INSTRUCTION MANUAL

Vibration Level Meter

VM-53/VM-53A

RION CO., LTD.

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http://www.rion.co.jp/english/

Organization of this manual

This manual describes the features and operation of the Vibration Level Meter VM-53/VM-53A. Page iii and following contain important information about safety. Be sure to read and observe these in full.

The manual contains the following sections.

Outline

Gives basic information on the configuration and features of the unit, and contains a block diagram.

Controls and Features

Briefly identifies and explains all parts of the unit.

Preparations

Describes power supply and pre-use checks, installation, connections, key settings, and other steps.

Reading the Displays

Explains symbols and other information that appears on the two displays of the unit.

Power-On/Off

Explains how to turn the unit on and off.

Measurement

Describes the steps for measurement.

Store Operations

Explains how to store measurement data.

Comparator

Explains how to use the comparator function.

Memory Card (VM-53A only)

Explains how to use the memory card.

Default Settings

Lists the ex-factory default settings of the unit.

Output Connectors

Describes the output connectors of the unit.

Accessories

Explains connection of accessories and steps for recording measurement data etc.

Serial Interface

Describes how to use the serial interface for connection to a computer, to control measurement parameters and export measurement data.

Reference Information

Explains use of the external power switching jumper pins and provides information about how to copy setting information.

Backup Battery

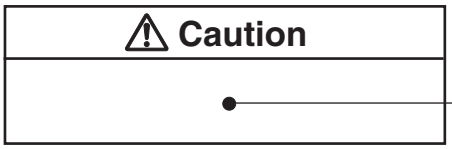
Explains the internal backup battery used for the data hold of the clock.

Specifications

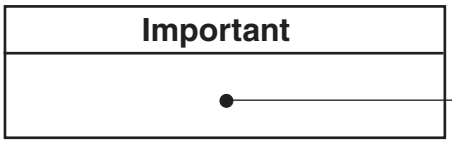
Lists the technical specifications of the unit.

FOR SAFETY

In this manual, important safety instructions are specially marked as shown below. To prevent the risk of death or injury to persons and severe damage to the unit or peripheral equipment, make sure that all instructions are fully understood and observed.

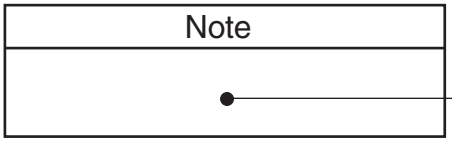


Disregarding instructions printed here incurs the risk of injury to persons and/or damage to peripheral equipment.



Disregarding instructions printed here incurs the risk of damage to the product.

Indicates a prohibited action. This information is given to prevent accidents and ensure safe use of the unit.



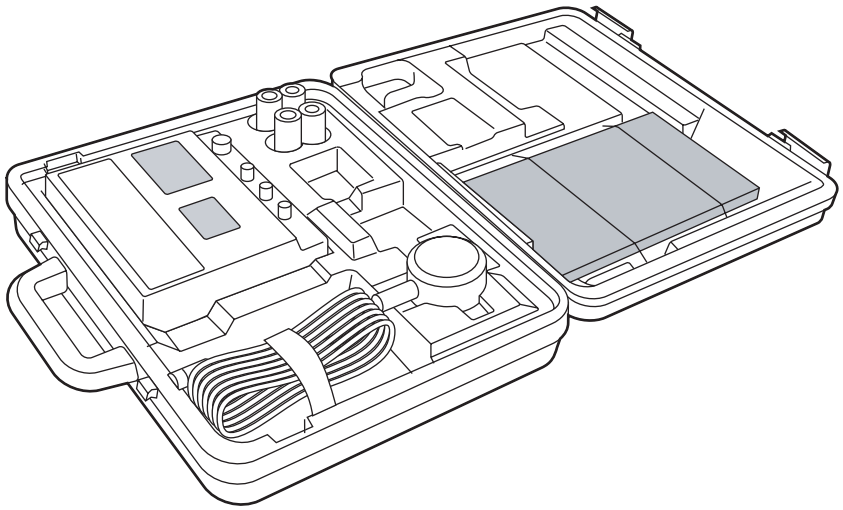
Mentioned about the tips to use this unit properly. (This messages do not have to do with safety.)

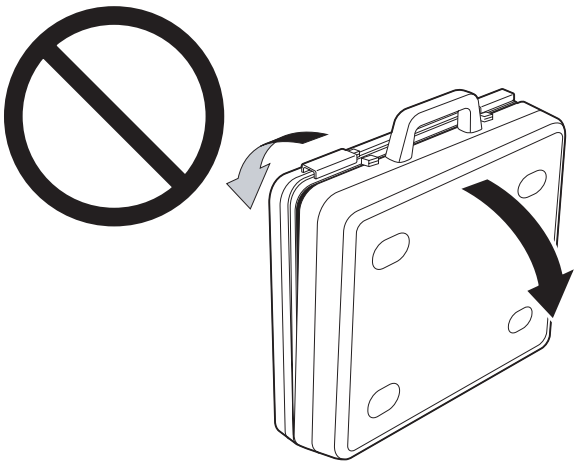
Precautions

- Operate the unit only as described in this manual.
- Take care not to drop the unit, and protect it from shocks and vibrations.
- Take care not to drop the accelerometer, and protect it from shocks.
- Ambient conditions for operation of the unit are as follows: temperature range -10 to +50°C, relative humidity up to 90%RH.
  Protect the unit from water, dust, extreme temperatures, humidity, and direct sunlight during storage. Also keep the unit away from air with high salt or sulphur content, gases, and stored chemicals during storage and use.
- Always turn the unit off after use. Remove the batteries from the unit if it is not to be used for a long time.
- When disconnecting cables, always grasp the plug and do not pull the cable.
- Clean the unit only by wiping it with a soft, dry cloth or, when necessary, with a cloth lightly moistened with water. Do not use any solvents, cleaning alcohol or chemical cleaning agents.
- Do not tap the LCD panel or other surfaces of the unit with a pointed object such as a pen, pencil, screwdriver, etc.
- Take care that no conductive objects such as wire, metal scraps, conductive plastics etc. can get into the unit.
- Do not disassemble the unit or attempt internal alterations.
- In case of malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- When powering the unit externally, use only the specified AC adapter (option). Using a different adapter may cause malfunction or damage.
- To ensure continued accuracy, have the unit checked and serviced at regular intervals. Contact the supplier.
- Dispose of the unit and of batteries only according to national and local regulations at the place of use.

Precautions for opening the case

Before opening the case and removing any equipment, place the case on sturdy, flat table or on the floor. Then open the case fully as shown below.





Never open the case while it is standing upright. Otherwise equipment may fall out, possibly causing damage and accidents.

Contents

Outline

The VM-53/VM-53A conforms to the standards specified by the Weight and Measure Act of Japan and the Japanese Industry Standard for vibration level meters (JIS C 1510: 1995).

The unit is designed mainly for measuring ground vibrations in order to evaluate vibration pollution. It can measure vibration levels in the vertical and horizontal plane and display values weighted according to human vibration sensitivity characteristics. The system consists of the main unit and the 3-axis accelerometer PV-83C.

The VM-53/VM-53A is equipped to measure the vibration level and vibration acceleration level as well as the time percentile level, power average, maximum and minimum value in three axes. Measurement data can be stored automatically, and a timer function for automatically carrying out measurements at certain intervals is provided.

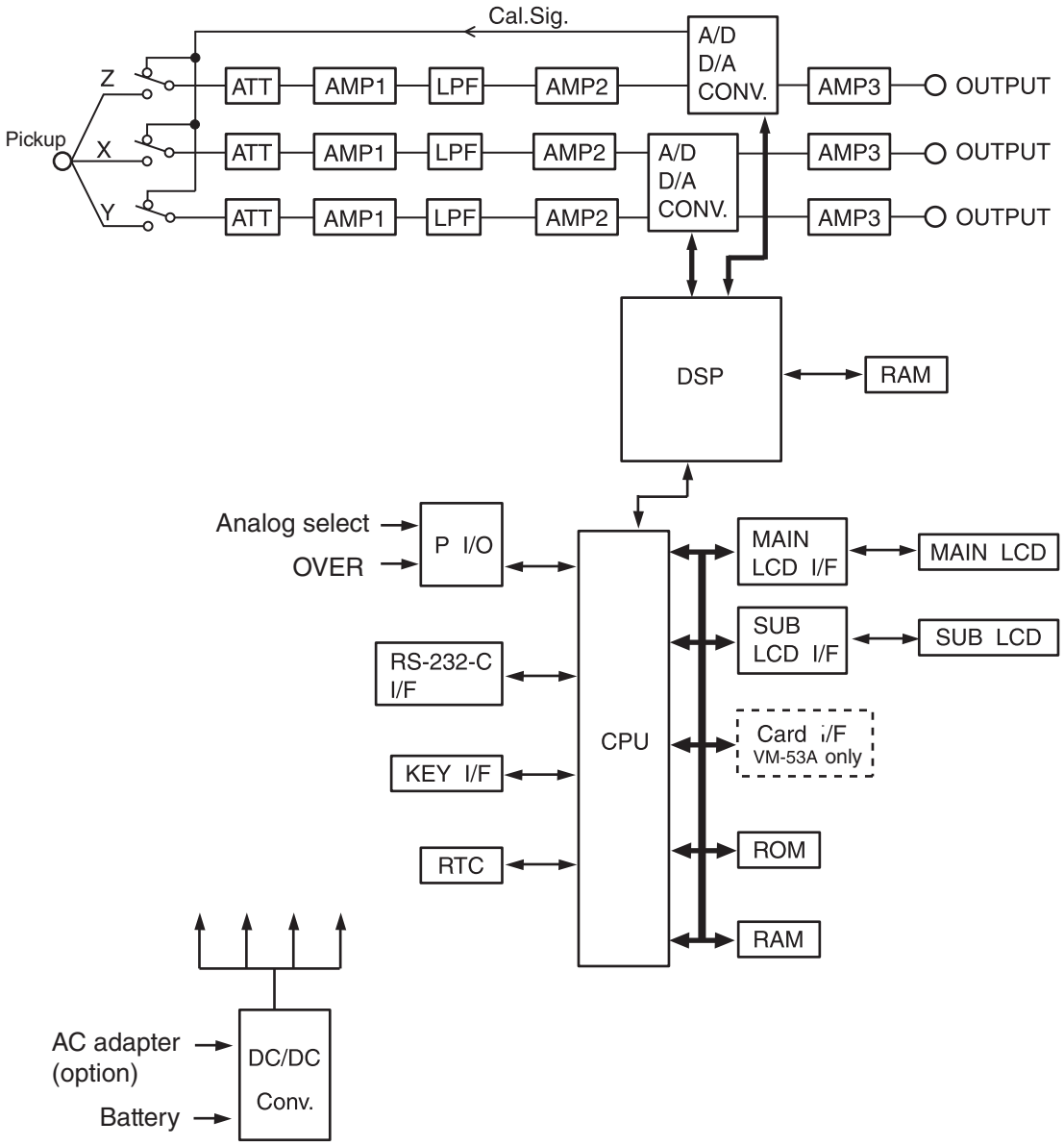
Measurement data for three axes can be stored in the internal memory. The model VM-53A can use memory cards (CompactFlash™ cards) to store large amounts of measurement data as files. Because these files are in text format, the data can easily be imported into commercial spreadsheet software for data management.

The unit is equipped with two backlit LCD panels. While the large main display shows the instantaneous measurement value, the dot matrix type sub display can show a 3-axis or single-axis level/time graph, a bar graph, parameter settings, menu screens etc. This ensures efficient operation of the unit.

Separate X, Y, Z outputs can be connected to a level recorder, analyzer, or data recorder. An I/O jack for connection to a printer or computer and a comparator output are also provided. This makes the unit suitable for a wide range of measurement system applications.

The VM-53/VM-53A consists of the following parts.

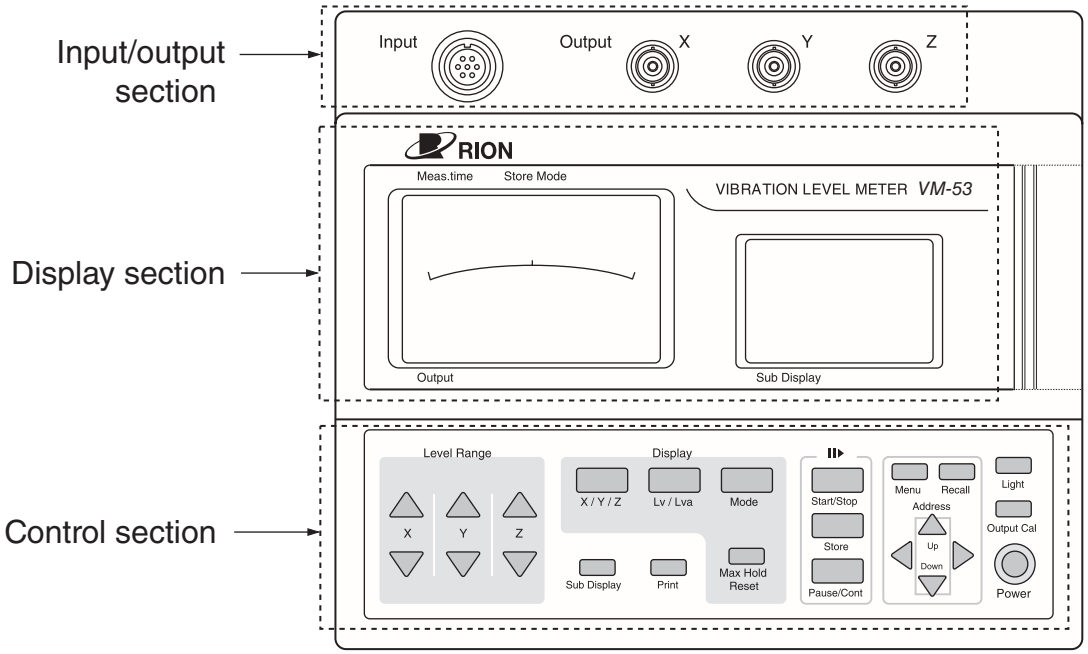
Vibration level meter	VM-53 or VM-53A main unit
3-axis accelerometer	PV-83C
Vibration level meter/accelerometer cable	EC-02S



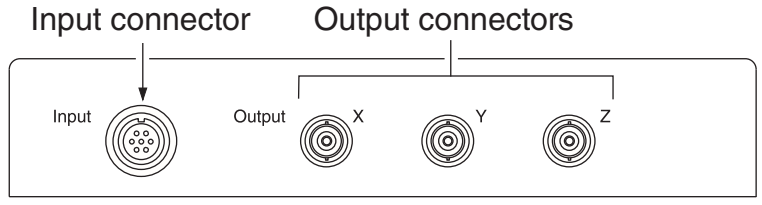
Vibration Level meter VM-53 / VM-53A Block Diagram

Controls and Features

Front Panel



Input/output section



Input connector

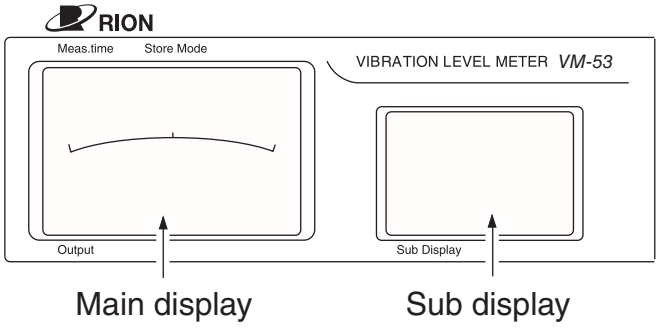
The 3-axis accelerometer PV-83C is to be connected here, using the supplied EC-02S cable. If the accelerometer is to be installed at a greater distance, optional extension cable (EC-02S series or EC-02 series) can also be used.

Output connectors

These are BNC connectors which carry the output signal for the X, Y, and Z axis.

Using the menu screen 1/5, you can select AC or DC for these outputs.

Display section



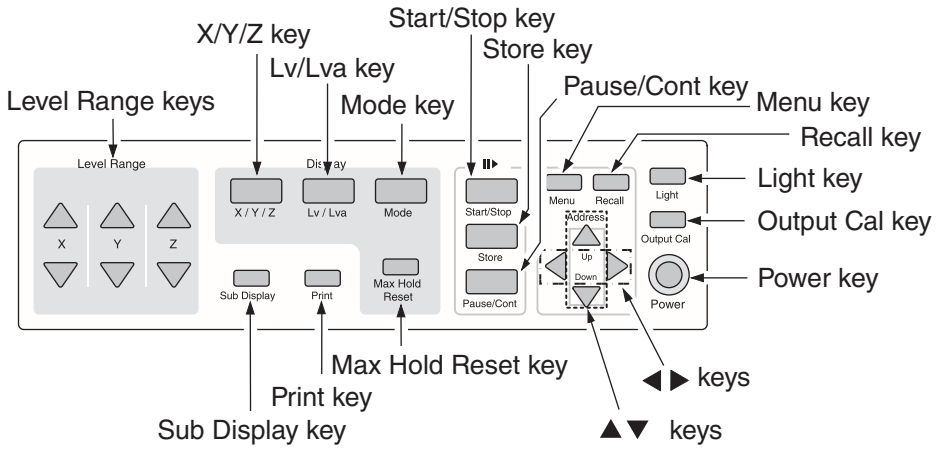
Main display

Shows the instantaneous measurement value and various setting information. (For details, see "Reading the Displays" on page 34.)

Sub display

Can be switched to show a level/time screen, bar graph screen, or other measurement screens. The sub display also shows menus. (For details, see "Reading the Displays" on page 39.)

Control section



Note
Protective film The unit is shipped with a protective film covering the operation panel. When using the unit, you can remove this film.

Level Range keys

These keys control the level range for the X, Y, Z axis.

The ▲ key switches the level range up, and the ▼ key switches the level range down.

The following six settings are available: [10 to 70], [20 to 80], [30 to 90], [40 to 100], [50 to 110], [60 to 120]

X / Y / Z key

Switches the vibration axis to be shown on the display.

With each push of the key, the display cycles through the settings in the order X → Y → Z → X etc.

Lv / Lva key

Switches the measurement function between vibration level (L_v) and vibration acceleration level (L_{va}).

Mode key

Switches the display mode.

Each push of the key cycles through the settings in the following order: instantaneous value → Max Hold (maximum value hold) → L_{eq} → L_{max} → L_{min} → L_5 → L_{10} → L_{50} → L_{90} → L_{95} → instantaneous value

Sub Display key

Switches the function mode of the sub display.

With each push of the key, the display cycles through level/time screens, bar graph screen, processing list screen, etc.

Print key

Allows printing on the optional printer DPU-414, CP-11, or CP-10. The contents of the sub display in pause mode or recall data can be printed.

Max Hold Reset key

Resets the value of the max hold function.

When the comparator function is being used, this key resets the comparator output.

Start/Stop key

Serves to start / stop processing for the following functions:

Power average (L_{eq})

Time percentile level (L_5, L_{10}, L_{50}, L_{90}, L_{95})

L_{max}, L_{min}

When the Start/Stop key is pressed while data are being stored in memory, the store procedure is terminated.

Store key

Serves to store the measurement data in various store modes.

In Manual store mode, the instantaneous value and processing values are stored in memory at the point when the Store key is pressed.

In Auto1 and Timer Auto1 store mode, pressing the key starts or stops the Auto1 store process.

In Auto2 and Timer Auto2 store mode, pressing the key starts or stops the Auto2 store process.

Pause/Cont key

Serves to pause the measurement (processing).

Pressing the key again restarts the measurement.

In Auto1 store mode, the key functions not as pause key but as marker key.

In Auto2 store mode, the key functions as pause key.

In Timer Auto1 and Timer Auto2 mode, the key has no effect.

Menu key

Pressing this key brings up a menu screen on the sub display.

Each push of the key cycles through the menu screens in the order 1/5 → 2/5 → 3/5 → 4/5 → 5/5. Pressing the key again closes the menu display.

The menu display can also be closed by pressing any other key except the Light key, Print key, and Power key.

Recall key

This key serves to call up data stored in memory. These data are shown on the sub display.

▲ / ▼ keys

When the main display is showing a measurement screen and the store mode is Manual, these keys select the address for manually storing the data.

When the sub display is showing a menu screen, these keys serve to select an item.

When the sub display is showing a recall data screen, these keys serve to select the recall data address.

◀ / ▶ keys

When the sub display is showing a menu screen, these keys serve to change the setting of the selected item.

