to 90% RH.

\* In the event of a product defect caused by Rion, Rion will repair or replace the unit.

# Precautions for use

- Avoid using and storing the product in places with high temperatures and humidity, or in places exposed to direct sunlight for long periods of time.
- If there is a drastic change in the surrounding temperature, the product may malfunction due to internal condensation.
- As the unit is a precision electronic device, avoid using or storing it in locations subject to shock or vibration.
- If you do not intend to use the unit for a long time, remove the batteries, and store it.
- Do not insert wires, metal pieces, conductive plastics, etc. through any holes or gaps of the product. Doing so may result in a malfunction.
- If you are using the unit outdoors and it starts raining, stop measuring and keep the unit dry. If the unit gets wet, wipe it off with a dry cloth and dry it in a well-ventilated environment.
- We recommend storing the unit in its designated location within the carrying case, which is optional accessory.
- The touch panel surface is easily damaged, so do not poke or hit it with an object such as a pen, pencil, or screwdriver.
- To maintain the accuracy of measurements, inspect the unit regularly. In such circumstances, please contact your dealer.
- Be aware that removing the sticker seals will cause the unit to be no longer subject to the warranty.
- The rechargeable backup battery for the clock of this unit is a consumable item. We recommend regularly replacing this battery (for a fee). For replacement of the rechargeable battery, please contact your dealer.
- Be sure to turn off the power before inserting or removing the SD card.
- Never format the optional program card such as VX-14S with SD card formatting software (such as SD Formatter).
   Otherwise, the program data on the card will be erased and can no longer be used. Restoration of the erased program is not guaranteed. Note that using the formatting function of the unit or the formatting function provided in the computer's operating system is acceptable and will not cause any issues.

# [Disclaimer]

- Rion shall not be held accountable for the following damages:
   Any damage caused by earthquakes, lightning, wind and floods, fires for which Rion is not responsible, actions or accidents by a third party, intentional or negligent misuse by the customer, or use under other abnormal conditions.
- Rion shall not be held accountable for the following incidental damages arising from the use or inability to use this product:
  - Alteration or loss of recorded content, loss of business profits, or the interruption of business, etc.
- Rion shall not be held accountable for any damage caused by not following the contents of this document.

# [Cleaning the product]

• To clean the unit, use a dry, soft cloth or a cloth wrung out with lukewarm water. Do not use organic solvents such as benzene or alcohol.

## [What to do when disposing of the product]

When disposing of this product or batteries, make sure to consult with your local municipality.

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# **General Operation**

1
Product Outline

This product is a handheld, single-channel vibration analyzer with FFT analysis capabilities.

The basic configuration includes a vibration accelerometer with a built-in amplifier and the main vibration analyzer unit. The accelerometer is equipped with the PV-57I and a magnetic attachment, and it can be used with either a push-fit or screw-fit installation.

The sensor input connector of the unit is a BNC with constant current line drive (CCLD). You can change the accelerometer according to the application and set the sensitivity on the main unit for use. Additionally, by using the optional charge converter VP-40, charge-type accelerometers can also be connected.

Measurement functions include the vibration meter function (VM mode), time waveform display function (TIME mode), and frequency analysis function (FFT analysis mode).

In VM mode, acceleration, the crest factor (C.F.), velocity, and displacement can be measured simultaneously. In TIME mode, the time waveforms of the selected acceleration, velocity, displacement, and envelope can be measured. In FFT analysis mode, the frequency span and the number of analysis points for the selected acceleration, velocity, displacement, and envelope can be adjusted, enabling the measurement of both instantaneous and average results. In time waveform (TIME) mode and FFT analysis mode, free trigger, level trigger, and external trigger can be used.

Measurement results in each mode are recorded on an SD card. The recording medium supports SDHC cards of up to 32 GB. No measurement data is stored in the unit's internal memory.

The unit features a 3.5-inch color LCD display, and the controls use membrane switches. Cursor movement can also be performed via the touch panel.

Additionally, the unit is equipped with USB and LAN ports, allowing it to be used not only for fieldwork but also as a stationary measuring instrument or integrated into a system by connecting with external communication devices.

Both an internal battery and an external power supply are available.

The unit can be powered by six AA batteries, either alkaline or Ni-MH rechargeable.

The AC adapter NE-21P (optional accessory) is the standard external power supply, and power can also be supplied from the USB terminal. The power supply can be used flexibly in various situations.

By installing the optional program VX-14S, FFT analysis with a connected microphone and preamp is possible. Additionally, by connecting to external communication devices, it is possible to remotely monitor the displayed values and calculated values, allowing for broader use, such as integrating the device into evaluation systems.

# 1.1 Features of this product

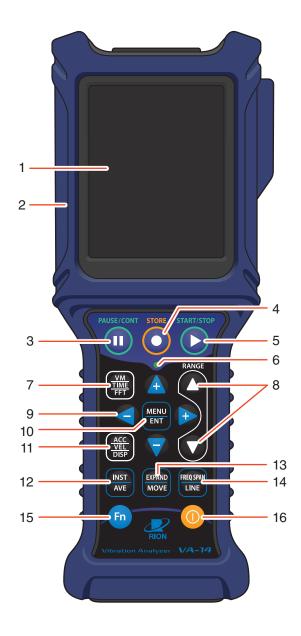
- Digital integration and RMS calculation are performed by a DSP (Digital Signal Processor) chip.
- In vibration meter (VM) mode, simultaneous display of acceleration, velocity, displacement, acceleration peak, and acceleration crest factor is available.
- The FFT analysis mode uses a 24-bit A/D converter, providing a dynamic range of up to 94 dB.
- FFT analysis mode allows for the overlapping display of measurement data and recall data.
- Capable of storing 9999 store names x 1000 store addresses, regardless of data type.
- · Data are stored on a convenient SD card.
- Up to 10 setup files can be saved.
- Up to 100 setup files can be stored as a group on an SD card.
- · Display image can be captured as a BMP file.
- An SD card installed in the unit can be recognized as a removable disk when the unit is connected to a computer via a USB cable.

## Device usage environment

Place of use	Indoors or outdoors
Altitude	Up to 2000 m
Ambient temperature	-10°C to 50°C
Relative humidity	10% to less than 90% RH (no condensation)
Fluctuations in mains voltage	(100 V to 240 V) ±10%
Overvoltage category	Category II (AC adapter)
Use in damp locations	Not recommended
Pollution degree of surrounding environment	Pollution degree 2
Dustproof and waterproof performance	Not applicable
Impact resistance	Not applicable

# Controls and Features

Front



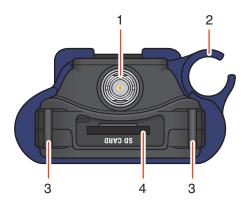
No.	Name	Description
1	Display	Shows measured data, menu screens and other information (page 48).
2	Protective cover	A cover to protect the unit.
3	PAUSE/CONT key	Serves to pause and resume the measurement (page 58). Also press to use the pause function.
4	STORE key	Serves to store data on SD card (page 59, 82).
5	START/STOP key	Serves to start and stop the measurement (page 73).  The key is also used to return to the measurement screen from the menu screen (page 48).
6	Indicator LED	Shows operation and status information for the unit by blinking in red and blue (page 44).

No.	Name	Description
7	VM/TIME/FFT key	Serves to select the analysis mode (page 50).
8	RANGE $\triangle/\nabla$ keys	These keys serve to select the input range for measurement (page 63).
9	$\triangle$ / $\nabla$ / $\triangleleft$ / $\triangleright$ keys	These keys are used for various functions, such as selecting menu items, moving the cursor, changing the display zoom factor, changing the store address, etc. (page 64, 77).
10	MENU/ENT key	Press to display the menu or confirm a selection on the menu screen (page 48).
11	ACC/VEL/DISP key	Serves to select measurement data type (acceleration, velocity, displacement, envelope) (page 77).
12	INST/AVE key	In FFT analysis mode, this key serves to switch between the instantaneous value display and the calculation type selected from a menu (linear average, exponential average, maximum hold) (page 68).
13	EXPAND/MOVE key	When display scaling is enabled, this key serves to switch between zoom (expand/shrink) mode and move mode (page 64, 77).
14	FREQ SPAN / LINE key	Serves to change the frequency span or number of analysis lines in time waveform (TIME) mode and FFT analysis mode (page 71).
15	Fn key	Press to execute the function assigned to the Function (Fn) key (page 64). You can assign it to Recall, Backlight, Screenshot, Filter settings, or Save/Load settings.
16	POWER key	Press to turn On/Off the power (page 34).

# **Important**

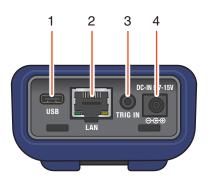
• Do not press the indicators or keys with hard, sharp objects such as nails or ballpoint pen tips. Doing so may damage the display or keys, rendering them inoperable.

Тор



No.	Name	Description
1	Accelerometer connector	The supplied Piezoelectric Accelerometer PV-57I or another accelerometer is to be connected here.  (Other supported accelerometers include PV-91C, etc.)
2	Accelerometer holder	A holder for storing the accelerometer.
3	Shoulder strap attachment part	Attach the shoulder strap (accessory) for drop prevention (page 27).
4	Card slot	A slot for inserting an SD card.

# Bottom



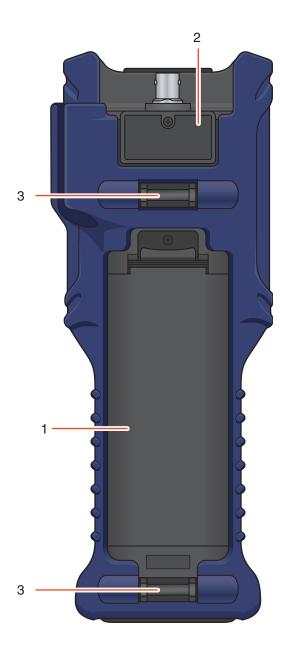
This figure shows the cover open.

No.	Name	Description
1	USB port (Type-C)	A port for connecting a computer or mobile battery (page 33, 102).
2	LAN port	A port for connecting a computer or router (page 106).
3	TRIG IN connector	Used for inputting an external trigger signal. This enables control over the measurement (page 148).
4	External power supply port (DC IN)	By connecting the optional AC adapter NE-21P, the unit can be used with 100 V to 240 VAC (page 32).

# **Important**

- $\bullet\,$  Do not use AC adapters or other than the specified ones. Doing so may result in a malfunction.
- When using the AC adapter NC-99 series to operate the unit, be sure to use the power jack adapter CC-43J (optional accessory).

Rear



No.	Name	Description
1	Battery compartment	Install six AA batteries to use the unit. There is a power-on mode switch in the battery compartment (page 34).
2	Nameplate	The serial number and the model of the main unit are indicated.
3	Hand strap attachment part	Attach the hand strap (optional accessory) for drop prevention (page 28).

# 3 Preparations

The unit can be operated with six AA batteries (alkaline batteries, Ni-MH rechargeable batteries), or, as an external power supply, AC Adapter NE-21P, or a USB power supply. The operating voltage is 5.7 V to 15 V (rated voltage 12 V).

# **⚠ WARNING**

- If you notice any abnormalities such as excessive heat, smoke, or a burning odor while using the unit, immediately remove the batteries, unplug the AC adapter from the outlet, and contact your dealer.
- If you do not intend to use the unit for a long time, remove the batteries. Failing to do so may result in battery leakage.

# Note

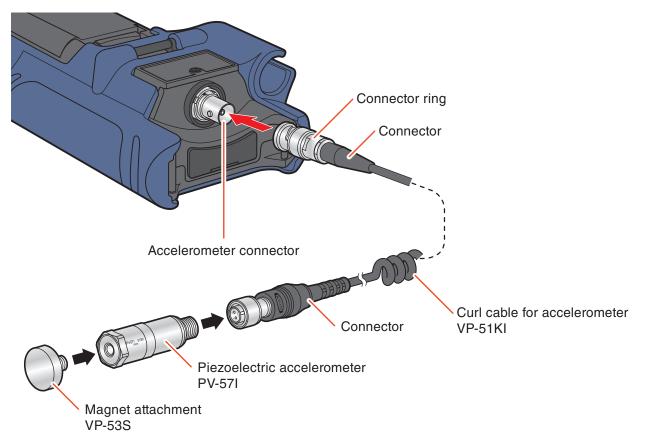
- Make sure to set the date and time before measuring.
   When using multiple power sources, the power supply is provided in the following order: AC adapter, USB, and batteries.
   When the batteries are installed and the AC adapter is connected to the unit, power is supplied from the AC adapter.
   In the event of a power outage or if the AC adapter is disconnected, the unit will automatically switch to battery power.
- When operating the unit with just an external power supply, if the unit is turned off when the external power supply turns off, the auto-file-closing and auto-shutdown operations will not be performed, and so we recommend installing new batteries in the main unit. However, make sure to set the power-on mode switch to the A side (page 34).
- The unit can tolerate momentary power failures in the commercial power supply for approximately 50 ms when using the specified AC adapter.

# 3.1 Connecting the accelerometer

# 3.1.1 How to connect the accelerometer

Connect the piezoelectric accelerometer as shown below.

1 Connect the piezoelectric accelerometer as shown below.



- Insert the connector plug of the cable into the INPUT connector, and rotate the connector ring clockwise to firmly lock the plug.
- If the accelerometer has been changed, use the supplied calibration chart to make the sensitivity setting (see page 38).
- 4 Lightly press the accelerometer and verify that the display indication changes.

# **A** Caution

- The magnet attachment VP-53S is extremely powerful (0.8 kG to 1 kG). Proceed with care to prevent the risk of injury when bringing the attachment in contact with the measurement object.
- Keep magnetic media, such as magnetic cards, at least 50 centimeters away from the magnet attachment VP-53S. Otherwise, data may be destroyed.

# **Important**

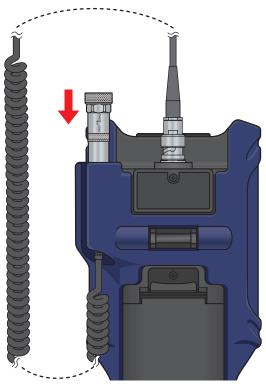
• Do not insert or remove the PV-57I or other sensors while turning on the power.

# Note

- In addition to the supplied Piezoelectric Accelerometer PV-57I, other accelerometers like the PV-91C can also be used. In this case, a BNC adapter (VP-52C), low-noise cable (VP-51A, VP-51L) and other accessories may be required.
- The Piezoelectric Accelerometer PV-57 or PV-57A cannot be used.
- Before starting to use the unit, the piezoelectric accelerometer sensitivity must be set. For the setting method, refer to "Making sensor settings" (page 38).
- When installing an attachment that uses a set screw, first tighten the set screw on the accelerometer side, and then attach the attachment.

# 3.2 Attaching the sensor to the protective cover

When transporting the unit, the sensor can be housed in the cradle on the protective cover of the unit, as shown in the illustration at right.



# **⚠** Caution

• Dropping the sensor or otherwise subjecting it to shocks can lead to damage.

If the unit is carried upside down with the sensor in the protective cover (with the INPUT connector for the accelerometer pointing down), the sensor may fall out. Take care to avoid this.

# Note

• The protective cover serves to protect the unit from external shocks. We recommend leaving the cover on during use.

# 3.3 Inserting the SD card

Measurement data can be recorded on an SD card and the results can be processed on a computer. Additionally, by installing the optional program VX-14S, the device can support various measurements.

# **Important**

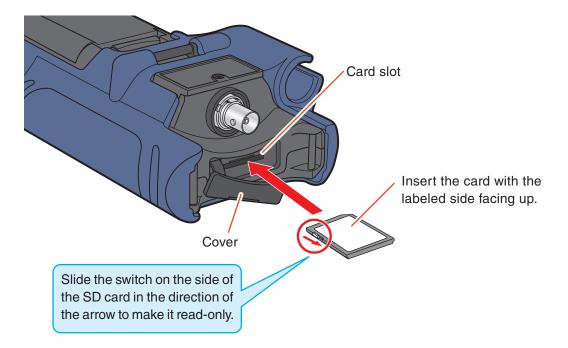
- Be sure to turn off the power before inserting or removing the card.
- If you remove the SD card while writing out or loading data, the data on the SD card may become corrupted.
- Use genuine SD cards provided by Rion. The performance of other cards is not guaranteed.
- · Note that we assume no responsibility for any damage or loss of stored measurement data.

# Note

• Prior to measurement, first format the card for storing data with the unit (page 37).

# Open the card slot cover and insert the SD card.

With the label on the SD card facing up, insert it into the card slot located at the top of the unit until a clicking sound is made.



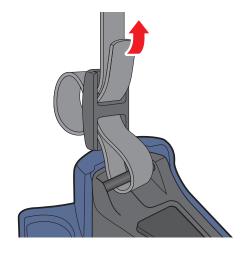
To remove the SD card, push it in until it makes a clicking sound.

The SD card will pop out, so take it out.

# 3.4 Attaching the shoulder strap

The supplied shoulder strap can be used to support the unit during a measurement.

Attach the strap to the bar on the top section of the unit.



Wear the strap around your neck, as shown in the figure.



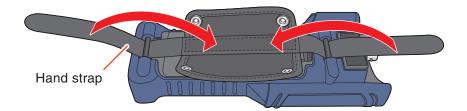
# **MARNING**

• When making measurements on exposed rotating parts or power train parts of machinery, never use the shoulder strap. It is very dangerous if the strap gets caught.

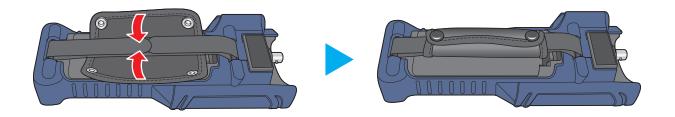
# 3.5 Attaching the hand strap

You can attach a hand strap (optional accessory) to prevent the unit from being dropped while holding it during use. For added security, pass your wrist through the strap while using the unit.

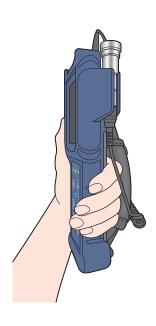
Pass the hand strap through the hand strap attachment section and fold it back.



2 Align the fasteners and snap them together.



3 Wear the hand strap over your hand as shown in the figure.



# 3.6 Using the carrying case

When storing or transporting the unit, the optional carrying case is convenient.

Slide the handle clasps to open the carrying case.



2 Store the unit in the carrying case.

It can also accommodate other devices such as accelerometers, microphones, and microphone preamps.



# 3.7 Power Supply

# 3.7.1 Battery-powered operation and external power supply operation

The unit can be powered by batteries or an external power supply (AC adapter) connected to the unit.

When using multiple power sources, the power supply is provided in the following order: AC adapter, USB, and batteries.

# 3.7.2 About batteries

## Continuous operating time with battery

This unit operates on six AA batteries.

Battery life varies depending on the operating environment and battery manufacturer, but the approximate values are as follows (at 23°C).

Battery type	Continuous operating time with battery	
Alkaline battery	12 hours	
Ni-MH rechargeable battery	12 hours	

\*When PV-57I is connected, LAN: Off

# Note

- Select [System (Language)] [Power] from the [Menu] screen according to the battery type, and set the [Battery Type] correctly.
- The continuous operating time of Ni-MH rechargeable batteries varies depending on the charging state.
- When the sensor drive power supply (CCLD) is turned off, the continuous operation time increases by approximately 1.1 times.
- · When communication control via LAN is turned on, the continuous operation time decreases by approximately 0.7 times.

### When to replace the batteries

During battery-powered operation, the battery capacity symbol is shown on the status bar, as illustrated below.

As the batteries are used, the remaining level decreases.

When the remaining power becomes low, replace the batteries with a new set.

Full	$\rightarrow$	Low	Running out
Green	Green	Orange	Red

# Note

- While the battery capacity symbol is (red), the display backlight will not turn on.
- When the battery capacity symbol flashes [ (red), Auto store and waveform recording will automatically stop. New measurements cannot be started.

### Auto shut-off function

When the battery power is depleted, the battery capacity symbol will flash red, and the power will automatically turn off.

# **Important**

• If the external power supply is lost, the unit will automatically switch to battery power, if batteries are installed, allowing it to continue operating. If no batteries are inserted, the unit will turn off.

# 3.7.3 Inserting the batteries

# **MARNING**

- Make sure to correctly insert the batteries with the polarities of the batteries "+" and "-" matching the marks. If the polarities are incorrect, the batteries may explode or leak. If you do not intend to use the unit, remove the batteries to prevent leakage. If electrolyte leaking from the batteries gets on your skin or clothes, wash it off immediately with water.
- · Be careful not to injure yourself by pinching or cutting your hand when installing the battery compartment cover.

## **Important**

• Insert six new batteries of the same type. Using different types of batteries or mixing old and new batteries may cause a failure.

1 Remove the battery compartment cover.



Insert six AA batteries, ensuring that the orientation matches the "+" and "-" marks.



3 Reinstall the cover.

## **Important**

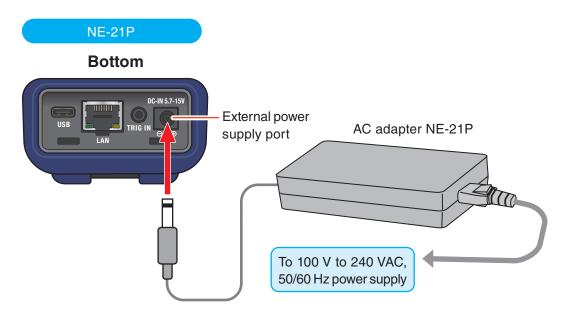
· Make sure that the battery compartment is closed securely.

# 3.7.4 Connecting an external power supply

# **Important**

- Do not use AC adapters or other than the specified ones. Doing so may result in a malfunction.
- When using the AC adapter NC-99 series to operate the unit, be sure to use the power jack adapter CC-43J (optional accessory).

The following connection methods are possible for operation using an external power supply.



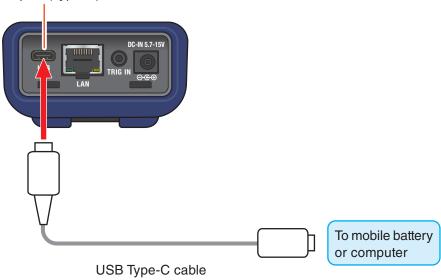
# Note

- For the external power supply, the dedicated AC adapter NE-21P is recommended.
- When the AC adapter is connected to the unit, power will be supplied from the adapter, also if batteries are inserted. (The AC adapter has priority.)
- When power is no longer supplied from the AC adapter due to a power outage, etc., the unit automatically switches to being powered by the batteries.
- While the unit is powered from an external power supply, the AC adapter symbol

# USB power supply (from mobile battery, computer, etc.)

To power the unit via USB, connect the USB Type-C cable to the USB port of the computer or USB charger.

## USB port (Type-C)



# Note

- For USB power supply, it is recommended to keep a battery installed in the unit. USB power supply may cause a drop in measurement performance depending on the quality of the commercially available computer power supply and USB charger.
- · Power may not be supplied depending on the type of cable or batteries connected.
- When the unit is powered via USB, a USB symbol is displayed in the status bar.

# 3.7.5 Backup battery

This unit is equipped with a backup battery (rechargeable battery) for the clock.

The rechargeable battery is charged when the power supply of the main unit is ON. Even when the power is OFF, the battery will be charged if an external power supply port is supplied.

The relationship between charging time and the duration of time the battery typically lasts is as follows. It takes 24 hours to be fully charged.

Charging time	Approximate battery power duration	
1 hour	1 week	
12 hours	3 months	
24 hours	6 months	

- When connecting an external power supply to charge the backup battery while the device is powered off, use the AC adapter.
- The backup battery has a limited service life. Check the battery during inspection and calibration, and replace it if necessary (please contact your dealer).

# Note

- The charging time, battery power duration, and battery service life vary according to the usage environment.
- If you use an old rechargeable battery, the battery power duration will be shorter.

# 3.7.6 Power on/off

### When turning on the power

# Press the POWER key.

Release your finger from the POWER key when the startup screen appears.

After the startup screen appears, the measurement screen appears.

During startup, the indicator LED flashes red, blue, and red in cycles.



## When turning off the power

# Press and hold the POWER key for several seconds.

Release your finger from the POWER key when the power-off screen appears.

# **MARNING**

• If the unit is to be stored for a long time with the power turned off, remove the batteries. Leaving the batteries inside the unit may cause electrolyte to leak. Remove the AC adapter, and USB charger as well.

# Note

• Wait at least 10 seconds after turning off the power of the unit before turning it on again.

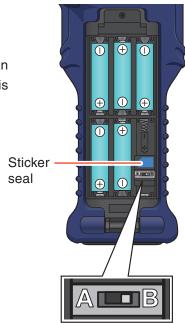
### When switching the power-on mode

Remove the cover of the battery compartment to find the "power-on mode switch". Normally, the "A" side is used, however, if this switch is set to the "B" side, you can control whether the power supplied to the unit with the external power supply port is turned on/off.

In this case, the POWER key on the front panel will not function.

## **Important**

- If you use the unit with the switch set to the B side, do not insert the batteries. If batteries
  are installed, even if the external power supply or USB power is turned off, the unit will
  continue to run on the batteries, so it will not respond to being turned on/off the control
  externally.
- When using the unit with the switch set to the B side, the settings may not be reflected if the power is turned off immediately after changing the settings of the unit.
   Wait 10 seconds after changing the settings before turning off the power.
  - If you need to resume quickly, you can use a command to save the settings (see page 143). VX-14S
- Be aware that removing the sticker seals will cause the unit to be no longer subject to the warranty.



Power-on mode switch

# 3.8 Installing the function extension program VX-14S

# **Important**

- · Check that the power of the unit is turned off before installing the program card.
- When installing, do so with sufficient battery power remaining, while charging via the USB cable, or with the AC adapter connected.
- Never remove the program card while installing the optional program. Doing so may result in a malfunction.
- Never format the program card with SD card formatting software (such as SD Formatter etc.). Otherwise, the program data on the card will be erased and can no longer be used. Restoration of the erased program is not guaranteed.
- Upgrade the firmware of the unit to the latest version before installing the optional program. For the latest firmware version, Check the "Download" section in the Support Room on the Rion website (https://www.rion-sv.com).

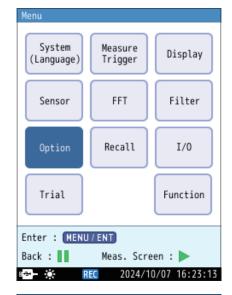
# Note

- If you install the optional program on one vibration analyzer, you will not be able to install it on other vibration analyzers. To install the optional program for the other vibration analyzers, you will need to uninstall the optional program from the vibration analyzer where it is installed.
- After installation is complete, the program card from which the program was installed can be used as an SD card for storing data.
- After inserting the program card into the card slot, install the program card software.

# **□** Note

- You will not be able to install the optional program if the write protection (read-only) of the program card is enabled.
   Unlock it and make it writable.
- On the [Menu] screen, select [Option] and press the MENU/ENT key.

The [Option] screen appears.



On the [Option] screen, select [Install/Uninstall] and press the MENU/ENT key.

The option software installation screen appears.





# Press the MENU/ENT key.

The selection screen appears.



5 Select [YES] and press the MENU/ENT key.

"The installation is complete. Restart." will be displayed. Press the MENU/ENT key to restart.



 You can check the installed programs in the [Option] section of the [Menu] screen.



# 3.9 Formatting the SD card

On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.

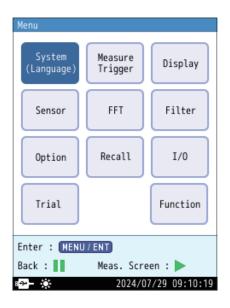
The [System (Language)] screen appears.

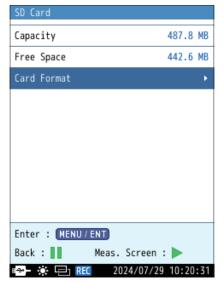
On the [System (Language)] screen, select [SD Card] and press the MENU/ENT key.

The [SD Card] screen appears.

On the [SD Card] screen, select [Card Format] and press the MENU/ENT key.

The confirmation screen appears.





4 Select [YES] and press the MENU/ENT key.

The SD card will be formatted.



#### 3.10 Display language setting

- On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.
- On the [System (Language)] screen, select [Language] and press the MENU/ENT key.
- Use the  $\triangle$ / $\overline{\lor}$  keys to select the language, and press the MENU/ENT key.



PV-57I Sensitivity

Sensor Type

Enter MENU/ENT

Meas. Screen : >

PV-57I

Others Microphone

Back :

Back :

Enter : MENU/ENT

510 ▶

#### 3.11 Making sensor settings

Use the supplied calibration chart of the accelerometer you intend to use, and make the sensitivity setting by performing the following steps.

- On the [Menu] screen, select [Sensor] and press the MENU/ENT key.
- 2 On the [Sensor] screen, select [Sensor Type] and press the MENU/ENT key.
- Select [PV-57I], [Others] or [Microphone] and press the MENU/ENT key.

Selecting [Others] allows you to choose the sensor drive power supply (CCLD). VX.14S

Selecting [Microphone] will lock it into FFT analysis mode. VX-14S

Use the supplied calibration chart of the accelerometer to set the [Sensitivity] and magnification of the sensor you intend to use, and then press the MENU/ENT key.

Use the  $\triangle/\nabla$  keys to move to the item to change, and use the  $\triangle/\nabla$  keys to change the numeric value.

Holding down the  $\triangle/\nabla$  keys changes the value more quickly. When the correct value has been set, press the ENT key to accept the setting.

To cancel the procedure without changing the current setting, press the PAUSE/CONT kev.

The cursor returns to the menu item name, and the setting value reverts to the previous condition.



• When selecting [PV-57I], a popup window appears, asking whether you want to change the sensitivity setting.

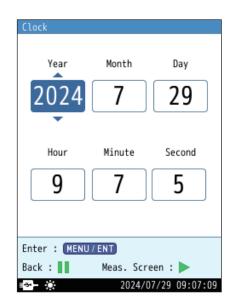
#### 3.12 Setting the date and time

This unit has a built-in clock.

The date and time of measurements can be saved to the SD card along with the measurement data. Follow the steps below to set the date and time.



- Make sure to set the time before measuring.
- 1 Turn on the power to the unit.
- On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.
- On the [System (Language)] screen, select [Clock] and press the MENU/ENT key.
- Set the year, month, day, hour, minute, and second, and press the MENU/ENT key.



#### Note

- This device has a calculation error of up to about 1 minute per month.
- The clock of this device is retained by the built-in backup rechargeable battery when the power is turned off.

  The retention period of the clock depends on the charging time of the backup rechargeable battery (page 33).

# 3.13 LCD brightness and off setting

Assign the backlight function to the function (Fn) key so that pressing the Fn key on any screen will turn the backlight on or off.



• While the battery capacity symbol is [ (red), the display backlight will not turn on.

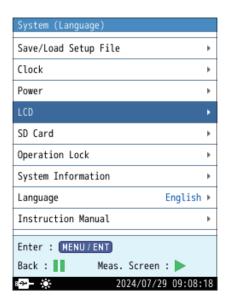
Set the brightness and lighting time of the backlight as follows.

On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.

The [System (Language)] screen appears.

On the [System (Language)] screen, select [LCD] and press the MENU/ENT key.

The [LCD] screen appears.



3 Set the brightness and auto off time of the backlight.

Using the backlight requires power and therefore results in shorter battery life.

You can select the delay until the backlight is turned off automatically.

Item	Description		
Brightness	Select the brightness of the backlight from [Light] or [Dark].		
Backlight	Cont.	The backlight stays on.	
Auto Off	3 m	After three minutes of inactivity, the backlight will turn off.	



- The [3m] setting is recommended to conserve battery power.
- When the backlight turns off automatically, pressing any key other than the POWER key or touching the display will turn the backlight back on.



(m = minutes)

#### 3.14 System information

The unit's model, serial number, index number, and VA-14 program version can be viewed.