Light key

This key turns on the backlight for the main display and sub display. This is convenient when using the unit in a dark location. To turn the backlight off, press the key again.

When the unit is operating on battery power, the backlight will be automatically turned off after 10 minutes. When the unit is powered from an external power supply, the backlight will not be automatically turned off.

Battery current consumption increases by a factor of about 2 when the backlight is on.

Output Cal key

This key serves for level matching between the unit and peripheral equipment.

After power-on, pressing the Output Cal key while the initialization screen is displayed brings up the software version information screen of the unit.

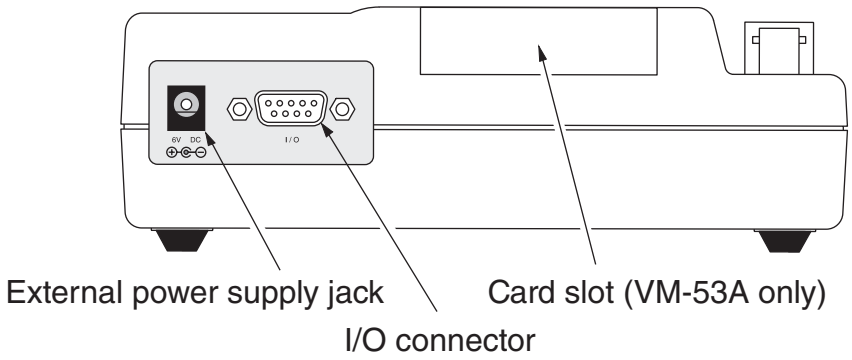
Power key

Serves to turn the unit on and off.

Hold down the key for at least one second to turn power on or off.

After switching the unit off, wait at least five seconds before turning power back on again. Otherwise the unit may not start up properly.

Right Side View



External power supply jack

The optional AC adapter NC-34 (for 100 V AC) or NC-98 series (for 100 to 240 V AC) can be connected here to power the unit from an external source.

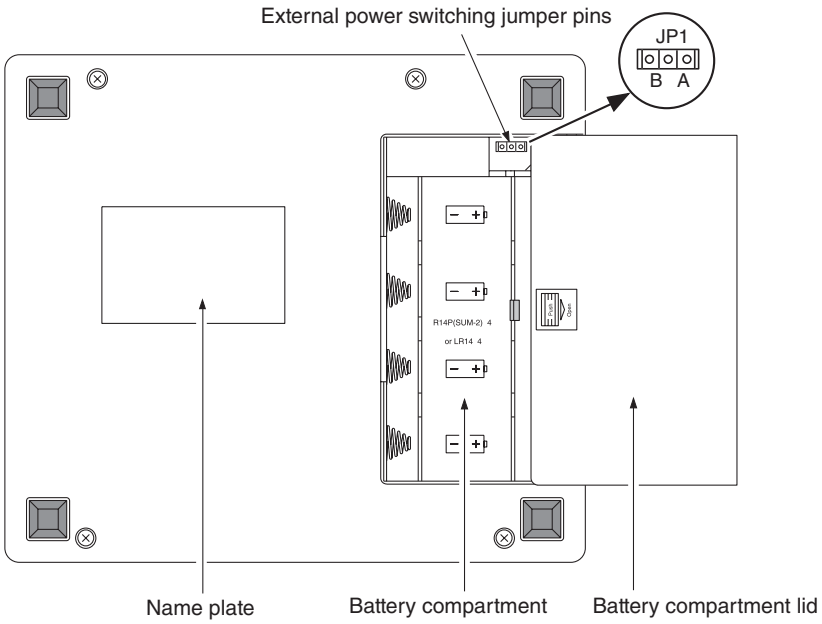
I/O connector

Serves for connection to a computer or the printer DPU-414, CP-11, or CP-10 using a dedicated cable. This allows parameter setting control, measurement data input/output, and printout.

Card slot (VM-53A only)

This is a memory card slot (not present on model VM-53).

Bottom View



Battery compartment

Holds four IEC R14 (size "C") batteries.

External power switching jumper pins

Normally, the supplied jumper should be set on the side marked "A" 

. If the jumper is set to the side marked "B" 

, the VM-53/VM-53A will come on even without pressing the Power key when the external power supply becomes active.

⚠ Caution

The external power switching jumper pins are small and pointed. Take care not to hurt your fingers.

Important

Never connect any equipment to the external power switching jumper pins. Otherwise damage can occur.

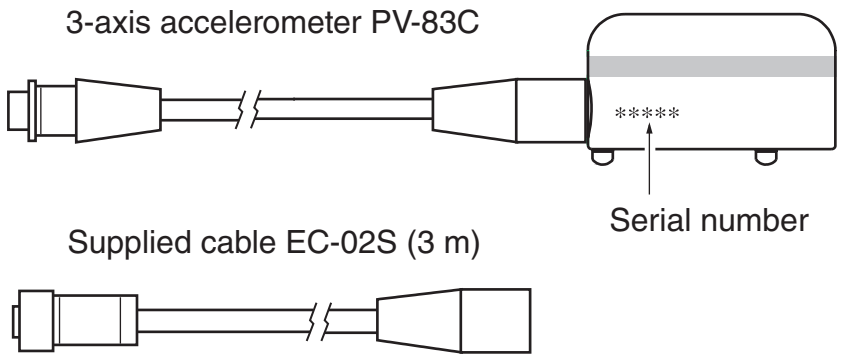
Name plate

Shows the serial number of the unit and the accelerometer as well as the manufacturing date of the unit and other information.

Accelerometer and extension cable

For measurement, the 3-axis accelerometer PV-83C is required. Plug one end of the supplied EC-02S cable into the accelerometer and plug the other end into the Input connector on the unit.

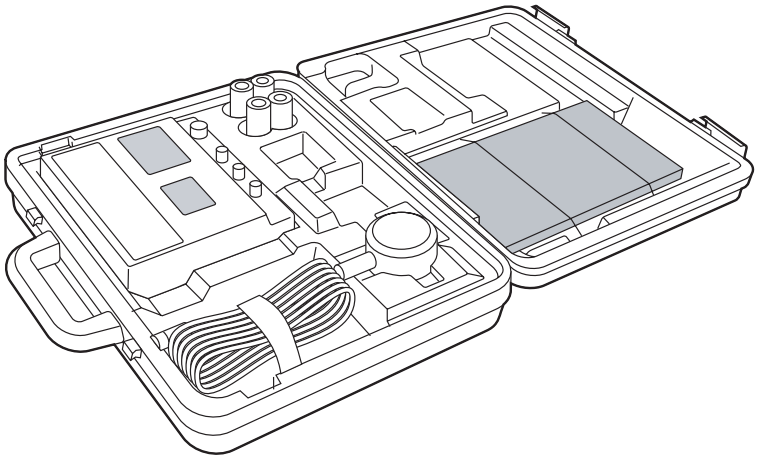
For more information, see the section on accelerometer placement and connection in "Preparations" on page 17.

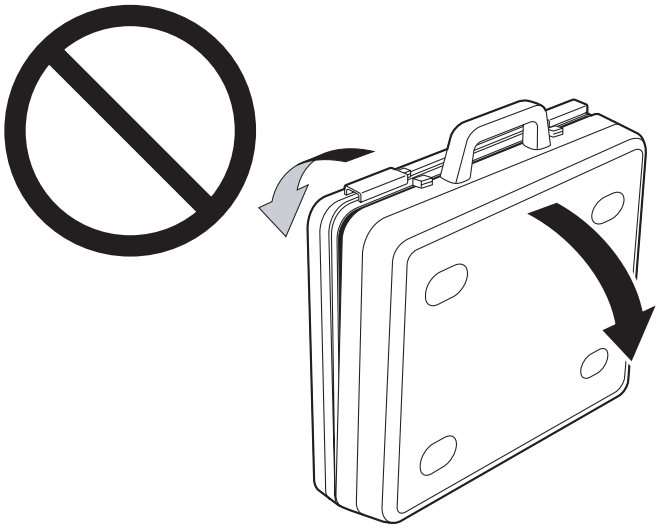


Preparations

Removing the equipment from the case

Before opening the case and removing any equipment, place the case on sturdy, flat table or on the floor. Then open the case fully as shown below.





⚠ Caution
Never open the case while it is standing upright. Otherwise equipment may fall out, possibly causing damage and accidents.

Power supply

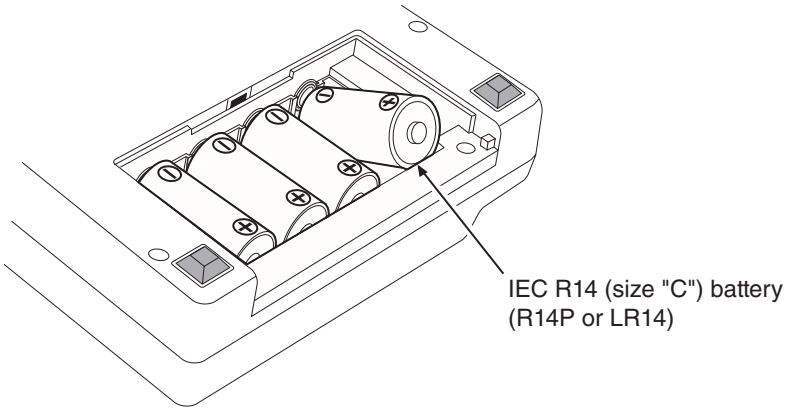
The VM-53/VM-53A can be powered from four IEC R14 (size "C") batteries (alkaline or manganese), or from an optional AC adapter (NC-98 series or NC-34).

It is also possible to use rechargeable IEC R14 (size "C") batteries, but the VM-53/VM-53A does not have a facility for recharging such batteries.

Note
Power failure backup function When an AC adapter is connected to the VM-53/VM-53A, power will be supplied by the adapter also if batteries are inserted. However, if power from the AC adapter is interrupted (for example due to a power line blackout), the VM-53/VM-53A will automatically switch to battery operation.

Batteries

1. Remove the battery compartment lid on the bottom panel.
2. Insert four IEC R14 (size "C") batteries with correct orientation, as shown in the battery compartment.
3. Replace the battery compartment lid.



⚠ Caution
Take care not to insert batteries with wrong + and - polarity. Otherwise battery fluid may leak, or the batteries may overheat, emit smoke, or explode.

Battery life will differ, depending on the battery type, usage conditions, and other factors.

Approximate battery life at 20ºC, using the accelerometer PV-83C for 3-axis measurement, with backlight OFF, AC output OFF, and serial interface OFF is shown in the table below.

Battery life with continuous operation		
Alkaline batteries	LR14	approx. 35 hours
Manganese batteries (black)	R14P	approx. 12 hours

When the backlight is used, current consumption will increase by a factor of about 2.

When performing single-axis measurement (as selected from menu screen 1/5), current consumption will be about 10% lower.

Important

Always replace all four batteries at the same time, and do not mix different types of batteries or old and fresh batteries. Otherwise damage may occur.

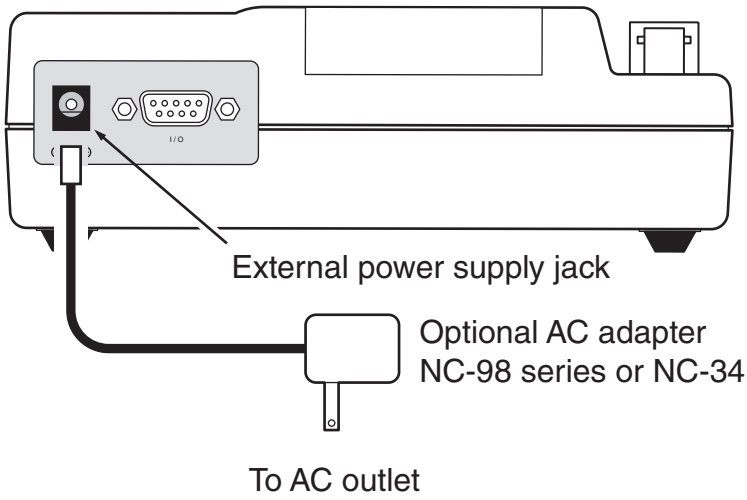
While not using the unit, the batteries should be removed.

When the battery capacity indicator flashes, you should replace the batteries. Correct measurement is not possible in this condition.

Note
When the unit is operating on batteries, power may not come on if the ambient temperature is lower than 10ºC (because the voltage of older batteries may have dropped below the required threshold). In such a case, replace all four batteries with fresh alkaline batteries. If the unit is to be operated on battery power for a long time, the optional battery pack BP-21 is recommended. This uses four LR20 (size "D") alkaline batteries which give a continuous operation time of about 100 hours (at room temperature) together with the four LR14 (size "C") alkaline batteries held in the unit.

AC adapter (option)

Connect the AC adapter as shown in the illustration below.



Important
Do not use any other kind of AC adapter except the NC-98 series or NC-34. Otherwise damage may occur.

Note
The optional AC adapter NC-98 series is for 100 to 240 V AC and, NC-34 is for 100 V AC.

Current/power consumption

Approx. 120 mA (at 6 V DC)

Approx. 5.5 VA (with AC adapter NC-98B, at 100 V AC)

Approx. 3.5 VA (with AC adapter NC-34, at 100 V AC)

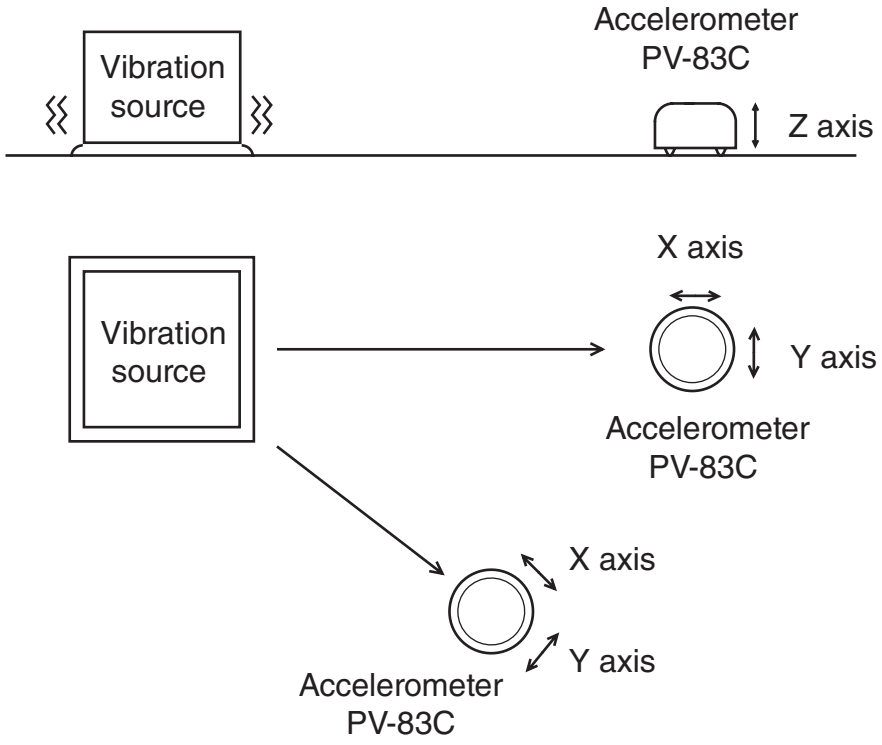
Accelerometer placement and connection

Vibration axis

Environmental vibrations are normally measured in two horizontal planes (front/back and left/right) and one vertical plane. This means that complex vibration phenomena are reduced to three axes (X, Y, Z), for easier observation.

The axes are defined as follows (facing the vibration source).

Horizontal front/back: X
Horizontal left/right: Y
Vertical: Z



Accelerometer placement

On hard surfaces

On hard surfaces such as concrete, asphalt, wood, or solid ground, choose a level area and place the accelerometer carefully on the surface.

On soft surfaces

For measurements on soft ground, you should first harden the surface, for example by treading the ground with your feet. For measurements on a grassy surface, the grass should be cut first. Then place the accelerometer on the ground and push it slightly into the surface.

Extremely soft surfaces such as sand, or thick carpeting within buildings should be avoided.

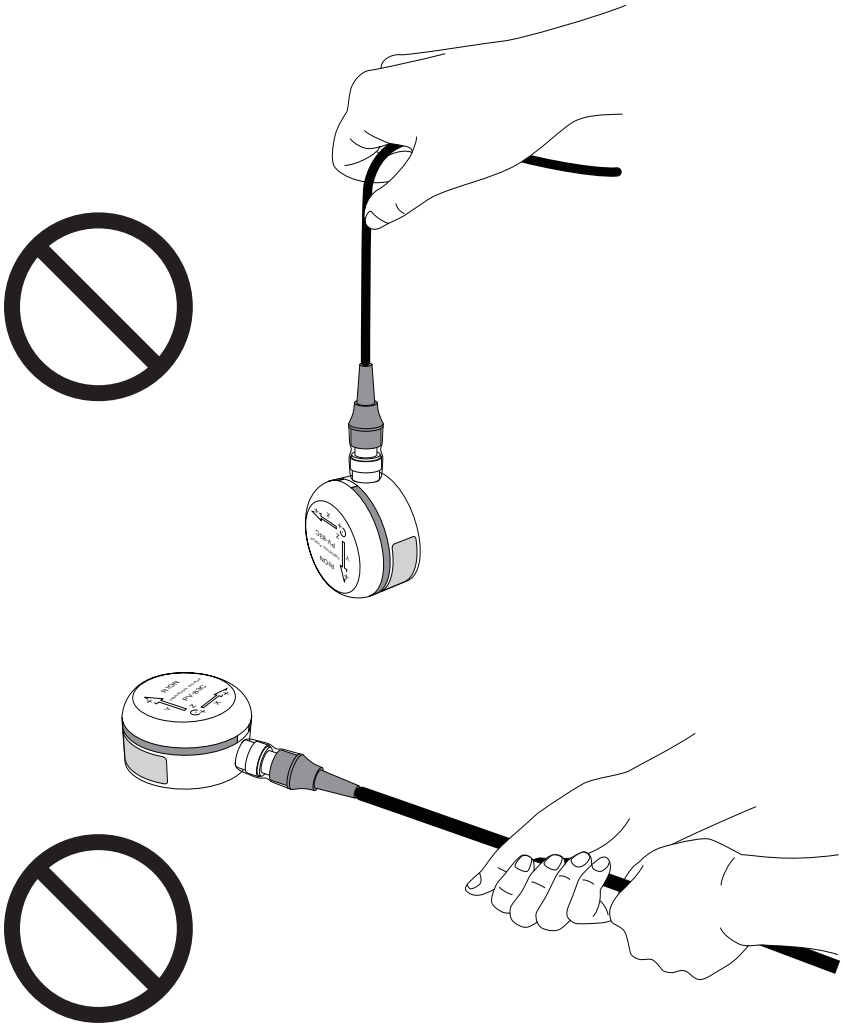
Important
Avoid locations exposed to direct sunlight or to drastic temperature changes. Such conditions can cause changes in accelerometer sensitivity, which will impair the accuracy of measurement results.

Accelerometer connection

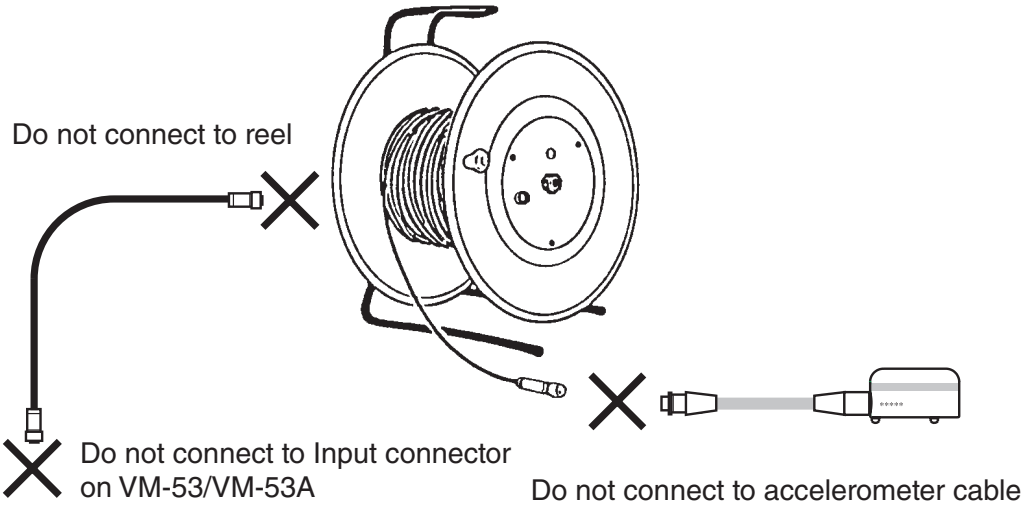
1. Insert the plug of the supplied accelerometer cable EC-02S (3 meters) into the connector on the tip of the accelerometer, aligning the guide on the plug with the connector. Turn the locking ring clockwise to fasten the plug.
2. Insert the plug at the other end of the cable into the Input connector on the VM-53/VM-53A.

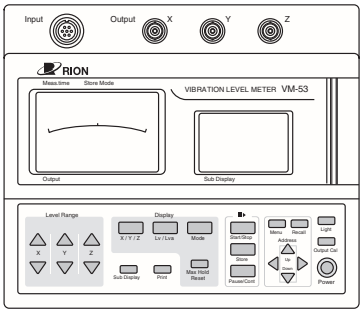
Important
The accelerometer is a precision device. Never drop it or subject it to shocks.

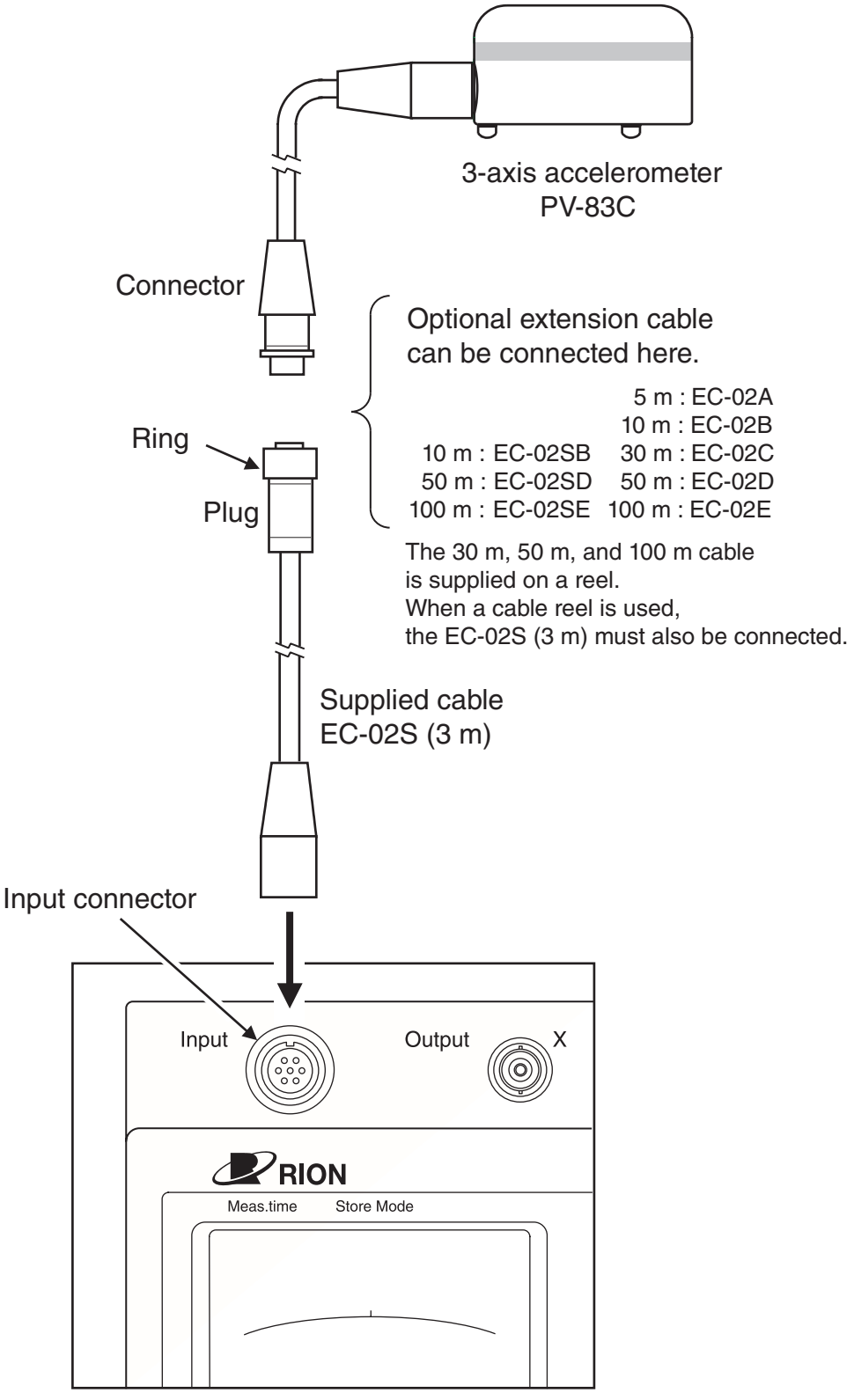
Important
Never suspend the accelerometer by its cable or pull at the cable. Otherwise cable breaks may occur.



Important
When installing or dismantling a system, always make sure that all connection cables are disconnected from the cable reel. Otherwise cable breaks due to twisting may occur.

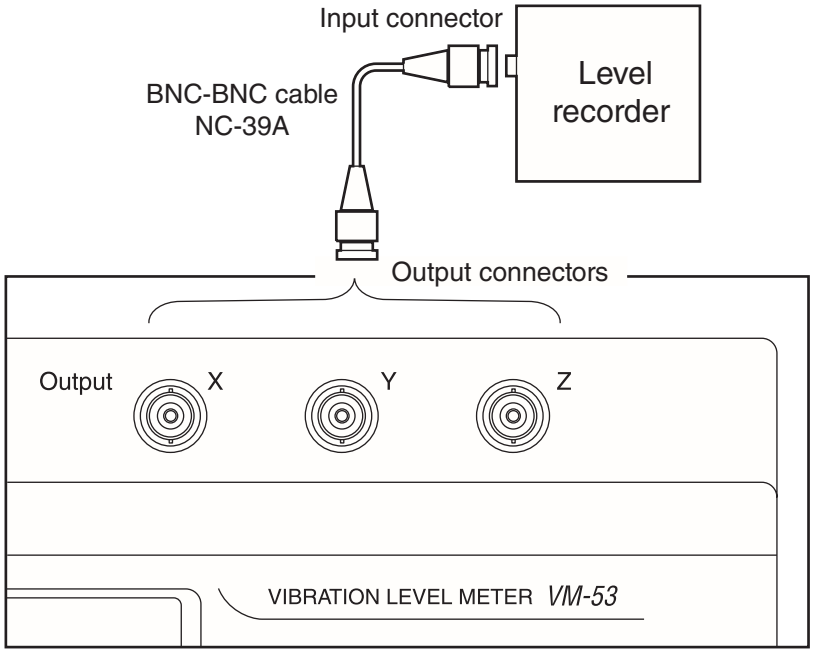





3-axis accelerometer
PV-83C
Connector
Optional extension cable
can be connected here.
5 m : EC-02A
10 m : EC-02B
10 m : EC-02SB
30 m : EC-02C
50 m : EC-02SD
50 m : EC-02D
100 m : EC-02SE
100 m : EC-02E
Ring
Plug
The 30 m, 50 m, and 100 m cable
is supplied on a reel.
When a cable reel is used,
the EC-02S (3 m) must also be connected.
Supplied cable
EC-02S (3 m)
Input connector
Input
Output
X
RION
Meas.time
Store Mode

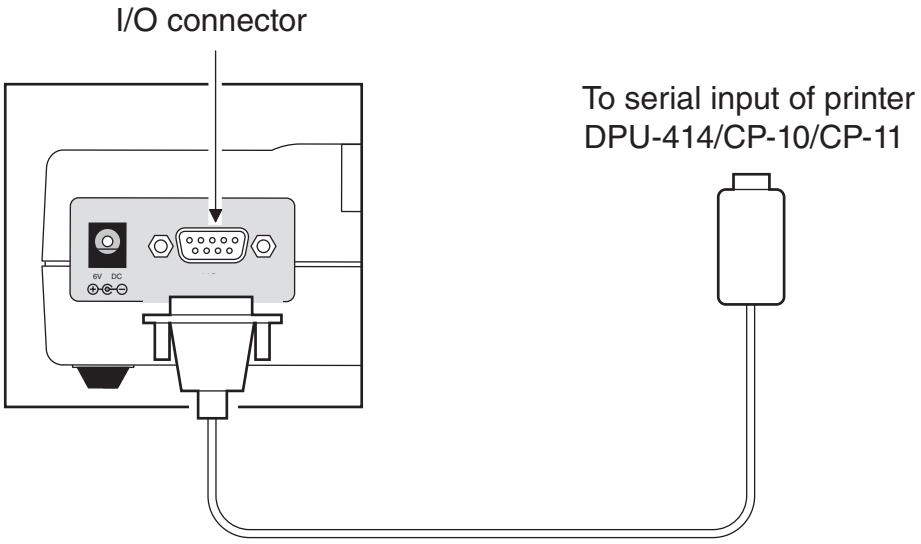
Connection of a level recorder (LR-07, LR-20A, LR-06, LR-04)

Use the BNC-BNC cable NC-39A (option) to connect the input of the level recorder with an output connector (X, Y, or Z) on the VM-53/VM-53A.



Connection to a printer (DPU-414, CP-10, CP-11)

Use a commercially available serial cable (straight cable) to connect the I/O connector on the side of the VM-53/VM-53A to the serial input of the printer (DPU-414, CP-10, CP-11).



Cable:	Straight serial cable (commercially available)
Connector on VM-53/VM-53A:	D-sub 9-pin male
Connector on printer:	D-sub 25-pin female (For DPU-414, conversion adapter supplied with DPU-414 must be used.)

Setting the VM-53/VM-53A for the connection with DPU-414

Use the menu to set the baud rate of this unit to 19200 bps.

Setting the software DIP switches of the DPU-414

Set the power switch to ON while keeping the ON LINE switch.

When printing starts, release the switch. The current settings are printed out.

To choose the "ON" setting, press the ON LINE switch.

To choose the "OFF" setting, press the FEED switch.

You should also refer to the instruction manual for the thermal printer DPU-414.

The procedure for changing DIP switches settings is described below.

Dip SW-1

1 (OFF)	:	Input = Serial
2 (ON)	:	Printing Speed = High
3 (ON)	:	Auto Loading = ON
4 (OFF)	:	Auto LF = OFF
5 (ON)	:	Setting Command = Enable
6 (OFF)	:	Printing
7 (ON)	:	Density
8 (ON)	:	100 %

Dip SW-2

1 (OFF)	:	Printing Columns = 80
2 (ON)	:	User Font Back-up = ON
3 (ON)	:	Character Select = Normal
4 (ON)	:	Zero = Normal
5 (ON)	:	International
6 (ON)	:	Character
7 (ON)	:	Set
8 (ON)	:	=Japan

Dip SW-3

1 (ON)	:	Data Length = 8 bits
2 (ON)	:	Parity Setting = ON
3 (OFF)	:	Parity Condition = Even
4 (OFF)	:	Busy Control = XON / XOFF
5 (OFF)	:	Baud
6 (ON)	:	Rate
7 (ON)	:	Select
8 (OFF)	:	= 19200 bps
Continue ?	:	Push'-line SW'
Write ?	:	Push' Paper feed SW'

DIP SW setting complete !!

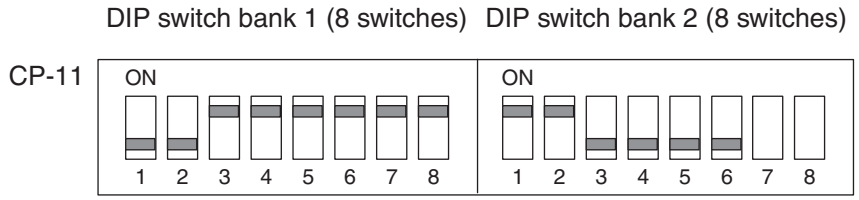
For details, please refer to the documentation of the DPU-414.

Setting the VM-53/VM-53A for the connection with CP-11/CP-10

Use the menu3/5 to set the baud rate of this unit to 9600 bps.

Setting the software DIP switches of the CP-11/CP-10

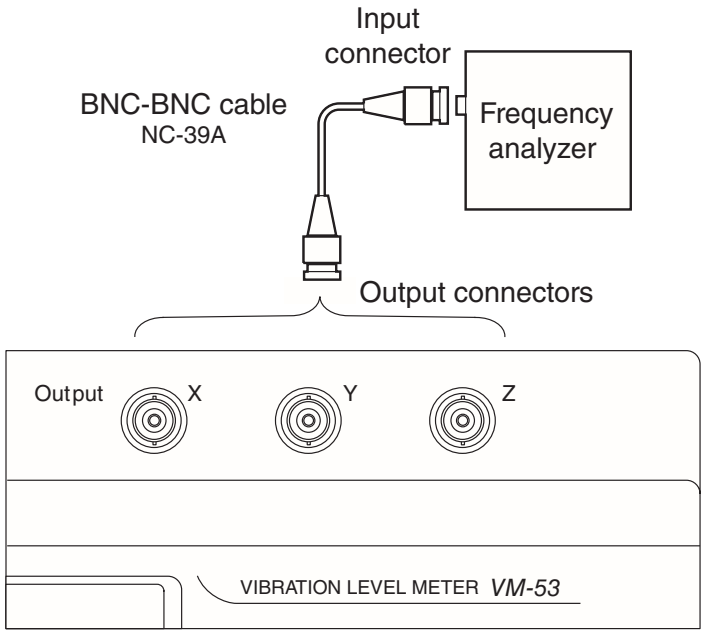
Set the DIP switches shown below.



Important
Switches 7 and 8 of DIP switch bank 2 of printer CP-11 are set at the factory and should not be changed. Otherwise, correct printing may not be possible.

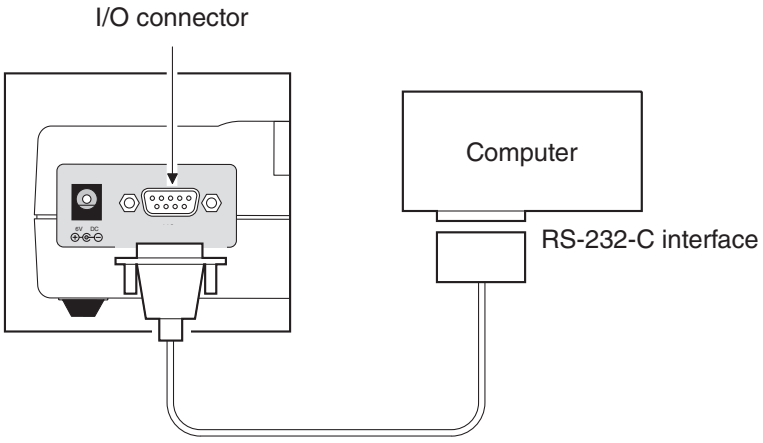
Connection to a frequency analyzer

Use the BNC-BNC cable NC-39A (option) to connect the input of the frequency analyzer with an output connector (X, Y, or Z) on the VM-53/VM-53A. Make the AC/DC output selection with menu screen 1/5.



Connection to a computer

Use a cross-wired (null modem) serial cable to connect the I/O connector on the side of the VM-53/VM-53A to the RS-232C connector of the computer.



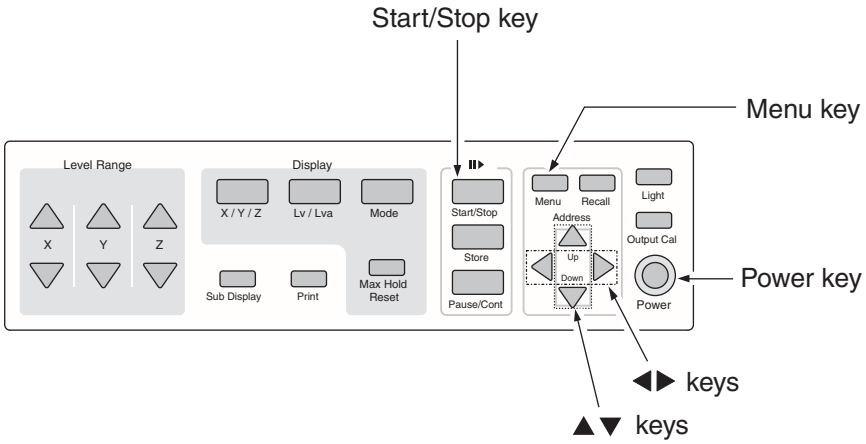
I/O connector on VM-53/VM-53A: D-sub 9-pin male

Setting the date and time

The VM-53/VM-53A incorporates a clock which lets you save date and time information along with measurement data. The clock is also used by the timer function for automated storing.

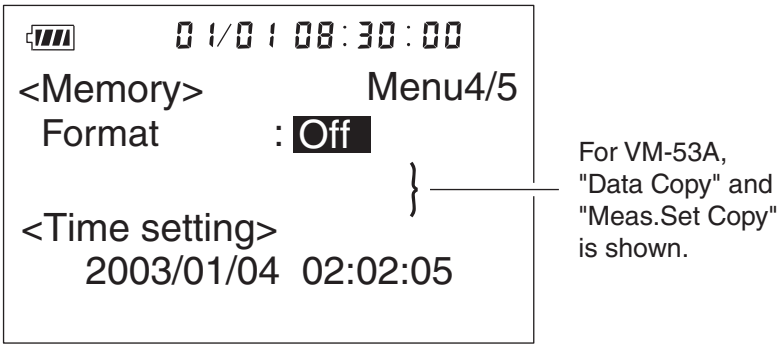
Set the date and time as follows.

1. Press the Power key to turn the unit on.



2. Press the Menu key.
   The menu screen 1/5 appears on the sub display.
3. Press the Menu key 3 times to bring up the indication "Menu 4/5" in the top right of the display.

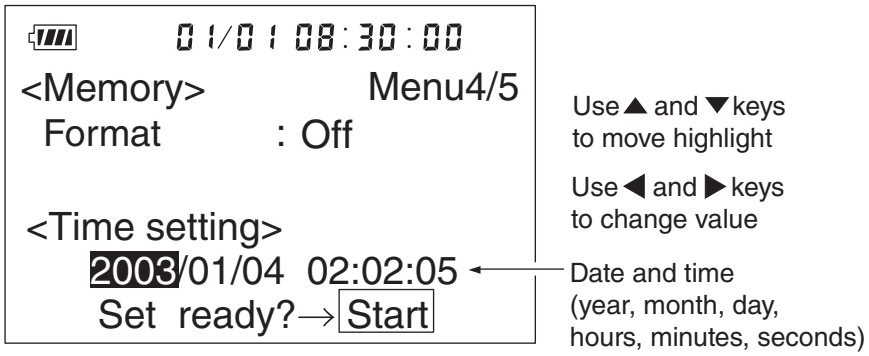
Sub display



VM-53 menu screen 4/5

4. Use the ▲ and ▼ keys to highlight the date or time item that you want to change, and use the ◀ and ▶ keys to change the setting.

Sub display



VM-53 menu screen 4/5

5. Press the Start/Stop key.
   The internal clock is set to the selected date and time.

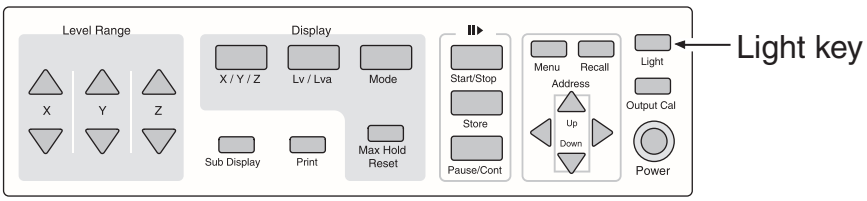
6. Press the Menu key several times to return to the menu screen.

Note
The clock IC used in this unit has an error of about 1 minute per month. Before measurement, be sure to check and set the time if required.
An internal rechargeable backup battery keeps the clock of the unit running when the power is turned off. The backup battery is recharged by the main batteries. The clock will keep running for about 1.5 months on the backup battery alone. If the unit is not to be used for an extended period, the main batteries should be taken out to prevent possible damage due to battery fluid leakage. After reinserting the batteries, be sure to set the date and time.
For information on the rechargeable backup battery, please refer to page 244.

Measurement in dark locations

Pressing the Light key turns the display backlight on, making it easier to read in dark locations. Pressing the key once more turns the light off.