- On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.
- On the [System (Language)] screen, select [System Information] and press the MENU/ENT key.

Displays the system information of the unit.

3 Change the index number as necessary.





#### 3.15 Instruction manual

Displays a QR code linking to the web page where you can view the instruction manual for this unit.

- On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.
- On the [System (Language)] screen, select [Instruction Manual] and press the MENU/ENT key.

The QR code corresponding to https://svmanual.rion.co.jp/va-14 will be displayed. You can scan it with your smartphone or other device.

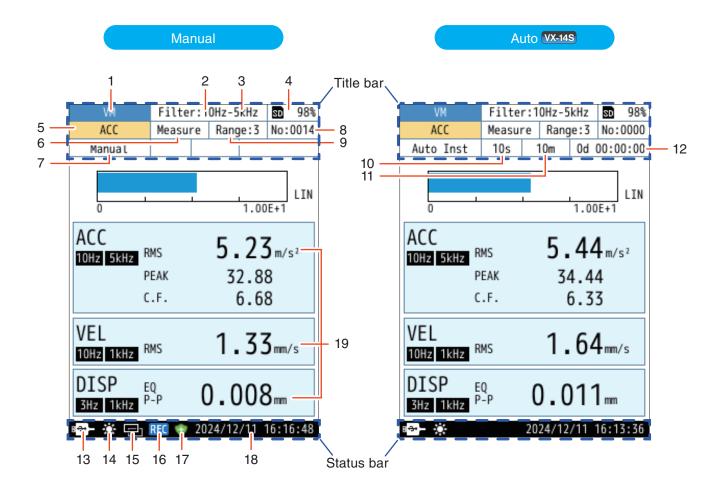


#### 3.16 Resume function

The unit memorizes the settings when the power is turned off and resumes with the same settings when it is turned on again.

For details on the items covered by the resume function, see "Factory default settings" (page 173). Measurement data is not included in the resume function.

# Reading the Common Display



No.	Name	Description
1	Analysis mode	Either "VM", "TIME" or "FFT" is displayed. The function can be switched with the VM/TIME/FFT key.
2	High-pass filter	The high-pass filter value set from [Filter] on the [Menu] screen is shown here.
3	Low-pass filter	The low-pass filter value set from [Filter] on the [Menu] screen is shown here.
4	SD card remaining capacity	Displays the free space of the SD card. Appears when an SD card is inserted into the unit.
5	Measurement data type	Displays "ACC" (Acceleration), "VEL" (Velocity), "DISP" (Displacement), or "ACCe" (Envelope) when in TIME or FFT mode. This can be switched with the ACC/VEL/DISP key. When [Microphone] is selected in [Sensor Type] on the [Sensor] screen, "-" will be displayed.
6	Current/Recall	The measurement screen displays "Measure" during current mode and "Recall" during recall mode.
7	Store mode	Shows "Manual", "Auto Inst", or "Auto Calc".
8	Store address / Store name	Shows the address that will be used when storing data on the SD card. This can be changed with the $\triangle/\overline{\forall}$ keys. If an address is selected which already contains data, the indication is highlighted in red, to alert the user that the data will be overwritten. In Auto Store mode, the store name is displayed.

No.	Name	Description
9	Input range	Shows the currently selected input range. This can be adjusted using the RANGE $\triangle/\nabla$ keys. Available settings depend on the sensor sensitivity and the measurement data type. For details, see the "Specifications" section on page 201.
10	Total measurement time	In Auto Store mode, the set total measurement time is displayed.
11	Calculated value store interval (Auto) VX-14S	In Auto Store mode, the set calculated value store interval is displayed.
12	Elapsed time since the start of measurement VX-14S	Displays the elapsed time since starting measurement (up to 200 hours).
13	Battery level / power status	Displays the power status (page 30). Check this indicator when using the unit on batteries. As the batteries are used, the remaining level decreases.
14	Backlight status	This is shown when the backlight is turned on.
15	Overlapping	This is shown when the overlapping function is turned on.
16	Waveform recording indicator VX-14S	This is shown when the waveform recording function is turned on. It can be set via [Wave Rec] in the [Measurement, Time, Trigger] screen. For details on the waveform recording function, see the "Waveform data recording" section on page 84.
17	Operation lock / Key lock symbol	When the operation lock is enabled, the operation lock symbol is displayed (page 174). When the key lock is enabled, the key lock symbol is displayed. When both locks are enabled, the key lock symbol appears.
18	Date / Current time	Displays the current date and time.
19	Unit	The units for each type of measurement data are displayed. In the SI unit system, acceleration is displayed in m/s², velocity in m/s, and displacement in mm or um. In the Imperial unit system, acceleration is displayed in G, velocity in inch/s, and displacement in mil. The setting can be switched using the [Unit System] item on the [Display] screen.

# 5 Indicator

# 5.1 Lighting patterns for status indication

Status	LED color	Operation	Operation symbol at the upper left of the screen
Startup	Red » Blue » Purple » Red	Flash	-
Calculating	Purple	Flash	•
Pause	Blue	Flash	H .
Overload	Red	Lit	-
Single trigger standby	Blue	Sequence of 2 flashes	•
Repeat trigger standby	Blue	Sequence of 2 flashes	•
Shutdown processing	-	Off	-

# 5.2 Lighting patterns for operation indication

Status	LED color	Operation
STORE key pressed	Red	Rapid flashes during data store 3 flashes when complete
Calculation complete	Purple	3 flashes
Data store on SD card	Red	Rapid flashes during data store 3 flashes when complete
Data load from SD card	Red	Rapid flashes during data store 3 flashes when complete



• Operation indication has priority over status indication.

# 6 Setting Menu

#### 6.1 Menu structure

The menus of the VA-14 are organized in a hierarchical structure. To return to the next higher level from a lower level, press the PAUSE/CONT key.

To directly return to the measurement screen, press the START/STOP key.

Menu structure					Options
Save/Load Setup I					_
	Clock			_	
	Power		Battery <sup>-</sup>	Гуре	Alkaline / Nickel Hydride
	1.00		Brightne	SS	Dark/Light
	LCD		Backligh	t Auto Off	Cont. / 3 m
			SD Card	Capacity	_
	SD Card		Free Spa	ace	_
System			Format		_
(Language)	Operation Los	sle.	Authorit	/	No Authorized / Authorized
	Operation Loc	K	Passwoi	d	_
			Type		_
			Serial N	umber	_
	System Information		Index		_
			Program	Version	_
	Language		3		English/日本語/中国語
	Instruction Ma	anual			VA-14 (QR code)
	Store Name				0000 to 9999
	Wave Rec				Off/On
	VM				
	Store Mode				Manual/Auto
		Manual	Store Address		1 to 1000
		Auto	Total Meas. Time		10 s / 1 m / 10 m / 24 h / User Setting
				User Setting	1 to 59 s, 1 to 59 m, 1 to 200 h
			Inst. Store Interval		Off / 100 ms / 1 s
Measure/		VX-14S	Calc. Store Interval		Off / 10 s / 1 m / User Setting
Trigger*				User Setting	10 to 59 s, 1 to 59 m, 1 h
	Wave Rec: Wa		Wave Samplin	g Freq.	51.2 kHz / 12.8 kHz
	On	On Recording Target			Acc./Vel./Disp.
TIME/FFT					
	Trigger Mode				Free/Repeat/Single
				Trigger Source	Level/External
			Repeat/Single	Trigger Level	-7/8 to +7/8
				Trigger Slope	+/-
				Pre-Trigger	Off/On

Menu structure				Options
	Display Charast	ics	Standard Setting / User Setting The standard settings are fixed for acceleration, velocity, displacement, and FFT units	
			ACC.	PEAK/RMS
			ACC. Unit	_
			Vel.	PEAK(VX-14S)/RMS/EQPEAK
		User Setting	Vel. Unit	
			Disp.	P-P VX-14S / RMS / EQPEAK / EQP-P
Dioploy			Disp. Unit	mm/um
Display			FFT	PEAK/RMS
	Unit System		1	SI Units / Imperial Units
	VM Scale*			Linear/Log
	FFT X Unit*			Hz/Kcpm/Odr
		Odr	Standard Frequency*	Specify from the set frequency range
	FFT Y Scale*			Linear/Log
	TOP10 List*			Off/TOP10/PEAK10
	Overlapping Dis	play*		Off/On
	0	n De	elete Overlapping Data*	None/Exist
	Sensor Type		PV-57I/Others/Microphone VX-14S	
			100 to 999	
	PV-57I Sensitivi	ty (included as	×0.1 mV/(m/s²) / ×0.01 mV/(m/s²) / ×0.001 mV/(m/s²)	
				100 to 999
Sensor*	Others Sensitivi	ty	×0.1 mV/(m/s²) / ×0.01 mV/(m/s²) / ×0.001 mV/(m/s²)	
	Mic. Sensitivity	VX-14S	-99.9 to +10.0 dB re 1V/Pa	
	Select [Others] f Type] VX-14S	or [Sensor	CCLD	Off/On
	dB Standard VX-	148		1.00 to 9.99 ×10^–8 to 4
	Calibration			-
	Window Func.			Rectangular/Hanning/Flat-top
	Operation Type		LIN/MAX/EXP/LIN+MAX	
	Average Numbe			1 to 2048
*	Max Average Nu			2048
FFT*	Total Meas. Time	. ,	-	
	Total Harmonic	Distortion		Off/On Specify from half of the set frequency
		On	Dist. Factor Freq.	range
	Dist. Factor Order			2 to 5
	Filter Setting			Common/Individual
Filter*			High Pass filter	3 Hz / 10 Hz / 1 kHz In the individual setting, 1 kHz is added to the acceleration of the high-pass filter.
			Low Pass filter	1 kHz / 5 kHz / 20 kHz

Menu structure				Options	
Option	Install/Uninstall			_	
VX-14S			Installed		VX-14S
	Manual		VM		_
			TIME		_
			FFT		_
	Auto (INST) VX-1	45			_
	Auto (CALC) VX-	145			_
Recall*	ScreenShot				_
riodan			Start	Manual	1 to 1000
			Address*	Auto VX-14S	1 to 7200000
	Cont. ScreenShot	End Address*	Manual	1 to 1000	
	Com. Corconcinct		Auto VX-14S	1 to 7200000	
			Execute Cont. ScreenShot		_
	USB				Off / Communication (CDC) / Mass Storage (MSC)
	LAN			On/Off	
			DHCP		Off/On
I/O			IP Address	3	0-255.0-255.0-255
		On	Subnet Ma	ask	0-255.0-255.0-255
		On	Gateway		0-255.0-255.0-255
			FTP		On/Off
	TCP			On/Off	
Trial	VX-14S			On	
Function*	Assignment				Recall / Back Light / ScreenShot Filter Setting / Save/Load Setup File

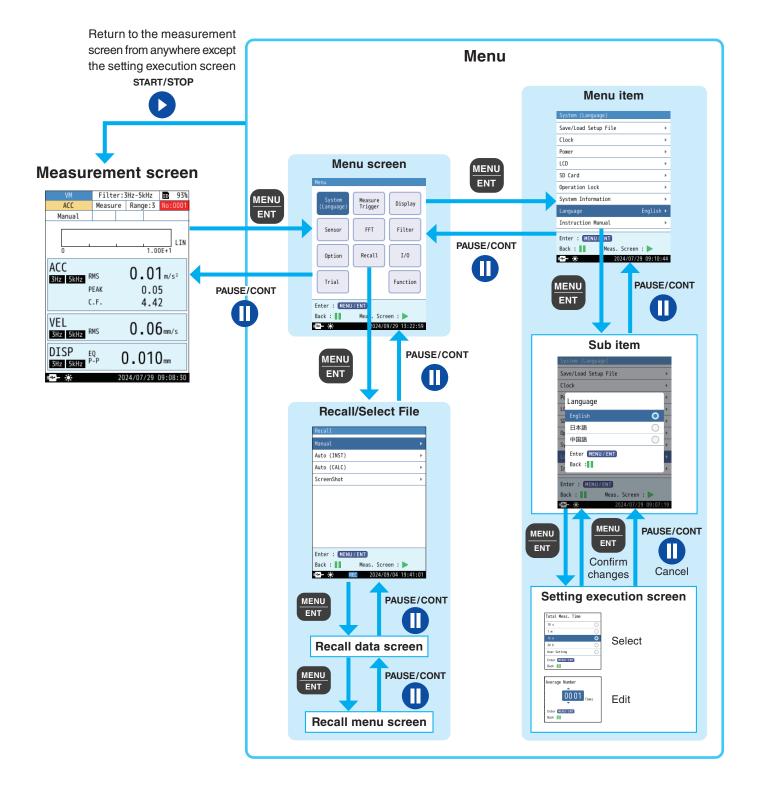
<sup>\*</sup>Can also be displayed in recall mode

# 6.2 Menu flow diagram

A diagram of the overall menu structure is shown below.

You first access the menu screen then proceed to the desired menu page.

To directly return to the measurement screen, press the START/STOP key.



# 7 Analysis Functions

# 7.1 Available analysis types

The unit has three analysis functions: "vibration meter (VM) mode," "time waveform (TW) mode," and "FFT analysis mode."

These can be chosen as required by the application.

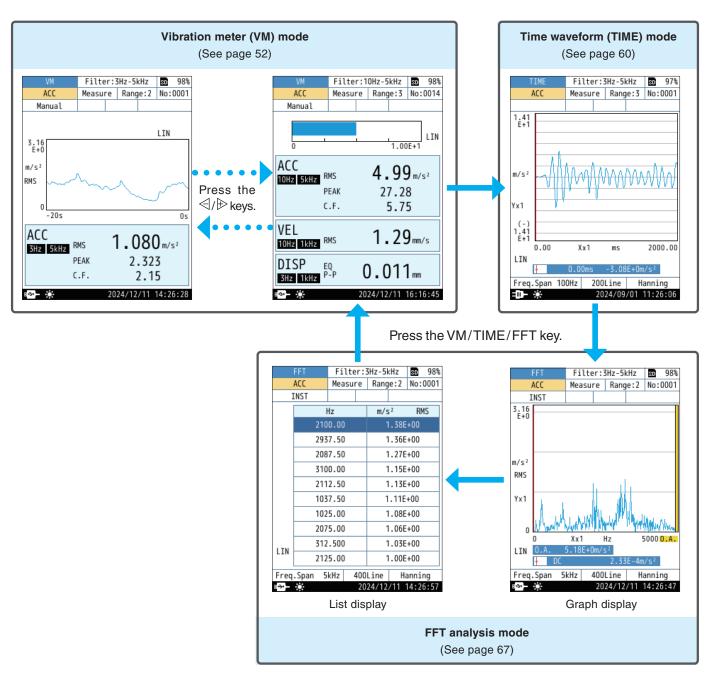
Vibration meter (VM) mode	(M) mode Select this mode to use the VA-14 as a vibration meter (page 52).	
Time waveform (TIME) mode	Select this mode to use the VA-14 for checking time waveforms (page 60).	
FFT analysis mode	Select this mode to perform FFT analysis (page 67). You can choose between graph display and list display.	

#### Note

• In the default condition, the vibration meter (VM) mode, time waveform mode and FFT analysis mode (graph display) can be called up on the display. To display the FFT analysis mode (list view), set it in [Top10 List] on the [Display] screen (see page 51).

#### 7.2 Switching between analysis functions

Each pressing of the VM/TIME/FFT key cycles the unit through the following settings: vibration meter (VM) mode » time waveform (TIME) mode » FFT analysis mode (graph display) » FFT analysis mode (list display) » vibration meter (VM) mode » ... (solid arrows in the illustration below)



The FFT analysis mode (list display) is not shown in the default condition.

#### • To display the FFT analysis mode (list display)

Select [TOP10] or [PEAK10] in the [Top10 List] on the [Display] screen.

#### Note

• The action of the VM/TIME/FFT key may differ, depending on the operation status of the unit. In vibration meter (VM) mode and time waveform (TIME) mode, the VM/TIME/FFT key is disabled while the measurement is paused and during trigger operation.

For information on key action in FFT analysis mode, see page 70.

8

# Measurement in Vibration Meter (VM) Mode

Before starting a measurement, be sure to set the clock of the unit to the correct date/time (see page 39). This section contains the instructions for measurement in vibration meter (VM) mode. The following items are explained.

Reading the display	Page 53
Changing measurement parameters and display parameters	Page 55
Measuring	Page 58
Storing measurement data	Page 59

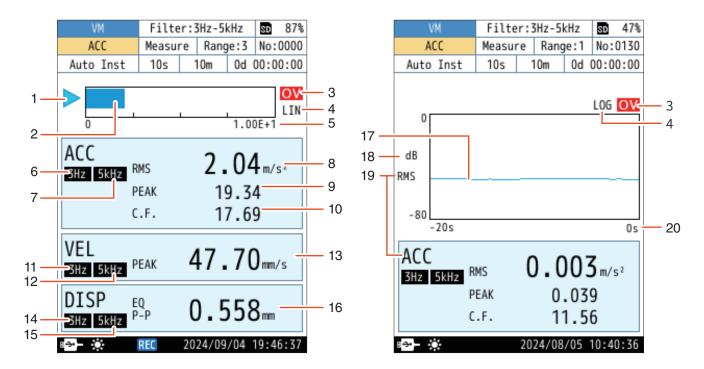
For information on other items related to vibration meter (VM) mode measurement, refer to the following sections.

Saving the Screen as a BMP File	Page 96
Data Folder Structure	Page 85

# 8.1 Vibration meter (VM) mode screen

#### Note

• While the actual display will not look like the one shown in the figures below, the explanation is based on the assumption that all the text are displayed.



Level graph display

Time-level display

No.	Name	Description	
1	Operation status indicator	Measurement pause (PAUSE/CONT key pressed)  Storing in progress (only when VX-14S is installed VX-14S)	
2	Level bar	The level bar displays the value of the selected measurement data type (acceleration, velocity, displacement) based on the specified indicator characteristics.  The measurement data type can be switched using the ACC/VEL/DISP key.  The indicator characteristics can be switched for [Acc.], [Vel.], and [Disp.] on the display screen when [User Setting] is selected for [Display Characteristics] on the display screen.  Note  In the pause condition (see page 58), the measurement parameters cannot be changed.	
3	Overload display	When an overload occurs, the following display appears.	
4	Vibration meter scale	The indication shows "LOG" if the selected level bar scale is logarithmic, or "LIN" if the scale is linear.  The setting can be switched using the VM mode scale item on the [Display] screen.	
5	Upper and lower limit values of level bar	The right-side indication shows the upper limit value and the left-side indication shows the lower limit value.  The values depend on the measurement data type, input range, and vibration meter mode scale.	

No.	Name	Description		
6	Acceleration high-pass filter	The high-pass filter value for acceleration is shown here. The following settings are available. 3 Hz / 10 Hz / 1 kHz * When the filter setting is "Individual" on Filter screen, 1 Hz can be selected for the high-pass filter for acceleration.		
7	Acceleration low-pass filter	The low-pass filter value for acceleration is shown here. The following settings are available. 1 kHz / 5 kHz / 20 kHz		
8	Acceleration RMS value indication	The acceleration RMS value is displayed.		
9	Acceleration peak value indication	The acceleration peak value (single amplitude maximum value) is shown here as a numeric indication.		
10	Acceleration crest factor indication	The acceleration crest factor (peak value / RMS value) is shown here as a numeric indication.		
11	Velocity high-pass filter	The high-pass filter value for velocity is shown here. The following settings are available. 3 Hz / 10 Hz / 1 kHz		
12	Velocity low-pass filter	The low-pass filter value for velocity is shown here. The following settings are available. 1 kHz / 5 kHz / 20 kHz		
13	Velocity indication	Among the velocity RMS, velocity equivalent PEAK, and velocity PEAK values, the value set on the display screen will be shown.  The velocity PEAK value is selectable only when the VX-14S is installed. VX-14S  This can be switched with [Vel.] on the display screen when [User Setting] is selected for [Display Characteristics] on the display screen.		
14	Displacement high-pass filter	The high-pass filter value for displacement is shown here. The following settings are available. 3 Hz / 10 Hz / 1 kHz		
15	Displacement low-pass filter	The low-pass filter value for displacement is shown here. The following settings are available. 1 kHz / 5 kHz / 20 kHz		
16	Displacement indication	Among the displacement equivalent P-P, displacement equivalent peak, displacement RMS, or displacement P-P values, the value set on the display screen will be shown. The displacement P-P value is selectable only when the VX-14S is installed. VX-14S This can be switched with [Disp.] on the display screen when [User Setting] is selected for [Display Characteristics] on the display screen.		
17	Time-Level graph	A time-level graph is displayed for the selected measurement data type, showing data from 20 seconds ago to the present.		
18	Y axis units of time-level graph	If the level bar scale is set to logarithmic, "dB" is displayed. If the scale is linear, the unit corresponding to the measurement value is displayed.  The setting can be switched using the VM mode scale item on the [Display] screen.		
19	Measurement values on the time-level graph	The values of the selected measurement data type (acceleration, velocity, displacement) are displayed based on the specified indicator characteristics.  This can be switched with the ACC/VEL/DISP key.		
20	Upper and lower limit values of the X-axis for the time-level graph	The right-side indication shows the upper limit value and the left-side indication shows the lower limit value. Represents data from 20 seconds ago to the present.		

# 8.2 Changing measurement parameters and display parameters

The measurement parameters and display parameters in vibration meter (VM) mode are as follows.

		Menu	Key operation	See page
	Sensor information	Sensor	_	Page 38, 55
	High-pass filter	Filter	-	Page 54, 54
	Low-pass filter	Filter	-	Page 54, 54
Measurement parameters	Input range	_	RANGE≜/▽	Page 55
	Store name	Measure/Trigger	-	Page 55
	Measurement data type (data shown as level bar)	-	ACC/VEL/DISP	Page 42
	VM mode scale	Display	-	Page 56
Display parameter	Display Charastics	Display	_	Page 54
	Unit	Display	-	Page 57

For information on menu structure and menu operation, see the "Setting Menu" section "Setting Menu" (page 45).



• While measurement is paused ( symbol shown on the left side of the screen), measurement parameters cannot be changed.

#### 8.2.1 Making sensor settings

Use the supplied calibration chart of the accelerometer you intend to use, and make the sensitivity setting (see "Making sensor settings" (page 38)).

#### 8.2.2 Changing the input range

Set the input range to an optimum setting.

If overload occurs (measurement value display background is red, and  $\boxed{\text{ov}}$  indication appears on the right side of the display), the input range setting is too low. Use the RANGE $\triangle$  key to increase the setting.

#### 8.2.3 Specifying the store name

To store measurement data, it is necessary to first specify a store name.

On the [Measure/Trigger] screen, set a 4-digit number in [Store Name].

The measurement data will be stored in the folder specified by the [Store Name] item (see "Data File Structure" (page 85)).

#### 8.2.4 Selecting the vibration meter scale

- Select [Display] on the [Menu] screen and press the MENU/ENT key.
- Select [VM Scale] on the [Display] screen and press the MENU/ENT key.
- Select one of the following and press the MENU/ ENT key.

Linear	Linear scale
Log	Logarithmic scale

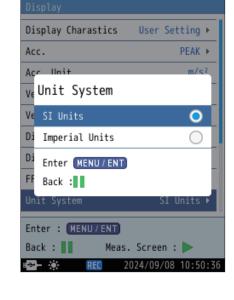




#### 8.2.5 Selecting the Unit System

- Select [Display] on the [Menu] screen and press the MENU/ENT key.
- Select [Unit System] on the [Display] screen and press the MENU/ENT key.
- Select one of the following and press the MENU/ ENT key.

SI Unit		SI Unit is displayed			
Imp	perial Units	Imperial Units are displayed			

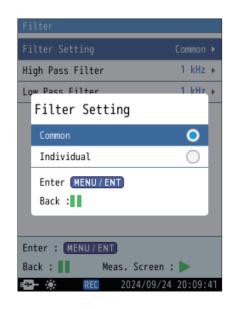


The unit on the measurement screen is changed.

#### 8.2.6 Selecting the high-pass filter and low-pass filter

- Select [Filter] on the [Menu] screen and press the MENU/ENT key.
- Select [Filter Setting] on the [Filter] screen and press the MENU/ENT key.
- Select one of the following and press the MENU/ ENT key.

Common	For the high-pass filter and low-pass filter settings, acceleration, velocity, and displacement are configured together as a group.
Individual	For the high-pass filter and low-pass filter settings, acceleration, velocity, and displacement are configured individually.  When selected, the filter screen will display the options for acceleration, velocity, and displacement.



4 Select the frequency of the desired setting and press the MENU/ENT key.

The filter frequency range on the measurement screen is changed.

#### 8.3 Measurement

When the vibration meter (VM) mode screen is displayed, the following values are updated every second.

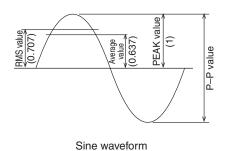
For velocity and displacement, only the indicator characteristics specified on the display screen will be shown as a numerical value (page 58).

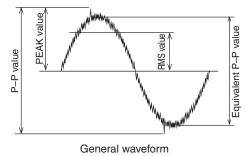
The items displayed as numerical values are as follows.

The peak value for velocity and displacement can be selected when the VX-14S is installed (page 192).

Item	Name		
ACC RMS	Acceleration RMS value		
ACC PEAK	Acceleration peak value		
ACC C.F.	Acceleration peak crest factor		
VEL RMS	Velocity RMS value		
VEL PEAK VX-14S	Velocity PEAK value		
VEL EQ PEAK	Velocity EQ PEAK value		
DISP RMS	Displacement RMS value		
DISP P-P VX-14S	Displacement P-P value		
DISP EQ PEAK	Displacement equivalent PEAK value		
DISP EQ P-P	Displacement equivalent P-P value		

The relationship between indicator characteristic values is shown in the diagram below.





For a sine waveform, PEAK value equals the RMS value multiplied by √2, but this does not hold true for general waveforms.

#### 8.3.1 Pausing the measurement

To pause the measurement, press the PAUSE/CONT key.

During a pause, the symbol is shown on the left side of the display.

To resume the measurement, press the PAUSE/CONT key once more.



• In the pause condition ( symbol shown on the left side of the display), the measurement parameters cannot be changed.

#### 8.4 Storing measurement data

You can store measurement data on an SD card inserted in the unit.

Verify that the SD card symbol is shown on the title bar.

If no symbol is shown, insert an SD card (page 26).

Check the store address shown at the right end of the title bar.

If the address is shown on a white background:

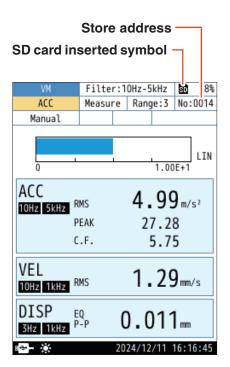
Proceed to step 3.

If the address is shown on a red background:

This indicates that the store address already contains measurement data.

To overwrite the data, proceed to step 3.

If you do not overwrite the data, use the  $\triangle/\nabla$  keys to select a different store address that is shown on a white background.



#### 3 Press the STORE key.

The popup indication "STORE XXXX" (where XXXX is the store address) appears, storing is carried out, and the LED indicator flashes in red.

When storing is complete, the store address is incremented by one. If the store address was 1000, the indication returns to 0001.

For information on how to view stored data, refer to "Recalling Stored Data" (page 98).

For information on the folder structure of stored data, refer to "Data File Structure" (page 85).

9

# Measurement in Time Waveform (TIME) Mode

Before starting a measurement, be sure to set the clock of the unit to the correct date/time (see page 39). This section describes measurements in time waveform (TIME) mode.

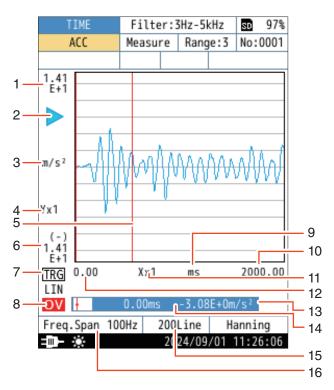
The following items are explained.

Reading the display	Page 61
Changing measurement parameters and display parameters	Page 62
Zooming/moving the display	Page 64
Performing measurement	Page 66
Storing measurement data	Page 66

For information on other items related to time waveform (TIME) mode measurement, refer to the following sections.

Saving the Screen as a BMP File	Page 96
Data Folder Structure	Page 85

# 9.1 Time waveform (TIME) mode screen



No.	Name	Description			
1	Y axis upper limit	Shows the upper limit value of the Y axis for the current display range.			
2	Operation status indicator	During trigger standby, the symbol flashes.  While measurement or trigger operation is paused (PAUSE/CONT key pressed), the symbol is shown.			
3	Y axis unit	The unit indication changes according to the measurement data type.  Acceleration m/s², G  Velocity mm/s, inch/s  Displacement mm, µm, mil  Envelope None			
4	Y-axis zoom factor	The Y-axis zoom factor for the currently displayed graph is shown here. The following settings are available. $\times 1, \times 2, \times 4, \dots, \times 16384 (\times 2^n = 0 \text{ to } 14))$			
5	Cursor	The cursor can be moved right and left with the    Example 10   Property 10			
6	Y axis lower limit	Shows the lower limit value of the Y axis for the current display range.			
7	Trigger display	Displayed while the repeat trigger or single trigger is enabled.			
8	Overload display	When an overload occurs, OV is displayed.			
9	X axis unit	Shows "ms".			
10	X axis upper limit	Shows the upper limit value of the X axis for the current display range.			
11	X axis zoom factor	Shows the X axis zoom factor for the currently displayed graph.  The following settings are available.  Number of analysis lines is 3200			

No.	Name Description			
12	X axis lower limit Shows the lower limit value of the X axis for the current display range.			
13	Display magnify/move icon	This icon is displayed when the display is in zoom-in or move mode. (page 64)		
14	Cursor value readout  This shows the value at the marker symbol on the cursor. The left value is for the X axis and the right value for the Y axis.			
15	Number of analysis lines	Indicates the currently selected maximum frequency that can be measured. Press the FREQ SPAN / LINE key to change the value using the $\triangle$ $\nabla$ keys. The following settings are available. 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz		
16	Frequency span	Press the FREQ SPAN / LINE key to change the value using the $\triangle$ $\overline{\nabla}$ keys. The following settings are available. 200Line, 400Line, 800Line, 1600Line, 3200Line		

# 9.2 Changing measurement parameters

The measurement parameters in time waveform (TIME) mode are as follows.

		Menu	Key operation	See page
	Sensor information	Sensor	_	Page 55
	High-pass filter	Filter	_	Page 54
	Low-pass filter	Filter	_	Page 54
	Measurement data type	-	ACC/VEL/DISP	Page 42
Measurement parameters	Input range	-	RANGE $\triangle/\nabla$	Page 55
	Frequency span	-	FREQ SPAN / LINE	Page 62
	Number of analysis line	-	FREQ SPAN / LINE	Page 62
	Trigger operation settings	Measure/Trigger	_	Page 160
	Store name	Measure/Trigger	_	Page 55

For information on menu structure and menu operation, see the "Setting Menu" section (page 45).



• While measurement is paused ( symbol shown on the left side of the screen), measurement parameters cannot be changed.

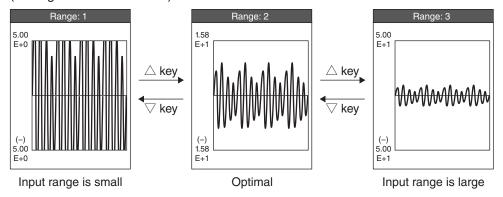
#### 9.2.1 Making sensor settings

Use the supplied calibration chart of the accelerometer you intend to use, and make the sensitivity setting (see "Making sensor settings" (page 38)).

#### 9.2.2 Changing the input range

Set the input range to an optimum setting (see middle illustration below).

If overload occurs (measurement value display background is red, and ov indication appears on the right side of the display), the input range setting is too low. Use the RANGE $\triangle$  key to increase the setting (see left illustration below). If the graph amplitude is too small, the input range setting is too high. Use the RANGE $\nabla$  key to decrease the setting (see right illustration below).