When the backlight is used, current consumption will increase by a factor of about 2.

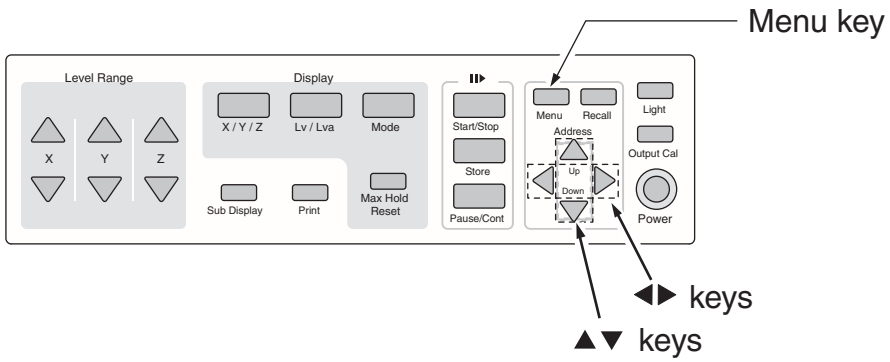


Note
When the unit is operating on battery power, the backlight will be automatically turned off after 10 minutes.

Adjusting the sub display contrast

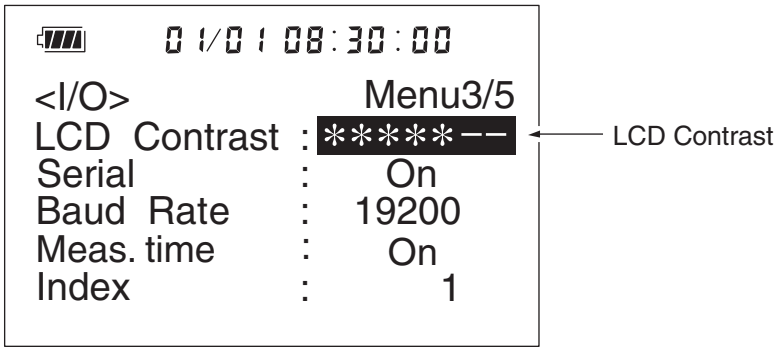
You can adjust the contrast of the sub display as follows.

1. Press the Menu key.
   The menu screen appears on the sub display.



2. Press the Menu key until the indication "Menu 3/5" is shown in the top right of the display.
3. Use the ▲ and ▼ keys to highlight the "✻" symbols of the item "LCD Contrast".

Sub display



Menu screen 3/5

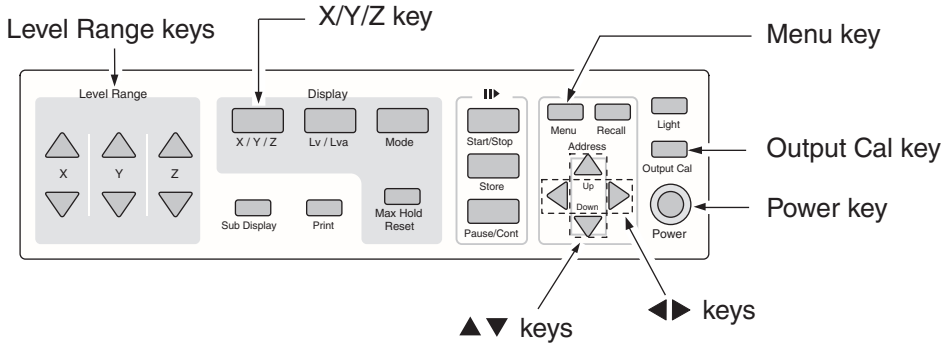
4. Use the ◀ and ▶ keys to increase or decrease the "✻" symbols. This changes the contrast.
5. Press the Menu key several times to return to the menu screen.

Note
The contrast for the main display cannot be changed.

Calibration

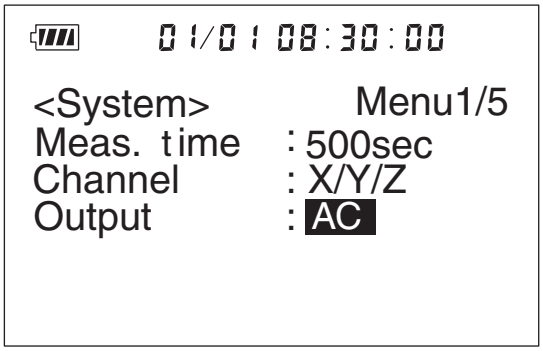
When using external equipment to record measurement data, level calibration should be performed as follows.

1. Press the Power key to turn the unit on.



2. Press the Menu key until the indication "Menu 1/5" is shown in the top right of the display.

Sub display



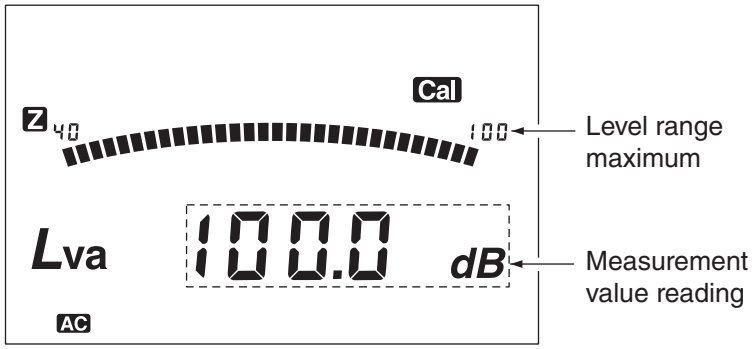
Menu screen 1/5

3. Use the ▲ and ▼ keys to highlight the "Output" item and use the ◀ and ▶ keys to select "AC" or "DC".
   AC: The Output connectors provide AC signal.
   DC: The Output connectors provide DC signal.
   Select the output type that is appropriate for the equipment to be connected.

Note
It is not possible to select different AC or DC settings for individual channels.

4. Press the Menu key several times to return to the menu screen.
5. Press the Output Cal key.
   The main display and sub display switch to calibration indication.
   Verify that the measurement value reading is the same as the maximum value for the level range in each axis (X, Y, Z).

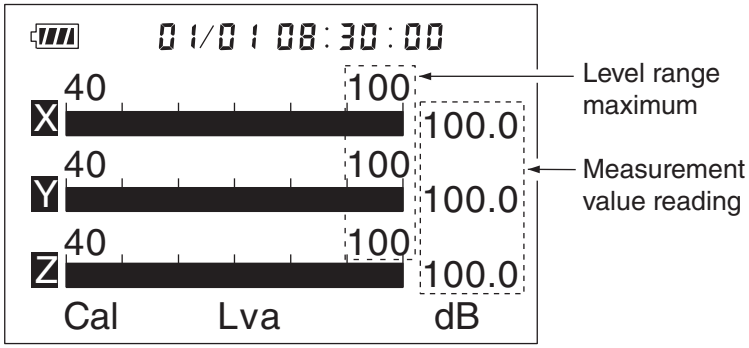
Main display



Calibration screen example

Use the X/Y/Z keys to switch the main display to other vibration axes.

Sub display



Calibration screen example

The sub display is automatically set to bar graph indication for the three vibration axes, allowing you to check all three readings simultaneously.

During calibration, the Output connectors supply the following signal.

AC: 31.5 Hz, 1 Vrms ("AC" selected from menu screen 1/5)

DC: 2.5 V ("DC" selected from menu screen 1/5)

Use this signal to calibrate the external equipment such as a level recorder or analyzer.

6. Press the Output Cal key again to cancel the calibration mode.

Reading the Displays

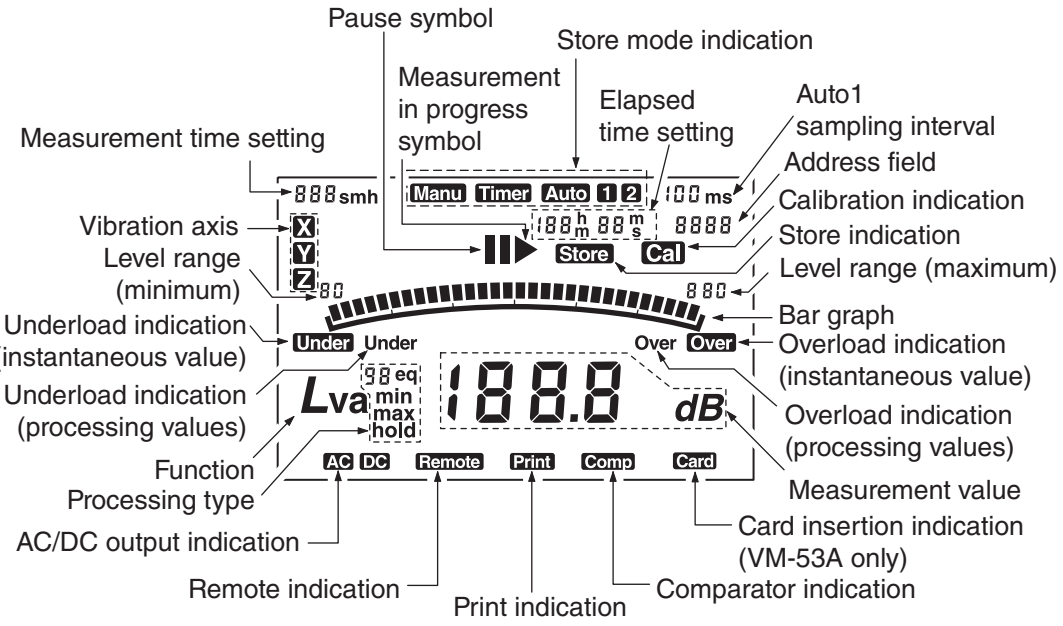
The VM-53/VM-53A has two LCD panels. The left-side panel is the main display and the right-side panel is the sub display.

The main display shows the measurement value reading (instantaneous value, processing values) for the selected vibration axis (X, Y, Z) as well as various parameter settings.

The sub display shows the 3-axis bar graph, level/time screen, menu screens, recall screen, and other information, depending on the measurement mode.

Main display

The illustration below is for demonstration purposes only. In actual use, not all display elements will be visible at the same time.



Measurement time setting

Shows the measurement time as set from menu screen 1/5.

Available settings are 500 s (seconds), 10 s, 1 m (minute), 5 m, 10 m, 15 m, 30 m, 1 h (hour), 4 h, 8 h, 24 h. When the measurement time is set to "Manual", nothing is shown here.

Pause symbol

Appears when the unit is in pause mode.

Measurement in progress symbol

Flashes during processing and while data are being stored in memory.

Store mode indication

Shows the selected store mode.

Available settings are Manual, Auto1, Auto2, Timer Auto1, and Timer Auto2.

The store mode is selected from menu screen 2/5.

Elapsed time indication

Shows the elapsed time for processing or for storing data in memory. When the time is less than one hour, the indication is in minutes (m) and seconds (s). When the time is one hour and above, the indication is in hours (h) and minutes (m).

Auto1 sampling interval

When the store mode is Auto1 or Timer Auto1, the sampling interval (100 ms or 1 s) is shown here.

The sampling interval is selected from menu screen 2/5.

Address field

The content of this indicator depends on the store mode.

Manual:	The address is shown.
Auto2, Timer Auto2:	The number of stored data in the measurement time is shown.

Calibration indication

Appears when the Output Cal key was pressed and the unit is in calibration mode.

Store indication

Appears when data are being stored in memory.

Level range (maximum)

Shows the maximum (full-scale) value for the bar graph, as set with the level range keys.

Bar graph

A bar graph corresponding to the measurement value is shown here. The display update frequency is 100 ms.

Overload indication (instantaneous value)

Appears when overload in the instantaneous value was detected.

Overload indication (processing values)

Appears when overload during processing was detected. The indication remains on until the start of the next processing measurement. The indication also appears when overload was detected during maximum value hold.

Measurement value

The measurement result is shown here. The display update frequency is 1 s.

Card insertion indication (VM-53A only)

Appears when a memory card is inserted in the card slot.

Comparator indication

Appears when the comparator function is being used.

The comparator function is selected from menu screen 5/5.

Print indication

Appears while data are being sent to the printer.

Remote indication

Appears when the unit is being controlled via a serial link.

AC/DC output indication

Shows the selected output type.

AC: Output connectors supply AC signal.

DC: Output connectors supply DC signal.

The AC/DC output is selected from menu screen 1/5.

Processing type

Shows the kind of processing function that has been selected with the Mode key.

98:	Time percentile level (5, 10, 50, 90, 95)
eq:	Power average
min:	Minimum value during measurement interval
max:	Maximum value during measurement interval
max hold:	Maximum value hold

Function

Shows the function that has been selected with the Lv/Lva key.

Lv:	Vibration level
Lva:	Vibration acceleration level

Underload indication (processing values)

Appears when underload during processing was detected. The indication remains on until the start of the next processing measurement.

Underload indication (instantaneous value)

Appears when underload was detected.

Level range (minimum)

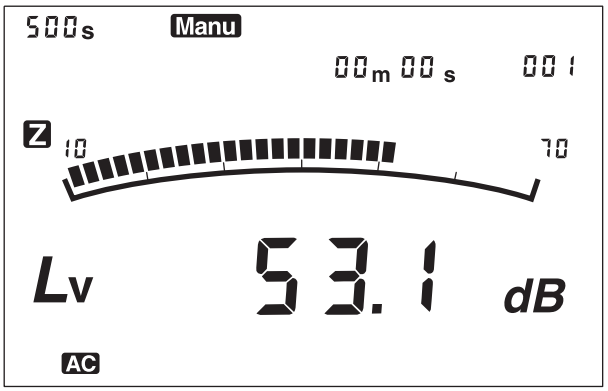
Shows the minimum value for the bar graph.

Vibration axis

Shows which vibration axis is currently selected for measurement value display.

The axis is selected with the X/Y/Z keys.

Main display content example



Instantaneous value display example

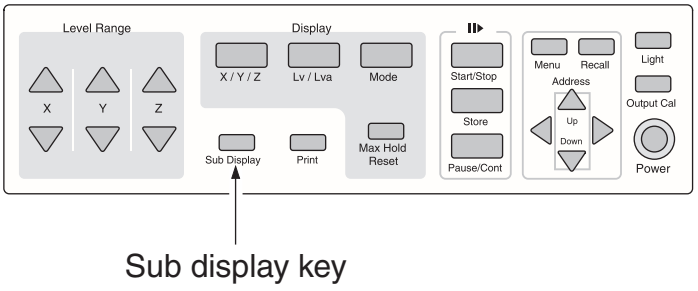
While a menu is shown and during recall operation, the display shows "--- dB".

When single-axis measurement was selected with menu screen 1/5, 0.0 dB is shown for the other channels.

Sub display

The sub display employs a dot-matrix type LCD which allows various display functions.

The Sub Display key serves to switch between these functions. The screen also changes according to the operation mode.



The battery capacity and date/time indications also appear on the sub display.

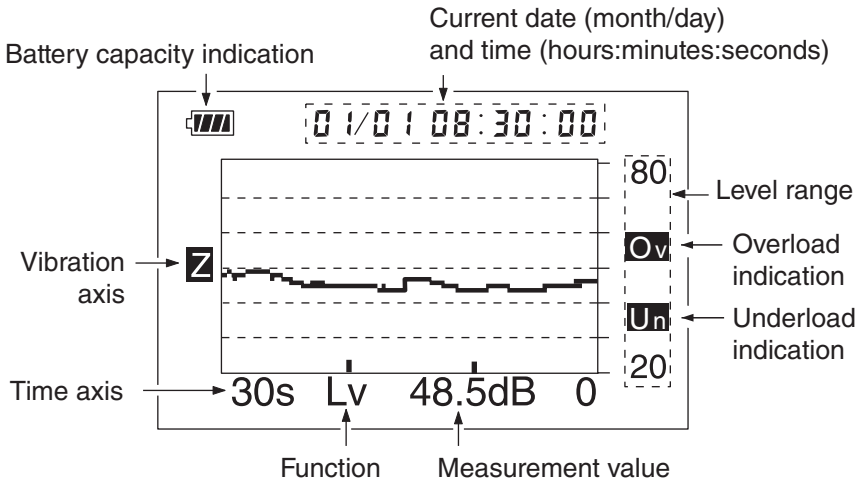
Instantaneous value and processing measurement

You can select the display screens for level/time, bar graph, processing list, or parameter setting check.

Single-axis level/time screen

This screen shows a level/time graph for the same axis as selected for the main display (X, Y, Z).

The level resolution (vertical direction) is 1.25 dB per dot, with a range of 60 dB. The time axis (horizontal direction) corresponds to 30 seconds.

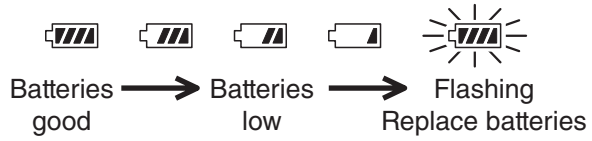


Single-axis level/time screen example

Battery capacity indication

When the unit is operating on battery power, you should periodically check the battery capacity indicator. The number of black segments decreases as the batteries are used up. When the display starts to flash, correct measurement is no longer possible. Replace the batteries with a fresh set.

The battery capacity indication is also displayed while the unit is powered from the AC adapter.

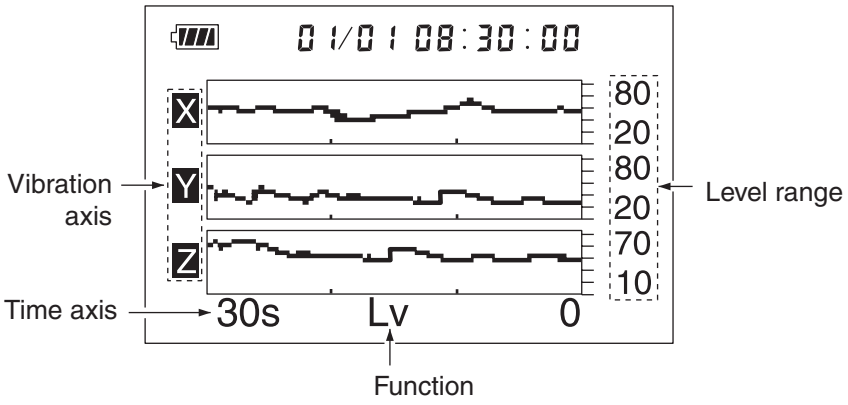


3-axis level/time screen

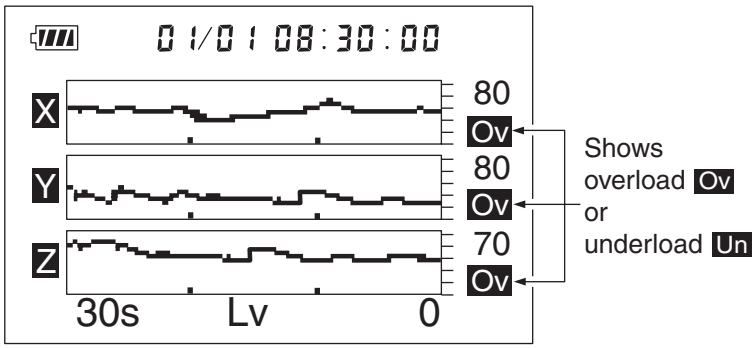
This screen shows level/time graphs for all three axes simultaneously. The level resolution (vertical direction) is 4 dB per dot for one axis, with a range of 60 dB. The time axis (horizontal direction) corresponds to 30 seconds.

This screen is shown when 3-axis (X, Y, Z) measurement is being carried out.

If the setting of the <System> Channel item on menu screen 1/5 is not "X/Y/Z", this screen is not shown.



3-axis level/time screen example



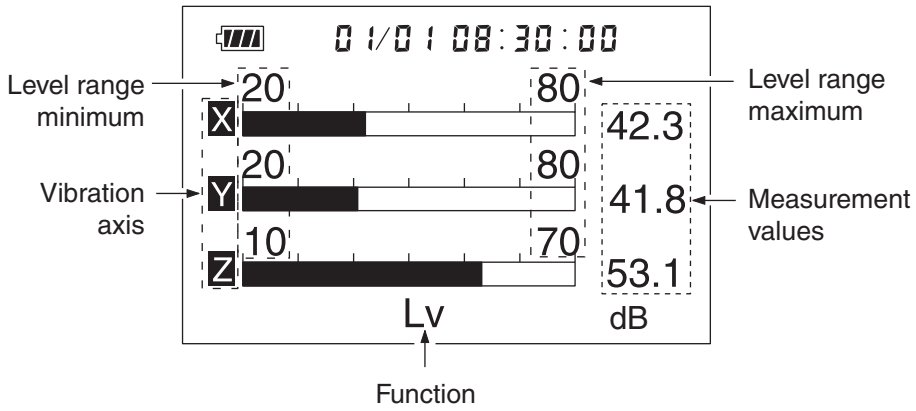
Overload and underload indication on 3-axis level/time screen

3-axis bar graph screen

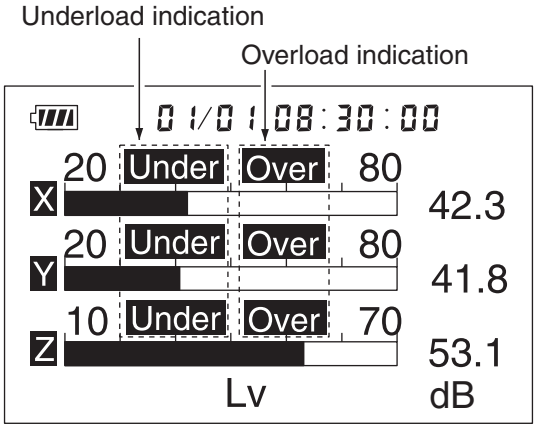
This screen bar graphs for all three axes and the instantaneous values simultaneously.

This screen is shown when 3-axis (X, Y, Z) measurement is being carried out.

If the setting of the <System> Channel item on menu screen 1/5 is not "X/Y/Z", this screen is not shown.



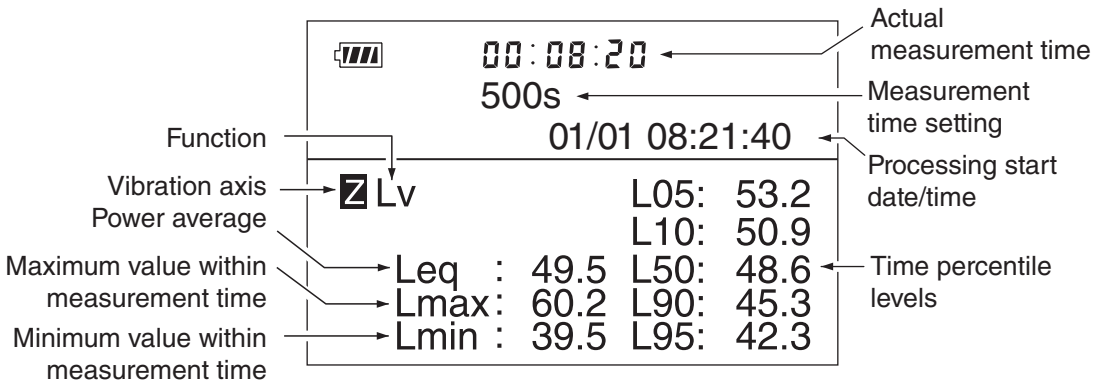
3-axis bar graph screen example



Overload and underload indication on 3-axis bar graph screen

Processing list screen

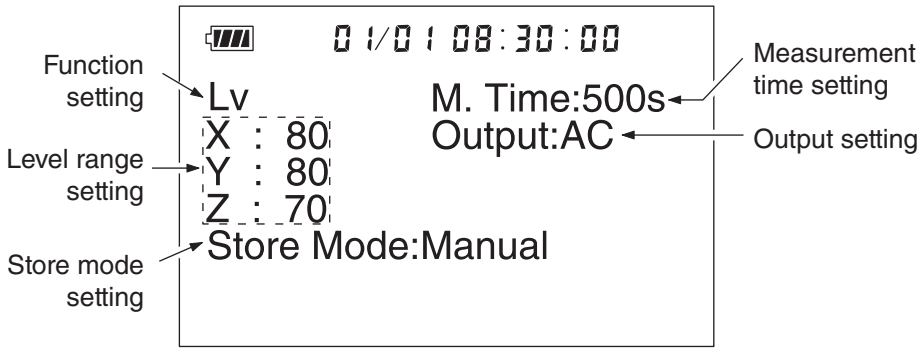
Shows the processing results as a list display.



Processing list screen example

Parameter setting check screen

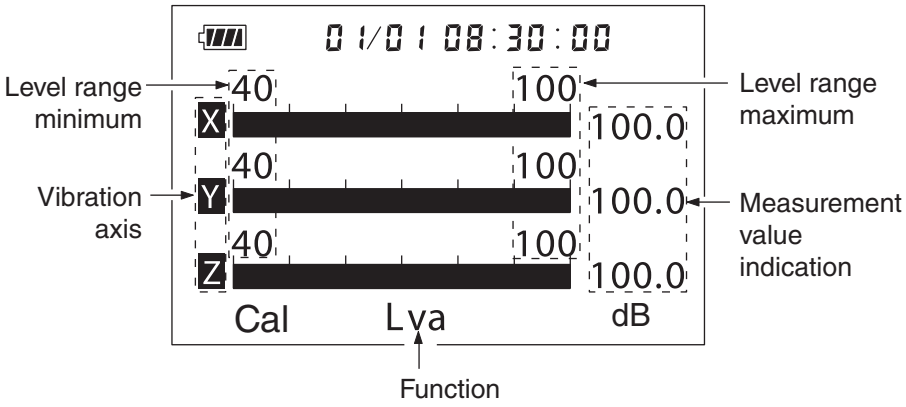
Lets you check the current settings of some major parameters.



Parameter setting
check screen example

Calibration mode

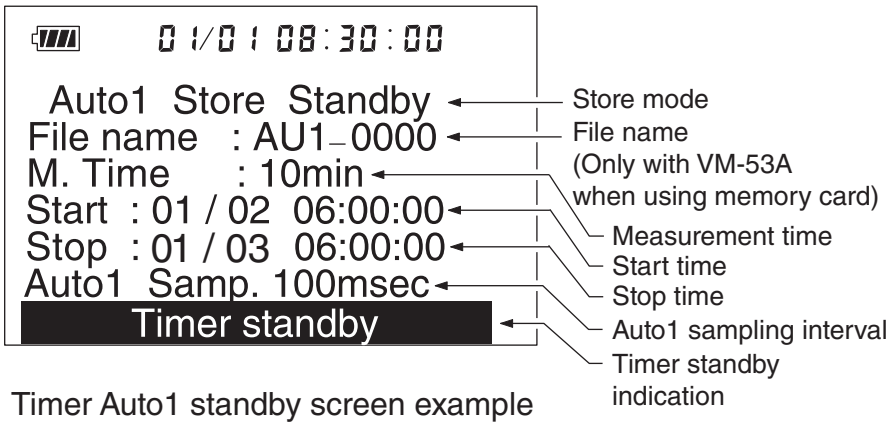
During calibration, the 3-axis bar graph screen is shown.



Calibration screen example

Timer standby mode

When the store mode is Timer Auto1 or Timer Auto2 and the unit is in the standby condition, the standby screen is shown.



Timer Auto1 standby screen example

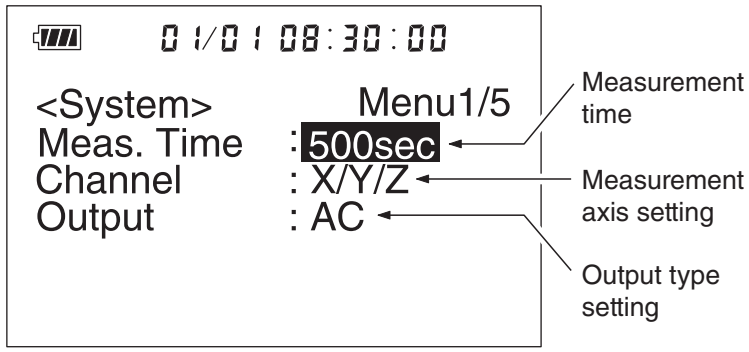
Menu screens

The VM-53/VM-53A has five menu screens which are shown on the sub display and are numbered 1/5 to 5/5. The Menu key lets you cycle through the screens.

To select an item on a menu screen, you use the ▲ and ▼ keys.

To change the setting of an item, you use the ◀ and ▶ keys.

Menu screen 1/5



Menu screen 1/5

Meas.Time (Measurement time)

Selects the measurement time.

Available settings are 500 s (seconds), 10 s, 1 m (minute), 5 m, 10 m, 15 m, 30 m, 1 h (hour), 4 h, 8 h, 24 h, and Manual.

When the measurement time is set to "Manual", the longest actual measurement time will be 199 hours 59 minutes 59 seconds.

The Start/Stop key can be used at any time to stop a measurement.

Channel (Measurement axis setting)

Selects whether 3-axis (X, Y, Z) measurement or single-axis measurement in a selected direction (X or Y or Z) is carried out.

When single-axis measurement is performed, current consumption will be reduced by about 10% compared to 3-axis measurement.

X/Y/Z:	3-axis (X, Y, Z) measurement
X:	X-axis measurement
Y:	Y-axis measurement
Z:	Z-axis measurement

When single-axis measurement is performed, the measurement value readings for the other channels will be 0.0 dB.

OUTPUT (Output type)

Selects the type of signal provided at the Output connectors.

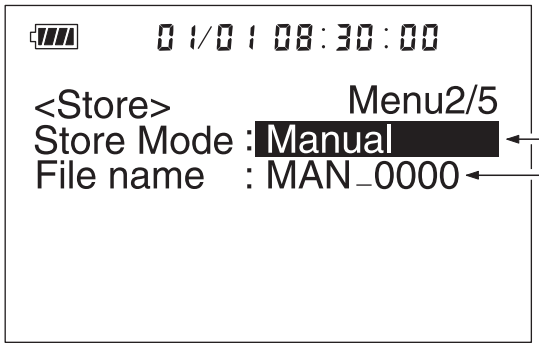
AC: Output connectors supply AC signal.

DC: Output connectors supply DC signal.

Note
It is not possible to select different AC or DC settings for individual channels.

Menu screen 2/5

Menu screen 2/5



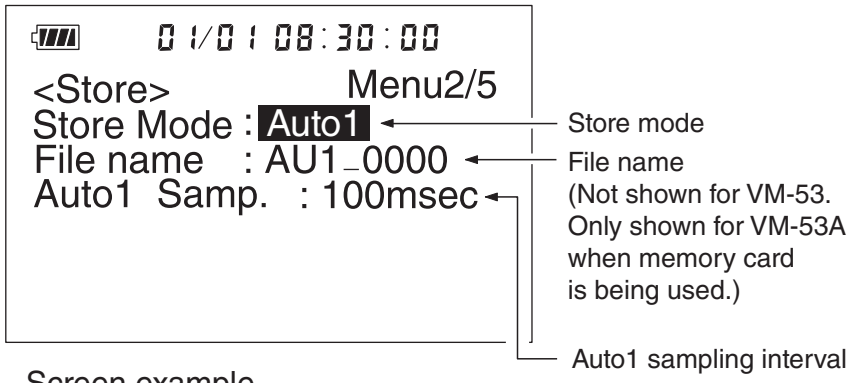
Screen example
for Manual store mode setting

Store Mode

Sets the store mode.

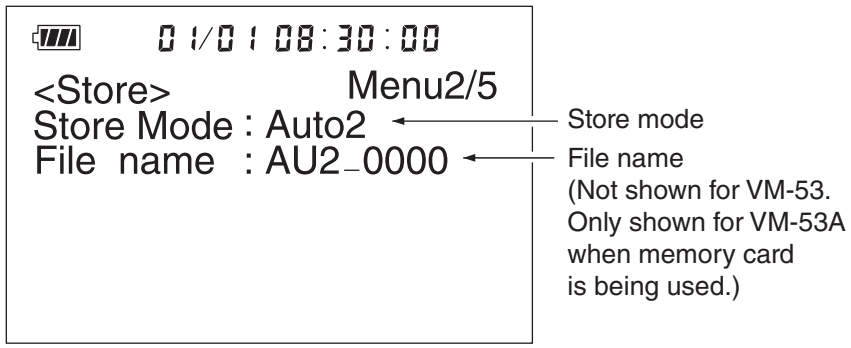
Manual:	The instantaneous value (vibration level or vibration acceleration level) is stored when the Store key is pressed.
Auto1:	The vibration level or vibration acceleration level is stored continuously every sampling interval (100 ms or 1 s).
Auto2:	The processed measurement values are stored continuously for each measurement time (Meas.Time) interval.
Timer Auto1:	Auto1 mode with timer control
Timer Auto2:	Auto2 mode with timer control

Sub display



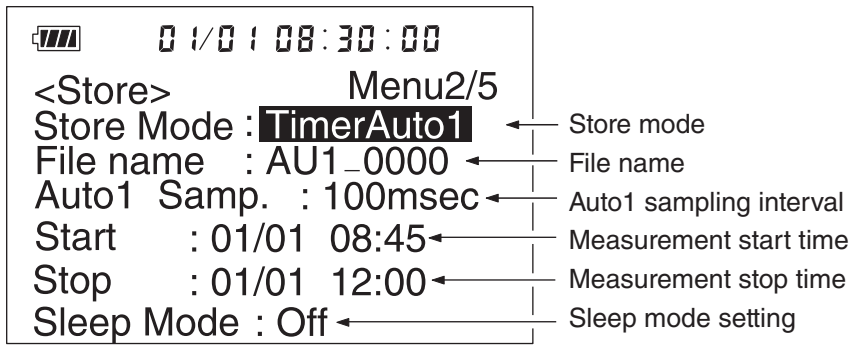
Screen example
for Auto1 store mode setting

Sub display



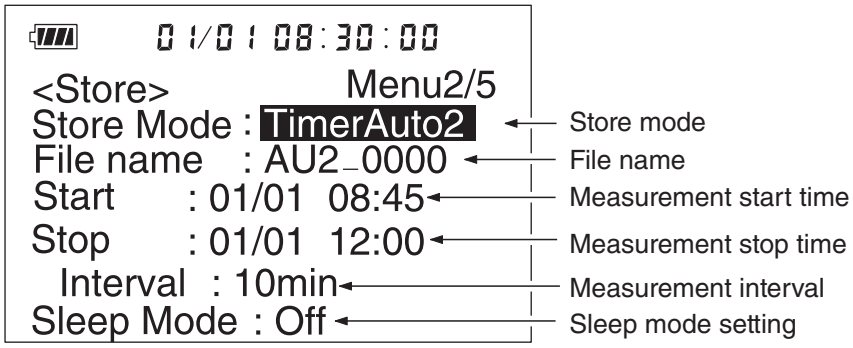
Screen example
for Auto2 store mode setting

Menu screen 2/5



Screen example
for Timer Auto1 store mode setting

Menu screen 2/5



Screen example
for Timer Auto2 store mode setting

File name (only shown for VM-53A)

This item is shown when a memory card is being used in the VM-53A.

A four-digit number can be specified as file name.

When no memory card is being used in the VM-53A, the item is not shown.

Auto1 Samp. (Auto1 sampling interval)

Sets the sampling interval for continuous data storing in Auto1 mode.

The available settings are 100 msec and 1 sec.

This item can be set in the Auto1 and Timer Auto1 store mode.

Start (Measurement start time)

Sets the start time for timer controlled measurement.

This item can be set in the Timer Auto1 and Timer Auto2 store mode.

Stop (Measurement stop time)

Sets the stop time for timer controlled measurement.

This item can be set in the Timer Auto1 and Timer Auto2 store mode.

Interval (Measurement interval)

Sets the measurement interval.

Available settings are Off, 5 min, 10 min, 15 min, 30 min, and 1 hour.

This item can be set in the Timer Auto2 store mode.

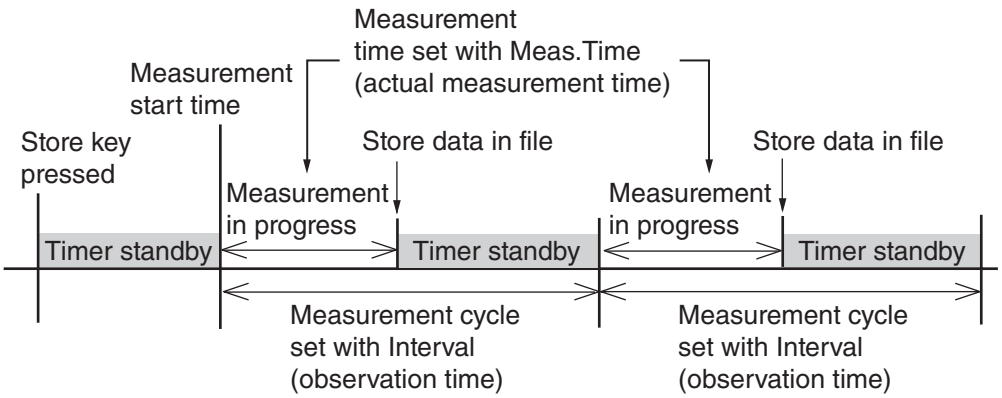
Sleep mode (Timer standby sleep setting)

This setting controls the condition of the internal circuits of the unit during the timer standby period.

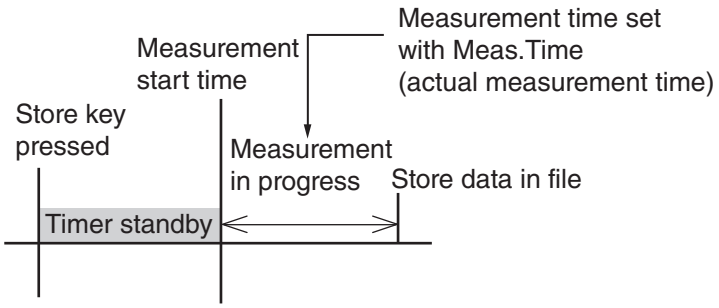
When set to "On", the internal circuits will be in sleep mode during timer standby, which reduces current consumption by about 50%.

This item can be set in the Timer Auto1 and Timer Auto2 store mode.

If the "On" setting is selected, there will be no output signal at the Output connectors during timer standby.



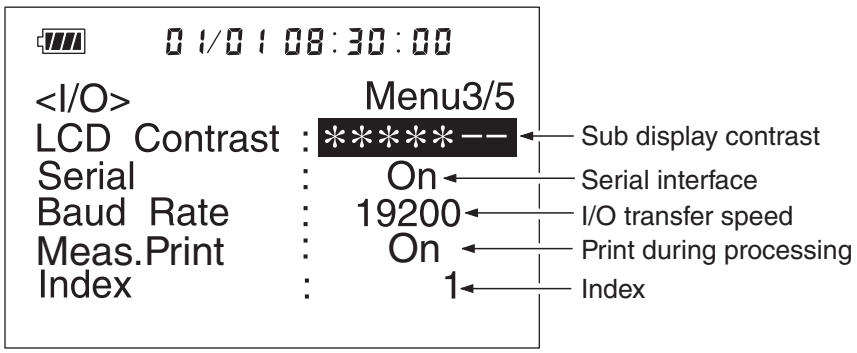
Operation example for Timer Auto2 mode with Interval setting and Sleep Mode On



Operation example for Timer Auto1 mode with Sleep Mode On

Menu screen 3/5

Menu screen 3/5



LCD Contrast (Sub display contrast)

The number of asterisks "*" corresponds to the contrast setting.

Serial (Serial interface)

Sets the serial interface to On or Off. To use the I/O connector, the setting must be "On".

Baud Rate (I/O transfer speed)

Sets the transfer speed for RS-232-C serial communication or data transfer to a printer.

Available settings are 4800 bps, 9600 bps, and 19200 bps.

Meas.Print (Print during processing)

Sets the printing function to On or Off.

When the setting is "On", instantaneous value data will be printed automatically every 5 seconds after processing was started with the Start/Stop key.

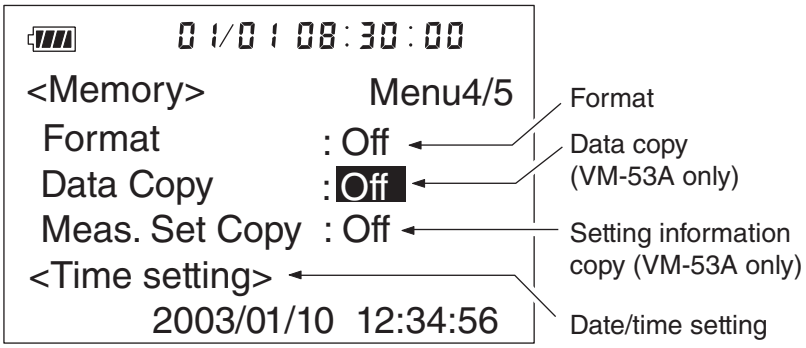
The processing result is also printed when processing is completed.