#### 9.2.3 Specifying the store name

To store measurement data, it is necessary to first specify a store name (see "Specifying the store name" (page 55)).

# 9.3 Zooming/moving the display

To expand or shrink the display, proceed as follows.

Functions of  $\triangleleft/\triangleright/\triangle/\nabla$  keys differ, according to display mode.

Display mode	Symbol	Cursor		Key	operation	tion	
Display Illoue	Symbol	Cursor	$\triangleleft$	₽	A	lacksquare	
Overall data display	None	(Solid line)	Move cursor left*	Move cursor right*	Increment store address (+)	Decrement store address (–)	
Display scaling mode	Q	 (Broken line)	Shrink X axis	Expand X axis	Expand Y axis	Shrink Y axis	
Display move mode	<b>◆</b>	 (Solid line)	Move cursor left*	Move cursor right*	-	_	

<sup>\*</sup> When the cursor is near the display edge, the cursor does not move but the display is scrolled. If you continue to move the cursor to the edge, it will eventually shift to the opposite edge of the screen. When the X axis display range is not 100%, the screen also scrolls to the other edge.

#### 9.3.1 Zooming the display

Press the EXPAND/MOVE key to enter the display scaling mode.

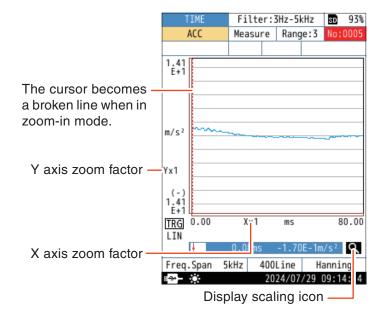
The display scaling icon will appear in the lower right corner of the screen.

To zoom along the X axis, use the ⊲/⊮ keys.

The zoom is centered around the cursor. The zoom factor of the X axis is shown at the bottom of the graph.

To zoom along the Y axis, use the  $\triangle$ / $\nabla$  keys.

The zoom factor of the Y axis is shown on the left of the graph.



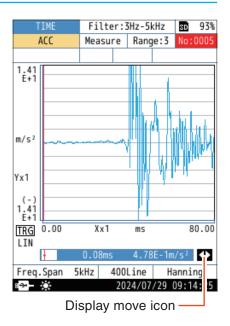
#### 9.3.2 Moving the display

Press the EXPAND/MOVE key to enter the display move mode.

The display move icon will appear in the lower right corner of the screen.

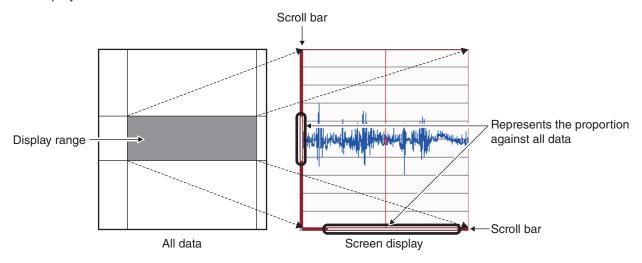
Press the ⊲/⊮ key to move the cursor.

The cursor position can also be set by touching the screen.



#### 9.3.3 Relation between overall data and display range

In display scaling mode, scroll bars are shown to indicate which section of the overall data is currently shown on the display.



#### 9.4 Measurement

The screen in time waveform (TIME) mode shows the fluctuation in the measurement data (acceleration, velocity, displacement, or acceleration envelope curve) in a graphical format. The screen display is updated continuously. The measurement duration that can be displayed on screen is determined as follows: number of analysis lines / frequency span (see "Frequency resolution ( $\triangle$ f) and frame time (TFrame)" (page 79)). In time waveform (TIME) mode, the measurement duration is the same as the "frame time" in FFT analysis mode.

#### Note

- In FFT analysis mode, it is possible to continuously record time waveform (TIME) data for longer than the measurement duration available in time waveform mode. For details, see "Recording waveform data" (page 83).
- · Measurement parameters cannot be changed during calculation and during trigger standby.

For information on measurement using the trigger functions, see "Trigger Function" (page 148).

#### 9.5 Storing measurement data

You can store measurement data on an SD card inserted in the unit.

1 Verify that the SD card symbol is shown on the title bar.

If no symbol is shown, insert an SD card (page 26).

2 Check the store address shown at the right end of the title bar.

If the address is shown on a white background:

Proceed to step 3.

If the address is shown on a red background:

This indicates that the store address already contains measurement data.

To overwrite the data, proceed to step 3.

If you do not overwrite the data, use the  $\triangle/\nabla$  keys to select a different store address that is shown on a white background.

Note

• If the display scaling icon is displayed in the lower right corner of the graph, press the EXPAND/MOVE key. Ensure the icon changes to or disappears, then press the  $\triangle/\nabla$  keys.

#### 3 Press the STORE key.

The popup indication "STORE XXXX" (where XXXX is the store address) appears, storing is carried out, and the LED indicator flashes in red.

When storing is complete, the store address is incremented by one. If the store address was 1000, the indication returns to 0001.

For information on how to view stored data, refer to "Recalling Stored Data" (page 98).

For information on the folder structure of stored data, refer to "Data File Structure" (page 85).

# 10 Measurement in FFT Analysis Mode

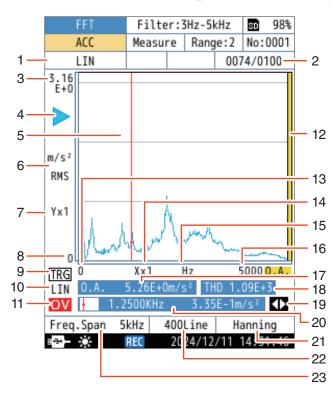
Before starting a measurement, be sure to set the clock of the unit to the correct date/time (see page 39). This section contains basic instructions for measurement in FFT analysis mode. The following items are explained.

Reading the display	Page 68, 70
Changing measurement parameters and display parameters	Page 71
Zooming/moving the display	Page 77
Measuring	Page 80
Storing measurement data	Page 82

For information on other items related to FFT analysis mode measurement, refer to the following sections.

Trigger Functions	Page 148
Overlapping Display	Page 160
Saving the Screen as a BMP File	Page 96
Data Folder Structure	Page 85

# 10.1 FFT analysis mode screen (graph display)

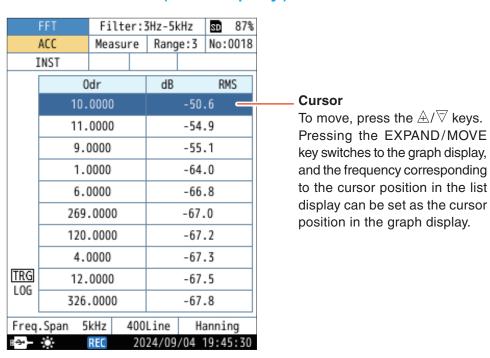


No.	Name	Description		
		The calculation type is displayed while in the FFT screen.		
		INST Instantaneous value		
4	Calculation type	LIN Linear average		
1		MAX Maximum hold		
		EXP Exponential average		
		Pressing the INST/AVE key toggles between INST and the set calculation type.		
2	Current average count / Average count indication	The "Average count" displays the value set in [Average count] on the FFT screen.  The "Current average count" shows how many averaging runs have been performed at the current point.  When the calculation type is instantaneous value, the "Current average count / Average count" is not displayed.  In the case of exponential averaging, the averaging count will reset to 1 once it exceeds 2048 counts.		
3	Y axis upper limit	Shows the upper limit value of the Y axis for the current display range.		
4	Operation status indicator	During calculation, the ▶ symbol appears.  During trigger standby, the ■ symbol flashes.  While measurement or trigger operation is paused (PAUSE/CONT key pressed), the ■ symbol is shown.		
5	Cursor	The cursor can be moved right and left with the    Example 10   Example 20   Example 20		

No.	Name	Description			
	If the FFT mode Y-axis scale is [Log], the indication [dB] is shown here.				
		Acceleration Referenced to 1 m/s <sup>2</sup>			
		Velocity Referenced to 1 mm/s			
		Displacement Referenced to 1 mm			
		Envelope Referenced to 1			
	Y axis unit	If the FFT mode Y-axis scale is [Linear], the unit indication changes according to the measurement data type.			
6	T axis utill	Acceleration m/s², G			
		Velocity mm/s, inch/s			
		Displacement mm, µm, mil			
		Envelope None			
		The setting can be switched using the [FFT Scale] item on the [Display] screen.  Additionally, when [User Setting] is selected for the indicator characteristics on the display screen, you can choose either [PEAK] or [RMS] in the FFT settings on the display screen.			
		The Y axis zoom factor for the currently displayed graph is shown here.			
7	Y-axis zoom factor	Values can be changed using the $ riangle 4/\overline{ riangle}$ keys.			
		The zoom factor varies according to the selected measurement data type (acceleration, velocity, displacement, envelope).			
8	Y axis lower limit	Shows the lower limit value of the Y axis for the current display range.			
9	Trigger display	Displayed while the repeat trigger or single trigger is enabled.			
		The indication shows "LOG" if the selected level bar scale is logarithmic, or "LIN" if the scale is			
10	FFT scale	linear.			
		The setting can be switched using the [FFT scale] item on the [Display] screen.			
		If momentary overload has occurred, the OV indication is shown. The indication goes out			
44		1 second after the overload condition has been cleared.			
11	Overload display	If a momentary overload occurs during a calculation, the calculation overload ov will continue to be displayed until the average calculation is complete. However, the momentary overload ov			
		display takes priority.			
12	Level bar for overall	The overall value (spectrum power sum without DC components) is shown as a yellow bar.			
10	value				
13	X axis lower limit	Shows the lower limit value of the X axis for the current display range.			
		Shows the X axis zoom factor for the currently displayed graph.  The following settings are available.			
14	X axis zoom factor	Number of analysis lines is 3200 $\times$ 1, $\times$ 2, $\times$ 4, $\times$ 8, $\times$ 16 Number of analysis lines is 1600 $\times$ 1, $\times$ 2, $\times$ 4, $\times$ 8			
14	A axis 200111 lactor	Number of analysis lines is 800 ×1, ×2, ×4, ×6  Number of analysis lines is 800 ×1, ×2, ×4			
		Number of analysis lines is 400 ×1, ×2			
		Number of analysis lines is 200 ×1			
15	X axis unit	The indication [Hz] is shown here.			
16	X axis upper limit	Shows the upper limit value of the X axis for the current display range.			
17	Overall value	The spectrum power sum without DC components is shown.			
		Displays the results of the distortion calculation (%).			
	Total harmonic distortion	Switching this function can be done in [Total harmonic distortion (THD)] on the [FFT] screen			
18		Note —			
		When the frequency span or the number of analysis lines is changed, the distortion fundamental			
		frequency or the distortion order may also change.			

No.	Name	Description		
19	Display magnify / move icon	This icon is displayed when the display is in zoom-in or move mode (page 64).		
20	Cursor value readout	This shows the value at the cursor.  The left value is for the X axis and the right value for the Y axis.  The unit set in [FFT X Unit] on the [Display] screen is displayed.		
20		Hz Hertz		
		Kcpm Kilo Cycle per Minute		
		Odr order (Reference frequency set. For setting procedure, see page 75.)		
21	Window function	Shows the time window setting made with [Window Func.] in the FFT screen.  Rectangular Rectangular  Hanning Hanning  Flat-top Flat-top window		
22	Number of analysis line	Indicates the currently selected number of analysis lines.  Press the FREQ SPAN / LINE key to change the value using the ≜/ keys.  The following settings are available.  200Line, 400Line, 800Line, 1600Line, 3200Line		
23	Frequency span	Indicates the currently selected maximum frequency that can be measured. Press the FREQ SPAN / LINE key to change the value using the ≜/ ♥ keys. The following settings are available.  100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz		

#### 10.2 FFT analysis mode screen (list display)



The ten highest level values out of the data range by the graph display are listed, in descending order.

Pressing the VM/TIME/FFT key in graph display mode switches to list display.

Use the VM/TIME/FFT key to switch to graph display.

However, in the following cases, the unit will switch to vibration meter (VM) mode:

- When INST is shown as calculation type and the unit is not in pause mode
- During calculation standby (see page 73)

# 10.3 Changing measurement parameters and display parameters

The measurement parameters and display parameters in FFT analysis mode are as follows.

		Menu	Key operation	See page
	Sensor information	Sensor	_	Page 38, 71
	High-pass filter	Filter	_	Page 42
	Low-pass filter	Filter	_	Page 42
	Measurement data type	_	ACC/VEL/DISP	Page 42
	Input range	_	RANGE $\triangle/\nabla$	Page 43
	Frequency span	Measure/Trigger	FREQ SPAN / LINE	Page 70
Measurement parameters	Number of analysis line	Measure/Trigger	FREQ SPAN / LINE	Page 70
parametere	Trigger operation settings	Measure/Trigger	_	Page 160
	Time window function	FFT	_	Page 70
	Calculation type	FFT	_	Page 68
	Average count	FFT	_	Page 68
	Store name	Measure/Trigger	_	Page 75
	Waveform recording	Measure/Trigger	ACC/VEL/DISP	Page 83
	FFT	Display	_	Page 69
	VM mode scale	Display	_	Page 76
Display	FFT analysis mode cursor X axis unit	Display	VM/TIME/FFT	Page 75
parameter	FFT analysis mode Y axis scale	Display	VM/TIME/FFT	Page 69
	Top 10 list	Display	VM/TIME/FFT	Page 75
	Overlapping Display	Display	_	Page 160

#### 10.3.1 Making sensor settings

Use the supplied calibration chart of the accelerometer you intend to use, and make the sensitivity setting (see "Making sensor settings" (page 38)).



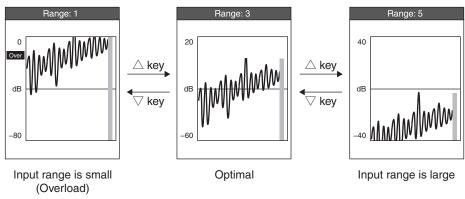
• Selecting Microphone will lock it into FFT analysis mode. Refer to "Microphone and preamplifier connection function" (page 191). VX-145

#### 10.3.2 Changing the input range

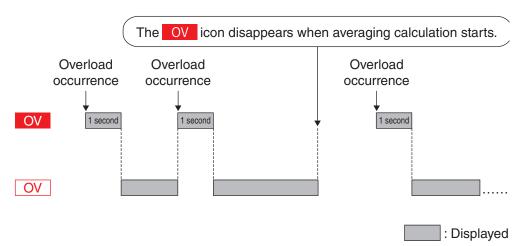
Set the input range to an optimum setting (see middle illustration below).

If an overload occurs (ov indicated on the lower left of the screen), the input range setting is too low. Press the RANGE $\triangle$  key to increase the input range (see the left figure below).

If the graph amplitude is too small, the input range setting is too high. Use the RANGE $\nabla$  key to decrease the setting (see right illustration below).



The overload indication timing is as follows.

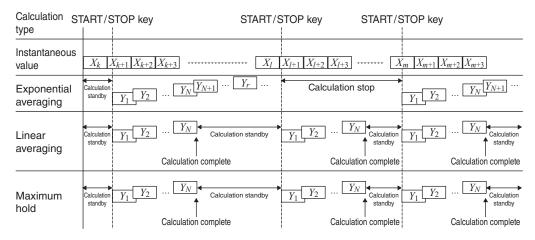


# 10.3.3 Setting the calculation type

### Calculation type overview

The operation principles for measurement in FFT analysis mode are explained in this section. For information on measurement using the trigger functions, see "Trigger Function" (page 148).

The chart below shows an outline of the various calculation types.



Exponential averaging

Weighting when performing exponential averaging

 $Y_k = \alpha Y_{k-1} + (1 - \alpha) X_k$ 

 $\alpha = exp^{-\frac{1}{N}}$ 

ing  $Y_k$ :

*Y<sub>k</sub>*: *k*-th average value*X<sub>k</sub>*: *k*-th instantaneous value

N: Set average count

Linear averaging

 $Y_k = \frac{\sum_{i=1}^k X_i}{k}$ 

 $k = 1, 2, \ldots, N$ 

Maximum hold

 $Y_k = \text{maximum value from } X_1 \text{ to } X_k$ 

The meaning of the [Average count] (N in the above diagram) set in the [FFT] screen differs, depending on whether exponential averaging or linear averaging (or maximum hold) is selected.

#### Setting the calculation type

The calculation type is set in [Operation Type] on the [FFT] screen.

LIN	Linear average	A general averaging method for steady-state vibration. This method is used to determine the average of the measurement results. The analysis stops when the average count is reached.
MAX	Maximum hold	Used to determine the maximum value of each frequency component during the measurement time. The analysis stops when the average count is reached.
EXP	Exponential average	Displays the results of the FFT analysis continuously with a time constant applied. If the results change drastically, they will appear smoother. Like with instantaneous values, it is used to observe the time variability of a phenomenon and understand its characteristics. In cases where occasional sudden vibrations occur, they may be missed in the instantaneous value display. However, when the time constant is applied, these vibrations will be reflected in the averaged result, ensuring they are not overlooked.
LIN+MAX	Linear average + maximum hold	Both LIN and MAX are measured simultaneously. Files are created in the order of LIN and MAX, and the addresses increment automatically.

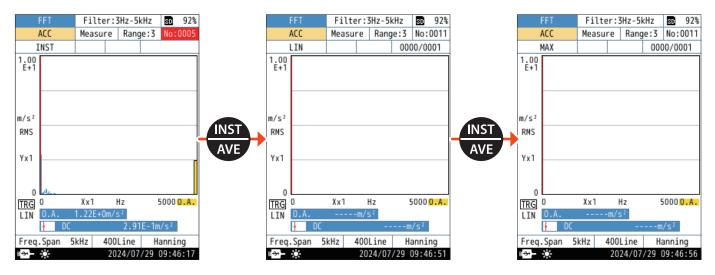


Instantaneous values cannot be selected from the [FFT] menu.
 To display instantaneous values, press the INST/AVE key on the FFT analysis mode screen.

Press the INST/AVE key to use the average function.

The calculation type is displayed in the upper left corner of the screen. Linear average is displayed as LIN, exponential average as EXP, and the maximum hold as MAX. The average count is also displayed along with the calculation type. Pressing the INST/AVE key again returns to the instantaneous value (without averaging).

In the instantaneous value (without averaging) state, INST is displayed in the upper left corner of the screen.



Pressing the START/STOP key while the calculation type is displayed starts averaging, and the counter of the average count goes up. In the state of instantaneous value, averaging does not start even if the START/STOP key is pressed. Pressing the START/STOP key again during averaging execution terminates averaging at that point.

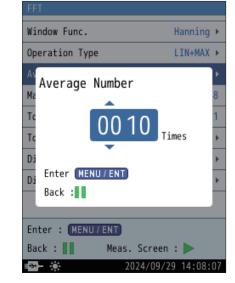
# 10.3.4 Setting the average count

Set the average count in [Average count] on the [FFT] screen.

For information on the relation between the calculation type and the average count, see "Setting the calculation type" (page 73).

Select [FFT] on the [Menu] screen and press the MENU/ENT key..

- Select [Average Number] on the [FFT] screen and press the MENU/ENT key.
- Set the average number and press the MENU/ENT key.



[Total Meas. Time (s)] on the [FFT] screen will be updated.

\*Total measurement time (in seconds) is an estimate. It may differ from the actual measurement time.

# 10.3.5 Fixing the FFT analysis screen

When the calculation type is linear average or maximum hold, the screen is fixed when the average count is reached and the analysis ends.

For instantaneous value and exponential average, the analysis continues continuously. If it is necessary to read a frequency or amplitude while the screen is fixed, press the PAUSE/CONT key. The measurement will be paused and the analysis results will be fixed. Press the PAUSE/CONT key again to resume analysis.

# 10.3.6 Specifying the store name

To store measurement data, it is necessary to first specify a store name (see "Specifying the store name" (page 55)).

# 10.3.7 Top 10 list

The Top 10 list is set in [Top 10 list] in the [Display] menu.

In TOP10 mode, it displays the frequencies and level values of the top 10 data within the frequency range, in order of highest level.

In PEAK10 mode, it displays the frequencies and level values of the top 10 peak data within the frequency range.

# 10.3.8 Setting the FFT mode cursor X axis unit

- 1 Select [Display] on the [Menu] screen.
- Select [FFT X Unit] on the [Display] screen and press the MENU/ENT key.
- Select one of the following units and press the MENU/ENT key.

Hz	Hertz
Kcpm	1 Hz = 0.06 Kcpm
Odr	Set reference frequency (order). Ord = Cursor frequency (Hz) / Standard frequency (Hz)



If [Odr] is selected, select [Standard frequency] on the [Display] screen and enter to the standard Frequency you want to set.

# 10.3.9 Setting the FFT mode Y-axis scale

- 1 Select [Display] on the [Menu] screen.
- Select [FFT Scale] on the [Display] screen and press the MENU/ENT key.
- Select one of the following and press the MENU/ ENT key.

Linear	Linear scale
Log	Logarithmic scale

The scale on the FFT analysis mode screen is changed.

Additionally, the measurement data is stored using the set scale.



# 10.4 Zooming/moving the display

To expand or shrink the display, proceed as follows.

Functions of  $\triangleleft / \triangleright / \triangle / \triangledown$  keys differ, according to display mode.

Display mode	Symbol	Cursor	Key operation					
Display mode		Guisoi	$\triangleleft$	$\Rightarrow$	A	lacksquare		
Overall data display	None	(Solid line)	Move cursor left*	Move cursor right*	Increment store address (+)	Decrement store address (-)		
Display scaling mode	(Broken line)		Shrink X axis	Expand X axis	Expand Y axis	Shrink Y axis		
Display move mode	LIA .		Move cursor left*	Move cursor right*	-	-		

\* When the cursor is near the display edge, the cursor does not move but the display is scrolled. When the edge is reached, the cursor moves to the other edge. When the X axis display range is not 100%, the screen also scrolls to the other edge.

# 10.4.1 Zooming the display

1 Press the EXPAND/MOVE key to enter the display scaling mode.

The display scaling icon will appear in the lower right corner of the screen.

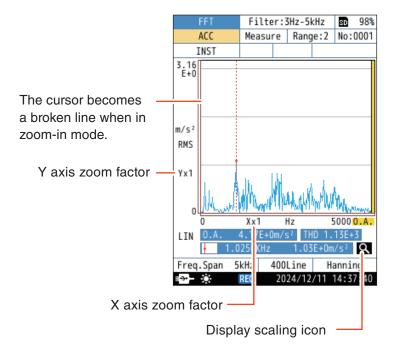
To zoom along the X axis, use the ⊲/⊮ keys.

The zoom is centered around the cursor.

The zoom factor of the X axis is shown at the bottom of the graph.

To zoom along the Y axis, use the  $\triangle$ / $\triangledown$  keys.

The zoom factor of the Y axis is shown on the left of the graph.



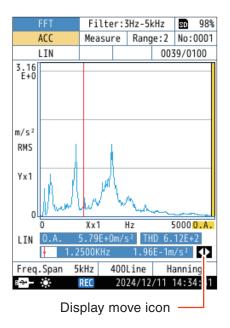
# 10.4.2 Moving the display

Press the EXPAND/MOVE key to enter the display move mode.

The display move icon will appear in the lower right corner of the screen.

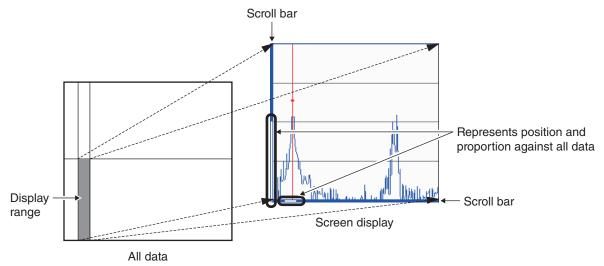
Press the ⊲/⊮ keys to move the cursor.

The cursor position can also be set by touching the screen.



# 10.4.3 Relation between overall data and display range

In display scaling mode, scroll bars are shown to indicate which section of the overall data is currently shown on the display.



# 10.5 Frequency resolution ( $\triangle f$ ) and frame time ( $T_{Frame}$ )

The frame time duration is determined by the number of analysis lines and the frequency span. The values are shown in the table below.

	Number of analysis line										
Frequency	200	lines	400 lines		800 lines		1600	lines	3200	lines	
span	T <sub>Frame</sub>	⊿f <b>(Hz)</b>	T <sub>Frame</sub>	⊿f <b>(Hz)</b>	T <sub>Frame</sub> (s)	⊿f ( <b>Hz)</b>	T <sub>Frame</sub> (s)	⊿f ( <b>Hz)</b>	T <sub>Frame</sub> (s)	⊿f ( <b>Hz</b> )	
100 Hz	2.00	0.5	4.00	0.25	8.00	0.125	16.00	0.0625	32.00	0.03125	
200 Hz	1.00	1.0	2.00	0.50	4.00	0.250	8.00	0.1250	16.00	0.06250	
500 Hz	0.40	2.5	0.80	1.25	1.60	0.625	3.20	0.3125	6.40	0.15625	
1 kHz	0.20	5.0	0.40	2.50	0.80	1.250	1.60	0.6250	3.20	0.31250	
2 kHz	0.10	10.0	0.20	5.00	0.40	2.500	0.80	1.2500	1.60	0.62500	
5 kHz	0.04	25.0	0.08	12.50	0.16	6.250	0.32	3.1250	0.64	1.56250	
10 kHz	0.02	50.0	0.04	25.00	0.08	12.500	0.16	6.2500	0.32	3.12500	
20 kHz	0.01	100.0	0.02	50.00	0.04	25.000	0.08	12.5000	0.16	6.25000	

# FFT calculation interval (data acquisition time per frame): $\triangle t$ (s)

Frequency span	200 lines	400 lines	800 lines	1600 lines	3200 lines	Frame time ratio (Overlap ratio)
100 Hz	0.25 s	0.5 s	1.0 s	2.0 s	4.0 s	1/8
200 Hz	0.125 s	0.25 s	0.5 s	1.0 s	2.0 s	1/8
500 Hz	0.1 s	0.2 s	0.4 s	0.8 s	1.6 s	1/4
1 kHz	0.1 s	0.2 s	0.4 s	0.8 s	1.6 s	1/2
2 kHz	0.1 s	0.2 s	0.4 s	0.8 s	1.6 s	1/1
5 kHz	0.04 s	0.08 s	0.16 s	0.32 s	0.64 s	1/1
10 kHz	0.02 s	0.04 s	0.08 s	0.16 s	0.32 s	1/1
20 kHz	0.01 s	0.02 s	0.04 s	0.08 s	0.16 s	1/1

Note 1 The FFT calculation interval is a value specific to the VA-14.

Note 2 The time required until the first FFT calculation results is displayed is equal to the frame time.

# 10.5.1 Measuring instantaneous values

- Configure the measurement and display settings using the [FFT] screen, [Measure/Trigger] screen, etc. (see page 71).
- Press the VM/TIME/FFT key repeatedly to access the FFT analysis mode screen.
- Press the INST/AVE key to set the calculation type to [INST] in the upper left corner of the screen.

The screen display is updated continuously.

Adjust settings such as input range, frequency span, and number of analysis lines to obtain accurate measurement data (see page 71).

# 10.5.2 Performing exponential averaging value measurement

Configure the measurement and display settings using the [FFT] menu screen, the [Measure/Trigger] screen, etc. (see page 71)

Set [Operation Type] in the [FFT] screen to [EXP].

- Press the VM/TIME/FFT key repeatedly to access the FFT analysis mode screen.
- Press the INST/AVE key to set the calculation type to [EXP] in the upper left corner of the screen.
- Adjust settings such as input range, frequency span, and number of analysis lines to obtain accurate measurement data (see page 71).
- Note
- During calculation, settings such as input range, frequency span, and the number of analysis lines cannot be changed. Set these parameters before pressing the START/STOP key.
- 5 Press the START/STOP key to start the calculation measurement.

Pressing the PAUSE/CONT key during a calculation will pause the process. Pressing the PAUSE/CONT key during a pause will resume the calculation. Press the START/STOP key during a calculation to stop the calculation.

# 10.5.3 Performing linear averaging or maximum hold measurement

Configure the measurement and display settings using the [FFT] screen, [Measure/Trigger] screen, etc. (see page 71).

Select [Operation Type] in the [FFT] screen from [LIN], [MAX], or [LIN+MAX].

- Press the VM/TIME/FFT key repeatedly to access the FFT analysis mode screen.
- Press the INST/AVE key to set the calculation type to [LIN] or [MAX] in the upper left corner of the screen.
- Adjust settings such as input range, frequency span, and number of analysis lines to obtain accurate measurement data (see page 71).
- **■** Note
- During calculation, settings such as input range, frequency span, and the number of analysis lines cannot be changed. Set these parameters before pressing the START/STOP key.
- Press the START/STOP key to perform calculations for the specified number of averages.

Pressing the PAUSE/CONT key during a calculation will pause the process.

Pressing the PAUSE/CONT key during a pause will resume the calculation.

Press the START/STOP key during a calculation to stop the calculation.

# 10.6 Storing measurement data

You can store measurement data on an SD card inserted in the unit.

When the trigger function is enabled, refer to "Trigger Function" (page 148).

#### **Important**

 While the indicator lamp is blinking rapidly, data is being saved or loaded. Do not turn off the power to the unit or remove the SD card. This may damage the SD card.

# Note

- If the waveform recording function (see page 83) has been set to [On], WAVE files will be stored on the SD card along with the FFT store data files. However, this applies in the following cases:
  - Exponential averaging calculation is in progress or paused
  - Linear averaging or maximum hold calculation is paused or completed

If the calculation type is instantaneous value measurement, WAVE files are not stored.

For information on the data storage location, see the "Data File Structure" (page 85).

• If measurement parameters are changed after calculation, the display is cleared, but the previous data and measurement parameters are maintained. Consequently, if the STORE key is pressed at this point, the measurement parameters that will be stored are the parameters that were active during calculation.

# Verify that the SD card symbol is shown on the title bar.

If no symbol is shown, insert an SD card (page 26).

Check the store address shown at the right end of the title bar.

If the address is shown on a white background:

Proceed to step 3.

If the address is shown on a red background:

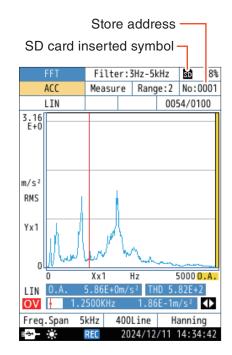
This indicates that the store address already contains measurement data.

To overwrite the data, proceed to step 3.

If you do not overwrite the data, use the  $\triangle/\nabla$  keys to select a different store address that is shown on a white background.



• If the display scaling icon is displayed in the lower right corner of the graph, press the EXPAND/MOVE key. Ensure the icon changes to or disappears, then press the ≜/ ∀ keys.



# 3 Press the STORE key.

The popup indication "STORE XXXX" (where XXXX is the store address) appears, storing is carried out, and the LED indicator flashes in red.

When storing is complete, the store address is incremented by one. If the store address was 1000, the indication returns to 0001.

For information on how to view stored data, refer to "Recalling Stored Data" (page 98).

For information on the folder structure of stored data, refer to "Data File Structure" (page 85).

# 10.7 Recording waveform data

The unit can record waveform data in files of up to 1 MB per recording operation. The recorded waveform information is stored as a RIFF format WAVE file along with the FFT store data on the SD card.

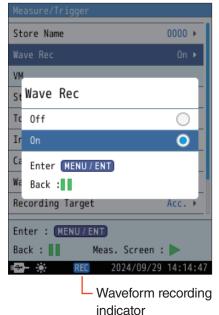
- For information on the data storage location, see "Data File Structure" (page 85).
- Waveform data that are stored are vibration waveform data collected while calculation is performed.

# 10.7.1 Waveform recording function setting

To use the waveform recording capability, the function must be enabled beforehand in the [Measure/Trigger] screen.

- On the [Menu] screen, select [Measure/Trigger] and press the MENU/ENT key.
- Select [Wave Rec] in the [Measure/Trigger] screen and press the MENU/ENT key.
- 3 Select [On] and press the MENU/ENT key.

The waveform recording symbol is shown on the status bar. (Waveform recording is valid only during calculation.)



# 10.7.2 Waveform data recording

- 1 Display the FFT analysis mode measurement screen.
- 2 Store the measurement data (see page 82).

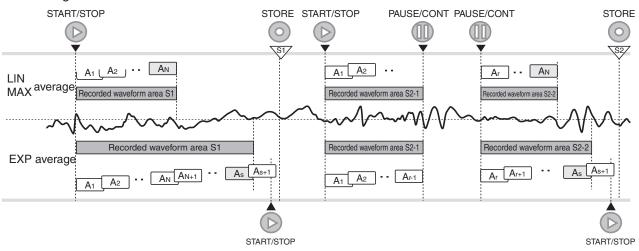
If the waveform recording function is set to [On], waveform data will also be stored at this point. However, data is only stored during a pause in the average calculation or after the calculation has stopped. The duration of the recording time depends on the average count. Up to 1 MB can be recorded, and if the waveform area is longer, the first 1 MB from the start will be recorded. For an estimate of the maximum recording time, please refer to the table below.

	Frequency span							
	100 Hz	200 Hz	500 Hz	1000 Hz	2000 Hz	5000 Hz	10000 Hz	20000 Hz
Maximum Recording Time (Approx.)	2000 s	1000 s	400 s	200 s	100 s	40 s	20 s	10 s

# Note

- · If the calculation type is instantaneous value measurement, waveform data are not stored.
- When data are stored after calculation, or at the point when data are stored after averaging calculation was stopped by pressing the START/STOP key, the waveform data used for averaging calculation are recorded. However, more than 1 MB cannot be recorded.
- When the calculation is paused, the waveform recording data may become discontinuous.

#### <Save range of waveform data>



(Past waveform data related to the latest average calculation value when the STORE key is pressed is saved.)

• When saving data by pressing the STORE key in S2, the recording waveform area is separated due to intermittent pause states. The WAVE file saves these separated waveforms connected together.

# 10.7.3 Re-analyzing waveform data

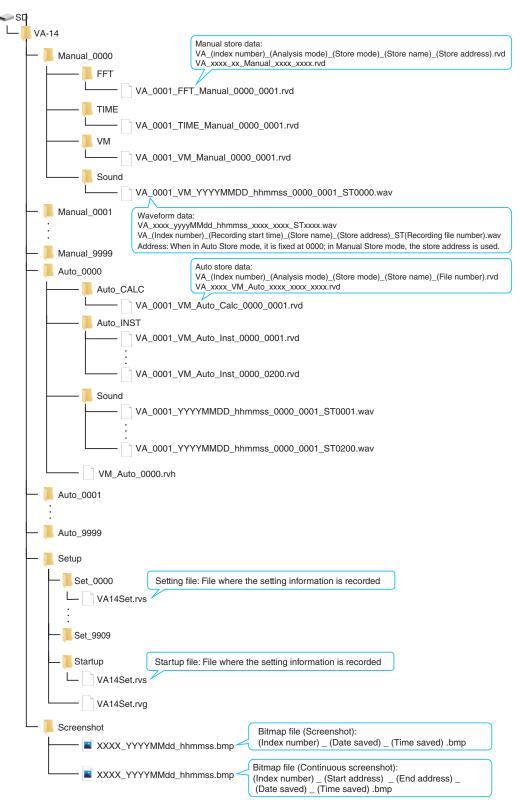
The optional waveform analysis software AS-70 or CAT-WAVE can be used to reanalyze the waveform data. The recorded waveform cannot be reanalyzed on this unit.

11

# Data File Structure

# 11.1 File organization

The diagram below illustrates the data folder structure on the SD card.



Item	Extension	Description
Header file	.rvh	Created in Auto Store mode. Records the setting information related to the corresponding store. Not created in Manual Store mode.
Data file	.rvd	Created in both Manual and Auto Store modes.  The measurement values for the corresponding store (instantaneous values, calculated values, and their overload information) are recorded.
(Settings file) Startup file	.rvs	Records the setting information related to the device itself.  It is also possible to load settings from a settings file.
Settings group file	.rvg	Records the names of the setting groups saved on the SD card.
Wave file	.wav	Records each waveform during waveform recording.
Bitmap file	.bmp	Files are created when a screenshot is taken.

Among the data stored on the SD card, the following seven types of files are used to store measurement data.

		Item	Description		
	VM	VA_0001_VM_Manual_0000_0001.rvd	This file is stored when in Manual, vibration meter (VM mode.		
Manual	TIME	VA_0001_TIME_Manual_0000_0001.rvd	This file is stored when in Manual, time waveform (TIME) mode.		
	FFT	VA_0001_FFT_Manual_0000_0001.rvd	This file is stored when in Manual, FFT analysis mode.		
	Auto_CALC	VA_0001_VM_Auto_Calc_0000_0001.rvd	This file is stored when in Auto mode with a calculation interval.		
Auto VX-14S	Auto_INST	VA_0001_VM_Auto_Inst_0000_0001.rvd	This file is stored when in Auto mode with an instantaneous value.		
	Setup	VA_Auto_0001.rvh	An Auto mode setup file is stored.		
\$	Sound VA_0001_20240102_024833_0000_ 0001_ST0001.wav		This file is stored along with the FFT store data file when in FFT analysis mode and the waveform recording function is enabled. For details, refer to "Waveform data recording (page 84).		

Stored data files (RVD files) can be opened in Microsoft Excel by changing the file extension to "CSV".

# 11.2 Measurement data file structure

Below is the file structure for measurement data. (The symbol "\_" indicates a space.) The file structure varies depending on the type of measurement data.

An example of an FFT store data file is shown below.

Root block	Sub block	Block member	Remarks
[Setting]			
	[Property]	[VA-14]	
		Analysis_Mode	
		Data_Type	
		Overload_Current	
		(Skipped)	
		Standard_Frequency_Index	
		Distortion_Order	
		Start_Time	
		[VX-14S]	
		Configurable_Filter_(Ch1)	
		Configurable_Filter_(Ch2)	
		Configurable_Filter_(Ch3)	
[Data]			
	_	Frequency	
		0	
		0.625	
		1.25	
		(Skipped)	
		2000	
		O.A	
		THD	

# 11.2.1 VM store data file (Manual)

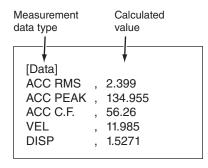
The data content is as follows.

- Item order is as shown in the table, with CR+LF used as a delimiter.
- Each item consists of the following parts: "(header string), \_ (content)(CR+LF)".
   ("\_" indicates a space.)
- The "\_" in the header string column and content column indicates a space.

Item	Header string	Bytes	Content	Maximum Bytes	Description
		0	[Setting]	9	
		0	[Property]	10	
System version	System_Version	14	x.x (major version.minor version)	3	
S option version	VX-14S_Version	14	x.x (major version.minor version)	3	
Serial number	Serial_Number	13	00000000 to 99999999	8	
		0	[VA-14]	7	
Store Name	Store_Name	10	0000 to 9999	4	
Store address	Store_Address	13	0001 to 1000	4	
Store time	Store_Start_Time	16	YYYY/MM/DD hh:mm:ss	19	
Analysis contents	Analysis_Mode	14	VM, TIME, FFT	4	
Acceleration indicated value	Display_Characteristics_(ACC)	29	RMS, PEAK	4	
Velocity indicated value	Display_Characteristics_(VEL)	29	RMS, PEAK, EQPEAK	6	

Item	Header string	Bytes	Content	Maximum Bytes	Description
Displacement indicated value	Display_Characteristics_(DISP)	30	RMS, PEAK, EQPEAK, EQp-p	6	When P-P is selected in the displacement indicated value settings on the [Display] screen, it is saved as PEAK
Acceleration unit	Display_Unit_(ACC)	18	m/s^2, G	5	
Velocity unit	Display_Unit_(VEL)	18	mm/s, inch/s	6	
Displacement unit	Display_Unit_(DISP)	19	mm, um, mil	3	
Acceleration high-pass filter	High_Pass_Filter_(ACC)	22	1Hz, 3Hz, 10Hz, 1kHz	4	
Acceleration low-pass filter	Low_Pass_Filter_(ACC)	21	1kHz, 5kHz, 20kHz	5	
Velocity high-pass filter	High_Pass_Filter_(VEL)	22	3Hz, 10Hz, 1kHz	4	
Velocity low-pass filter	Low_Pass_Filter_(VEL)	21	1kHz, 5kHz, 20kHz	5	
Displacement high-pass filter	High_Pass_Filter_(DISP)	23	3Hz, 10Hz, 1kHz	4	
Displacement low-pass filter	Low_Pass_Filter_(DISP)	22	1kHz, 5kHz, 20kHz	5	
Level range	Level_Range	11	1 to 7	1	
Acceleration overload information	Overload_(ACC)	14	, OV	2	
Velocity overload information	Overload_(VEL)	14	, OV	2	
Displacement overload information	Overload_(DISP)	15	, OV	2	
Manufacturer	Manufacturer	12	Rion	4	
Туре	Туре	4	VA-14	5	
Index	Index_Number	12	1 to 9999	4	
Sensor type	Sensor_Type	11	PV-57I, Other, Mic.	6	
Sensitivity	Sensitivity	11	XXXXX mV/m/s^2 5 characters including the dot "."	13	
dB reference value	dB_Standard	11	X.XXE±Y	7	
Data		0	[Data]	6	
Acceleration RMS	ACC_RMS	7	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration PEAK	ACC_PEAK	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration crest factor	ACC_C.F.	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Velocity	VEL	3	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values cor- responding to the velocity indicated value
Displacement	DISP	4	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values corresponding to the displacement indicated value

An example is shown below. From the left, the values indicate measurement data type and calculated value. The units are the same as those that were shown during measurement.



# 11.2.2 TIME store data file (Manual)

Item	Header string	Bytes	Content	Maximum Bytes	Description
		0	[Setting]	9	
		0	[Property]	10	
System version	System_Version	14	x.x (major version.minor version)	3	
S option version	VX-14S_Version	14	x.x (major version.minor version)	3	
Serial number	Serial_Number	13	00000000 to 99999999	8	
		0	[VA-14]	7	
Store Name	Store_Name	10	0000 to 9999	4	
Store address	Store_Address	13	0001 to 1000	4	
Store time	Store_Start_Time	16	YYYY/MM/DD hh:mm:ss	19	
Analysis contents	Analysis_Mode	14	VM, TIME, FFT	4	
Acceleration indicated value	Display_Characteristics_(ACC)	29	PEAK	4	
Velocity indicated value	Display_Characteristics_(VEL)	29	PEAK	4	
Displacement indicated value	Display_Characteristics_(DISP)	30	P-P	4	When P-P is selected in the displacement indicated value settings on the [Display] screen, it is saved as PEAK
Acceleration Unit	Display_Unit_(ACC)	18	m/s^2, G	5	
Velocity unit	Display_Unit_(VEL)	18	mm/s, inch/s	6	
Displacement unit	Display_Unit_(DISP)	19	mm, um, mil	3	
Acceleration high-pass filter	High_Pass_Filter_(ACC)	22	1Hz, 3Hz, 10Hz, 1kHz	4	
Acceleration low-pass filter	Low_Pass_Filter_(ACC)	21	1kHz, 5kHz, 20kHz	5	
Velocity high-pass filter	High_Pass_Filter_(VEL)	22	3Hz, 10Hz, 1kHz	4	
Velocity low-pass filter	Low_Pass_Filter_(VEL)	21	1kHz, 5kHz, 20kHz	5	
Displacement high-pass filter	High_Pass_Filter_(DISP)	23	3Hz, 10Hz, 1kHz	4	
Displacement low-pass filter	Low_Pass_Filter_(DISP)	22	1kHz, 5kHz, 20kHz	5	
Level range	Level_Range	11	1 to 7	1	
Overload information	Overload	8	, OV	2	
Trigger mode	Trigger_Mode	12	Free, Single, Repeat	6	
Trigger source	Trigger_Source	14	Level, External	8	
Trigger level	Trigger_Level	13	-7 to +7	2	
Trigger slope	Trigger_Slope	13	+, -	1	
Trigger slope	PreTrigger	10	Off, On	3	
Manufacturer	Manufacturer	12	Rion	4	
Туре	Туре	4	VA-14	5	
Index	Index_Number	12	1 to 9999	4	
Sensor type	Sensor_Type	11	PV-57I, Other, Mic.	6	
Sensitivity	Sensitivity	11	XXXXX mV/m/s^2 5 characters including the dot "."	13	
EU Unit	EU_Unit	7		0	
Measurement parameter	Data_Type	9	Acc, Vel, Disp, Env	4	

Item	Header string	Bytes	Content	Maximum Bytes	Description
Frequency span	Frequency_Span	14	100Hz, 200Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz,	5	
Analysis line	Analysis_Line	13	200, 400, 800, 1600, 3200	4	
Analysis average	Average_Disp	12	Inst, Ave	4	
Average method	Average_Type	12	Max, Linear, Exp	6	
Average count	Average_Count	13	1 to 2048	4	
Completed average count	Average_Complete	16	0 to 2048	4	
Time window	Window_Function	15	Rectangular, Hanning, Flattop	11	
Sampling interval seconds	Sampling_Interval	17	x.xxxxxxE±yy	11	«1/(Frequency span × 2.56)
Start	Start_Time	10	YYYY/MM/DD hh:mm:ss	19	
Data		0	[Data]	6	
	0	1	-x.xxE±yy 9 digits including the dot "." and symbol	9	
	1	1	-x.xxE±yy 9 digits including the dot "." and symbol	9	
	2	1	-x.xxE±yy 9 digits including the dot "." and symbol	9	
	:	1	-x.xxE±yy 9 digits including the dot "." and symbol	9	
	8191	4	-x.xxE±yy 9 digits including the dot "." and symbol	9	« Dependent on the number of lines

In the case of a waveform store data file, the entire waveform data for one interval section are listed, using 1 line per data.

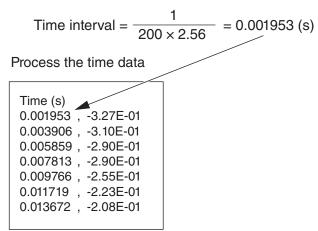
An example is shown below.

# [Data] 0 , -3.27E-01 1 , -3.10E-01 2 , -2.90E-01 3 , -2.90E-01 4 , -2.55E-01 5 , -2.23E-01 6 , -2.08E-01

Although the left column is in numerical order, the data is actually arranged as a time series, with the time interval determined by the frequency span and the data in the right column.

This time interval is obtained from the sampling period in the table on the previous page, in seconds:  $1/(\text{frequency span} \times 2.56)$ .

When the frequency span is 200 Hz:



# 11.2.3 FFT store data file (Manual)

Item	Header string	Bytes	Content	Maximum Bytes	Description
		0	[Setting]	9	
		0	[Property]	10	
System version	System_Version	14	x.x (major version.minor version)	3	
S option Version	VX-14S_Version	14	x.x (major version.minor version)	3	
Serial number	Serial_Number	13	00000000 to 99999999	8	
		0	[VA-14]	7	
Store Name	Store_Name	10	0000 to 9999	4	
Store address	Store, Address	13	0001 to 1000	4	
Store time	Store, Start, Time	16	YYYY/MM/DD hh:mm:ss	19	
Analysis contents	Analysis_Mode	14	VM, TIME, FFT	4	
Acceleration indicated value	Display_Characteristics_(ACC)	29	RMS, PEAK	4	
Velocity indicated value	Display_Characteristics_(VEL)	29	RMS, PEAK	4	
Displacement indicated value	Display_Characteristics_(DISP)	30	RMS, PEAK	4	When P–P is selected in the displacement indicated val- ue settings on the [Display] screen, it is saved as PEAK
Acceleration Unit	Display_Unit_(ACC)	18	m/s^2, G	5	
Velocity unit	Display_Unit_(VEL)	18	mm/s, inch/s	6	
Displacement unit	Display_Unit_(DISP)	19	mm, um, mil	3	
Acceleration High-pass filter	High_Pass_Filter_(ACC)	22	1Hz, 3Hz, 10Hz, 1kHz	4	
Acceleration Low-pass filter	Low_Pass_Filter_(ACC)	21	1kHz, 5kHz, 20kHz	5	
Velocity High-pass filter	High_Pass_Filter_(VEL)	22	3Hz, 10Hz, 1kHz	4	
Velocity Low-pass filter	Low_Pass_Filter_(VEL)	21	1kHz, 5kHz, 20kHz	5	
Displacement High-pass filter	High_Pass_Filter_(DISP)	23	3Hz, 10Hz, 1kHz	4	
Displacement Low-pass filter	Low_Pass_Filter_(DISP)	22	1kHz, 5kHz, 20kHz	5	

Item	Header string	Bytes	Content	Maximum Bytes	Description
Level range	Level_Range	11	1 to 7	1	
Overload information	Overload	8	, OV	2	
Trigger mode	Trigger_Mode	12	Free, Single, Repeat	6	
Trigger source	Trigger_Source	14	Level, External	8	
Trigger level	Trigger_Level	13	-7 to +7	2	
Trigger slope	Trigger_slope	13	+, -	1	
Trigger slope	PreTrigger	10	Off, On	3	
Manufacturer	Manufacturer	12	Rion	4	
Туре	Туре	4	VA-14	5	
Index	Index_Number	12	1 to 9999	4	
Sensor type	Sensor_Type	11	PV-57I, Other, Mic.	6	
Sensitivity	Sensitivity	11	XXXXXmV/m/s^2 XXXXX: 5 characters including the dot "."	13	When PV-57I or Other is selected
Sensitivity	Sensitivity	11	XXXXXdB re 1V/Pa XXXXX: 5 characters including the dot "."	17	When Mic. is selected
EU Unit	EU_Unit	7		0	
dB reference value	dB_Standard	11	X.XXE±Y	7	
Measurement parameter	Data_Type	9	Acc, Vel, Disp, Env	4	
Frequency span	Frequency_Span	14	100Hz, 200Hz, 500Hz, 1kHz, 2kHz, 5kHz, 10kHz, 20kHz	5	
Analysis line	Analysis_Line	13	200, 400, 800, 1600, 3200	4	
Analysis average	Average_Disp	12	Inst, Ave	4	
Average method	Average_Type	12	Max, Linear, Exp	6	
Average count	Average_Count	13	1 to 2048	4	
Completed average count	Average_Complete	16	0 to 2048	4	
Window function	Window_Function	15	Rectangular, Hanning, Flattop	11	
Total harmonic distortion	Total_Harmonic_Distortion	25	Off, On	3	
Distortion fundamental frequency Index	Standard_Frequency_Index	24	1 to 3200	4	
Distortion order	Distortion_Order	16	2 to 5	1	
Start	Start_Time	10	YYYY/MM/DD hh:mm:ss	19	
		0	[VX-14S]	8	
	Configurable_Filter_(Ch1)	25		1	
	Configurable_Filter_(Ch2)	25		1	
	Configurable_Filter_(Ch3)	25		1	
Data		0	[Data]	6	

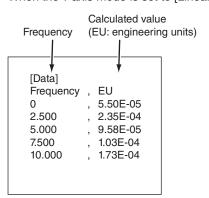
Item	Header string	Bytes	Content	Maximum Bytes	Description
EU	Frequency	9	EU	2	
	0	1	x.xxE±yy 8 digits including the dot "."	8	
	6.25	4	x.xxE±yy 8 digits including the dot "."	8	
	12.5	4	x.xxE±yy 8 digits including the dot "."	8	
		1	x.xxE±yy 8 digits including the dot "."	8	
	20000	5	x.xxE±yy 8 digits including the dot "."	8	« Dependent on the number of lines
Overall	O.A.	4	x.xxE±yy 8 digits including the dot "."	8	
Total harmonic distortion	THD	3	x.xxE±yy 8 digits including the dot "."	8	« Dependent on the number of lines
dB	Frequency	9	dB	2	
	0	1	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	
	6.25	4	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	
	12.5	4	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	
		4	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	
	20000	5	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	« Dependent on the number of lines
Overall	O.A.	4	-XXX.X to XXX.X Up to 6 characters including the dot "." and symbols	6	
Total harmonic distortion	THD	3	x.xxE±yy 8 characters including the dot "."	6	« When the distortion is calculated

In the case of an FFT store data file, the data section has the following content.

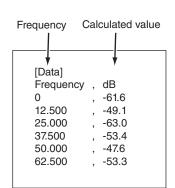
An example is shown below.

The units displayed will differ depending on the setting made in [FFT Y Scale] on the [Display] screen.

When the Y-axis mode is set to [Linear]:



When the Y-axis mode is set to [Log]:



<sup>\*</sup>Frequencies are given in ascending order Number of digits after decimal point differs depending on file; range: 0 to 5.

# 11.2.4 VM store data file (Auto\_INST) VX-14S

Item	Header string	Bytes	Content	Maximum Bytes	Description
Data No.	Store_Address	13	1 to 7200000	7	
Store time	Store_Time	10	YYYY/MM/DD hh:mm:ss.sss	23	
Acceleration RMS_ Instantaneous value	ACC_RMS	7	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration PEAK_ Instantaneous value	ACC_PEAK	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration crest factor_ Instantaneous value	ACC_C.F.	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Velocity_Instantaneous value	VEL	3	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values corresponding to the velocity indicated value
Displacement_Instantaneous value	DISP	4	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values corresponding to the displacement indicated value When P-P is selected in the displace- ment indicated value settings on the [Display] screen, it is saved as PEAK
Acceleration overload information during Instantaneous store interval	Overload_(ACC)	14	, OV	2	
Velocity overload information during Instantaneous store interval	Overload_(VEL)	14	, OV	2	
Displacement overload information during Instantaneous store interval	Overload_(DISP)	15	, OV	2	

In the case of an FFT store data file, the data section has the following content.

Acceleration RMS calculated values, acceleration PEAK calculated values, acceleration C.F. calculated values, velocity calculated values, etc., are listed in chronological order. Number of digits after decimal point differs depending on file; range: 0 to 5.

An example is shown below.

```
Store Address ,Store Time ,ACC RMS ,ACC PEAK ,ACC C.F. ,VEL
                                                                                 , Overload (ACC) , Overload (VEL) , Overload (DISP)
                                                                         , DISP
             , 26:53.1
                          , 0.014
                                       , 0.034
                                                    , 2.42
                                                              , 0.042
                                                                        , 0.0005 , -
              , 26:53.2
                           , 0.014
                                       , 0.034
                                                    , 2.42
                                                              , 0.042
2
                                                                        , 0.0005 , -
              , 26:53.3
3
                           , 0.014
                                       , 0.037
                                                    , 2.64
                                                              , 0.042
                                                                        , 0.0004 , -
              , 26:53.4
                           , 0.014
                                       , 0.037
                                                    , 2.64
                                                              , 0.042
                                                                        , 0.0004 , -
4
              , 26:53.5
                          , 0.014
                                                              , 0.042
5
                                       , 0.037
                                                    , 2.64
                                                                        , 0.0004 , -
6
              , 26:53.6
                           , 0.014
                                       , 0.037
                                                    , 2.65
                                                              , 0.042
                                                                        , 0.0004 , -
```

# 11.2.5 VM store data file (Auto\_CALC) WX-14S

Item	Header string	Bytes	Content	Maximum Bytes	Description
Data No.	Store_Address	13	1 to 7200000	7	
Store time	Store_Time	10	YYYY/MM/DD hh:mm:ss.sss	23	
Acceleration RMS_ Calculated value	ACC_RMS	7	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration PEAK_ Calculated value	ACC_PEAK	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Acceleration crest factor_ Calculated value	ACC_C.F.	8	XXXXXX.X Up to 7 characters including the dot "."	7	
Velocity_Calculated value	VEL	3	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values corresponding to the velocity indicated value
Displacement_Calculated value	DISP	4	XXXXXX.X Up to 7 characters including the dot "."	7	Measurement values corresponding to the displacement indicated value When P-P is selected in the displace- ment indicated value settings on the [Display] screen, it is saved as PEAK
Acceleration overload information during calculation store interval	Overload_(ACC)	14	, OV	2	
Velocity overload information during calculation store interval	Overload_(VEL)	14	, OV	2	
Displacement overload information during calculation store interval	Overload_(DISP)	15	, OV	2	

In the case of an FFT store data file, the data section has the following content.

An example is shown below.

```
Store Address , Store Time , ACC RMS , ACC PEAK , ACC C.F. , VEL , DISP , Overload (ACC), Overload (VEL) , Overload (DISP) 1 , 15:43.9 , 2.25 , 460.45 , 153.2 , 9.61 , 2.07 , OV , OV , OV
```

<sup>\*</sup>Frequencies are given in ascending order Number of digits after decimal point differs depending on file; range: 0 to 5.

12

# Saving the Screen as a BMP File

The unit can create a BMP file of the screen image from the measurement data and save it to the SD card. Assign the screenshot function to the function (Fn) key (page 192) and press the Fn key on the screen you want to save.

# 12.1 Saving the recall screen

Verify that the SD card symbol [50] is displayed on the title bar at the top of the measurement screen.

If no symbol is shown, insert an SD card.

- Press the MENU/ENT key on the [Recall] screen (menu).
- 3 Select [Cont. ScreenShot] and press the MENU/ENT key.
- 4 Set [Start Address] and [End Address].

The valid address range for manual store is 1 to 1000. The valid address range for auto store is 1 to 7200000.

Select [Execute Cont. ScreenShot] and press the MENU/ENT key.

The display switches to the measurement screen and continuous screenshots are taken.

After the screenshot is taken, the screen will return to the continuous screenshot mode.

- Note
- If the address range is large, continuous screenshot operation may take time.

It is recommended to save no more than about 100 pieces of data at a time.



# 12.2 Checking the saved screens

Check the screen data saved on the SD card.

- Select [Recall] on the [Menu] screen and press the MENU/ENT key.
- 2 Select [ScreenShot] on the [Recall] screen and press the MENU/ENT key.
- Select the data to load and press the MENU/ENT key.

File names are different for screenshots and continuous screenshots.

For information on the file names, refer to "Data File Structure" (page 85).

4 Select [Display] and press the MENU/ENT key.

The saved screen appears. Settings and other operations are not available.

Pressing the MENU/ENT key or the PAUSE/CONT key will return to the screenshot screen.



# 13

# **Recalling Stored Data**

# 13.1 Recalling Stored Data

Select [Recall] on the [Menu] screen and press the MENU/ENT key.

#### Manual store:

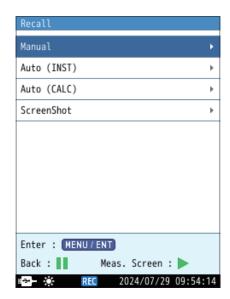
Select [Manual] and press the MENU/ENT key. The selection screen for VM, TIME, and FFT will be displayed.

#### Auto store:

The instantaneous and calculated values are displayed.

For information on the folder structure, refer to "File organization" (page 85).

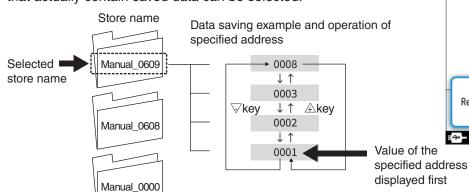
Select the store data file you want to display and press the MENU/ENT key.



- 3 Use the  $\mathbb{A}/\mathbb{V}$  keys to select the store name and press the MENU/ENT key.
  - Note
  - Insert the SD card, and the store names will be displayed. If no store names are displayed, ensure the SD card is properly inserted (see "Inserting the SD card" (page 26)).
- At the bottom of the screen, the [Recall Address] selection box will appear.

#### Manual store:

Use the  $\triangle/\nabla$  keys to increase or decrease the specified address to select the recall data, then press the MENU/ENT key. Only addresses that actually contain saved data can be selected.





#### Auto store:

The minimum store address is displayed. There is no option to select a specific address.

5

# On the selection screen for [Display] or [Delete], choose the appropriate option and press the MENU/ENT key.

The selected data appears.

# **Important**

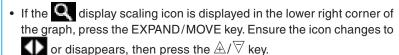
 It may take several seconds for the data to appear. While the indicator lamp is blinking rapidly, data is being saved or loaded. Do not turn off the power to the unit or remove the SD card. This may damage the SD card.

Refer to the next page and beyond for the [Recall] screen. For information on deletion, refer to "USB connection" (page 102).

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# To change the address, press the $\triangle/\nabla$ keys.

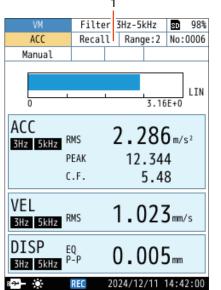


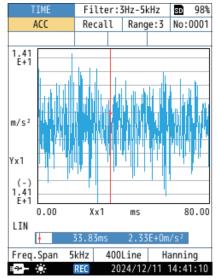


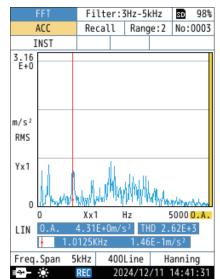
# 13.2 Recall screen

The display is generally the same as the measurement screen. Changes are limited to certain display-related items.

For details on the available display items, refer to "Menu structure" (page 45).







Vibration meter (VM) mode

Time waveform (TIME) mode

FFT analysis mode

No.	Name	Description
1	Current / Recall	Displays the [Recall] screen.

# 13.3 Changing the display

Generally similar to the measurement screen, but the items that can be changed are limited. However, the VM/TIME/FFT key functions as follows.

Vibration meter (VM) mode	Invalid
Time waveform (TIME) mode	Invalid
FFT analysis mode	Toggles between graph display and list display

The steps for changing the display according to the analysis function are as listed below.

# 13.3.1 Vibration meter (VM) mode

The ACC/VEL/DISP key can be used to change the measurement data type (data shown on the level bar and time-level graph). Additionally, the VM mode scale can be changed from the menu screen.

# 13.3.2 Time waveform (TIME) mode

The display can be zoomed in or out (see page 64).

You can change the overlapping display settings and save overlapping data from the menu screen.

# 13.3.3 FFT analysis mode

The display can be zoomed in or out (see page 77).

You can change the FFT mode cursor X-axis units, FFT mode Y-axis scale, Top 10 list, overlapping display settings, and save overlapping data from the menu screen.

# 13.4 Deleting stored data

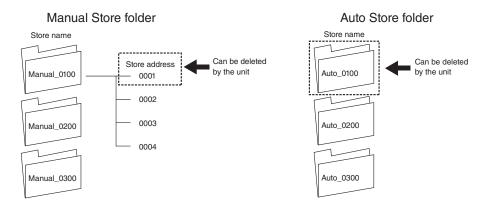
You can delete data stored on the SD card using the unit.

#### Manual store:

Specify the store name and address, then delete the address.

#### Auto store:

Select a store name and press the MENU/ENT key to delete.



14
Serial Interface

The unit can communicate with a computer via USB or LAN for device control and file transfer.

# 14.1 USB connection

# 14.1.1 Communication control by CDC

This unit allows you to check and change settings through communication control via USB connection. Additionally, when the VX-14S is installed, it is possible to retrieve the unit's measurement values using commands Refer to page 117 and beyond for commands.

# Compatible OS

- Microsoft Windows 10 Pro (64-bit version)
- Microsoft Windows 11 Pro

# **Important**

Connect the computer and the unit directly with a USB cable. If the unit is connected via a USB hub, it may not operate
properly.

# Note

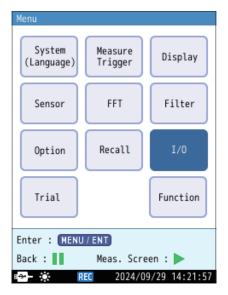
- When the unit is connected to a computer, the lower measurement limit level may be raised due to noise from the computer.
- When using the USB communication control function, LAN communication control cannot be set.
- When using the USB communication control function, the USB driver installation operation is not required. The driver is automatically installed when the unit is connected to a computer running a compatible OS with a USB cable.
- · If any abnormalities are observed during the transmission or reception of communication commands, close the computer's
- port once and reconnect.