Index

Sets an index number from 1 to 255. This can be used to identify the unit when multiple VM-53/VM-53A units are used in a system.

Menu screen 4/5

Menu screen 4/5



Format

VM-53: Set to "On" when wishing to clear all data stored in the internal memory.

VM-53A: Set to "On" when wishing to clear all data on a memory card inserted in the unit. (This does not perform a physical format.)

If no memory card is inserted, all data stored in the internal memory will be cleared.

Data Copy (VM-53A only)

This lets you copy all data stored in the internal memory onto a memory card, using a specified file name.

Meas. Set Copy (Measurement setting information copy) (VM-53A only)

This lets you copy setting information about level range, L_v/L_{va} etc. onto a memory card. This information can later be used to start the VM-53A with these settings. (For details, see page 233.)

Time setting (Date/time setting)

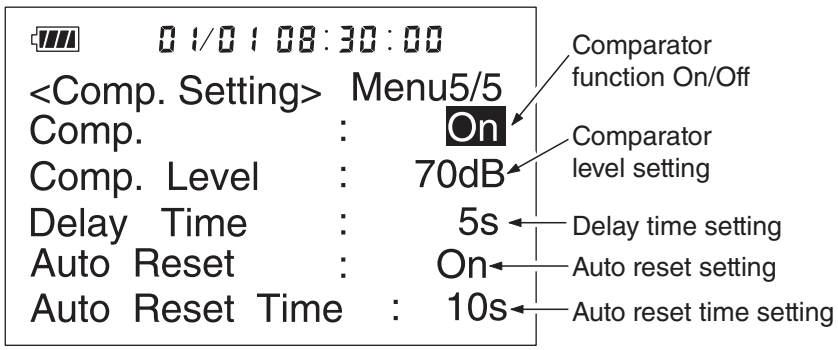
Lets you set the year, month, day, hours, minutes, and seconds.

When you press the Start/Stop key, the internal clock is set to the selected date and time and starts to run.

Settings will not become active unless the Start/Stop key is pressed.

Menu screen 5/5

Menu screen 5/5



Screen example
for comparator function On

Comp. (Comparator function On/Off setting)

Turns the comparator function on or off.

When this item is set to "On", various other settings for the comparator function can be made. (When this item is set to "Off", the other settings are not shown.)

Comp. Level (Comparator level setting)

Sets the level at which the comparator function becomes active. When this level is exceeded, an output signal is provided at the I/O connector.

The setting range is 30 to 120 dB in 1-dB steps.

Delay Time

Sets the delay between the point where the comparator level is exceeded and the I/O connector output becomes active.

The setting range is 0 to 9 seconds in 1-s steps.

Auto Reset

This item controls the I/O connector output when the level falls under the comparator level again.

On:	The comparator output is automatically reset (turned off).
Off:	The comparator output remains on.

Auto Reset Time

Sets the delay until auto reset becomes active.

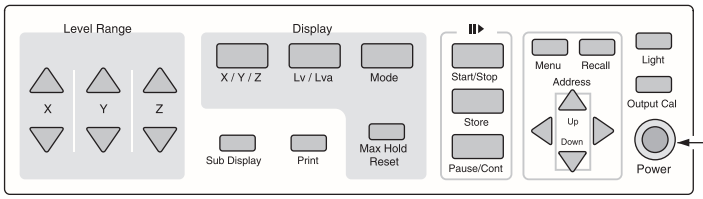
The setting range is 0 to 90 seconds in 1-s steps.

Power-On/Off

Power-on

Hold down the Power key for about 1 second until the sub display shows the power-on screen. When the screen appears, release the Power key.

After the initialization screen was shown, the measurement screen appears.



Sub display screen during power-on (initialization screen)

Note
Pressing the Output Cal key while the initialization screen shown above is displayed brings up the software version information screen of the unit.

Power-off

Hold down the Power key for about 1 second until the sub display shows the power-off screen. When the screen appears, release the Power key.

Sub display screen
during power-off

Note
After turning the unit off, wait at least 5 seconds before turning power back on again.

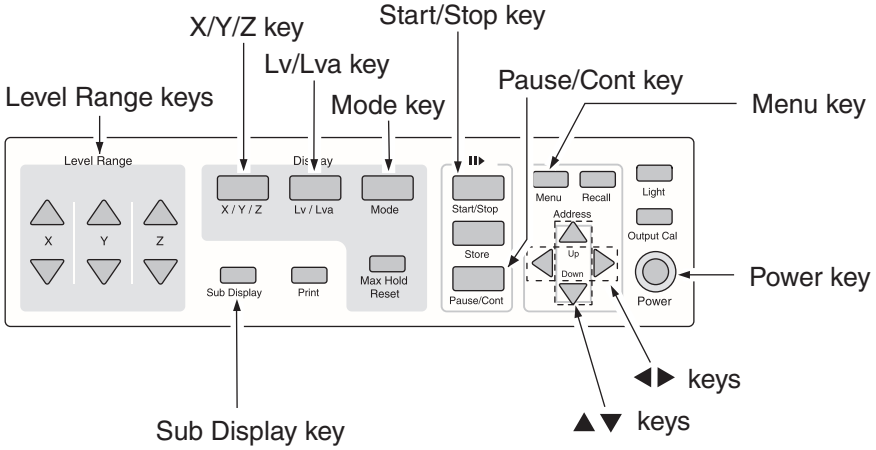
Measurement

The VM-53/VM-53A can measure the vibration level or vibration acceleration level as defined by the Japanese Industry Standard for vibration meters (JIS C 1510: 1995). Vibration level measurements are weighted according to human vibration sensitivity characteristics.
When the "Channel" item on menu screen 1/5 is set to X/Y/Z, 3-axis measurement and processing is performed. When one axis (X or Y or Z) is selected, measurement and processing is performed for that axis only.
The following description assumes that the steps described in the paragraph "Preparations" (on page 12) have been completed.

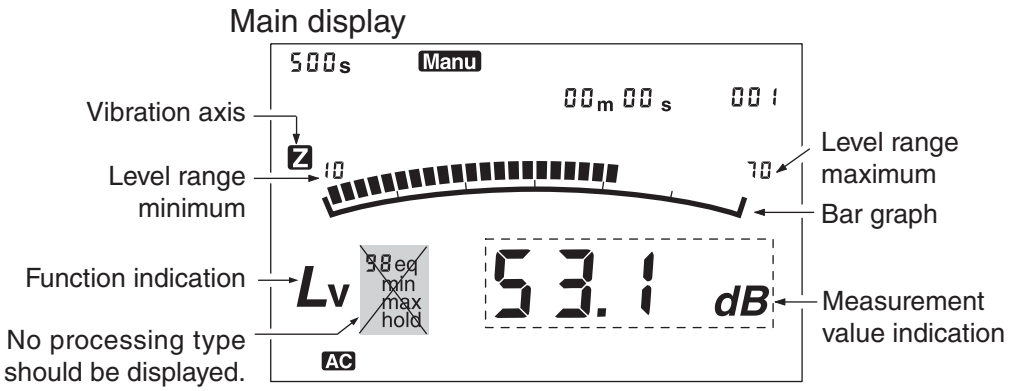
Vibration level measurement

To carry out vibration level measurement, proceed as follows.

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again.
   The display shown below is only an example.

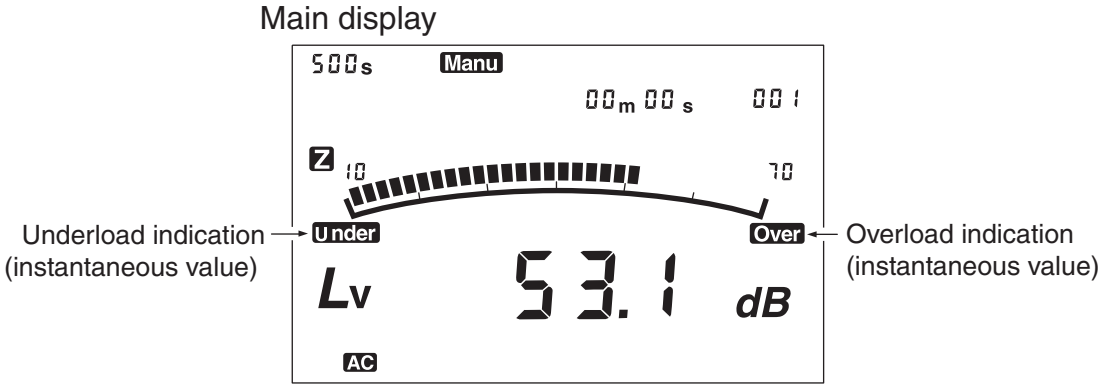


2. Use the "Channel" item on menu screen 1/5 to select the vibration axis for the measurement. If X/Y/Z is selected, measurement is performed for all 3 axes.
   Otherwise measurement is performed only for the selected axis.
3. Select the "Lv" function with the Lv/Lva key.
4. Select the vibration axis with the X/Y/Z key.



Vibration level
measurement screen example

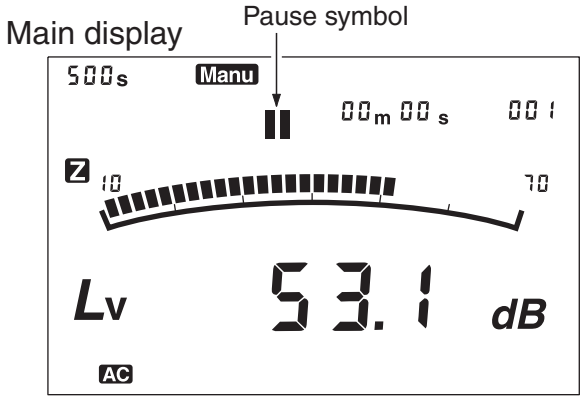
5. Select the level range with the Level Range keys.
   If [Over] or [Under] is shown frequently, change the level range setting.



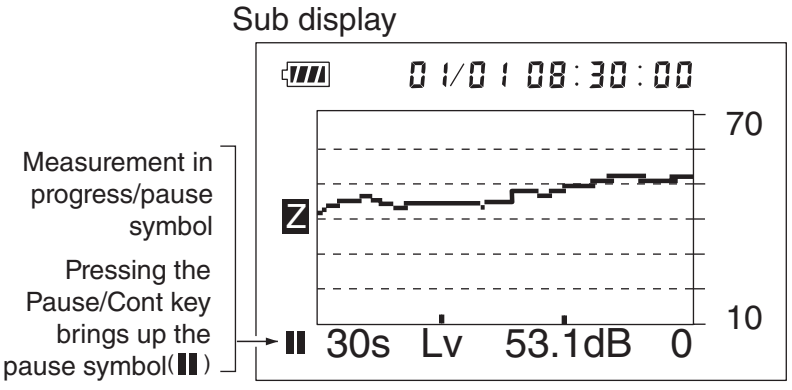
Over, Under indication

6. The measurement value indicated on the display is the vibration level.
   The reading is updated every second.

   You can use the Pause/Cont key to pause the numeric value indication and to resume normal operation. The bar graph will be updated also in pause mode.
   While the unit is in pause mode, a pause symbol (❚❚) is shown.



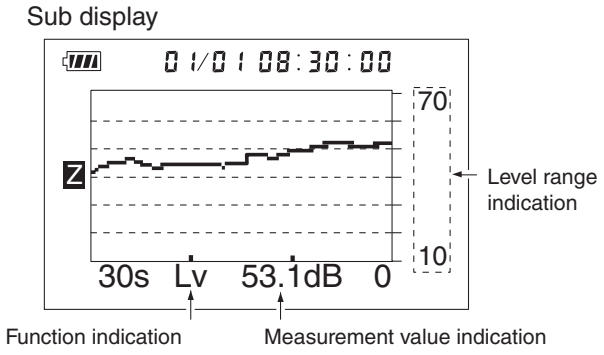
Paused display



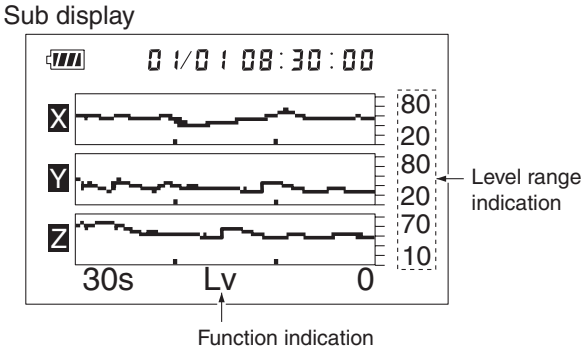
Symbol indication on sub display

Note
When single axis is selected for the "Channel" item on menu screen 1/5, the reading for the other channels is "0.0". After power was turned on, the internal circuits of the unit take about one minute to stabilize. Start the measurement only after waiting at least a minute. When no processing type is shown, the unit is in vibration level mode. If any processing type is shown, press the Mode key several times until the indication disappears.

Sub display screen examples

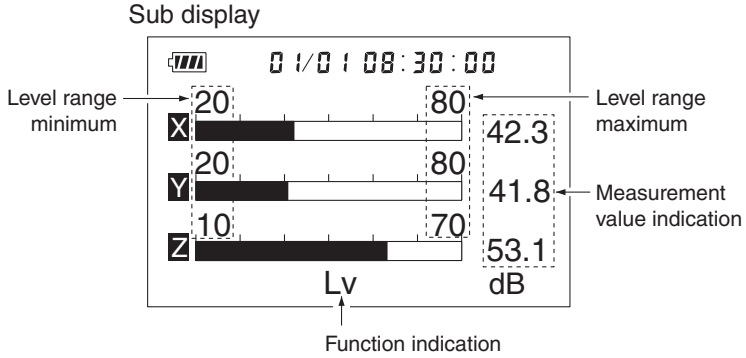


Single-axis level/time graph example



3-axis level/time graph example

Only shown when "Channel" item on menu screen 1/5 is set to X/Y/Z.

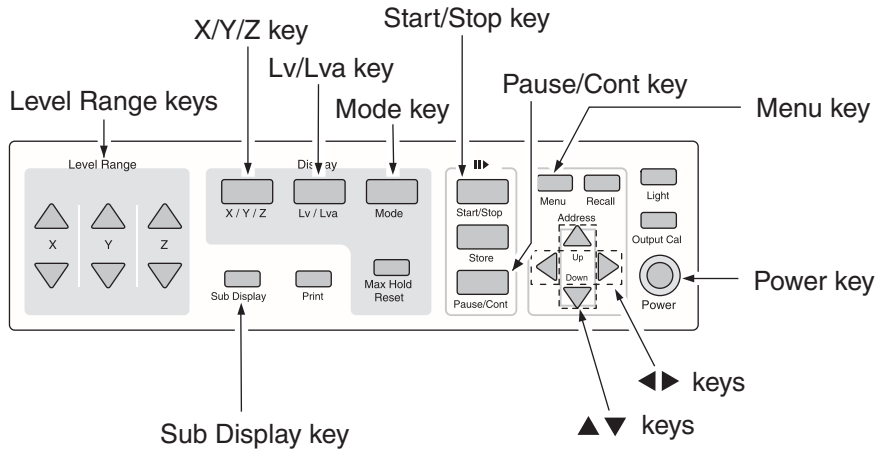


3-axis bar graph screen example

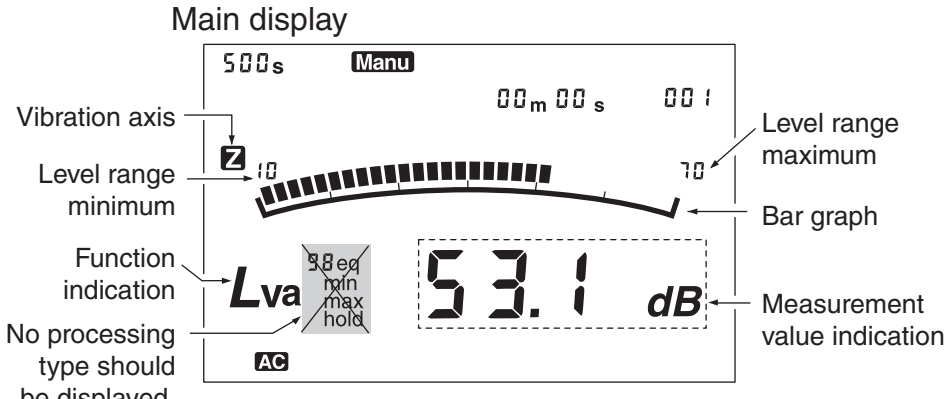
Only shown when "Channel" item on menu screen 1/5 is set to X/Y/Z.

Vibration acceleration level measurement

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again.
   The display shown below is only an example.

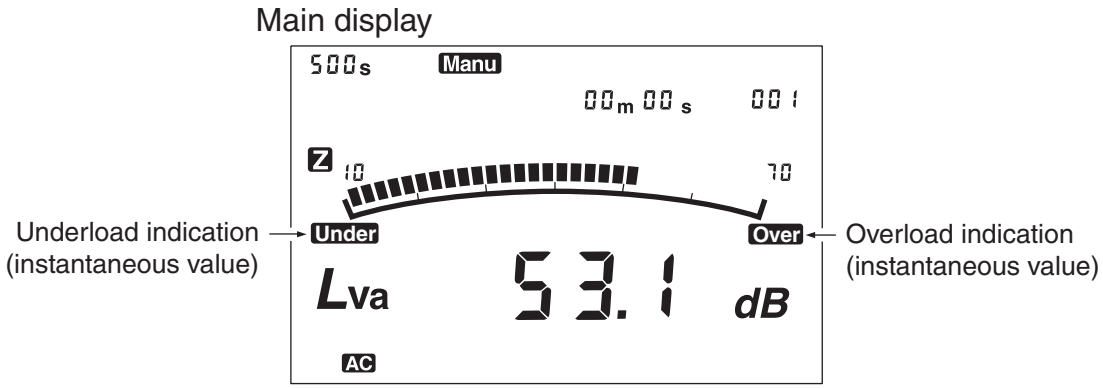


2. Use the "Channel" item on menu screen 1/5 to select the vibration axis for the measurement. If X/Y/Z is selected, measurement is performed for all 3 axes.
   Otherwise measurement is performed only for the selected axis.
3. Select the "Lva" function with the Lv/Lva key.
4. Select the vibration axis with the X/Y/Z key.



Vibration acceleration level measurement screen example

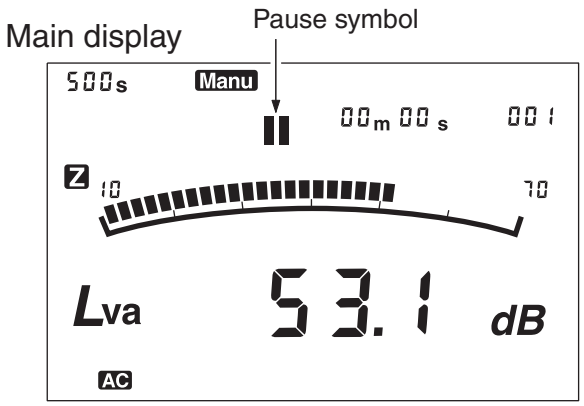
5. Select the level range with the Level Range keys.
   If [Over] or [Under] is shown frequently, change the level range setting.



Over, Under indication

6. The measurement value indicated on the display is the vibration acceleration level.
   The reading is updated every second.

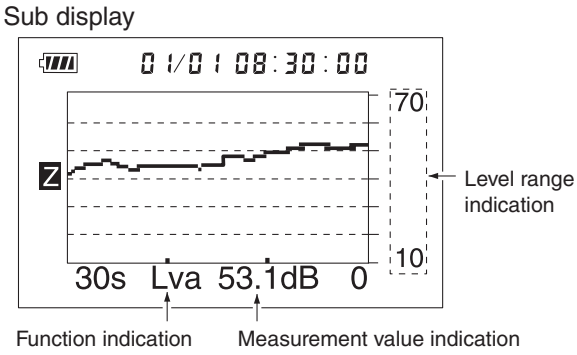
   You can use the Pause/Cont key to pause the numeric value indication and to resume normal operation. The bar graph will be updated also in pause mode.
   While the unit is in pause mode, a pause symbol (▮▮) is shown.