Follow the procedure below to set the communication functions of the unit.

Plug the USB Type-C cable into the USB port on the bottom of the unit and the USB port of the computer.

On the [Menu] screen, select [I/O] and press the MENU/ENT key.

The [I/O] screen appears.



On the [I/O] screen, select [USB] and press the MENU/ENT key.

The selection screen appears.



Select [Communication (CDC)] and press the MENU/ENT key.

The USB communication control (CDC) is set.



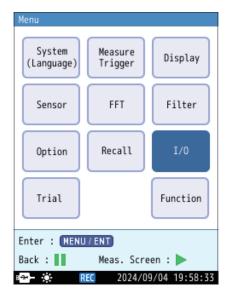
# 14.2 File transfer by MSC

Allows data from the SD card to be transferred by making the computer recognize the unit as a removable disk. To prevent data corruption and avoid access conflicts with Windows, the MSC function is switched ON and OFF. Additionally, this function cannot be used during measurement.

# **□** Note

- When using mass storage, only USB commands are accepted; other commands are not recognized. If communication control is needed, switch back to communication control using the USB command.
- Plug the USB Type-C cable into the USB port on the bottom of the unit and the USB port of the computer.
- On the [Menu] screen, select [I/O] and press the MENU/ENT key.

The [I/O] screen appears.



On the [I/O] screen, select [USB] and press the MENU/ENT key.

The selection screen appears.





# Select [Mass Storage (MSC)] and press the MENU/ENT key.

This completes the connection between the unit and the computer.

- Once recognized as a removable disk, measurement data file and setting file saved on the unit can be checked and changed in the USB drive folder.
- To remove the main unit from the computer, select [Remove main unit] on the main unit display screen before disconnecting it from the computer.



# 14.3 LAN (network function)

The system communicates over a wired LAN, and in combination with an access point, forms a wireless network to provide participation in networks, measurement data transfer, and remote monitoring and operation.

The IP address can be set automatically using the DHCP function. It can also be configured manually. Secure communication such as SSL is not supported.

Communication is carried out with a user-specified IP address, providing the following functions. These functions can be used together.

## **Important**

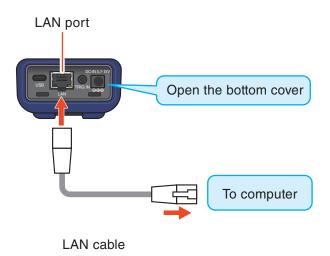
· Connect the computer and the unit directly with a LAN cable.



• When the unit is connected to a computer, the lower measurement limit level may be raised due to noise from the computer.

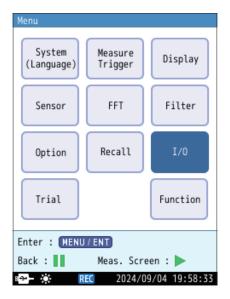
Follow the procedure below to set the communication functions of the unit.

- 1 Open the bottom cover of the unit.
- Plug the connector of the LAN cable into the LAN port of the unit and the computer.



On the [Menu] screen, select [I/O] and press the MENU/ENT key.

The [I/O] screen appears.



On the [I/O] screen, select [LAN] and press the MENU/ENT key.

The selection screen appears.



On the selection screen, select [On] and press the MENU/ENT key.

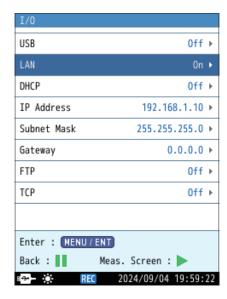
The [I/O] screen will be updated.





# Configure the settings related to LAN.

Item	Description
LAN	Sets On/Off for the LAN function.
DHCP	Sets automatic acquisition of network settings (IP address, subnet, gateway).  If you want to automatically acquire network settings from a DHCP server on the network, set it to [On].  If you want to manually configure the unit's network settings, set it to [Off].
IP Address	Sets the IP address and displays the automatically acquired settings.
Subnet Mask	Sets the subnet mask and displays the automatically acquired settings.
Gateway	Sets the default gateway and displays the automatically acquired settings.
FTP	Sets On/Off for file transfer.
TCP	Sets On/Off for the communication control.





# Manually set the IP address, subnet mask, and gateway as necessary.

 On the [LAN] screen, select [IP Address] and press the MENU/NET key.

The input screen for the IP address appears.

2. Enter the IP address.

Use the  $\triangle/\nabla$  keys to change the numbers and the  $<\!\!\!/\!\!\!>$  keys to move between digits.

- Manually configure subnet mask and gateway in the same way.
- Configure the corresponding settings for communication.



# 14.3.1 Communication control through socket communication

Measurement values can be acquired and settings can be changed by using communication commands.

Commands are the same as those used for USB communication (see page 110 onward).

The following setting is required for the connection:

• Port number: 2255



• When using the LAN communication control function, it cannot be used in conjunction with USB connection.

# 14.3.2 File transfer by FTP server

Using an FTP client application (e.g., on a PC, iPhone, or Android™ device), you can download data from the SD card. You can download data even while measurements are in progress.

The following settings are required for the connection:

Port Number: 21User Name: VA-14

• Password: Operation lock release password (page 174)

Active Mode

## Note

- The file transfer function using LAN and USB connections cannot be used simultaneously.
- · Refrain from deleting files via FTP.

## 14.4 Command

# 14.4.1 Command types and formats

## · 🖹 Note

• Communication commands should be sent after waiting for a "\$" response following transmission. In this case, it is recommended to leave an interval of 1 second or more.

There are two types of commands: setting commands and request commands.

#### Setting command

Setting commands are used to configure or change the unit's status or various conditions.

Commands that generate a response will return a response after the setting process is executed.

To change the unit's settings using setting commands, ensure that the key lock is turned on. This is not necessary for commands used to confirm information.

#### Format

Command = "\$" + "command name" + "," + "parameter" + [CR] + [LF]



• The part enclosed with "" represents a character string. It does not mean that "" is actually sent or received.

The basic components of a setting command include the command name and parameters.

The leading "\$" indicates the status of the command and is automatically displayed. It is not shown during command processing, and command input is not accepted.

Additionally, a "," (comma) is required between the command name and the parameter to distinguish them. The [CR] + [LF] (carriage return + line feed) sequence is needed to indicate the end of the setting command.

#### Prohibitions

- More than two spaces in a row in a command name
- Omission of "," (comma) after a command name
- Use of double-byte characters

#### Permissible actions

- Use of lowercase letters instead of uppercase letters
- · Use of uppercase letters instead of lowercase letters

#### Command examples

lcd_auto_off, _short_ [CR] [LF]	Acceptable	Can be written entirely in lowercase letters.
LCDAuto Off, _ Short [CR] [LF]	Not acceptable	Violation of space in the command name.
LCD_Auto_Off_Short [CR] [LF]	Not acceptable	Missing "," after the command name.

\* The symbol " \_ " indicates a space.

#### Request command

Request commands are used to inquire about the status, various settings of the unit, or to request measurement data such as display data or store data.

The unit responds with a data response.

#### Format

# Command = "command name" + "?" + [CR] + [LF]

A request command is structured with the command name followed by "?". The [CR] + [LF] (carriage return + line feed) sequence is required to indicate the end of the request command.

#### Prohibitions

- Omission of spaces in command names
- More than two spaces in a row in a command name

#### Permissible actions

- Use of lowercase letters instead of uppercase letters
- Use of uppercase letters instead of lowercase letters

# 14.4.2 Communication echo

When the communication echo is activated, the transmitted command string is sent back from the destination to confirm that the command was entered correctly.

The status of the communication echo (On/Off) and its current settings can be checked using the Echo command.

#### 14.4.3 Result code

This represents the response data indicating the execution result of the command. The result code has the following structure:

#### Result code = "R+" + "4-digit number"

The meaning of the 4-digit number following the prefix "R+" is as follows.

Number	Description
0000	Normal completion The command was successfully executed (set or requested).
0001	Command error The specified command cannot be recognized.
0002	Parameter error The number of parameters and parameter format do not match those allowed for the specified command.
0003	Specification error Settings were performed for commands that can only be requested, or requests were made for commands that can only be set.
0004	Status error The command cannot be executed (set or requested) due to the current status.

## 14.4.4 Transmission code

The control codes used in the communication of the unit are shown below.

Code name	Hexadecimal notation	Meaning
[CR]	0Dн	Terminator 1st letter
[LF]	ОАн	Terminator 2nd letter
[SUB]	1Ан	Stop request

# 14.4.5 Default value

# Guaranteed value

Case	Default value	Note
Time until the unit returns a response	Within 3 s	The unit responds with result code 0004 (status error) for processing reasons.
Time between characters sent	Within 100 ms	-
Time until the unit enters the idling state after sending data	Within 200 ms	Communication commands should be sent after waiting for a "\$" response following transmission. In this case, it is recommended to leave an interval of 1 second or more.

# Default value

Case	Default value	Note
Timeout between received characters	Unlimited	-

# 14.5 Command List

S: Setting command (used to configure the unit's settings)

R: Request command (used to obtain information on the unit's status and measurement results)

	Commands	Function	See page
System	Туре	Type (R)	page 117
	Serial Number	Serial number (R)	page 117
	Index Number	Index number (S/R)	page 117
	System Version	System version (R)	page 117
	Battery Type	Battery type (S/R)	page 117
	Battery Level	Battery level (R)	page 118
	Clock	Current time display (S/R)	page 118
	SD Card Total Size	Capacity (MB) (R)	page 118
	SD Card Free Size	Remaining capacity (MB) (R)	page 118
	SD Card Percentage	Remaining capacity (%) (R)	page 119
	Key Lock	Operation key lock (S/R)	page 119
Measurement	Measure	Start/Stop measurement (S)	page 120
	Measurement Mode	Analysis mode (S/R)	page 120
	Data Type	Measurement data type (S/R)	page 120
	Display Characteristics Mode	Indicator characteristics (S/R)	page 121
	Display Characteristics (Acc)	Indicator characteristics (Acceleration) (S/R)	page 121
	Display Unit (Acc)	Display unit (acceleration) (R)	page 121
	Display Characteristics (Vel)	Indicator characteristics (Velocity) (S/R)	page 122
	Display Unit (Vel)	Display unit (velocity) (R)	page 122
	Display Characteristics (Disp)	Indicator characteristics (displacement) (S/R)	page 122
	Display Unit (Disp)	Display unit (displacement) (S/R)	page 123
	Display Characteristics (FFT)	Indicator characteristics (FFT) (S/R)	page 123
	Scale FFT	Graph Y axis scale (S/R)	page 123
	Individual Filter Setting	Filter individual setting (S/R)	page 124
	High Pass Filter	High-pass filter (common) (S/R)	page 124
	Low Pass Filter	Low-pass filter (common) (S/R)	page 124
	High Pass Filter (ACC) High Pass Filter (VEL) High Pass Filter (DISP)	High-pass filter (Ch) (S/R)	page 125
	Low Pass Filter (ACC) Low Pass Filter (VEL) Low Pass Filter (DISP)	Low-pass filter (Ch) (S/R)	page 125
	Analysis Line	Number of analysis line (S/R)	page 125
	Frequency Span	Frequency span (S/R)	page 126
	Window Function	Window function (S/R)	page 126

	Commands	Function	See page
Measurement	Average Disp	FFT analysis mode calculation display (S/R)	page 126
	Average Type	Calculation type (S/R)	page 127
	Average Disp Mode	Average calculation display type mode (S/R)	page 127
	Average Count	Average count (S/R)	page 127
	Average Complete	Average count (Complete) (R)	page 127
	Trigger Mode	Trigger operation mode (S/R)	page 128
	Trigger Source	Trigger source (S/R)	page 128
	Trigger Level	Trigger level (Full scale) (S/R)	page 128
	Trigger Level Value	Trigger level (Measurement data) (R)	page 128
	Trigger Slope	Trigger slope (S/R)	page 129
	Pretrigger	Pretrigger (S/R)	page 129
	Wave Recording	Waveform recording (S/R)	page 129
Measurement	dB Standard	dB Standard (S/R)	page 129
(with VX-14S installed) VX-14S	Calc Disp	Vibration meter (VM) mode calculation display (S/R)	page 130
	Wave Recording Target	Vibration meter (VM) mode waveform recording target (S/R)	page 130
Store	Store	Store (S)	page 131
	Store Name	Storage name (S/R)	page 131
	Store Address	Store address (S/R)	page 131
Store	Measurement Time	Auto store total measurement time (Preset) (S/R)	page 131
Store (with VX-14S installed)	Measurement Time (Num)	Auto store total measurement time (User: time) (S/R)	page 132
VX-14S	Measurement Time (Unit)	Auto store total measurement time (User: unit) (S/R)	page 132
	Inst Store Interval	Instantaneous store interval (S/R)	page 132
	Calc Store Interval	Calculation store interval (Preset) (S/R)	page 133
	Calc Store Interval (Num)	Calculation store interval (User: time) (S/R)	page 133
	Calc Store Interval (Unit)	Calculation store interval (User: unit) (S/R)	page 133
	Wave Sampling Frequency	Sampling frequency (S/R)	page 134
	Store Mode	Store mode (S/R)	page 134
Screen	Standard Frequency	Standard frequency (R)	page 135
	Standard Frequency Index	Standard frequency index (S/R)	page 135
	Total Harmonic Distortion	Total harmonic distortion (S/R)	page 135
	Distortion Order	Distortion order (S/R)	page 135
	Measure Status	Measurement status (R)	page 136
	Store Elapsed Time	Store elapsed time sec (R)	page 136
	Units	System of units (S/R)	page 136

	Commands	Function	See page
Input/Output	Level Range	Input range (S/R)	page 137
	Sensor Type	Sensor type (S/R)	page 137
	Sensitivity (PV-57I)	Sensor sensitivity (PV-57I) (S/R)	page 137
	Sensitivity (Other)	Sensor sensitivity (Other) (S/R)	page 138
	Echo	Communication echo (S/R)	page 138
	USB Class	USB communication (S/R)	page 138
	Ethernet	Ethernet (S/R)	page 138
	Ethernet DHCP	DHCP (S/R)	page 139
	Ethernet IP	IP address (S/R)	page 139
	Ethernet Subnet	Subnet mask (S/R)	page 139
	Ethernet Gateway	Gateway (S/R)	page 139
	FTP	FTP (S/R)	page 139
	TCP	TCP (S/R)	page 140
Input	Sensitivity (Mic.)	Sensor sensitivity (Mic.) (S/R)	page 140
(with VX-14S installed) VX-14S	CCLD Power Supply	CCLD power supply (S/R)	page 140
Data output (with VX-14S installed) VX-14S	DOD	Output displayed value (R)	page 142
	DLC	Final calculation result output (R)	page 143
	DRD	Continuous output (R)	page 144
Execute	Screenshot	Screenshot (S)	page 145
	Write Resume	Write resume (S)	page 145

# 14.6 Command Description

# System

Туре	
Function	Туре
Description	Type acquisition
Request command	Type?
Response data	d1 = VA-14

Serial Number	
Function	Serial Number
Description	Serial number acquisition
Request command	Serial_Number?
Response data	d1
Returned value	d1 = 00000000 to 99999999

Index Number	Index Number	
Function	Index	
Description	Index number setting	
Setting command	Index_Number,p1	
Parameter	p1 = 0001 to 9999	
Request command	Index_Number?	
Response data	d1	
Returned value	Same as setting parameter	

System Version	
Function	System version
Description	System version information acquisition
Request command	System_Version?
Response data	d1 = "xx.xx" (x = 0 to 9)
Remarks	There is no setting command

Battery Type	
Function	Battery type
Description	Battery type setting
Setting command	Battery_Type,p1
Parameter	p1 = "Alkaline" p1 = "Nickel"
Request command	Battery_Type?
Response data	d1
Returned value	Same as setting parameter

Battery Level	
Function	Power level
Description	Power levels acquisition
Request command	Battery_Level?
Response data	d1
Return value	d1 = "SHUTDOWN" d1 = "EMPTY" d1 = "DANGER" d1 = "LOW" d1 = "MID" d1 = "FULL"

Clock	
Function	Current time display
Description	Current time setting
Setting command	Clock,p1/p2/p3_p4:p5:p6
Parameter	p1 = 2024-2079 (year) p2 = 01-12 (month) p3 = 01-31 (day) p4 = 00-23 (hour) p5 = 00-59 (minute) p6 = 00-59 (second)
Request command	Clock?
Response data	d1/d2/d3_d4:d5:d6
Returned value	Same as setting parameter

SD Card Total Size	
Function	Total SD card capacity
Description	SD card capacity (MB) acquisition
Request command	SD_Card_Total_Size?
Response data	d1 = O(MB) -
Returned value	There is no setting command

SD Card Free Size	
Function	SD card free space
Description	SD card remaining capacity (MB) acquisition
Request command	SD_Card_Free_Size?
Response data	d1 = 0(MB) -
Returned value	There is no setting command

SD Card Percentage	
Function	Remaining capacity (%)
Description	SD card remaining capacity (%) acquisition
Request command	SD_Card_Percentage?
Response data	d1 = 0 to 100
Returned value	There is no setting command

Key Lock	
Function	Key lock
Description	Key lock On/Off setting
Setting command	Key_Lock,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Key_Lock?
Response data	d1
Returned value	Same as setting parameter
Note	When Key Lock is Off  • (S) commands from communication are all disabled.

## Measurement

Measure	
Function	Measurement
Description	Measurement start and stop
Setting command	Measure,p1
Response data	p1 = "Start" p1 = "Stop"

Measurement Mode	
Function	Analysis mode
Description	Analysis mode setting
Setting command	Measurement_Mode,p1
Parameter	p1 = "VM" p1 = "TIME" p1 = "FFT"
Request command	Measurement_Mode?
Response data	d1
Returned value	Same as setting parameter

Data Type	
Function	Measurement data type
Description	Measurement data type setting
Setting command	Data_Type,p1
Parameter	p1 = "Acc" p1 = "Vel" p1 = "Disp" p1 = "Env"
Request command	Data_Type?
Response data	d1
Returned value	Same as setting parameter
Note	

Display Characteristics Mode	
Function	Indicator characteristics
Description	Indicator characteristics setting
Setting command	Display_Characteristics_Mode,p1
Parameter	p1 = "Off" (Standard Setting) p1 = "On" (User Setting)
Request command	Display_Characteristics_Mode?
Response data	d1
Returned value	Same as setting parameter
Note	For "On", the indicator characteristics of each Ch can be modified.

Display Characteristics (Acc)	
Function	Indicator characteristics (Acceleration)
Description	Indicator characteristics (Acceleration) setting
Setting command	Display_Characteristics_(Acc),p1
Parameter	p1 = "PEAK" p1 = "RMS"
Request command	Display_Characteristics_Mode?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On".  Corresponds to the vibration meter (VM) mode bar graph.

Display Unit (Acc)	
Function	Display unit (Acceleration)
Description	Display unit (Acceleration) acquisition
Request command	Display_Unit_(Acc)?
Response data	d1 = "m/s^2" (when the units setting is SI system) d1 = "G" (when the units setting is imperial system)
Returned value	p1
Note	Cannot be changed

Display Characteristics (Vel)	
Function	Indicator characteristics (Velocity)
Description	Indicator characteristics (Velocity) setting
Setting command	Display_Characteristics_(VeI),p1
Parameter	p1 = "PEAK" (with VX-14S installed) VX-14S p1 = "RMS" p1 = "EQPEAK"
Request command	Display_Characteristics_(VeI)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On".  Vibration meter (VM) mode indicated value

Display Unit (Vel)	
Function	Display unit (velocity)
Description	Display unit (Velocity) acquisition
Request command	Display_Unit_(Vel)?
Response data	d1
Returned value	d1 = "mm/s" (When set to SI units) d1 = "inch/s" (When set to Imperial units)
Note	Cannot be changed

Display Characteristics (Disp)	
Function	Indicator characteristics (Displacement)
Description	Indicator characteristics (Displacement) setting
Setting command	Display_Characteristics_(Disp),p1
Parameter	p1 = "PEAK" (with VX-14S installed) VX-14S p1 = "RMS" p1 = "EQPEAK" p1 = "EQP-P"
Request command	Display_Characteristics_(Disp)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On".  Vibration meter (VM) mode indicated value  The PEAK parameter corresponds to the displacement indicated value P-P on the [Display] screen.

Display Unit (Disp)	
Function	Display unit (Displacement)
Description	Display unit (Displacement) setting
Setting command	Display_Unit_(Disp),p1
Parameter	p1 = "mm" p1 = "um" p1 = "mil"
Request command	Display_Unit_(Disp)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On". For the SI unit system: "mm" or "um" is available For the Imperial unit system: Only "mil" is available

Display Characteristics (FFT)	
Function	Indicator characteristics (FFT)
Description	Indicator characteristics (FFT) setting
Setting command	Display_Characteristics_(FFT),p1
Parameter	p1 = "PEAK" p1 = "RMS"
Request command	Display_Characteristics_(FFT)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On". Indication value settings in FFT analysis mode Common settings for Acc/Vel/Disp.Acc.Env

Scale FFT	
Function	FFT graph Y axis scale
Description	FFT graph Y axis scale setting
Setting command	Scale_FFT,p1
Parameter	p1 = "Log" p1 = "Linear"
Request command	Scale_FFT?
Response data	d1
Returned value	Same as setting parameter
Note	Can be changed only when the indicator characteristics setting is "On". Indication value settings in FFT analysis mode Common settings for Acc/Vel/Disp.Acc.Env

Individual Filter Setting	
Function	Filter individual setting
Description	Filter individual setting configuration
Setting command	Individual_Filter Setting,p1
Parameter	p1 = "Off" (Common) p1 = "On" (Individual)
Request command	Individual_Filter Setting?
Response data	d1
Returned value	Same as setting parameter
Note	Only when On, LPF and HPF can be set for each channel

High Pass Filter	
Function	High-pass filter (common)
Description	High-pass filter (common) setting
Setting command	High_Pass_Filter,p1
Parameter	p1 = "3Hz" p1 = "10Hz" p1 = "1kHz"
Request command	High_Pass_Filter?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set only when the individual filter setting is set to Off When On, only request are allowed 1Hz cannot be set

Low Pass Filter	
Function	Low-pass filter (common)
Description	Low-pass filter (common) setting
Setting command	Low_Pass_Filter,p1
Parameter	p1 = "1kHz" p1 = "5kHz" p1 = "20kHz"
Request command	Low_Pass_Filter?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set only when the individual filter setting is set to Off When On, only request are allowed

High Pass Filter (ACC) High Pass Filter (VEL) High Pass Filter (DISP)	
Function	High-pass filter (Ch)
Description	High-pass filter (Ch) setting
Setting command	High_Pass_Filter_(ACC),p1
Parameter	p1 = "1Hz" p1 = "3Hz" p1 = "10Hz" p1 = "1kHz"
Request command	High_Pass_Filter_(ACC)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set only when the individual filter setting is set to On When Off, only request are allowed 1 Hz cannot be set for velocity and displacement

Low Pass Filter (ACC) Low Pass Filter (VEL) Low Pass Filter (DISP)	
Function	Low-pass filter (Ch)
Description	Low-pass filter (Ch) setting
Setting command	Low_Pass_Filter_(ACC),p1
Parameter	p1 = "1kHz" p1 = "5kHz" p1 = "20kHz"
Request command	Low_Pass_Filter_(ACC)?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set only when the individual filter setting is set to On When Off, only request are allowed

Analysis Line	
Function	Number of analysis line
Description	Number of analysis line setting
Setting command	Analysis_Line,p1
Parameter	p1 = "200" p1 = "400" p1 = "800" p1 = "1600" p1 = "3200"
Request command	Analysis_Line?
Response data	d1
Returned value	Same as setting parameter

Frequency Span	
Function	Frequency span
Description	Frequency span setting
Setting command	Frequency_Span,p1
Parameter	p1 = "20kHz" p1 = "10kHz" p1 = "5kHz" p1 = "2kHz" p1 = "1kHz" p1 = "1500Hz" p1 = "200Hz" p1 = "100Hz"
Request command	Frequency_Span?
Response data	d1
Returned value	Same as setting parameter

Window Function	
Function	Window function
Description	FFT window function settings
Setting command	Window_Function,p1
Parameter	p1 = "Rectangular" p1 = "Hanning" p1 = "Flattop"
Request command	Window_Function?
Response data	d1
Returned value	Same as setting parameter

Average Disp	
Function	FFT analysis mode calculation display
Description	FFT analysis mode calculation display settings
Setting command	Average_Disp,p1
Parameter	p1 = "Inst" p1 = "Ave" (LIN)
Request command	Average_Disp?
Response data	d1
Returned value	Same as setting parameter

Average Type	
Function	Calculation type
Description	Calculation type setting
Setting command	Average_Type,p1
Parameter	p1 = "Linear" p1 = "Max" p1 = "Exp" p1 = "Linear/Max"
Request command	Average_Type?
Response data	d1
Returned value	Same as setting parameter

Average Disp Mode	
Function	Average calculation display type mode
Description	Linear+Max display mode for time average calculation
Setting command	Average_Disp_Mode,p1
Parameter	p1 = "Linear" p1 = "Max"
Request command	Average_Disp_Mode?
Response data	d1
Returned value	Same as setting parameter

Average Count	
Function	Average count
Description	Average count setting
Setting command	Average_Count,p1
Parameter	p1 = 1 to 2048
Request command	Average_Count?
Response data	d1
Returned value	Same as setting parameter

Average Complete	
Function	Average count (Complete)
Description	Average count (Complete) acquisition
Request command	Average_Complete?
Response data	d1 = 0 to 2048

Trigger Mode	
Function	Trigger operation mode
Description	Trigger operation mode setting
Setting command	Trigger_Mode,p1
Parameter	p1 = "Free" p1 = "Repeat" p1 = "Single"
Request command	Trigger_Mode?
Response data	d1
Returned value	Same as setting parameter

Trigger Source	
Function	Trigger source
Description	Trigger source setting
Setting command	Trigger_Source,p1
Parameter	p1 = "Level" p1 = "External"
Request command	Trigger_Source?
Response data	d1

Trigger Level	
Function	Trigger level (Full scale)
Description	Trigger level (Full scale) setting
Setting command	Trigger_Level,p1
Parameter	p1 = -7 to 7
Request command	Trigger_Level?
Response data	d1 = Trigger level value
Returned value	Same as setting parameter
Note	-n/8 to +n/8 with n as the parameter

Trigger Level Value	
Function	Trigger level (Measurement data)
Description	Trigger level (Measurement data) acquisition
Request command	Trigger_Level_Value?
Response data	d1 = -12.374369 to $+12.374369$
Returned value	p1

Trigger Slope	
Function	Trigger slope
Description	Trigger slope setting
Setting command	Trigger_Slope,p1
Parameter	p1 = "Plus" p1 = "Minus"
Request command	Trigger_Slope?
Response data	d1
Returned value	Same as setting parameter

Pretrigger	
Function	Pretrigger
Description	Pretrigger setting
Setting command	Pretrigger,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Pretrigger?
Response data	d1
Returned value	Same as setting parameter

Wave Recording	
Function	Waveform recording
Description	Waveform recording setting
Setting command	Wave_Recording,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Wave_Recording?
Response data	d1
Returned value	Same as setting parameter

dB Standard (with VX-14S installed) VX-14S	
Function	dB Standard
Description	dB Standard setting
Setting command	dB Standard,p1
Parameter	p1 = 1.00E-8 to 9.90E+4
Request command	dB Standard?
Response data	d1
Returned value	Same as setting parameter

Calc Disp (with VX-14S installed) VX-14S	
Function	Vibration meter (VM) mode calculation display
Description	Vibration meter (VM) mode calculation display setting
Setting command	Calc_Disp,p1
Parameter	p1 = "Inst" p1 = "Calc"
Request command	Calc_Disp?
Response data	d1
Returned value	Same as setting parameter
Note	Switching instantaneous/calculated value display in vibration meter (VM) mode Calc setting is not available when option VX-14S is not installed or when store mode is Manual.

Wave Recording Target (with VX-14S installed) VX-14S	
Function	Vibration meter (VM) mode waveform recording target
Description	Vibration meter (VM) mode waveform recording target setting
Setting command	Wave_Recording_Target,p1
Parameter	p1 = "Acc" p1 = "Vel" p1 = "Disp"
Request command	Wave_Recording_Target?
Response data	d1
Returned value	Same as setting parameter

#### Store

Store Store	
Function	Store
Description	Perform store operation
Setting command	Store,p1
Parameter	p1 = "Store"

Store Name	
Function	Store name
Description	Store name setting
Setting command	Store_Name,p1
Parameter	p1 = 0000 to 9999
Request command	Store_Name?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set regardless of the store mode in VM.

Store Address	
Function	Store address
Description	Store address setting
Setting command	Store_Address,p1
Parameter	p1 = 0001 to 1000
Request command	Store_Address?
Response data	d1
Returned value	Same as setting parameter
Note	Can be set regardless of the store mode in VM.

Measurement Time VX-14S	
Function	Auto store total measurement time (Preset)
Description	Auto store total measurement time (Preset) setting
Setting command	Measurement_Time,p1
Parameter	p1 = "10s" p1 = "1m" p1 = "10m" p1 = "24h" p1 = "User Setting"
Request command	Measurement_Time?
Response data	d1
Returned value	Same as setting parameter

Measurement Time (Num)	
Function	Auto store total measurement time (User: time)
Description	Auto store total measurement time (User: time) setting
Setting command	Measurement_Time_(Num),p1
Parameter	p1 = 1 to 59 (when the calculation store interval (unit) is sec) p1 = 1 to 59 (when the calculation store interval (unit) is min) p1 = 1 to 200 (when the calculation store interval (unit) is hour)
Request command	Measurement_Time_(Num)?
Response data	d1
Returned value	Same as setting parameter

Measurement Time (Unit) (with VX-14S installed) VX-14S	
Function	Auto store total measurement time (User: time)
Description	Auto store total measurement time (User: time) setting
Setting command	Measurement_Time_(Unit),p1
Parameter	p1 = "sec" p1 = "min" p1 = "hour"
Request command	Measurement_Time_(Unit)?
Response data	d1
Returned value	Same as setting parameter

Inst Store Interval (with VX-14S installed) (VX-14S)	
Function	Instantaneous store interval
Description	Instantaneous store interval setting
Setting command	Inst_Store_Interval,p1
Parameter	p1 = "Off" p1 = "100ms" p1 = "1s"
Request command	Inst_Store_Interval?
Response data	d1
Returned value	Same as setting parameter

Calc Store Interval (with VX-14S installed) VX-14S	
Function	Calculation store interval (Preset)
Description	Calculation store interval (Preset) setting
Setting command	Calc_Store_Interval,p1
Parameter	p1 = "Off" p1 = "10s" p1 = "1m" p1 = "User Setting"
Request command	Calc_Store_Interval?
Response data	d1
Returned value	Same as setting parameter

Calc Store Interval (Num) (with VX-14S installed) VX-14S	
Function	Calculation store interval (User: time)
Description	Calculation store interval (User: time) setting
Setting command	Calc_Store_Interval_(Num),p1
Parameter	p1 = 10 to 59 (when the calculation store interval (unit) is sec) p1 = 1 to 59 (when the calculation store interval (unit) is min) p1 = "1" (when the calculation store interval (unit) is hour)
Request command	Calc_Store_Interval_(Num)?
Response data	d1
Returned value	Same as setting parameter
Note	If the calculation store interval (preset) is set by the user, it will be used as the store interval.

Calc Store Interval (Unit) (with VX-14S installed)  VX-14S	
Function	Calculation store interval (User: unit)
Description	Calculation store interval (User: unit) setting
Setting command	Calc_Store_Interval_(Unit),p1
Parameter	p1 = "sec" p1 = "min" p1 = "hour"
Request command	Calc_Store_Interval_(Unit)?
Response data	d1
Returned value	Same as setting parameter
Note	If the calculation store interval (preset) is set by the user, it will be used as the store interval.

Wave Sampling Frequency (with VX-14S installed) VX-14S	
Function	Sampling frequency
Description	Sampling frequency setting
Setting command	Wave_Sampling_Frequency,p1
Parameter	p1 = "51200" p1 = "12800"
Request command	Wave_Sampling_Frequency?
Response data	d1
Returned value	Same as setting parameter
Note	Fs during waveform recording in vibration meter (VM) mode

Store Mode (with VX-14S installed) VX-14S	
Function	Store mode
Description	Store mode setting
Setting command	StoreMode,p1
Parameter	p1 = "Manual" p1 = "Auto"
Request command	StoreMode?
Response data	d1
Returned value	Same as setting parameter
Note	Vibration meter (VM) mode store setting

## Screen

Standard Frequency	
Function	Standard frequency
Description	Standard frequency acquisition
Request command	Standard_Frequency?
Response data	d1
Returned value	d1 = 0.0625000 to 10000.000
Note	Standard frequency for total harmonic distortion The minimum value, maximum value, and resolution vary depending on the frequency span.

Standard Frequency Index	
Function	Standard frequency index
Description	Standard frequency index setting
Setting command	Standard_Frequency_Index,p1
Parameter	p1 = 1 to 1600
Request command	Standard_Frequency_Index?
Response data	d1
Returned value	Same as setting parameter
Note	Reference frequency index for distortion calculation * The maximum value is (Number of current LINE)/2.

Total Harmonic Distortion	
Function	Total harmonic distortion
Description	Total harmonic distortion setting
Setting command	Total_Harmonic_Distortion,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Total_Harmonic_Distortion?
Response data	d1
Returned value	Same as setting parameter

Distortion Order	
Function	Distortion order
Description	Setting of harmonic order for distortion calculation
Setting command	Distortion_Order,p1
Parameter	p1 = 2 to 5
Request command	Distortion_Order?
Response data	d1
Returned value	Same as setting parameter

Measure Status	
Function	Measurement status
Description	Measurement status acquisition
Request command	Measure_Status?
Response data	d1="Stop" d1="WaitTrigger" d1="Measurement"
Returned value	d1

Store Elapsed Time	
Function	Store elapsed time (sec)
Description	Store elapsed time (sec) acquisition
Request command	Store_Elapsed_Time?
Response data	d1
Returned value	d1=0.000000 to 7200000.000000
Note	Elapsed store time can be checked during Auto Store. Maximum value is $200 \times 60 \times 60$

Units	
Function	System of units
Description	Setting of system of units
Setting command	Units,p1
Parameter	p1 = "SI" p1 = "Imperial"
Request command	Units?
Response data	d1
Returned value	Same as setting parameter

# Input/Output

Level Range	
Function	Input range
Description	Input range setting
Setting command	Level_Range,p1
Parameter	p1 = 1 to 7
Request command	Level_Range?
Response data	d1
Returned value	Same as setting parameter
Note	

Sensor Type	
Function	Sensor type
Description	Sensor type setting
Setting command	Sensor_Type,p1
Parameter	p1 = "PV-57I" p1 = "Other" p1 = "Mic." VX-14S
Request command	Sensor_Type?
Response data	d1
Returned value	Same as setting parameter

Sensitivity (PV-57I)	
Function	Sensor sensitivity (PV-57I)
Description	Sensor sensitivity (PV-57I) setting
Setting command	Sensitivity_(PV-57I),p1
Parameter	p1 = 0.100 to 99.9
Request command	Sensitivity_(PV-57I)?
Response data	d1
Returned value	Same as setting parameter
Note	Adapted to acceleration

Sensitivity (Other)	
Function	Sensor sensitivity (Other)
Description	Sensor sensitivity (Other) setting
Setting command	Sensitivity_(Other),p1
Parameter	p1 = 0.100 to 99.9
Request command	Sensitivity_(Other)?
Response data	d1
Returned value	Same as setting parameter
Note	Adapted to acceleration

Echo	
Function	Communication echo
Description	Communication echo setting
Setting command	Echo,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Echo?
Response data	d1
Returned value	Same as setting parameter

USB Class	
Function	USB communication
Description	USB communication setting
Setting command	USB_Class,p1
Parameter	p1 = "Off" p1 = "CDC" p1 = "CDC/MSC"
Request command	USB_Class?
Response data	d1
Returned value	Same as setting parameter

Ethernet DHCP	
Function	DHCP
Description	DHCP setting
Setting command	Ethernet_DHCP,p1
Parameter	p1 = "Off" p1 = "On"
Request command	Ethernet_DHCP?
Response data	d1
Returned value	Same as setting parameter

Ethernet IP	
Function	IP address
Description	IP address setting
Setting command	Ethernet_IP,p1
Parameter	p1 = 0.0.0.0 to 255.255.255
Request command	Ethernet_IP?
Response data	d1
Returned value	Same as setting parameter

Ethernet Subnet	
Function	Subnet mask
Description	Subnet mask setting
Setting command	Ethernet_Subnet,p1
Parameter	p1 = 0.0.0.0 to 255.255.255
Request command	Ethernet_Subnet?
Response data	d1
Returned value	Same as setting parameter

Ethernet Gateway	
Function	Default gateway
Description	Default gateway setting
Setting command	Ethernet_Gateway,p1
Parameter	p1 = 0.0.0.0 to 255.255.255
Request command	Ethernet_Gateway?
Response data	d1
Returned value	Same as setting parameter

FTP	
Function	FTP
Description	FTP setting
Setting command	FTP,p1
Parameter	p1 = "Off" p1 = "On"
Request command	FTP?
Response data	d1
Returned value	Same as setting parameter

TCP			
Function	TCP		
Description	TCP setting		
Setting command	TCP,p1		
Parameter	p1 = "Off" p1 = "On"		
Request command	TCP?		
Response data	d1		
Returned value	Same as setting parameter		

Sensitivity (Mic.) (with VX-14S installed) VX-14S				
Function	Sensor sensitivity (Mic.)			
Description	Sensor sensitivity (Mic.) setting			
Setting command	Sensitivity_(Mic.),p1			
Parameter	p1 = -99.9 to 10.0			
Request command				
Response data				
Returned value	Same as setting parameter			

CCLD power supply (with VX-14S installed) VX-14S				
Function	Sensor driver power supply (CCLD)			
Description	Configuration of sensor driver power supply (CCLD)			
Setting command	CCLD_Power_Supply,p1			
Parameter	p1 = "Off" p1 = "On"			
Request command	CCLD_Power_Supply?			
Response data	Response data d1  Returned value Same as setting parameter  Note Sensor type is PV-57I or Mic, CCLD power supply is always On.			
Returned value				
Note				

# Data output VX-14S

The return value format for each data output command (DOD, DRD, DLC) is of fixed length.

If there is no calculation result, it is output as invalid values.

The format for invalid values in each analysis mode is as follows.

Vibration meter (VM) mode: Value: OV: -
Time waveform (TIME) mode: Value:
FFT analysis mode:  Spectrum (Linear display):  Spectrum (Log display):  Total Harmonic Distortion:  OV: 0

The following values are output right-aligned, with any missing digits filled in with spaces.

Vibration meter (VM) mode: "xxxxxxxx"

FFT analysis mode spectrum (Log display): "xxxxxx

<sup>\*</sup> The symbol "\_" indicates a space.

DOD (with VX-14S installed) VX-14S					
Function	Output displayed value				
Description	The format of the response data varies depending on the analysis mode and the calculated values displayed on the screen.				
Request command	DOD?	DOD?			
Response data	d0,d1,d2, *The response data length in TIME and FFT modes varies depending on the number of analysis lines set.				
	VM	d0 d1 d2 d3 d4 d5 d6	"xxxxxxx" "xxxxxxx" "xxxxxxx" "xxxxxxx" "xxxxxx	Acceleration RMS_Instantaneous value / calculated value Acceleration PEAK_Instantaneous value / calculated value Acceleration crest factor_Instantaneous value / calculated value Velocity_Instantaneous value / calculated value Displacement_Instantaneous value / calculated value Acceleration overload information (logical sum of instantaneous OV and calculated OV) Velocity overload information (logical sum of instantaneous OV and calculated OV) Displacement overload information (logical sum of instantaneous OV and calculated OV) Point 0	
	FFT data must	d1 d2 d3 : d8191	<pre>"-x.xxxxxE±yy" "-x.xxxxxE±yy" "-x.xxxxxE±yy" : "-x.xxxxxE±yy"</pre>	Point 1 Point 2 Point 3 Point 8191 e FFT mode Y-axis scale on the display screen.	
Returned value	FFT LINEAR	d0 d1 d2 d3 d4 : d3201 d3202 d3203	"-x.xxxxxE±yy"  "-x.xxxxxE±yy"  "-x.xxxxxE±yy"  "-x.xxxxxE±yy"  :  "-x.xxxxxE±yy"  "-x.xxxxxxE±yy"  "-x.xxxxxxE±yy"	O.A. (Overall value) DC 6.25 Hz 12.5 Hz 18.75 Hz : 20 000 Hz THD (Total harmonic distortion) FFT Over * OV information is the logical sum of instantaneous OV and calculated OV	
	FFT Log	d0 d1 d2 d3 d4 : d3201 d3202 d3203	"xxxxxx" "xxxxxx" "xxxxxx" "xxxxxx" :: "xxxxxx"x.xxxxxE±0y" "0"/"1"	O.A. (Overall value) DC 6.25 Hz 12.5 Hz 18.75 Hz : 20 000 Hz THD (Total harmonic distortion) FFT Over * OV information is the logical sum of instantaneous OV and calculated OV	

DLC (with VX-14S installed) VX-14S				
Function	Final calculation result output			
Description	The format of the response data varies depending on the analysis mode:  VM mode: Outputs the last Auto store calculated value.  FFT mode: Outputs the most recent average calculation result.  If the calculation type is LIN+MAX, it is necessary to specify which calculation value to output using the "Average calculation display type mode" command.			
Request command	DLC?			
Response data	d0,d1,d2, *The response data length in TIME and FFT modes varies depending on the number of analysis lines set.			
Returned value	Data format (Auto) See DOD for the format Outputs an invalid value VM     d0     d1     d2     d3     d4     d5     d6     d7      Data format (FFT) See DOD for the format Outputs an invalid value FFT data must switch for FFT LINEAR d0     d1     d2     d3     d4      d3201     d3202     d3203  FFT Log     d0     d1     d2     d3     d4      d3201     d3202     d3203	if there is no calculat  "xxxxxxxx"  "xxxxxxxx"  "xxxxxxxx"  "xxxxxx	Acceleration RMS_Calculated value Acceleration PEAK_Calculated value Acceleration crest factor_Calculated value Velocity_Calculated value Displacement_Calculated value Acceleration overload information (calculated OV) Velocity overload information (calculated OV) Displacement overload information (calculated OV)	

DRD (with VX-14S installed) VX-14S				
Function	Continuous output of data at DRD intervals			
Description	The format of the response data varies depending on the analysis mode:  VM mode: Outputs the last Auto store calculated value.  FFT mode: Outputs the most recent average calculation result.  If the calculation type is LIN+MAX, it is necessary to specify which calculation value to output using the "Average calculation display type mode" command.			
Request command	DRD?			
Response data	d0,d1,d2, *The response data length in FFT modes varies depending on the number of analysis lines set.			
Returned value	VM (FFT data musi FFT LINEAR	d0 d1 d2 d3 d4 d5 d6 d7 d8 switch form d0 d1 d2 d3 d4	"xxx" "xxxxxxxx" "xxxxxxxx" "xxxxxxxx" "xxxxxx	Counter (1–600) Acceleration RMS_Instantaneous value Acceleration PEAK_Instantaneous value Acceleration crest factor_Instantaneous value Velocity_Instantaneous value Displacement_Instantaneous value Acceleration overload information Velocity overload information Displacement overload information e FFT mode Y-axis scale on the display screen.) O.A. (Overall value) DC 6.25 Hz 12.5 Hz 18.75 Hz
	FFT Log	: d3201 d3202 d3203 d0 d1 d2 d3 d4 :: d3201	: "-x.xxxxxE±yy" "-x.xxxxxE±0y" "0"/"1" "xxxxxx" "xxxxxx" "xxxxxx" "xxxxxx" :: "xxxxxx" :: "xxxxxx"	E 20 000 Hz THD (Total harmonic distortion) FFT Over  O.A. (Overall value) DC 6.25 Hz 12.5 Hz 18.75 Hz E 20 000 Hz
Note			"-x.xxxxxE±0y" "0"/"1"  ransmission code [ iilable when LAN co	THD (Total harmonic distortion) FFT Over SUB] (page 112). ommunication control is in use.

#### Execute

Screenshot	
Function	Screenshot
Description	Screenshot execute
Setting command	Screenshot,p1
Response data	p1 = "Start"

Write Resume	
Function	Resume write
Description	Resume write execute
Setting command	Write_Resume,p1
Response data	p1 = Start
Note	Writing set values to the resume area *The resume function is disabled during communication control.

## **Advanced Operation**

# 15

## **Trigger Function**

The trigger function can be used in time waveform (TIME) mode and FFT analysis mode. However, in FFT analysis mode, the trigger cannot be used for instantaneous events.

#### 15.1 Trigger operation mode

There are three types of trigger operation modes: "Free," "Repeat," and "Single".

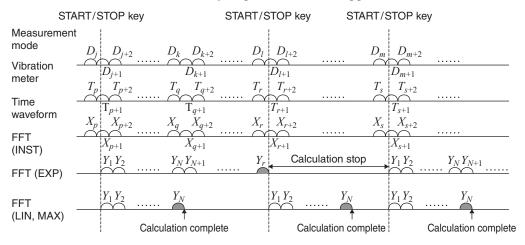
#### Note

- In vibration meter (VM) mode, only [Free] is available.

  If [repeat] and [Single] are selected, the setting will be ignored, and the mode will also operate in "Free" mode.
- Since data is not automatically saved for triggered measurements, press the Store key after the measurement is finished to save the necessary data.

#### Free

Calculation is carried out constantly, regardless of the trigger condition.



Exponential averaging

Weighting when performing exponential averaging

$$Y_k = \alpha Y_{k-1} + (1 - \alpha) X_k$$

$$\alpha = \exp^{-\frac{1}{N}}$$

Linear averaging

$$Y_k = \frac{\sum_{i=1}^k X_i}{k}$$

$$k = 1, 2, \dots, N$$

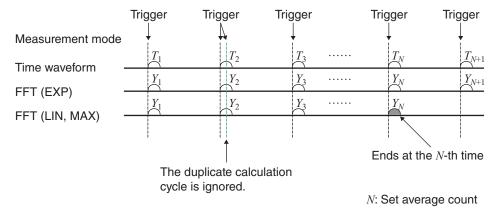
 $Y_k$ : k-th average value

 $X_k$ : k-th instantaneous value

N: Set average count

#### Repeat

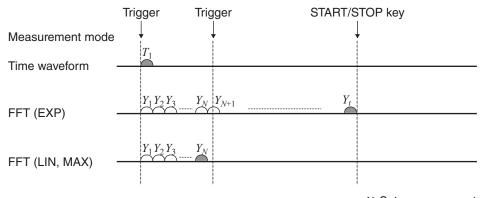
Calculation is carried out every time the trigger condition is met.



#### Single

Calculation is only carried out once, at the first trigger occurrence.

However, in FFT analysis mode (exponential averaging), calculation continues from the first trigger occurrence until the START/STOP key is pressed.



N: Set average count

#### 15.2 Trigger settings

#### 15.2.1 Making settings for repeat trigger and single trigger

On the [Menu] screen, select [Measure/Trigger] and press the MENU/ENT key.

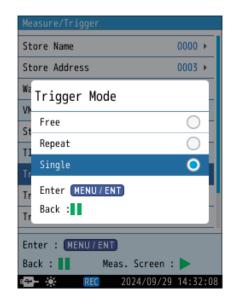
The [Measure/Trigger] screen appears.

On the [Measure/Trigger] screen, select [Trigger Mode] and press the MENU/ENT key.

The trigger operation mode selection screen appears.



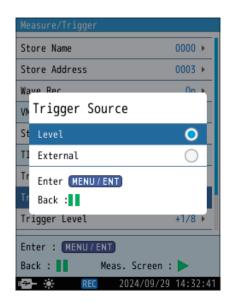
Select [Repeat] or [Single] and press the MENU/ ENT key.



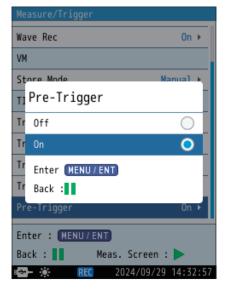
#### 4 Set [Trigger Source].

- 1. On the [Measure/Trigger] screen, select [Trigger Source] and press the MENU/ENT key.
- 2. Select the trigger source and press the MENU/ENT key.

Item	Description
Level	Sets the trigger source to the level trigger. (See page 152)
External	Sets the trigger source to the external trigger. (See page 152)



- 5 Set [Pre-Trigger] (page 153).
  - 1. On the [Measure/Trigger] screen, select [Pre-Trigger] and press the MENU/ENT key.
  - 2. Select [On] or [Off] and press the MENU/ENT key.
  - Note
     The unit does not have a post trigger function.



- When the [Trigger Source] has been set to [Level], the [Trigger Level] and [Trigger Slope] items must be set.
  - 1. On the [Measure] screen, select [Trigger Level] and press the MENU/ENT key.
  - 2. Set the trigger level and press the MENU/ENT key.

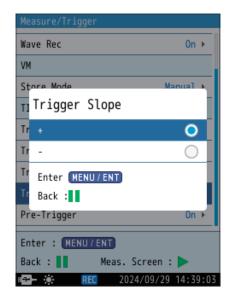
The trigger level can be selected from 15 levels, ranging from "-7/8" to "+7/8".

The value of the set trigger level, converted to the vibration amount, is displayed.

This level value is determined by the level range and vibration amount (acceleration, velocity, displacement, envelope) during operation, so changing these settings will also adjust this value accordingly.



- 3. Return to the [Measure/Trigger] screen. Select [Trigger Slope] and press the MENU/ENT key.
- **4.** Set the slope and press the MENU/ENT key. You can select [+] or [-].

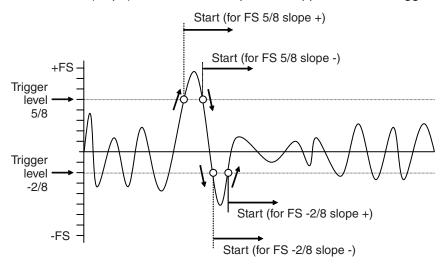


#### Level trigger

When the input level reaches the trigger level, calculation starts.

The trigger level can be set in 1/8 steps of the full-scale (FS) level, determined by the level range.

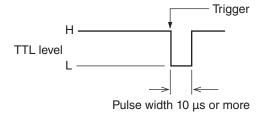
The direction (slope) from which the input level approaches the trigger level can be set to + or -.



#### External trigger

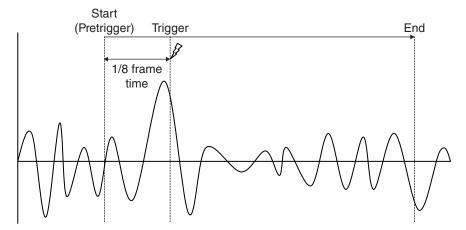
Calculation starts when an external signal is input.

When the falling edge of a TTL level signal (minimum pulse 10  $\mu$ s) is detected, or when the input is shorted, triggering occurs.



#### Pretrigger

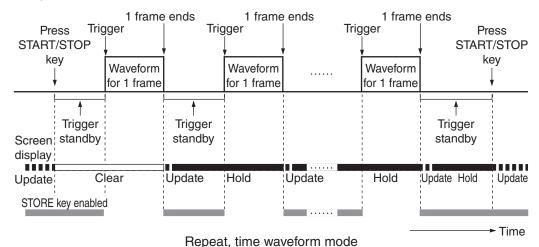
When triggering occurs, calculation starts and includes the data from a point preceding the current point by 1/8 frame time.



#### 15.3 Performing measurement with repeat trigger

#### 15.3.1 Time waveform (TIME) mode

The operation will be as follows:



Set the trigger operation mode to [Repeat] and make necessary settings (page 150).

#### Note

• During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.

Set these parameters before pressing the START/STOP key.

#### 2 Press the START/STOP key.

The "START" message appears.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.

#### Note

 To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no measurement will be made even if a trigger occurs.

To resume trigger operation, press the PAUSE/CONT key once more.

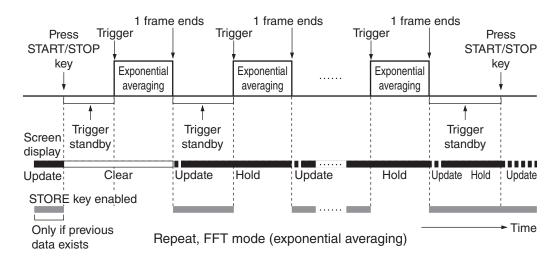
Whenever the trigger condition is met, the display is updated, and the display indication then is held until the next trigger occurrence.

#### 3 Press the START/STOP key to end the trigger operation.

The "STOP" message appears and the trigger operation is terminated.

The display reverts to the regularly updated condition.

#### 15.3.2 FFT analysis mode (exponential averaging)



## Set the trigger operation mode to [Repeat] and make necessary settings (page 150).

#### Note

- During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.
  - Set these parameters before pressing the START/STOP key.

#### 2 Press the START/STOP key.

The "START" message appears.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.

#### Note

• To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no measurement will be made even if a trigger occurs.

To resume trigger operation, press the PAUSE/CONT key once more.

Whenever the trigger condition is met, exponential averaging is carried out and the display is updated. The display indication then is held until the next averaging processing is completed.

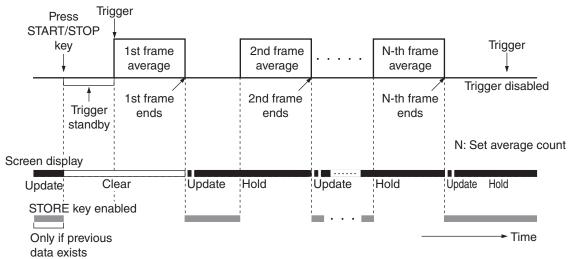
#### 3 Press the START/STOP key to end the trigger operation.

Then the "STOP" message appears and trigger operation is terminated.

The averaged data at this point are displayed.

If there was no trigger occurrence, no averaged data will be displayed when the trigger operation is terminated.

#### 15.3.3 FFT analysis mode (linear averaging, maximum hold)



Repeat, FFT mode (linear averaging, maximum hold)

### 1

## Set the trigger operation mode to [Repeat] and make necessary settings (page 150).



• During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.

Set these parameters before pressing the START/STOP key.

#### 2 Press the START/STOP key.

The "START" message appears.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.



• To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no measurement will be made even if a trigger occurs.

To resume trigger operation, press the PAUSE/CONT key once more.

Whenever the trigger condition is met, the display is updated.

The current average count shown on the left side of the display is incremented by one.

The display indication then is held until the next averaging is completed.

## When the current average count reaches the average count set on the FFT screen, the trigger operation is terminated.

Then the "STOP" message appears and trigger operation is terminated.

At this point, the linear averaged data or maximum hold data are displayed.

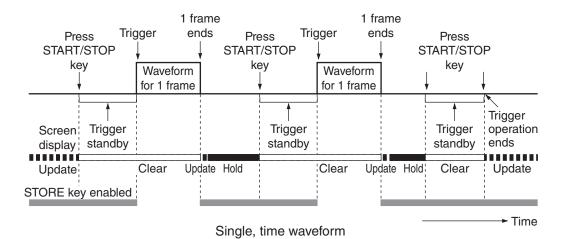
 To finish in the middle of measuring before the averaging calculation is completed, press the START/ STOP key.

The unit shows the averaged data calculated up to that point.

 If there was no trigger occurrence, no averaged data will be displayed when the trigger operation is terminated.

#### 15.4 Performing measurement with single trigger

#### 15.4.1 Time waveform (TIME) mode



1

#### Set the trigger operation mode to [Single] and make necessary settings (page 150).

- **■** Note
- During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.
   Set these parameters before pressing the START/STOP key.
- 2 Press the START/STOP key.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.

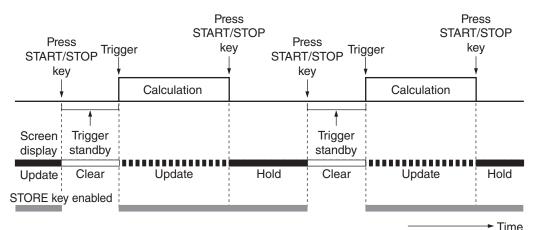
- Note
- To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no
  measurement will be made even if a trigger occurs.
   To resume trigger operation, press the PAUSE/CONT key once more.
- Trigger operation can be terminated by pressing the START/STOP key during trigger standby.

When the trigger condition is met, the "START" message appears, and the waveform for one frame is displayed. Next, the "STOP" message is shown.

The display indication is held.

• When you press the START/STOP key, the unit again goes into the trigger standby condition.

#### 15.4.2 FFT analysis mode (exponential averaging)



Single, FFT mode (exponential averaging)

## Set the trigger operation mode to [Single] and make necessary settings (page 150).

#### **■** Note

- During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.
  - Set these parameters before pressing the START/STOP key.

#### 2 Press the START/STOP key.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.

- Note
- To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no measurement will be made even if a trigger occurs.
  - To resume trigger operation, press the PAUSE/CONT key once more.
- Trigger operation can be terminated by pressing the START/STOP key.

  If there was no trigger occurrence, no data will be displayed when the trigger operation is terminated.

When the trigger condition is met, the "START" message appears, and exponential averaging is carried out. This continues until the START/STOP key is pressed.

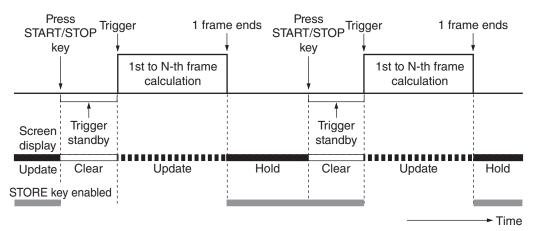
#### 3 Pressing the START/STOP key will terminate the trigger operation.

The "STOP" message appears and trigger operation is terminated.

The average value display indication at this point is held.

• When the START/STOP key is pressed once more, the unit goes into the trigger standby condition.

#### 15.4.3 FFT analysis mode (linear averaging, maximum hold)



Single, FFT mode (linear averaging, maximum hold)

1

#### Set the trigger operation mode to [Single] and make necessary settings (page 150).

- **■** Note
- During the trigger operation, measurement parameters such as the input range, frequency span, and number of analysis lines cannot be changed.
   Set these parameters before pressing the START/STOP key.
- 2 Press the START/STOP key.

The unit goes into the trigger standby condition, and the symbol flashes on the left side of the display.

- Note
- To pause the trigger operation, press the PAUSE/CONT key. While the trigger operation is paused, no measurement will be made even if a trigger occurs.
  - To resume trigger operation, press the PAUSE/CONT key once more.
- Trigger operation can be terminated by pressing the START/STOP key. If there was no trigger occurrence, no data will be displayed when the trigger operation is terminated.

When the trigger condition is met, the "START" message appears, and averaging calculation for the specified number of times is carried out.

When the averaging calculation for the specified number of times is completed, the trigger operation is terminated.

The "STOP" message appears and trigger operation is terminated.

The average value display indication at this point is held.

- When the START/STOP key is pressed once more, the unit goes into the trigger standby condition.
- To finish in the middle of measuring, press the START/STOP key.

# 16 Overlapping Display

In FFT analysis mode (graph display), the screen for displaying stored data can be shown together with the current measurement screen in an overlapping configuration. This makes a comparison of data easier.

#### 16.1 Performing the overlapping display

On the [Menu] screen, select [Display] and press the MENU/ENT key.

The [Display] screen appears.

On the [Display] screen, set the [Overlapping Display] item to [On] and press the MENU/ENT key.

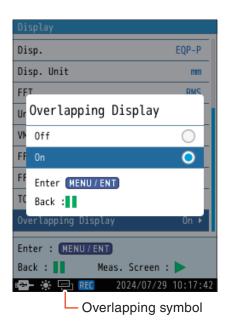
The overlapping symbol is shown on the status bar.

- Recall the data that you want to display overlapping with the measurement screen (page 98).
- On the recall measurement screen, press the MENU/ENT key.

The [Menu] screen appears.

On the [Menu] screen, select [Display] » [Save Overlap Data] and press the MENU/ENT key.

The overlapping data will be saved.



## Press the START/STOP key to return to the measurement screen and start the measurement.

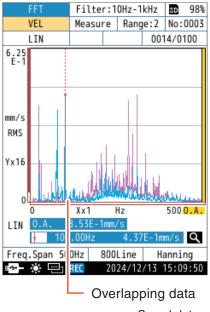
The saved data is displayed as a line graph in pink, while the current data is displayed in blue.

The stored data and the current data are now shown together in an overlapping configuration.

#### Note

- If stored data are not shown, set the [Overlapping Display] item in the [Display] screen to [On].
- Overlapping display is only possible if the following measurement parameters are identical for the recalled data and measurement data:

analysis mode, measurement data type, frequency span, and number of analysis lines.



: Saved data: Current data

#### 16.2 Canceling the overlapping display

On the [Menu] screen, select [Display] and press the MENU/ENT key.

The [Display] screen appears.

On the [Display] screen, set the [Overlapping Display] item to [Off] and press the MENU/ENT key.

To resume, set this setting to [On].

17

## Setup Files and Initialization

#### 17.1 Saving and loading setup files

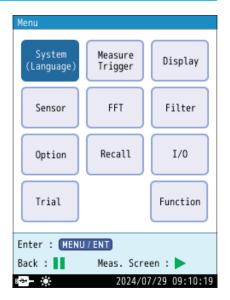
The configured settings can be saved on the unit and loaded as needed. If settings are accidentally changed, they can be restored by loading the previously saved settings

Up to 10 setup files can be saved in the unit's internal memory, and one setup file can be saved in the startup memory.

#### 17.1.1 Saving settings

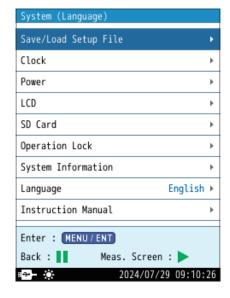
On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.

The [System (Language)] screen appears.



On the [System (Language)] screen, select [Save/Load Setup File] and press the MENU/ENT key.

The [Save/Load Setup File] screen appears.



Select where to save the setup file and press the MENU/ENT key.

The confirmation screen appears.

4 Select [Save] and press the MENU/ENT key.

The current settings of the unit are saved in the selected number.

Note

• The recall screen settings are not saved. Only the settings of the immediately preceding measurement screen will be saved.



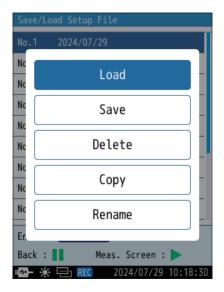
#### 17.1.2 Loading a setup file

Select the setup file you want to load and press the MENU/ENT key.

The confirmation screen appears.

2 Select [Load] and press the MENU/ENT key.

The setup file will be loaded.



#### Startup file loading function

If there are startup files in either the internal memory of the unit or on the SD card, a selection screen will appear when the unit is powered on, prompting you to choose whether or not to load a startup file.

Item	Description
NO	Starts up with the settings that were active the last time the power was turned off. Does not load settings from the startup file.
SD	Loads the settings from the startup file on the SD card.
Internal memory	Loads the settings from the startup file in the internal memory of the unit.

#### Note

- When you load settings from a file, the current settings will be overwritten.
- Before loading the settings file, we recommend saving the current settings if necessary.

#### 17.1.3 Saving a setup file to startup

On the [Save/Load Setup File] screen, select [Start Up] and press the MENU/ENT key.

The confirmation screen appears.