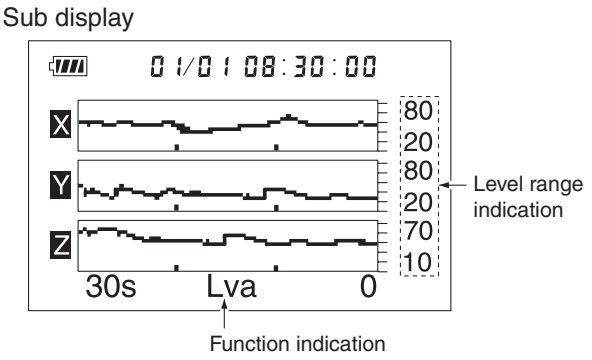
Paused display

Note
When single axis was selected for the "Channel" item on menu screen 1/5, the reading for the other channels is "0.0". After power was turned on, the internal circuits of the unit take about one minute to stabilize. Start the measurement only after waiting at least a minute. When no processing type is shown, the unit is in vibration level mode. If any processing type is shown, press the Mode key several times until the indication disappears.

Sub display screen examples

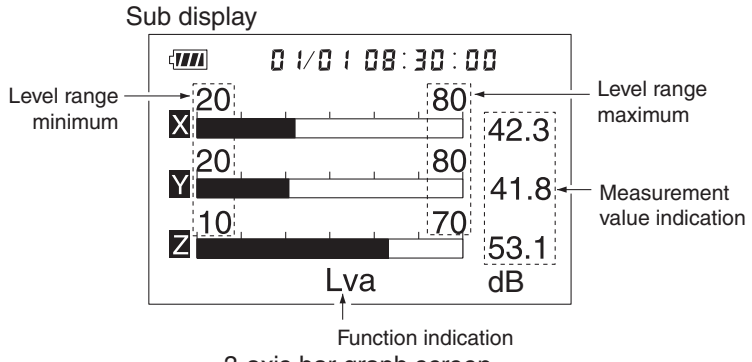


Single-axis level/time graph example



3-axis level/time graph example

Only shown when "Channel" item on menu screen 1/5 is set to X/Y/Z.



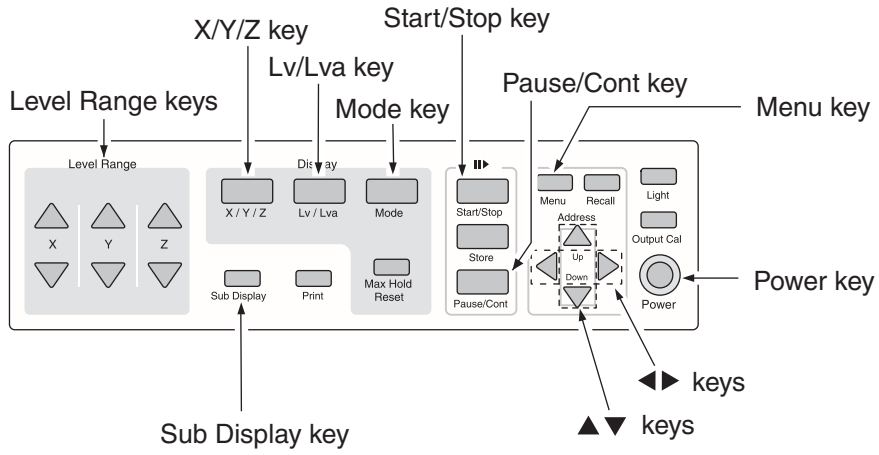
3-axis bar graph screen

Only shown when "Channel" item on menu screen 1/5 is set to X/Y/Z.

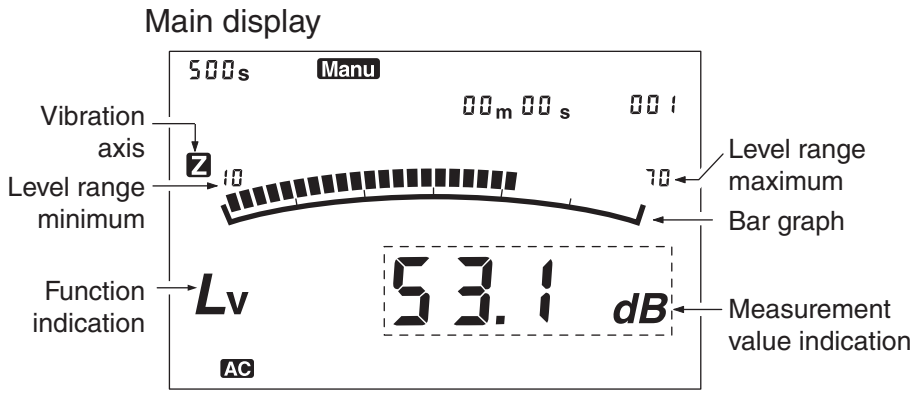
Power Average Measurement (L_{veq} or L_{vaeq})

To carry out power average measurement, proceed as follows.

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again.
   The display shown below is only an example.



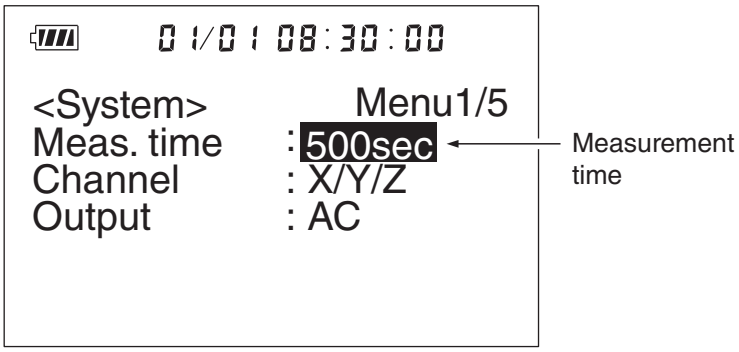
2. Use the "Channel" item on menu screen 1/5 to select the vibration axis for the measurement. If X/Y/Z is selected, measurement is performed for all 3 axes.
3. Select the "Lv" or "Lva" function with the Lv/Lva key.
4. Select the vibration axis with the X/Y/Z key.



Vibration level measurement screen example

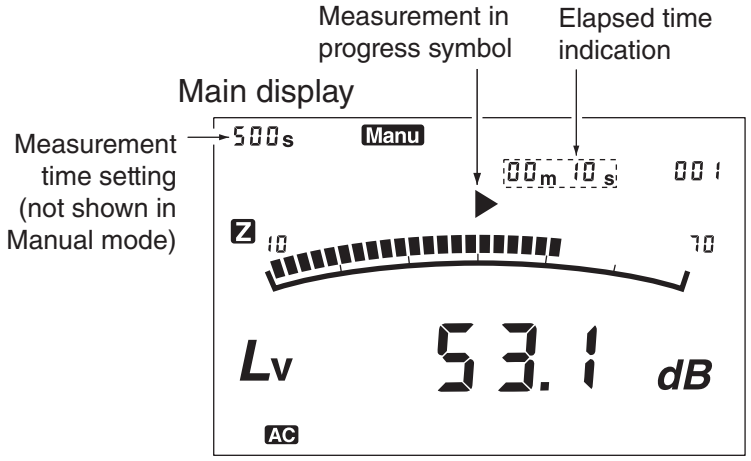
5. Select the level range with the Level Range keys.
6. Use the menu to set the measurement time.
   Press the Menu key to bring up menu screen 1/5.
7. Use the ▲ and ▼ keys to move the cursor to the "Meas.Time" field and use the ◀ and ▶ keys to select the measurement time.
   Each push of the ◀ and ▶ keys cycles through the following settings: 500 sec ↔ 10 sec ↔ 1 min ↔ 5 min ↔ 10 min ↔ 15 min ↔ 30 min ↔ 1 hour ↔ 4 hours ↔ 8 hours ↔ 24 hours ↔ Manual ↔ 500 sec
   When the Manual setting is selected, measurement continues until terminated by the operator. However, even in manual mode, measurement will automatically terminate after 199 hours 59 minutes 59 seconds have elapsed.

Menu screen 1/5

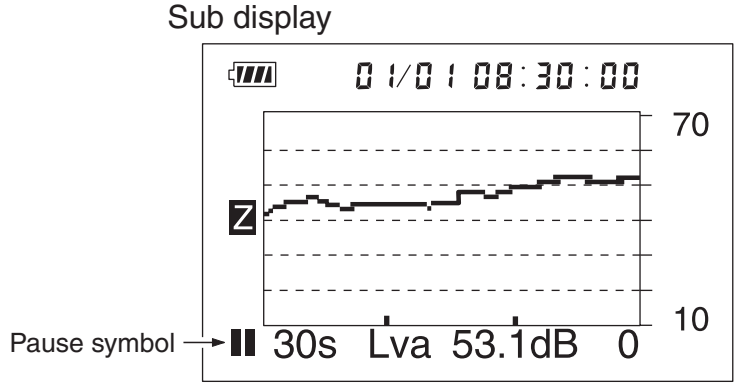


Measurement time selection screen example

8. Press the Menu key several times to return to the measurement screen.
9. Press the Start/Stop key to start processing.
   When processing measurement starts, the ▶ symbol flashes and the elapsed time is shown.
   When the measurement time set in step 7 has elapsed, the measurement is terminated automatically. It is also possible to stop the measurement before that by pressing the Start/Stop key.
   When the Manual setting is selected (no measurement time setting shown), the measurement must be terminated with the Start/Stop key.



Measurement in progress screen example



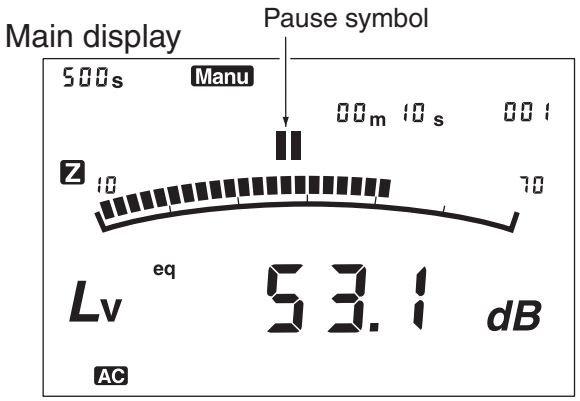
Measurement in progress symbol on sub display

Note
When a processing measurement is started, previous processing data are cleared.

Note
When 3-axis measurement is selected with the "Channel" item on menu screen 1/5, measurement for all three axes is performed simultaneously.
During measurement, most keys are inactive. Only the following six keys can be used: Start/Stop, Pause/Cont, Mode, Light, X/Y/Z, Sub Display All other settings must therefore be made before starting the measurement.

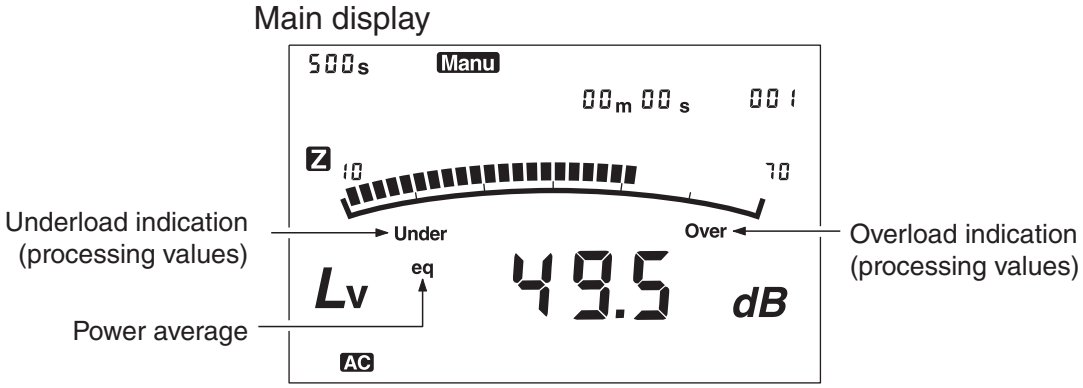
Pause

By pressing the Pause/Cont key during measurement, you can pause and resume the measurement. While the unit is in pause mode, a pause symbol (▮▮) is shown.



Paused display screen example

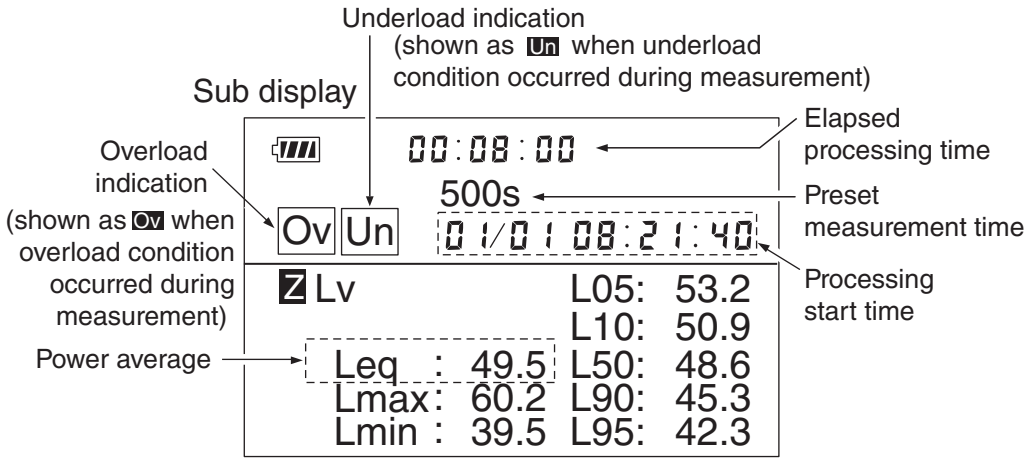
10. When measurement is completed, press the Mode key to set the processing type indication to power average (eq).
    Press the Sub Display key to bring up the processing list screen on the sub display.
    If [Over] (Ov on list screen) is shown, the result comprises overload data.
    If [Under] (Un on list screen) is shown, the result comprises underload data.



Power average screen example

Processing list screen

Besides the 3-axis level/time screen and 3-axis bar graph screen, the Sub Display key can also be used to call up a screen which lists all processing values. This screen lets you check not only the power average but also the L_{max}, L_{min}, and L_x values at the same time.



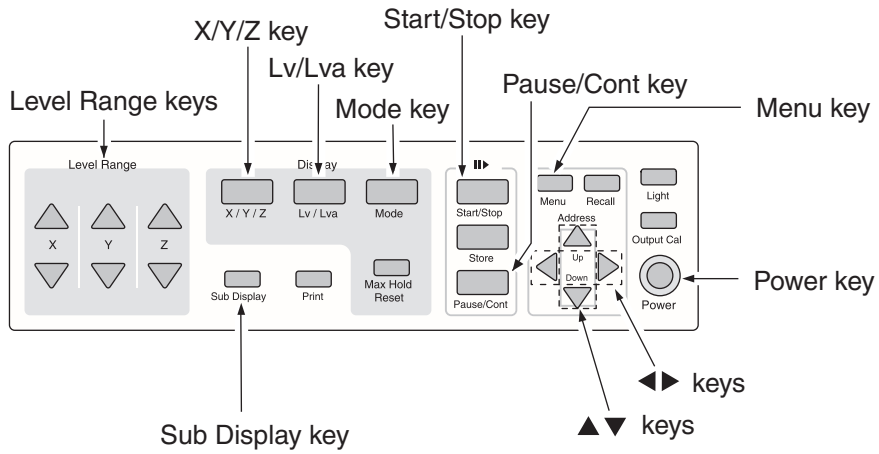
Processing list screen example

Note
Processing result data will be lost when the power is turned off. To keep the data, use the manual store function.

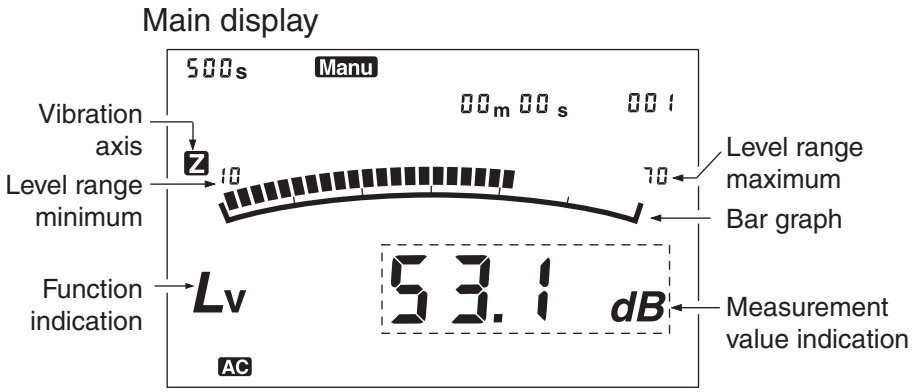
Time percentile level (L_x) measurement

To carry out time percentile level measurement, proceed as follows. The procedure is very similar to power average measurement. (on page 65)

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again.
   The display shown below is only an example.



2. Use the "Channel" item on menu screen 1/5 to select the vibration axis for the measurement. If X/Y/Z is selected, measurement is performed for all 3 axes.
3. Select the "Lv" or "Lva" function with the Lv/Lva key.
4. Select the vibration axis with the X/Y/Z key.



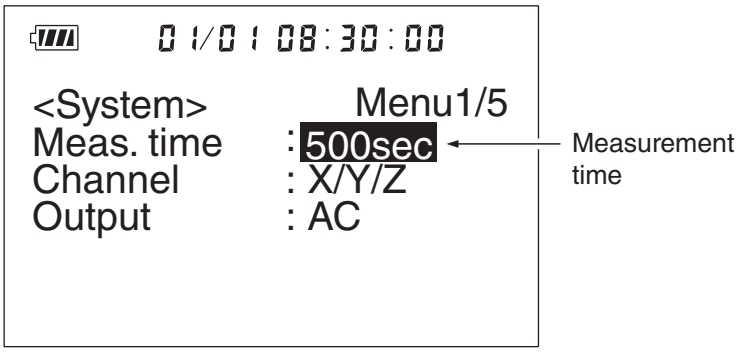
Vibration level measurement screen example

5. Select the level range with the Level Range keys.

6. Use the menu to set the measurement time.
   Press the Menu key to bring up menu screen 1/5.

7. Use the ▲ and ▼ keys to move the cursor to the "Meas.Time" field and use the ◀ and ▶ keys to select the measurement time.
   Each push of the ◀ and ▶ keys cycles through the following settings:
   500 sec ↔ 10 sec ↔ 1 min ↔ 5 min ↔ 10 min ↔ 15 min ↔ 30 min ↔ 1 hour ↔ 4 hours ↔ 8 hours ↔ 24 hours ↔ Manual ↔ 500 sec
   When the Manual setting is selected, measurement continues until terminated by the operator. However, even in manual mode, measurement will automatically terminate after 199 hours 59 minutes 59 seconds have elapsed.
   The L_x sampling time is normally 100 milliseconds, but when the measurement time is 500 seconds, L_x is 5 seconds.

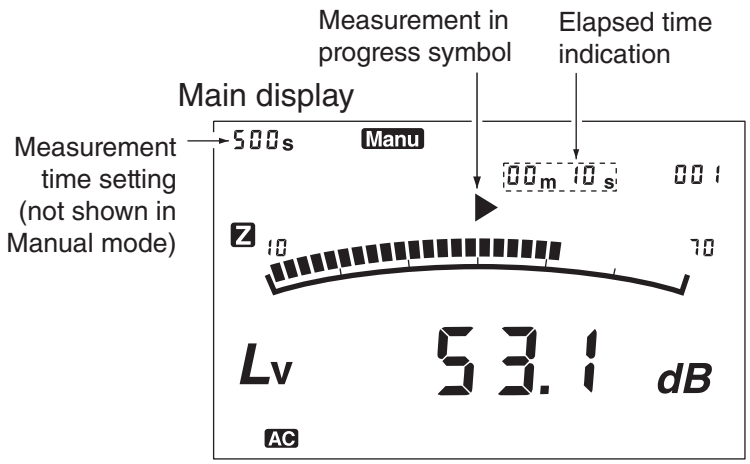
Menu screen 1/5



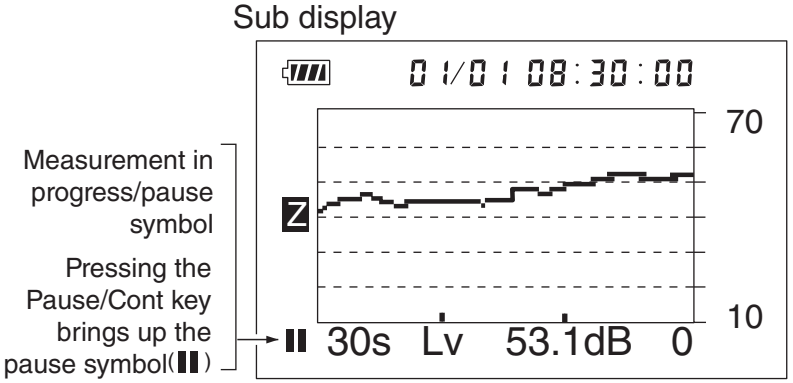
Measurement time selection screen example

8. Press the Menu key several times to return to the measurement screen.

9. Press the Start/Stop key to start processing.
   When processing measurement starts, the ▶ symbol flashes and the elapsed time is shown.
   When the measurement time set in step 7 has elapsed, the measurement is terminated automatically. It is also possible to stop the measurement before that by pressing the Start/Stop key.
   When the Manual setting is selected (no measurement time setting shown), the measurement must be terminated with the Start/Stop key.