2 Select [Save] and press the MENU/ENT key.

The current settings of the unit are saved in the [Start Up] of the internal memory.



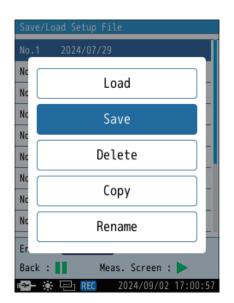
#### 17.1.4 Saving a setup file to startup (SD)

On the [Save/Load Setup File screen], select [Start Up (SD)] and press the MENU/ENT key.

The confirmation screen appears.

2 Select [Save] and press the MENU/ENT key.

The current settings of the unit are saved in the [Start Up (SD)] of the internal memory.

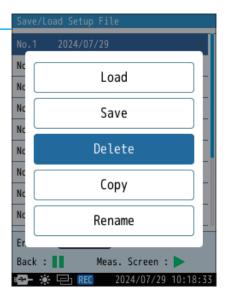


#### 17.1.5 Deleting a setup file

On the [Save/Load Setup File screen], select the setup file you want to delete and press the MENU/ENT key.

The confirmation screen appears.

2 Select [Delete] and press the MENU/ENT key.



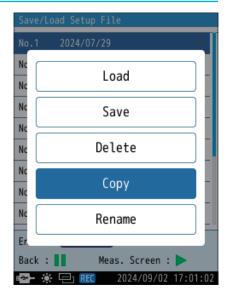
#### 17.1.6 Copying a setup file

On the [Save/Load Setup File] screen, select the setup file you want to copy and press the MENU/ENT key.

The confirmation screen appears.

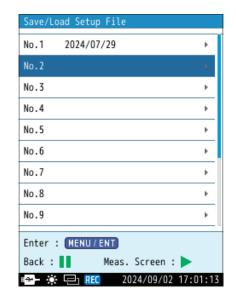
2 Select [Copy] and press the MENU/ENT key.

The destination selection screen appears.



Select the desired No. to write to and press the MENU/ENT key.

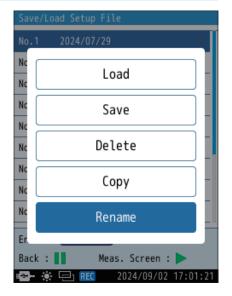
"Copied." is displayed.



#### 17.1.7 Renaming a setup file

On the [Save/Load Setup File screen], select the setup file you want to rename and press the MENU/ENT key.

The confirmation screen appears.



Enter the new name using alphanumeric characters and press the MENU/ENT key.

The message "The name was changed." is displayed. The input is limited to a maximum of 8 characters.

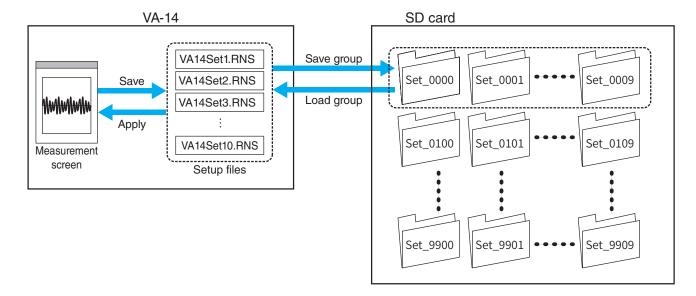


#### SD card setting group save function

You can save the settings of the unit onto an SD card.

Up to 10 settings saved in the unit can be managed as a group on the SD card.

The SD card can store settings for 100 groups (up to 1000 settings).



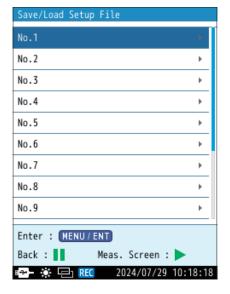
#### 17.1.8 Saving settings on SD card as a group

On the [Save/Load Setup File] screen, select [Setting Group (SD)] and press the MENU/ENT key.

The [Setting Group (SD)] screen appears.

Select the group No. to save the settings and press the MENU/ENT key.

The setup file group name entry screen appears.



Press the MENU/ENT key when "Copy to this group" is displayed.

The settings are saved as a group on the SD card.



#### 17.1.9 Loading a setup file group from SD card

- Note
- When a group of setup files is loaded, setup files in the unit will be overwritten.
- If necessary, you should save the current setup files on the SD card before loading a new group of files.
- On the [Save/Load Setup File] screen, select [Setting Group (SD)] and press the MENU/ENT key.

The [Setting Group (SD)] screen appears.

Select the group No. to load and press the MENU/ ENT key.



Select [Copy to Internal group] and press the MENU/ENT key.

Select [YES] and press the MENU/ENT key to load the setup file group.



#### 17.1.10 Deleting a setup file group from SD card

On the [Save/Load Setup File] screen, select [Setting Group (SD)] and press the MENU/ENT key.

The [Setting Group (SD)] screen appears.

2 Select the setup file group to delete and press the MENU/ENT key.



3 Select [Delete].

Select [YES] and press the MENU/ENT key to delete the setup file group.



#### 17.1.11 Renaming a setup file group from SD card

On the [Save/Load Setup File] screen, select [Setting Group (SD)] and press the MENU/ENT key.

The [Setting Group (SD)] screen appears.

Select the setup file group to rename and press the MENU/ENT key.



Enter the new name using alphanumeric characters and press the MENU/ENT key.

The message "The name was changed." is displayed. The input is limited to a maximum of 8 characters.



### 17.2 Restoring factory default settings

To return the settings to their default values, follow these steps:

- 1. On the [Save/Load Setup File] screen, select [Default Factory Settings] and press the MENU/ENT key.
- 2. The confirmation screen appears. Select [OK] and press the MENU/ENT key.

#### Default settings

The factory default settings for the main setting items are listed below.

Item		Default value	
Out to the	Power	Battery Type	Alkaline
	LCD	Brightness	Dark
		Backlight Auto Off	3 m
System	Operation Lock	Authority	Authorized
	System Information	Index Number	0001
	Language	Language	English
	Store Name		0000
	Store Address		0001
Measure/Trigger	Wave Rec		Off
	Store Mode		Manual
	Trigger Mode		Free
	Display Characteristics		Standard Setting
	Unit System		SI Units
	VM Mode Scale		Linear
Display	FFT X Unit		Hz
	FFT Scale		Linear
	Top10 List		Off
	Overlapping Display		Off
	Windows Func.		Hanning
FFT	Operation Type		LIN
FFT	Average Number		1
	Total Harmonic Distortion		Off
	Filter Setting		Common
Filter	High Pass Filter		3 Hz
	Low Pass Filter		5 kHz
Function	Assignment		Backlight

18

## Operation Lock / Key Lock

#### 18.1 Operation lock

When the operation lock is enabled, the number of analysis lines, filter coefficients, and window functions cannot be operated.

Additionally, the FREQ SPAN / LINE key will not function on the time waveform (TIME) screen and FFT analysis mode screen.

If a password is set to lock the operation, the password will be required to unlock it.

- On the [Menu] screen, select [System (Language)] and press the MENU/ENT key.
- On the [System (Language)] screen, select [Operation Lock] and press the MENU/ENT key.
- On the [Operation Lock] screen, select [Authority] and press the MENU/ENT key.
- Use the  $\triangle$ / $\overline{\lor}$  keys to select [Authorized] and press the MENU/ENT key.

The operation lock symbol is shown on the status bar.



- When using FTP, set a password of at least one character in this item, and use it as the password for access.
- If you forget the password, you can reset the device to factory settings to unlock the operation.



Operation lock symbol

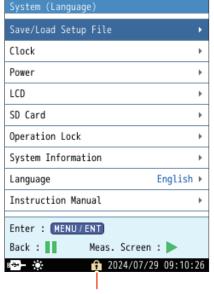
#### 18.2 Key lock

When the key lock is enabled, basic key operations are disabled. However, pressing and holding the POWER key will turn the power off.

To enable key lock, press and hold the description in the lock in th

The key lock symbol appears on the status bar.

Press and hold the 
/ keys simultaneously during key lock to unlock it.



Key lock symbol

# 19

## **Function Key**

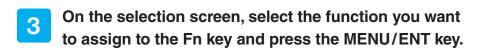
You can assign several functions to the Function key.

On the [Menu] screen, select [Function] and press the MENU/ENT key.

The [Function Key] screen appears.

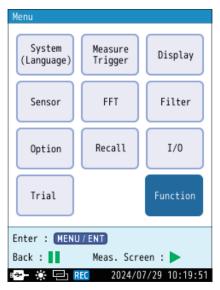
On the [Function Key] screen, select [Assignment] and press the MENU/ENT key.

The selection screen appears.

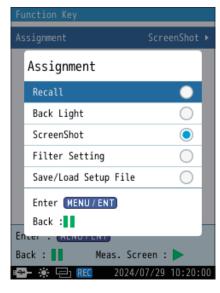


For information related to Assignment, refer to the following sections.

Item	See page
Recall	Page 98
Back Light	Page 40
Screenshot	Page 96
Filter Setting	Page 54
Save/Load Setup File	Page 162







# 20 Calibration

## 20.1 Basic relationship between the physical quantity to be measured and the recorded data

The sensor responds to the applied physical quantity and outputs a voltage (electrical signal).

However, even if the same physical quantity is applied, replacing the sensor with one of different sensitivity will result in a different output voltage.

For this reason, commercially available sensors are typically accompanied by performance charts that specified the unique sensitivity of each sensor.

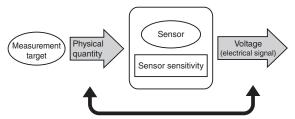
Sensor sensitivity is expressed as the magnitude of the voltage output by the sensor when a unit physical quantity is applied, as shown in the following example.

#### Example:

- Sensitivity of a built-in amplifier type accelerometer: 6.42 mV/(m/s²)
  - When a unit acceleration of 1 m/s<sup>2</sup> is applied, this accelerometer outputs a voltage of 6.42 mV.
- Sensitivity of a microphone: -28 dBV/Pa
  - When a unit sound pressure of 1 Pa is applied, this microphone outputs a voltage of approximately 28 dBV ≈ 0.04 V.

Once the "sensor sensitivity" is known, the physical quantity applied to the sensor can be calculated from the sensor's output voltage using the following equation:

Physical quantity = (1 / Sensor sensitivity) × Sensor output voltage



Physical quantity = (1 / Sensor sensitivity) × Sensor output voltage

#### 20.2 Calibration

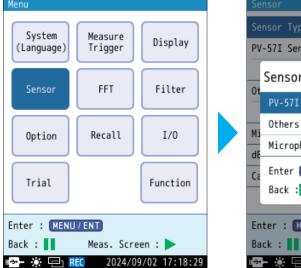
To obtain accurate measurement results, please calibrate the device according to the connected sensor before measurement

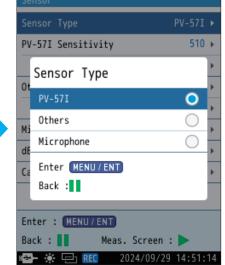
Calibration can be performed using the calibration exciter VE-10.



## On the [Menu] screen, select [Sensor] and choose the connected sensor from the [Sensor Type].

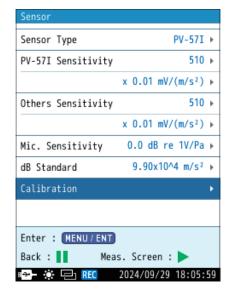
If necessary, select [CCLD] and choose [On] (see page 189).





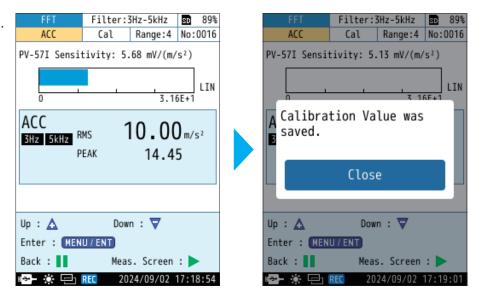
On the [Sensor] screen, select [Calibration] and connect the calibration exciter VE-10.

Refer to the VE-10 instruction manual for handling the calibration exciter and installing the sensor.



Press the  $\triangle$ / $\overline{\forall}$  keys to adjust the sensitivity to match the displayed value, and then press the MENU/ENT key.

The calibration value is saved.



# 21

## Optional Programs

By installing the function extension program VX-14S, the following functions are added (page 35):

- · Data transfer function via communication
- · Auto store function
- Long-time waveform recording function
- General input function
- dB reference value change function
- Microphone and preamplifier connection function
- PEAK calculation function (velocity and displacement)

Symbol	Description
VX-14S	Indicates a function granted by the function extension program VX-14S.

#### 21.1 Trial Version

When the trial version function is enabled, the optional program VX-14S can be used for 30 days.

Select [Trial] on the [Menu] screen and press the MENU/ENT key.

The [Trial Version] screen appears.

2 Select [VX-14S] and press the MENU/ENT key.

The selection screen appears.



On the selection screen, select [YES] and press the MENU/ENT key.

The trial version is activated, and the available usage period is displayed. Once the trial version function is enabled, it cannot be changed.



#### 21.2 Data transfer function via communication

Adds a command for obtaining measured values via command control.

For details on the corresponding commands, see the communication commands section (page 114).

#### 21.3 Auto store function

Operates in VM mode.

The instantaneous values at each set instantaneous value store interval and the calculated values at each set calculation store interval are recorded continuously.

When Auto Store is stopped, the stored data is saved to the SD card.

Switching the store mode is done via [Store Mode] for VM in the [Measure/Trigger] screen.

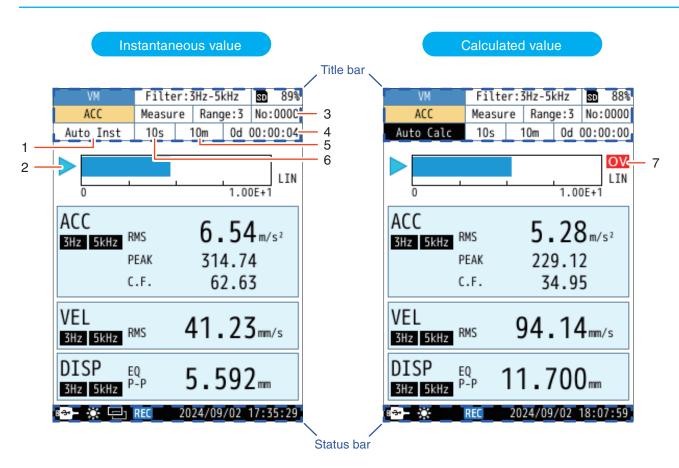
# Total measurement time, calculated value store interval, and instantaneous value store interval 1 h Total measurement time: 1 h Calculated value store interval: 10 s Calculated value store interval: 10 s Calculated value store st

#### **■** Note

• When operating the unit with just an external power supply, if the unit is turned off when the external power supply turns off, the auto-file-closing and auto-shutdown operations will not be performed, and so we recommend installing new batteries in the main unit. However, make sure to set the power-on mode switch to the A side (page 34).

(START/STOP)

#### 21.3.1 Auto store screen



1	Instantaneous value / Calculated value	[Auto Inst] or [Auto Calc] is displayed.	
2	Operation status indicator	Measurement pause (PAUSE/CONT key pressed during instantaneous value measurement)  Storing in progress	
3	Store name	Shows the store name that will be used when storing data on the SD card.  Pressing the START/STOP key with a store name that already contains data will prompt you to choose between [No], [Raise one store name], or [Overwrite and meas.] to start the store.	
4	Elapsed time since the start of measurement	Displays the elapsed time since the start of measurement.	
5	Total measurement time	Up to 200 hours can be set.	
6	Calculated value store interval	Configured calculated value store interval is displayed.	
7	Overload display	This appears when an overload occurs during calculation, remaining on the calculation result screen until the next calculation measurement begins.  If momentary overload has occurred, the overload indication in shown. The indication goes out a second after the overload condition has been cleared.  After a momentary overload occurs, overload occ	

# 21.3.2 Key operations in Auto Store

The main key operations in the Auto store are as follows

Name	Description
Store key	No function.
START/STOP key	Used to start and stop the measurement.
<u>A</u> /▽ keys	Invalid.
<li></li> <li>&lt;</li>	Switches between the level bar display and the time-level graph display on the instantaneous value store (Auto Inst) screen.
INST/AVE key	Switches between the instantaneous value store screen and the calculated value store screen.

#### 21.3.3 Total measurement time

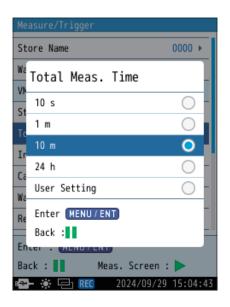
Calculation measurement can be performed according to the set measurement time.

- Select [Measure/Trigger] on the [Menu] screen.
- Select [Total Meas. Time] on the [Measure/Trigger] screen and press the MENU/ENT key.
- Select one of the following units and press the MENU/ENT key.

[10 s], [1 m], [10 m], [24 h], [User setting] (1 to 59 s, 1 to 59 m, 1 to 200 h)



 Set the total measurement time to a value equal to or greater than the calculation value store interval.



#### 21.3.4 Instantaneous value store interval

Calculation measurement can be performed according to the set measurement time.

From the start of measurement until either measurement stops or the total measurement time is reached, continuously records the measurement values at the specified instantaneous value store interval.

- Select [Measure/Trigger] on the [Menu] screen.
- Select [Inst. Store Interval] on the [Measure/Trigger] screen and press the MENU/ENT key.
- Select one of the following units and press the MENU/ENT key.

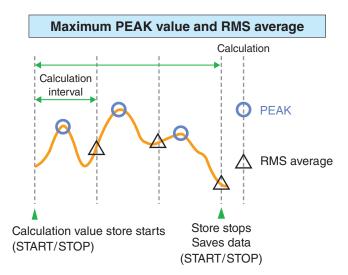
[Off], [100 ms], [1 s]

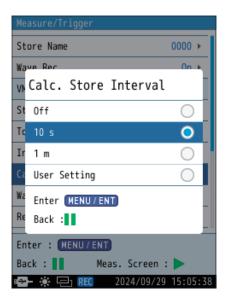


#### 21.3.5 Calculated value store interval

Calculation measurement can be performed according to the set measurement time.

From the start of measurement until either measurement stops or the total measurement time is reached, calculates and continuously records the calculated values at the specified calculated value store interval. The calculated values vary depending on the indicator characteristics. When acceleration, velocity, or displacement is set to "PEAK", the maximum PEAK value during the measurement period is stored. When set to anything other than "PEAK", the average value is stored.





- Select [Measure/Trigger] on the [Menu] screen.
- Select [Calc. Store Interval] on the [Measure/Trigger] screen and press the MENU/ENT key.
- 3 Select one of the following units and press the MENU/ENT key.

[Off], [10 s], [1 m], [User Setting] (10 to 59 s, 1 to 59 m, 1 h)

When the Auto Store function is enabled, the address cannot be changed and the store name is displayed. Data management is possible using the store name.

#### **■** Note

- Measurement cannot be started when both the instantaneous value store interval and the calculation store interval are set to Off.
- The pause function cannot be used after measurement begins.

# 21.3.6 Measurement time available in Auto Store mode

#### Potential measurement duration

The approximate measurement time or the number of available addresses for measurements on the SD card is as follows.

Measurement duration when storing instantaneous values

Instantaneous value steve interval	SD card capacity		
Instantaneous value store interval	512 MB	2 GB	32 GB
100 ms	160 h	660 h	10 100 h
1 s	1 600 h	6 600 h	101 000 h

<sup>\*</sup>Calculated value store interval: Off

· Number of available addresses for measurement when storing calculated values

	SD card capacity	
512 MB	2 GB	32 GB
5 990 000	24 000 000	365 000 000

<sup>\*</sup>Instantaneous value store interval: Off

#### Measurement stop conditions

The store will stop and data will be saved if any of the following conditions occur during Auto Store:

- · When it reaches the set total measurement time
- When the remaining space on the SD card reaches 1 MB
- When the battery capacity symbol starts flashing red

# 21.4 Long-time waveform recording function

#### 21.4.1 Long-time waveform recording function

Time waveforms within an Auto store section can be recorded as a WAVE file.

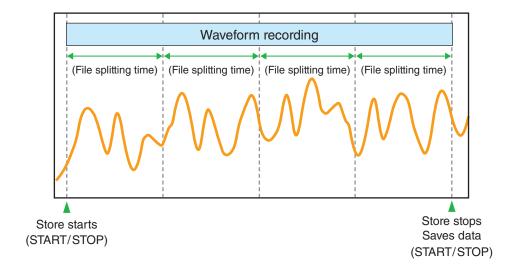
Press the START/STOP key to begin Auto Store and recording. Data is automatically stored each time the set instantaneous value store interval and calculated value store interval elapse.

To stop waveform recording, press the START/STOP key. Additionally, waveform recording will automatically end when the set total measurement time is reached.

When the remaining space on the SD card reaches 10 MB, waveform recording will stop, and only store data will be recorded.

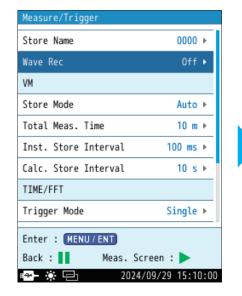
When the battery capacity symbol starts flashing red, waveform recording will stop, and the data will be saved.

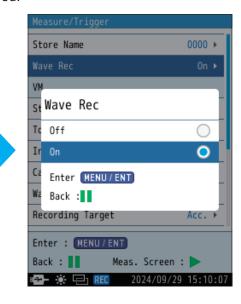
- \*Data is saved in segments according to each waveform recording period.
- \*The PAUSE/CONT key (Pause function) is not available during waveform recording.



- On the [Menu] screen, select [Measure/Trigger] and press the MENU/ENT key.
- On the [Measure/Trigger] screen, select [Wave Rec] » [On], and press the MENU/ENT key.

The items [Wave Sampling Freq.] and [Recording Target] are displayed.

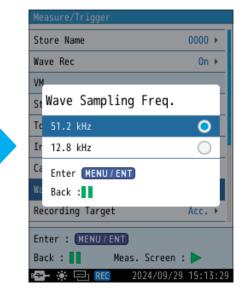




3

# In the [VM] menu, select [Wave Sampling Freq.] and [Recording Target], then press the MENU/ENT key.





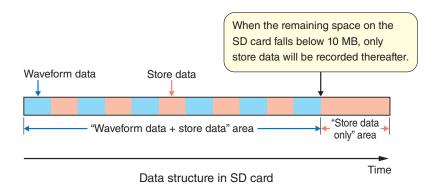
Item	Description
Wave sampling frequency	Select the recording sampling frequency from [51.2 kHz] or [12.8 kHz]. When the recording sampling frequency is 51.2 kHz, data up to 20 kHz can be recorded. At 12.8 kHz, data up to 5 kHz can be recorded.
Recording target	Select the waveform target from [Acceleration], [Velocity], or [Displacement].
Bit length	16 bit
File splitting interval	1 h

## 21.4.2 Waveform recording time

#### SD card capacity and waveform recording time

Data recording on the SD card is performed in two areas: the "waveform data (WAVE file) + store data" area and the "store data only" area.

When the remaining space on the SD card reaches 10 MB, recording in the "waveform data + store data" area stops, and only store data is recorded in the "store data only" area.



\* The amount of store data and waveform data varies depending on settings such as instantaneous value store interval, calculated value store interval, and sampling frequency.

If multiple short-duration waveform data files are created, additional memory areas are allocated, which can reduce the maximum waveform recording time by approximately 20%.

The estimated recording time on the SD card is as follows:

Compling fraguency	SD card capacity		
Sampling frequency	512 MB	2 GB	32 GB
51.2 kHz	1 h 15 min	5 h 10 min	80 h
12.8 kHz	5 h	20 h 40 min	330 h

<sup>\*</sup> Instantaneous value store interval: 100 ms, calculated value store interval: Off

<sup>\*</sup> The maximum total measurement time for a single Auto Store session is 200 hours.

# 21.5 General input function

The On/Off setting of the sensor drive power supply (CCLD) at the input terminal can be set.

When set to Off, AC voltage signals can be input.

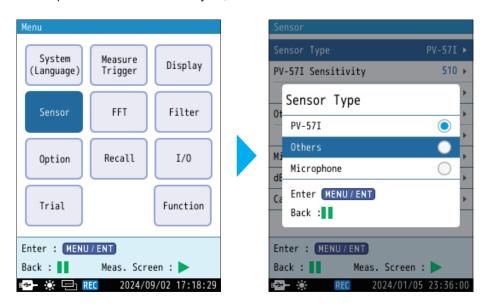
The input voltage range is from 0.0287 mV to 5100 mV (rms).

#### 🖹 Note

• When connecting accelerometers with built-in amplifiers or charge converters, set this function to On. If set to Off, power will not be supplied to these devices, resulting in incorrect measurements.

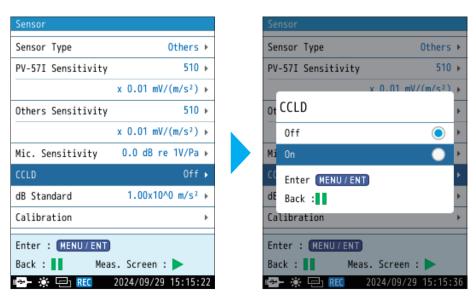
# On the [Menu] screen, select [Sensor] » [Sensor Type] » [Other], and press the MENU/ENT key.

The [CCLD] option appears, allowing you to set the setting On/Off. When set to On, AC signals can be input into the unit for analysis, etc.



# 2 Select [CCLD] » [On], and press the MENU/ENT key.

The message "Do you want to turn on CCLD? Check the sensor to be connected." is displayed. Verify the connected sensor before switching to [On].



# 21.6 dB reference value change function

By selecting [PV-57I] or [Others] for [Sensor Type], the dB reference value can be changed.

The dB reference value is used in calculations when [Log] is selected for the VM mode scale and FFT analysis mode Y-axis scale.

The conversion formula between linear scale and logarithmic scale using the dB reference value can be expressed as follows:

$$x_{\rm dB} = 20 \log_{10}(x_{linear}/x_{standard})$$

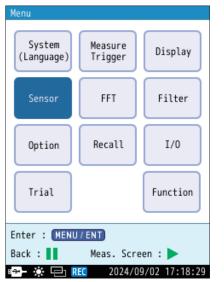
 $\mathcal{X}_{dB}$ : Value on the logarithmic scale

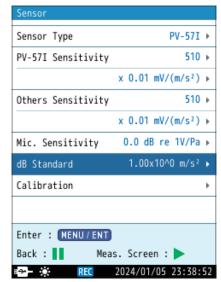
 $\mathcal{X}_{linear}$ : Value on the linear scale

 $\mathcal{X}_{standard}$ : dB reference value

# On the [Menu] screen, select [Sensor] » [dB Standard], and press the MENU/ENT key.

The dB reference value options will be displayed.





# 2 Set the dB reference value and press the MENU/ENT key.

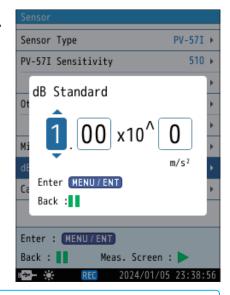
Use the  $\leq$ / $\bowtie$  keys to select the digit to change, and then use the  $\triangle$ / $\bigtriangledown$  keys to adjust the value.

Holding down the  $\triangle/\nabla$  keys changes the value more quickly.

When the correct value has been set, press the ENT key to accept the setting.

To cancel the procedure without changing the current setting, press the PAUSE/CONT key.

The cursor returns to the menu item name, and the setting value reverts to the previous condition.



#### Note

- Regardless of the unit setting, the dB reference value is set in m/s2.
- The set dB reference value is applied to both velocity (m/s) and displacement (mm).
- Before making any changes, the default value is set to 1 m/s<sup>2</sup>.
- When [Microphone] is selected for [Sensor Type], the dB reference value is fixed at 20 μPa.
- Changing the dB reference value will adjust the upper and lower limits of the graphs in both the vibration meter (VM) mode and FFT analysis mode.

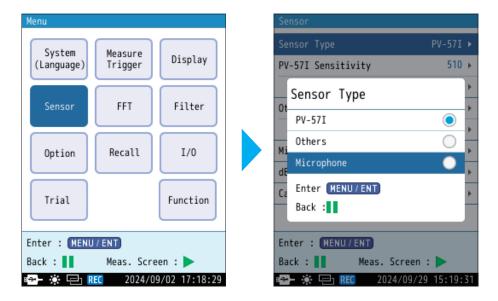
# 21.7 Microphone and preamplifier connection function

By selecting a microphone as the sensor and entering the sensitivity, the sound pressure level measurement becomes possible.

When a microphone is selected, only FFT analysis mode is available.

1

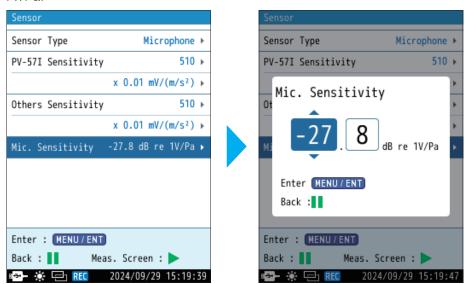
On the [Menu] screen, select [Sensor] » [Sensor Type] » [Microphone], and press the MENU/ENT key.



Select [Mic. Sensitivity] and enter the sensitivity of the connected microphone and preamplifier.

#### Example:

When connecting the UC-59 and NH-22A, input the value as -27.8 dB, since the UC-59 is -27 dB re 1V/Pa and the NH-22A is -0.8 dB re 1V/Pa.



#### Note

- The dB reference value is 20 μPa.
- Sound pressure measurement range for UC-59 is 42 dB to 138 dB.

# 21.8 PEAK calculation function (velocity, displacement)

PEAK values for velocity and P-P value for displacement can be detected in VM mode.

The maximum peak values for velocity is calculated based on the assumption that EQ PEAK is measurable as before and that the RMS is derived from a sinusoidal waveform.

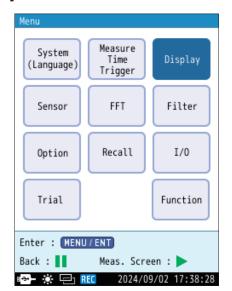
These relationship are RMS  $\times \sqrt{2}$  = EQ PEAK, RMS  $\times \sqrt{2}$  = EQ P-P.

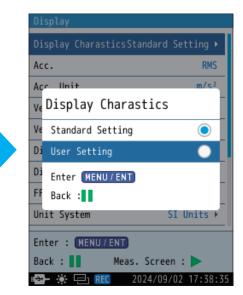
These function allows the detection of PEAK value in the amplitude waveforms of velocity and EQP-P in the amplitude waveforms of displacement.

By measuring true PEAK values that were previously unmeasurable, it enables more accurate and precise vibration measurements.

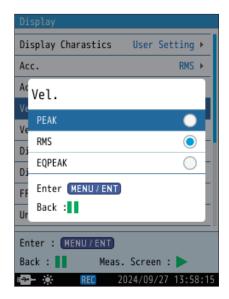
1

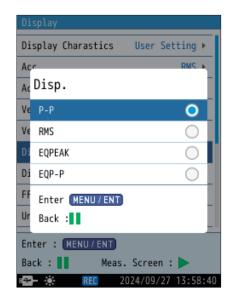
On the [Menu] screen, select [Display] » [Display Charastics] » [User Setting], and press the MENU/ENT key.





2 Select [PEAK] under [Vel.] and [P-P] under [Disp.].





Note

EQ PEAK may show a lower value than PEAK, indicating that there could actually be higher vibration levels. By using the PEAK function to accurately measure potential damage to machinery, maintenance can be performed at the appropriate time, leading to safer and longer operation.

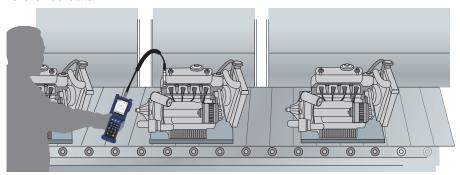
# Typical Measurements

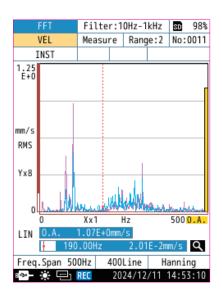
# 22.1 Product quality inspection

Product inspection and detection of abnormal vibrations on the production line can be performed by frequency analysis.

For example, by focusing on a particular frequency, the system determines whether frequency components near that frequency are present.

In addition, the frequency spectrum of a good product is used as reference data, and acceptability of the product is determined by comparing it with the reference data.





# 22.2 Precision diagnosis of rotating machinery

Precision diagnosis is used to identify the cause, degree, and location of abnormalities.

### 22.2.1 Bearing

Bearing abnormality is indicated by a large amount of acceleration.

Envelope analysis shows the equally spaced peaks as shown in the figure.

If the size of each bearing part, the number of rolling elements, and the shaft speed are known, the failure location can be determined from the primary frequency of the peaks.

RMS

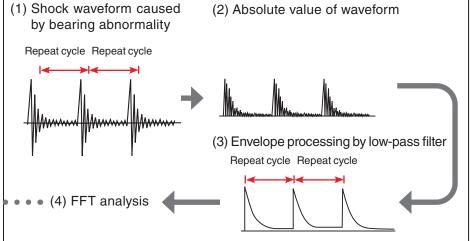
Yx1

0.000 Xx1 Hz 500.000 0.A.

LIN 0.A. 4.67E+0

Freq.Span 500Hz 400Line Hanning

In diagnosing bearing failures, it is necessary to know the repeat cycle of the shock waveform, so envelope processing (acceleration envelope processing) is used. Envelope processing is performed as shown in the figure.

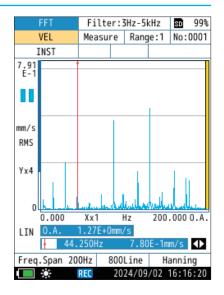


#### 22.2.2 Misalignment

Misalignment results in significant vibrations in the axial direction that are integer multiples of the rotational frequency.

The specific multiple depends on the type of bearing joint.

In this example, a vibration frequency of 3 times the rotational frequency is significantly observed.

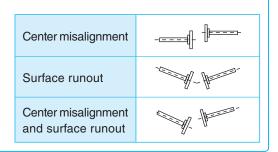


#### Note

#### What is misalignment?

This refers to a shaft alignment failure, where the centerlines of rotation of two rotary shafts coupled by a coupling are not aligned. It includes conditions such as center misalignment, surface runout, and a combination of these states.

When misalignment occurs, the thrust load on the bearing increases due to runout, reducing the bearing's life.



#### 22.2.3 Unbalance

In unbalance, only the frequency component that matches the rotational frequency appears significantly in the circumferential direction.

Almost no other frequencies are generated. The amplitude is proportional to the amount of unbalance.

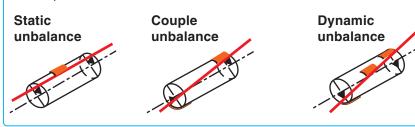
As the rotational frequency increases, the amplitude is proportional to the square of the rotational frequency.

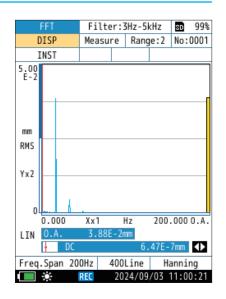
#### Note

#### What is unbalance?

Unbalance occurs when the center of gravity of a rotating body is offset from the center.

Static unbalance, couple unbalance, and dynamic unbalance are examples. Unbalance increases the circumferential load on the bearing and reduces its lifespan.



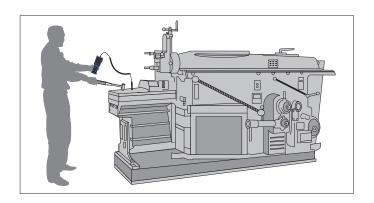


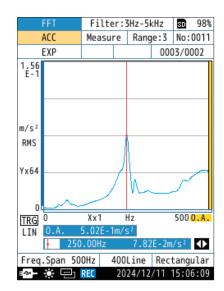
# 22.3 Resonant frequency measurement of a structure

When an external force with a frequency close to the resonant frequency is applied, the structure will vibrate significantly. This can cause damage to machinery, product defects, etc. To prevent such occurrences, it is important to measure the resonant frequency.

In the figure on the right, there is a resonant frequency of 250 Hz.

Resonant frequencies can be determined by applying vibrations to the structure with a hammer or a similar tool and analyzing the resulting vibration frequencies.





# Examples of Settings for Typical Measurements

#### Note

• When measuring vibration with the magnet attachment VP-53S connected, applying grease or similar substances between the structure and the magnet attachment can increase the contact area, leading to more accurate measurements.

The following items are example settings for some typical measurements. Only the minimum settings required for the measurement are listed.

The input range should be set to match the magnitude of the vibration to prevent overload.

# 23.1 Diagnosis of unbalance and misalignment

To diagnose structural abnormalities such as unbalance or misalignment, vibration velocity should be measured. The diagnosis involves measuring the bearing in three directions: horizontal (H), vertical (V), and axial (A). The direction with the highest vibration is used for the diagnosis.

For a simple diagnosis, the Vibration meter (VM) mode is used to assess the magnitude of vibration velocity (RMS value).

If the vibration velocity exceeds the judgment criteria and judged as abnormal in the simple diagnosis, a precision diagnosis is then performed. The time waveform (TIME) mode and FFT analysis mode are used to identify the location and cause of the abnormalities. In cases of unbalance, only the rotational frequency component appears, whereas in cases of misalignment, both the rotational frequency component and its harmonic components appear. Vibration velocity is related to vibration severity, a comprehensive measure of vibration intensity. Therefore, if the vibration velocity increases, it may indicate the presence of other abnormalities.

#### Basic settings

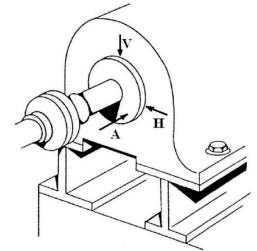
High-pass filter	10 Hz
Low-pass filter	1 kHz

#### ■ Simplified diagnosis

Measurement mode	Vibration meter (VM) mode
Measurement data	Vibration velocity (rms value)

#### Precision diagnosis (time waveform)

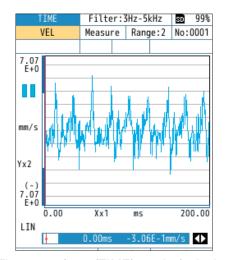
Measurement mode	Time waveform (TIME) mode
Measurement data	Vibration velocity
Analysis frequency, number of analysis lines	Set so that the time waveform can be observed

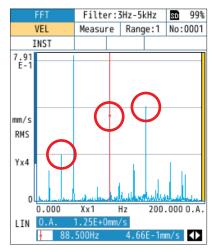


#### Precision diagnosis (frequency analysis)

Measurement mode	FFT analysis mode
Measurement data	Vibration velocity
Time window function	Hanning
Analysis frequency	200 Hz for unbalance, 200 Hz or 500 Hz for misalignment
Number of analysis lines	Set so that the frequency resolution is finer than 1 Hz
Average function	Use as needed

Analysis example of misalignment: 14.75 Hz is the rotational frequency, 3x (44.25 Hz) and 6x (88.5 Hz) harmonics generated.





Time waveform (TIME) mode (velocity)

FFT mode (velocity)

# 23.2 Bearing diagnosis

Diagnosis involves measuring vibration acceleration values, as progressive bearing abnormalities will result in increased vibration acceleration values.

The direction of measurement can be horizontal, vertical, or axial, but the accelerometer should be placed as close to the bearing as possible.

Simple diagnosis uses the vibration meter (VM) mode, and diagnosis is made according to the magnitude of vibration acceleration and the crest factor.

If the vibration acceleration exceeds the judgment criteria and judged as abnormal in the simple diagnosis, a precision diagnosis is then performed.

In the case of bearing abnormalities, FFT analysis of the acceleration envelope can be used to predict the location of the abnormality. In this case, information on the bearing, such as the shaft diameter and number of balls, is required.

#### Basic settings

High-pass filter	3 Hz, 10 Hz
Low-pass filter	5 kHz

#### **■** Simplified diagnosis

Measurement mode	Vibration meter (VM) mode
Measurement data	Vibration acceleration (rms value and peak crest factor)

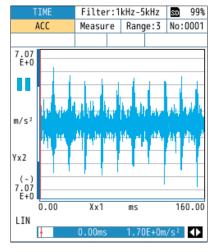
#### **■** Precision diagnosis (time waveform)

Measurement mode	Time waveform (TIME) mode
Measurement data	Vibration acceleration, envelope
Analysis frequency, number of analysis lines	Set so that the time waveform can be observed

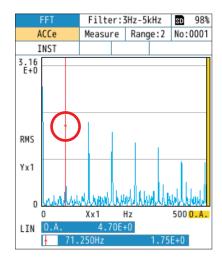
#### ■ Precision diagnosis (frequency analysis)

Measurement mode	FFT analysis mode	
Measurement data	Vibration acceleration, envelope	
Time window function	Hanning	
Analysis frequency	5 kHz for vibration acceleration measurement data, 200 Hz or 500 Hz for envelope	
Number of analysis lines	Set so that the frequency resolution is finer than 1 Hz	
Average function	Use as needed	

Example of bearing diagnosis (outer ring damage): 71.25 Hz is the ball pass frequency of the outer ring.







FFT analysis mode (envelope)

# 23.3 Natural frequency measurement

The natural frequency of a structure is measured by fixing an accelerometer to the object to be measured and applying vibrations with an impulse hammer. The trigger function of the VA-14 is used to capture the vibration of the accelerometer, and the data from multiple measurements is linearly averaged to obtain the final result.

Different natural frequencies may be measured depending on the positions of the excitation and measurement points, but all measured frequencies represent the natural frequencies at each point.

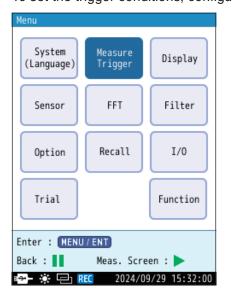
#### Basic settings

Sensor type	Normally use PV-57I; if the object to be measured is very small and light, use other compact and lightweight accelerometer (e.g., PV-91C)	
High-pass filter	10 Hz	
Low-pass filter	20 kHz	

#### ■ Measurement mode: FFT analysis mode

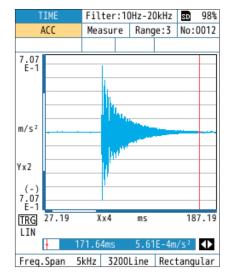
Measurement data	Vibration acceleration	
Time window function	Rectangular	
Analysis frequency	5 kHz (set to include the main natural frequencies of the measurement target)	
Number of analysis lines	3200 (set so that the decaying time waveform converges within one frame)	
Calculation type	Linear average, average count: Approx. 5 times	
Display FFT scale	Log (The display range becomes wider when the Y-axis of the graph is set to Log display. This is often used in vibration measurement, etc.)	
Trigger operation mode	Repeat	
Trigger source	Level	
Pretrigger	On	
Trigger level	Approx. 1/8 to 2/8	
Slope	+	

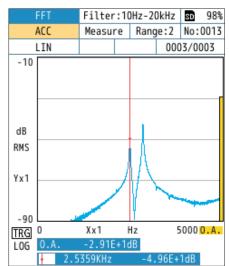
To set the trigger conditions, configure the trigger-related items on the [Measure/Trigger] screen.





Example of natural frequency measurement of a stainless steel plate (200 mm x 100 mm x 20 mm): 2.54 kHz and 2.89 kHz are natural frequencies.





Time waveform (TIME) mode

FFT analysis mode

# 24

# Specifications

#### Standard compliance

**CE Marking** 

EMC Directive 2014/30/EU EN 61326-1:2021

Low Voltage Directive 2014/35/EU EN 61010-1:2010/A1:2019 RoHS2 Directive 2011/65/EU EN IEC 63000:2018

WEEE Directive 2012/19/EU

China RoHS

KC Mark The KC Mark compliance for this product can be verified on the following website of the National Radio

Research Agency:

http://www.rra.go.kr/selform/RIO-VA14

The manufacturing date of this product is indicated on the main unit.

Input function

Number of measurement channels: 1

Connector and type, etc.: BNC connector

CCLD power supply 20 V, 2 mA

Sensitivity setting

PV-57I (supplied) sensitivity typical value:  $510 \times 0.01 \text{ mV/(m/s}^2)$ 

Others Sensitivity setting range: 0.100 mV/(m/s²) to 99.9 mV/(m/s²)

Calibration Calibration using VE-10 is possible in addition to inputting the sensitivity value supplied with the

accelerometer. However, consideration must be given to prevent the weight and shaking of the cable from affecting the measurement. (VE-10 can calibrate up to 70 g, and the weight of PV-57I

alone is about 45 g.)

Calibration frequency: 159.2 Hz Calibration level: 10 m/s<sup>2</sup>

Piezoelectric accelerometer PV-57I (accessory)

Accelerometer type: Shear-type piezoelectric accelerometer (CCLD type)

Sensitivity: Listed on supplied calibration chart of PV-57I

Frequency range: 1 Hz to 5 kHz (±10%)

Dimensions, weight: 17 mm (width across hexagonal flat) × 49 mm (height) Approx. 45 g

Magnet attachment Approx. 15 g

Input connectors

	× 1 channel (BNC)
	Connector for piezoelectric accelerometer (standard supplied accelerometer: PV-57I)
	Sensor drive (CCLD: 20 V, 2 mA) supported
Accelerometer connector	When using PV-57I with built-in charge amplifier (CCLD type)
	Frequency range: 1 Hz to 5 kHz
	Maximum continuous acceleration measurement limit: 200 m/s² peak
External trigger input × 1 (ultra mini jack, 2.5 mm dia.)	
connector (TRIG IN)	External trigger control using falling edge of TTL level signal

#### Input range

When the sensitivity is (0.100 to 0.999) mV/(m/s²)	Acceleration (ACC): (10, 31.6, 100, 316, 1000, 3160, 10000) m/s² (rms)  Velocity (VEL): (31.6, 100, 316, 1000, 3160, 10000, 31600) mm/s (rms)  Displacement (DISP): (0.89, 2.83, 8.94, 28.3, 89.4, 283, 894) mm (EQ P-P)
When using PV-57I or the sensitivity is (1.00 to 9.99) mV/(m/s²)	Acceleration (ACC): (1, 3.16, 10, 31.6, 100, 316, 1000) m/s² (rms)  Velocity (VEL): (3.16, 10, 31.6, 100, 316, 1000, 3160) mm/s (rms)  Displacement (DISP): (0.089, 0.283, 0.89, 2.83, 8.94, 28.3, 89.4) mm (EQ P-P)
When the sensitivity is (10.0 to 99.9) mV/(m/s²)	Acceleration (ACC): (0.1, 0.316, 1, 3.16, 10, 31.6, 100) m/s² (rms)  Velocity (VEL): (0.316, 1, 3.16, 10, 31.6, 100, 316) mm/s (rms)  Displacement (DISP): (0.0089, 0.0283, 0.089, 0.28, 0.89, 2.83, 8.94) mm (EQ P-P)

#### Measurement range

(using PV-57I, high-pass filter 3 Hz, low-pass filter 5 kHz)

Acceleration: 0.02 m/s<sup>2</sup> to 141.4 m/s<sup>2</sup> (rms) (limited by maximum continuous measurement

acceleration of PV-57I)

Instantaneous maximum acceleration: 700 m/s<sup>2</sup>

Velocity: 0.2 mm/s to 141.4 mm/s (rms) (at 159.15 Hz input)

Displacement: 0.02 mm to 40.0 mm (EQ P-P) (at 15.915 Hz input)

#### Linear operating range

With respect to the full-scale range, when an electrical signal is input (sensitivity setting: 5.10 mV/(m/s²))

Acceleration (ACC): 0.02 m/s² to 1000 m/s² (rms) ± 2% (at 80 Hz input)
 Velocity (VEL): 0.1 mm/s to 1000 mm/s (rms) ± 3% (at 159.15 Hz input)
 Displacement (DISP): 0.0283 mm to 283 mm (EQ P-P) ± 5% (at 15.195 Hz input)

#### Measurement frequency range

Acceleration: 1 Hz to 20 kHz
Velocity: 3 Hz to 3 kHz
Displacement: 3 Hz to 500 Hz
Acceleration envelope curve: 1 kHz to 20 kHz

#### Unit of measurement

Vertical axis can be changed between linear and dB. The dB reference criteria are as follows:

Acceleration: 1 m/s²
Velocity: 1 mm/s
Displacement: 1 mm
Envelope: 1

It is also possible to switch to acceleration G ( $\approx$  9.81 m/s<sup>2</sup>), velocity inch/s (= 25.4 mm/s), and displacement mils (= 0.0254 mm) to correspond to Imperial units.

#### Dynamic range in FFT mode

Acceleration (with 80 Hz electrical signal input): 94 dB Velocity (with 159.15 Hz electrical signal input): 80 dB Displacement (with 80 Hz electrical signal input): 80 dB

Input voltage range for general-purpose input function: 0.0287 mV to 5100 mV (rms) (with VX-14S option)

• Maximum measured sound pressure with UC-59 + NH-22A using the microphone-preamplifier connection function:

42 dB to 138 dB

#### Filter characteristics

Pre-filter Vibration severity (Velocity RMS values with a frequency range of 10 Hz to 1 kHz, in accordance with ISO 2954:2012. Corresponds to a velocity high-pass filter (HPF) at 10 Hz and a low-pass filter (LPF) at 1 kHz (–3 dB point).

High-pass filter (HPF): 1 Hz (acceleration only), 3 Hz, 10 Hz, 1 kHz (-10% point)

Cutoff slope -18 dB/oct

Low-pass filter (LPF): 1 kHz, 5 kHz, 20 kHz (-10% point)

Cutoff slope -18 dB/oct

HPF and LPF can also be set separately for acceleration, velocity, and displacement.

#### Residual noise

• HPF at 3 Hz, LPF at 20 kHz, lowest range setting

• Electrical characteristics of the main unit (VP-40+1000 pF dummy short)

Acceleration: 0.01 m/s² (rms) or less

Velocity: 0.1 mm/s (rms) or less

Displacement: 0.01 mm (EQ P-P) or less

PV-57I

Acceleration: 0.01 m/s² (rms) or less

Velocity: 0.1 mm/s (rms) or less

Displacement: 0.03 mm (EQ P-P) or less

#### RMS value detection circuit

Digital calculation method

• Calculation items (Vibration meter (VM) mode, Time waveform (TIME) mode, FFT analysis mode)

Vibration meter (VM) mode

ACC (Acceleration): m/s<sup>2</sup> RMS, PEAK, crest factor

VEL (Velocity): mm/s RMS, EQPEAK (and PEAK when VX-14S is installed)

DISP (Displacement): mm, µm RMS, EQPEAK, EQ P-P (and PEAK when VX-14S is installed)

• Time waveform (TIME) mode

Time waveform

Data type: ACC, VEL, DISP, Acceleration envelope curve

Number of analysis lines: 200, 400, 800, 1600, 3200

Frequency span: 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz

• FFT analysis mode

Spectrum

Data type: ACC, VEL, DISP, Acceleration envelope curve

Number of analysis lines: 200, 400, 800, 1600, 3200

Frequency span: 100 Hz, 200 Hz, 500 Hz, 1 kHz, 2 kHz, 5 kHz, 10 kHz, 20 kHz

Time window functions: Rectangular, Hanning, Flat-top

Calculation: Instantaneous value, linear average, maximum value, exponential average

Linear average and maximum value should be able to be calculated and saved simul-

taneously.

Average number: Maximum 2048 times The overlap ratios are shown in the table below:

Frequency (Hz)	Overlap ratio
100	0.875
200	0.875
500	0.75
1000	0.5
2000	0
5000	0
10000	0
20000	0

#### Sampling frequency

Sampling frequency 51.2 kHz

Waveform recording function

Vibration meter (VM) mode: Up to 200 hours (when VX-14S is installed).

FFT analysis mode: Can record up to 1 MB per file (up to 10 seconds at a sampling frequency of 51.2 kHz).

Records vibration waveforms during FFT analysis mode calculation.

#### Trigger

• Trigger source: External trigger, Level trigger

• Trigger level: Steps of 1/8 of full scale on one-sided amplitude

• Trigger slope: +/-

• Pre-trigger: 1/8 frame

• Trigger operation

Free: Calculation is carried out constantly, regardless of the trigger condition.

Repeat: Calculation is carried out every time the trigger condition is met.

Single: Calculation is carried out only once when the trigger condition is met.

#### External trigger connector input

TTL level

Jack 2.5mm dia.

#### Pause function

Pauses the display on the screen.

#### Display

Display			
	3.5-inch TFT-LCD monitor		
Device	In FFT analysis mode and time waveform (TIME) mode screens, the cursor position		
	is controlled via the touch panel.		
Screen resolution	QVGA (320 × 240)		
Backlight	Turns off or adjusts the brightness in two levels.		
TIME/FFT/VM (bar graph)	Min. 100 ms		
update cycle	Will. 100 His		
Numeric value update cycle	1 s		
	Overlapping display function	A function to overlap the selected FFT/TIME	
		measurement results from the [Recall] screen onto	
		the graph	
TIME/FFT	Top 10 list (FFT Analysis mode)		
		OFF, TOP10, PEAK10	
	Zoom	Vertical and horizontal axes of the graph can be	
		zoomed in.	

#### Languages

English, Chinese, Japanese

#### Overload indication

Notifies under the following conditions for each measurement mode: VM (vibration meter), TIME (time waveform), and FFT analysis.

Notifications are provided respectively for ACC, VEL, DISP, and envelope.

OVER is displayed for a signal input that is larger than the upper measurement limit.

Range	Acceleration (rms) (m/s <sup>2</sup> )	Velocity (rms) (mm/s)	Displacement (EQ P-P) (mm)
1	106.0	335.2	9.481
2	335.2	1060	29.98
3 to 7	1060	3352	94.81

#### Manual store

Starts/stops measurement manually.

Vibration meter (VM) mode	Records acceleration, velocity, displacement, and crest factor.
Time waveform (TIME) mode	Records the time waveform for one frame.
FFT analysis mode	Records the instantaneous spectrum or spectral average results for one frame.

#### Operation lock / Key lock

Key lock: Restricts key operations except for key lock release.

• Operation lock: Restricts changes to settings related to measurements. A password can be set to unlock the

restrictions.

#### Screenshot

Captures the current display on the screen and saves the image as a BMP file.

#### Index

Can be set as a 4-digit.

#### Data recall

Browses stored data and screenshot images.

#### Memorizing and recalling settings

Setting information can be saved to the internal memory or SD card and recalled at startup or at a specified time. Recorded settings can be renamed (up to 8 alphanumeric characters) to suit the application.

#### Memorizing and recalling settings

Setting information can be saved to the internal memory or SD card and recalled at startup or at a specified time. Recorded settings can be renamed (up to 8 alphanumeric characters) to suit the application.

#### SD card formatting

Initializes the contents of the SD card to free up space so that you can use it.

#### Communication

#### • USB

Connector	USB Type-C	
Command control	Settings can be retrieved and changed via communication commands.	
Data transfer	Enables the transferring of data by making the computer recognize the SD card as a removable disk.	

#### • LAN

The unit communicates with an IP address specified by the user or automatically assigned by the router to provide the following functions.

Command control Settings can be retrieved and changed via communication commands.	
Data acquisition	SD card can be accessed to retrieve data.

#### Power supply and battery operation time

Power supplied by six AA batteries or external power source

Alkaline battery	Approx. 12 h	
Ni-MH rechargeable battery	y Approx. 12 h (with eneloop pro TM battery)	
Current consumption	Approx. 130 mA (at 9 V supply)	
Measurement conditions	Measure in Vibration meter (VM) mode with communication turned off and backlight off, in a low-vibration environment.	

#### • External power source

Туре	DC jack (outer -, inner +), USB port (Type-C)		
Operating voltage	DC jack: 5.7 V to 15 V (recommended rated voltage 12 V) USB: 5 V (operates at rated current of 2.0 A or more)		
Power consumption	Approx. 1.5 W (with AC adapter NE-21P)		

#### Operating temperature range, storage temperature range

Main unit	-10°C to +50°C, 10% to 90% RH (no condensation)
Piezoelectric accelerometer PV-57I	-20°C to +70°C, 90% RH or less

#### Dimensions

Without protective cover: Approx. 238.9 mm (H)  $\times$  80 mm (W)  $\times$  44.5 mm (D) With protective cover: Approx. 240.7 mm (H)  $\times$  91.9 mm (W)  $\times$  47.9 mm (D)

#### Weight

Approx. 665 g (including protective cover, batteries, and PV-57I)

#### Supplied accessories

<ul> <li>Piezoelectric accelerometer PV-57I</li> </ul>	×1
<ul> <li>Curled cable (Attached to the PV-57I)</li> </ul>	×1
Magnet attachment VP-53S	×1
PV-57I calibration chart	×1
Shoulder strap	×1
Size AA alkaline battery	×6
• Instruction Manual: Quick Start Guide (English)	×1
• Instruction Manual: Quick Start Guide (Japanese)	×1
• 512 MB SD card	×1
Document for China RoHS	×1
<ul> <li>Supplied Accessories and Inspection Certificate</li> </ul>	×1

#### Optional accessories

• Function extension program VX-14S

• 512 MB SD card

• 2 GB SD card

• 32 GB SD card

Accelerometer	PV series
Charge converter	VP-40/VP-42
BNC adaptor	VP-52C
AC adapter (100 V to 240 V AC)	NE-21P
DC Polarity Converter	CC-43J
BNC pin output cable	CC-24 series
Hand strap	VA-14-020
Carrying case	VA-14-021
Calibration exciter	VE-10
Waveform analysis software	AS-70
Waveform analysis software	CAT-WAVE
Microphone preamplifier	NH-22A
• 1/2-inch electret microphone	UC-59

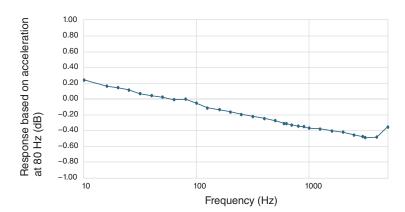
# 25

# **Technical Data**

# 25.1 Frequency characteristics when connecting the piezoelectric accelerometer PV-57I

The frequency characteristics when the piezoelectric accelerometer PV-57I is connected to the VA-14 and subjected to vibration are as follows.

The acceleration frequency characteristics when the accelerometer PV-57I is connected (typical values)



Frequency (Hz)	PV-57I connected (dB)
10	0.24
16	0.16
20	0.14
25	0.12
32	0.07
40	0.04
50	0.02
63	-0.01
80	0.00
100	-0.05
125	-0.11
160	-0.13
200	-0.16
250	-0.19
315	-0.22
400	-0.24
500	-0.27
600	-0.31
630	-0.31
700	-0.33
800	-0.34
900	-0.35
1000	-0.37
1250	-0.38
1600	-0.40
2000	-0.42
2500	-0.45
3000	-0.48
3150	-0.49
4000	-0.48
5000	-0.35

<sup>\*</sup> Reference value: 80 Hz

# 25.2 Residual noise when using the PV series accelerometer

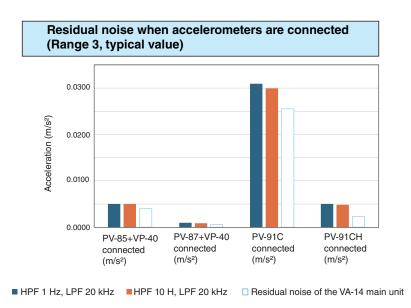
Regarding our typical accelerometers, the residual noise when sensitivity is set is as follows (Range 3, typical value). Additionally, a comparison is made with the residual noise of the VA-14 unit at the same sensitivity setting.

#### Sensitivity of various sensors

Туре	Voltage sensitivity [mV/(m/s²)] (Typical value)	
PV-85+VP-40	6.42	
PV-87+VP-40	40	
PV-91C	1	
PV-91CH	11	

#### Residual noise when accelerometers are connected (typical value)

Filter setting	PV-85 + VP-40 connected [m/s <sup>2</sup> ]	PV-87 + VP-40 connected [m/s <sup>2</sup> ]	PV-91C connected [m/s²]	PV-91CH connected [m/s <sup>2</sup> ]
HPF 1 Hz, LPF 20 kHz	0.0050	0.0009	0.0310	0.0050
HPF 10 Hz, LPF 20 kHz	0.0050	0.0008	0.0300	0.0048
Residual noise of the VA-14 main unit	0.0040	0.0006	0.0255	0.0023



# 25.3 Electromagnetic compatibility (EMC)

This product complies with the EMC standard EN IEC 61326-1:2021, which is required for device used in measurement, control, and laboratory settings. The EMC standard specifies emission performance to limit the electromagnetic noise generated by the device to a certain level so that it does not affect surrounding devices, as well as immunity performance to reduce the impact of electromagnetic noise from surrounding devices to a specified level. Since EN IEC 61326-1:2021 requires providing information about the EMC environment for the safe use of the device, the technical specifications of this product are described below. For details, refer to EN IEC 61326-1:2021.

# 25.3.1 Electromagnetic environment intended for use of this product and applicable standards

Intended electromagnetic environment	Industrial electromagnetic environment
Applicable standards	EN IEC 61326-1:2021

#### **⚠** Caution

• This product requires use with the specified connection method and electromagnetic environment. This product generates electromagnetic emissions in industrial environments, which may affect surrounding devices in basic electromagnetic environments, such as residential areas.

#### 25.3.2 Acceptable EMC performance level of this product

This product requires special attention to EMC. Please follow the information below during use.

#### Electromagnetic emissions

Test items	Test standards	Compliance level	Electromagnetic environment guidance	
Emission limits	EN 55011:2016/	Group 1,	This product uses RF energy for internal functions, which may affect surrounding devices through external emissions.	
Conducted emissions	A1:2017/A2:2021	Class B		
Harmonic emissions	EN IEC 61000-3-2:2019	Class A	This product is suitable for use in	
Voltage fluctuations / flicker	EN 61000-3-3:2013/ A1:2019/A2:2021	N/A	all facilities, including those directly connected to the commercial low-voltage power distribution system supplying buildings in industrial environments.	

#### Electromagnetic immunity

Test items	Test standards	Compliance level	Electromagnetic environment guidance	
Electrostatic discharge	EN 61000-4-2	Contact ±4 kV Air ±2 kV, ±4 kV, ±8 kV	This product is intended for use in industrial electromagnetic	
Radiated RF electromagnetic fields	EN 61000-4-3	80 MHz to 1000 MHz: 10 V/m 1400 MHz to 6000 MHz: 3 V/m	environments. Users of this product should particularly	
Fast transients/bursts	EN 61000-4-4	AC power input port: ±2 kV LAN, USB: ±1 kV	pay attention to the following electromagnetic immunity factors:	
Surge	EN 61000-4-5	AC power input port: ±0.5, ±1 kV	<ul> <li>Power quality (standard commercial power supply)</li> <li>Protection against electrostatic discharge</li> <li>Protection against external high-power radio waves</li> <li>Protection against external</li> </ul>	
Conducted interference	EN 61000-4-6	AC power input port, LAN, USB: 10 V, 0.15 MHz to 80 MHz		
Power frequency magnetic fields	EN 61000-4-8	30 A/m		
Voltage dips	EN 61000-4-11	0%, 1 cycle 40%, 10/12 cycles, 50/60 Hz 70%, 25/30 cycles, 50/60 Hz	magnetic fields	
Momentary interruptions		0%, 250/300 cycles, 50/60 Hz		

# 25.3.3 Recovery procedure and precautions in case of power loss

Electromagnetic noise may affect measurement operations or cause the power to turn off. In such cases, you can restart the device by pressing the POWER key; however, data measured before the power was turned off may be lost.

#### **Trademarks**

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