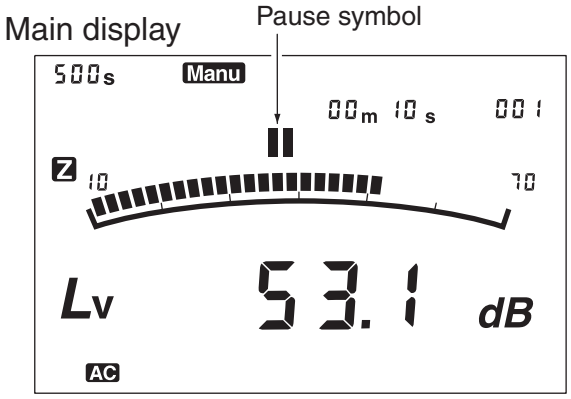
Measurement in progress screen example



Symbol indication on sub display

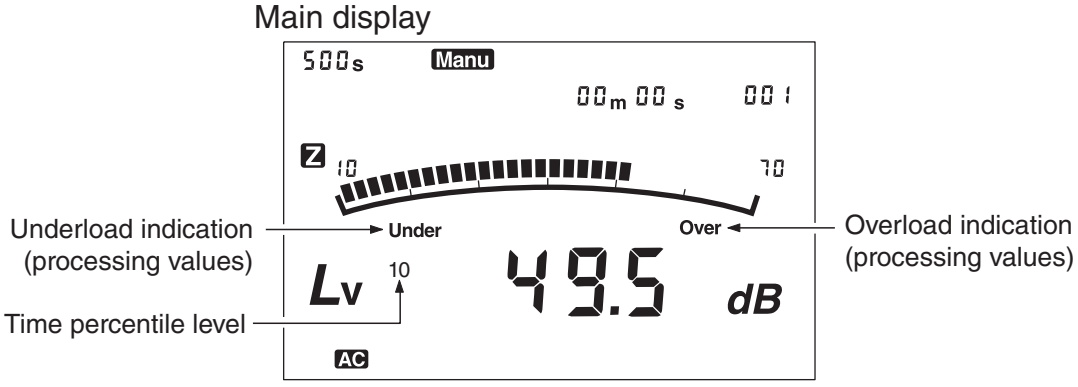
Note
If 3-axis measurement was selected with the "Channel" item on menu screen 1/5, measurement for all three axes is performed simultaneously. During measurement, most keys are inactive. Only the following six keys can be used: Start/Stop, Pause/Cont, Mode, Light, X/Y/Z, Sub Display All other settings must therefore be made before starting the measurement. When a processing measurement is started, previous processing data are cleared.

By pressing the Pause/Cont key during measurement, you can pause and resume the measurement. While the unit is in pause mode, a pause symbol (▮▮) is shown.



Paused display screen example

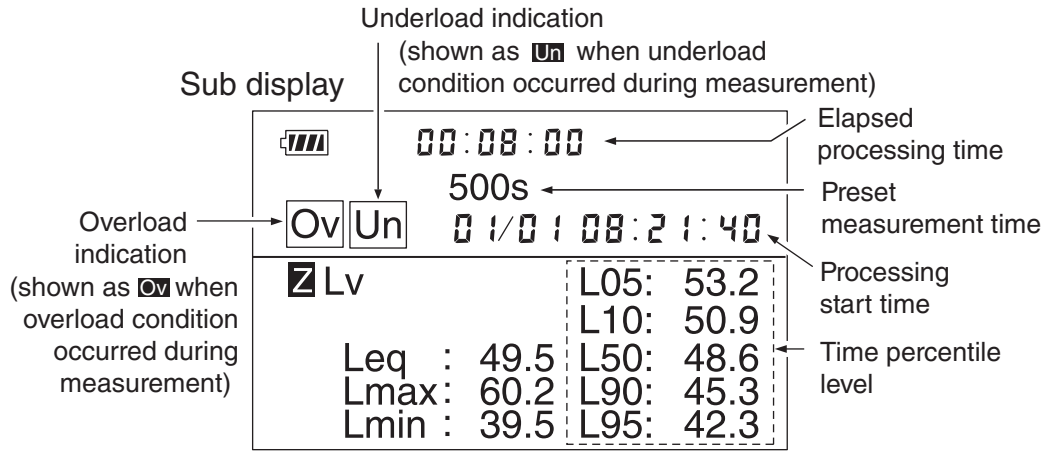
10. When measurement is completed, press the Mode key to select the time percentile level to display (5, 10, 50, 90, or 95).
Press the Sub Display key to bring up the processing list screen on the sub display. On this screen, all time percentile level data can be seen together (5, 10, 50, 90, 95).
If [Over] (Ov on list screen) is shown, the result comprises overload data.
If [Under] (Un on list screen) is shown, the result comprises underload data.



Time percentile level (L_{10}) screen example

Processing list screen

Besides the 3-axis level/time screen and 3-axis bar graph screen, the Sub Display key can also be used to call up a screen which lists all processing values. This screen lets you check not only the time percentile level but also the L_{eq}, L_{max}, and L_{min} values at the same time.



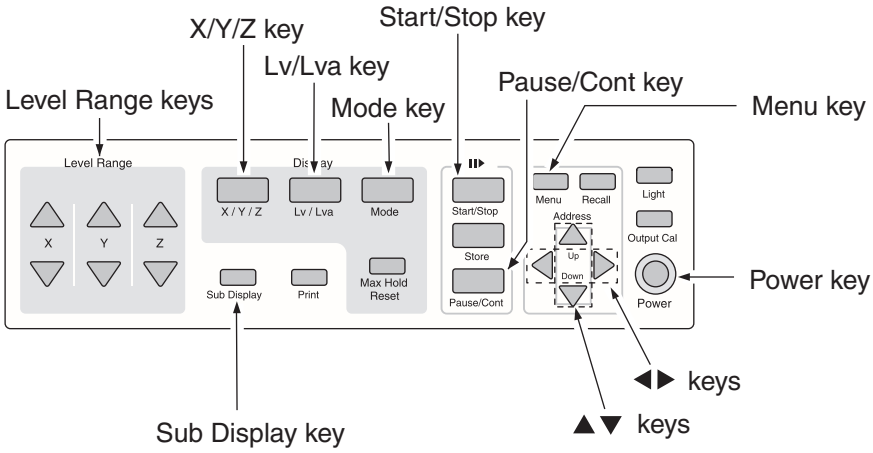
Processing list screen example

Note
The L_x sampling time is normally 100 milliseconds, but when the measurement time is 500 seconds, L_x is 5 seconds.
Processing result data will be lost when the power is turned off. To keep the data, use the manual store function.

Measurement interval maximum value (L_{max}) and minimum value (L_{min}) measurement

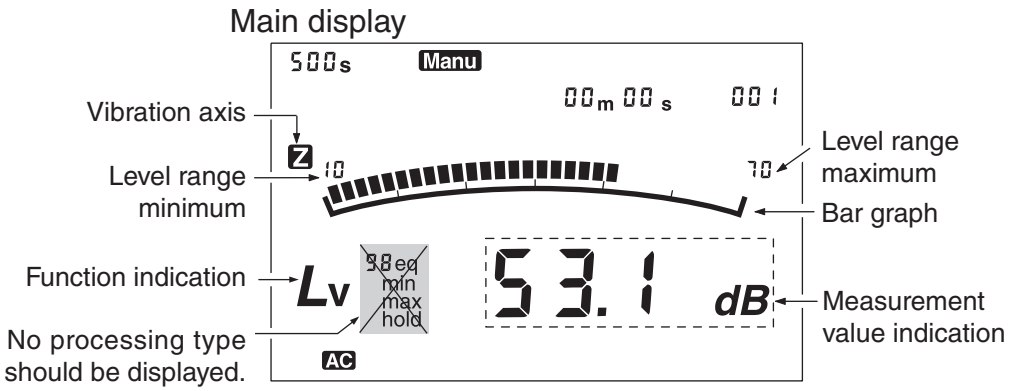
To carry out the maximum value and minimum value measurement time percentile level measurement, proceed as follows. The procedure is very similar to power average measurement.

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again. The display shown below is only an example.



2. Use the "Channel" item on menu screen 1/5 to select the vibration axis for the measurement. If X/Y/Z is selected, measurement is performed for all 3 axes.

3. Select the "Lv" or "Lva" function with the Lv/Lva key.

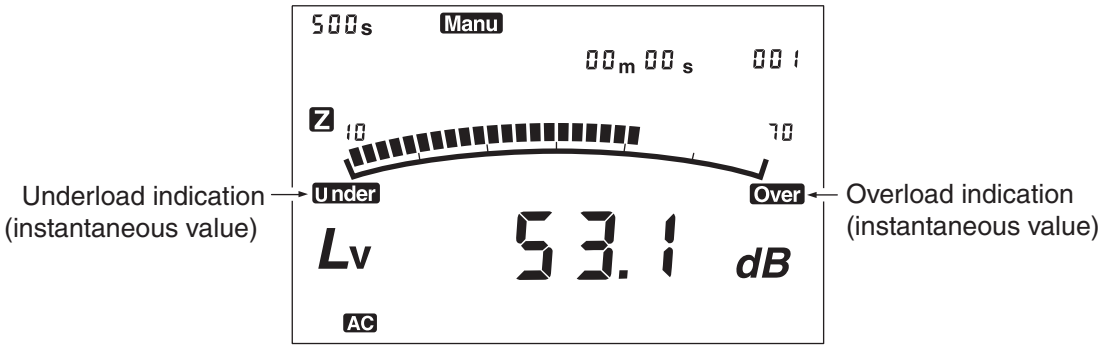


Vibration level measurement screen example

4. Select the vibration axis with the X/Y/Z key.

5. Select the level range with the Level Range keys.
   If [Over] or [Under] is shown frequently, change the level range setting.

Main display

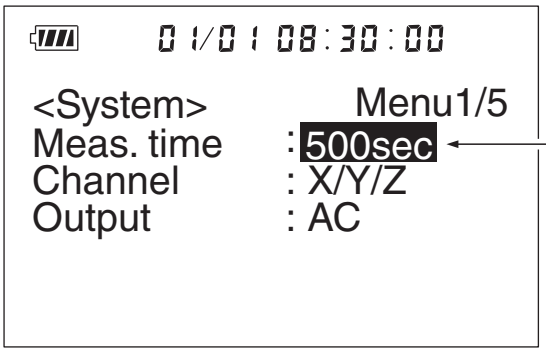


Over, Under indication

6. Use the menu to set the measurement time.
   Press the Menu key to bring up menu screen 1/5.

7. Use the ▲ and ▼ keys to move the cursor to the "Meas.Time" field and use the ◀ and ▶ keys to select the measurement time.
   Each push of the ◀ and ▶ keys cycles through the following settings:
   500 sec ↔ 10 sec ↔ 1 min ↔ 5 min ↔ 10 min ↔ 15 min ↔ 30 min ↔ 1 hour ↔ 4 hours ↔ 8 hours ↔ 24 hours ↔ Manual ↔ 500 sec
   When the Manual setting is selected, measurement continues until terminated by the operator. However, even in manual mode, measurement will automatically terminate after 199 hours 59 minutes 59 seconds have elapsed.

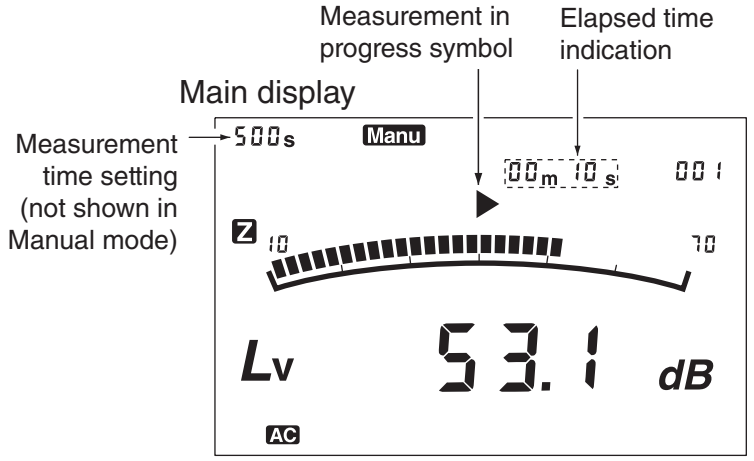
Menu screen 1/5



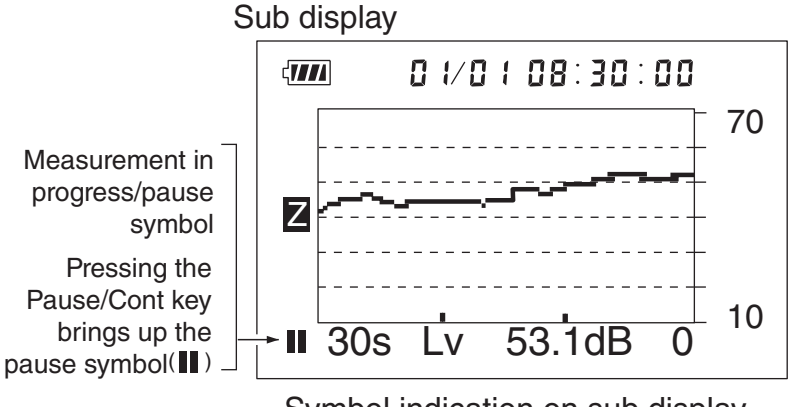
Measurement time selection screen example

8. Press the Menu key several times to return to the measurement screen.

9. Press the Start/Stop key to start processing.
   When processing measurement starts, the ▶ symbol flashes and the elapsed time is shown.
   When the measurement time set in step 7 has elapsed, the measurement is terminated automatically. It is also possible to stop the measurement before that by pressing the Start/Stop key.
   When the Manual setting is selected (no measurement time setting shown), the measurement must be terminated with the Start/Stop key.



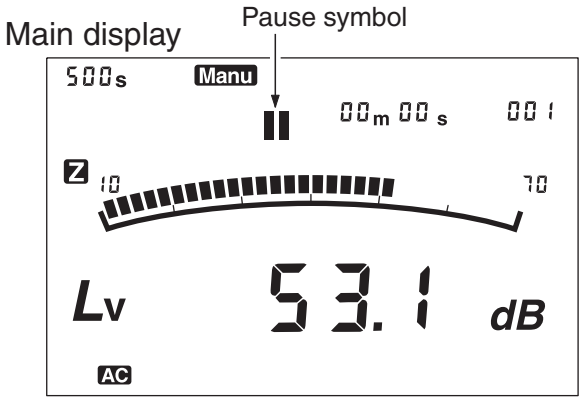
Measurement in progress screen example



Symbol indication on sub display

Note
During measurement, most keys are inactive. Only the following six keys can be used: Start/Stop, Pause/Cont, Mode, Light, X/Y/Z, Sub Display All other settings must therefore be made before starting the measurement.

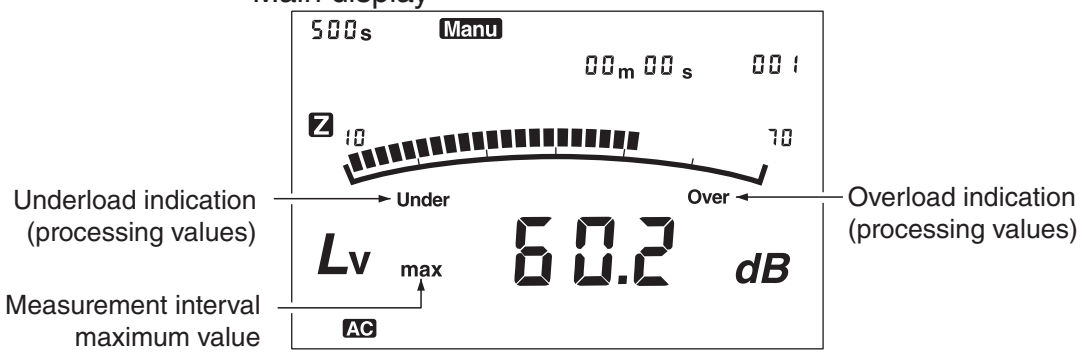
By pressing the Pause/Cont key during measurement, you can pause and resume the measurement. While the unit is in pause mode, a pause symbol (⏸) is shown.



Paused display

10. When measurement is completed, press the Mode key to select the maximum value ("max") or minimum value ("min").
    Press the Sub Display key to bring up the processing list screen on the sub display.
    If [Over] (Ov on list screen) is shown, the result comprises overload data.
    If [Under] (Un on list screen) is shown, the result comprises underload data.

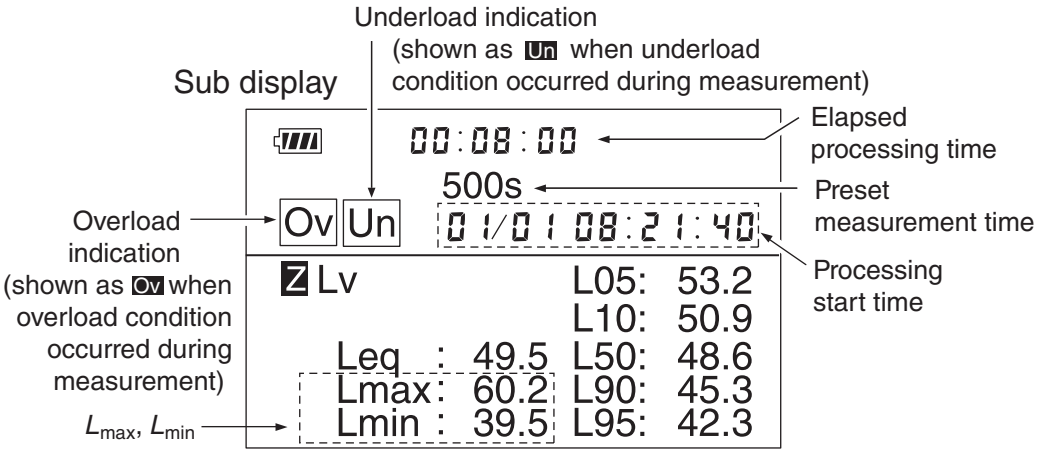
Main display



Measurement interval maximum value screen example

Processing list screen

The Sub Display key can also be used to call up a screen which lists all processing values. This screen lets you check not only the L_{max} and L_{min} values but also the L_{eq} and L_x values at the same time.

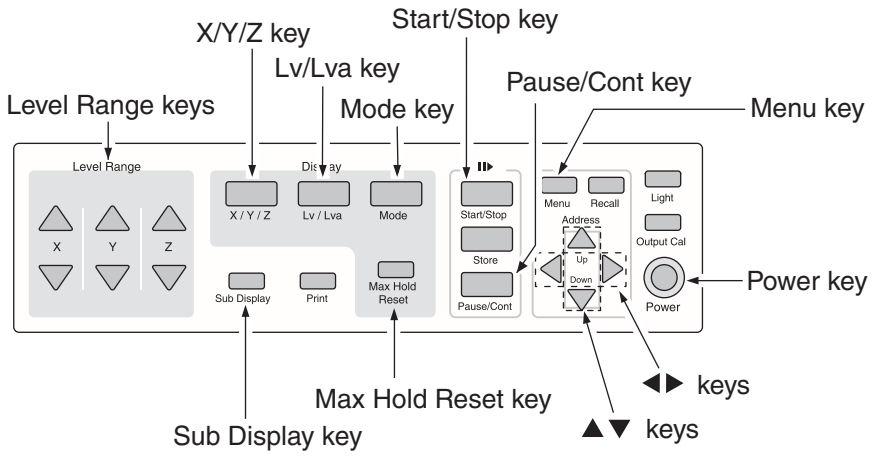


Processing list screen example

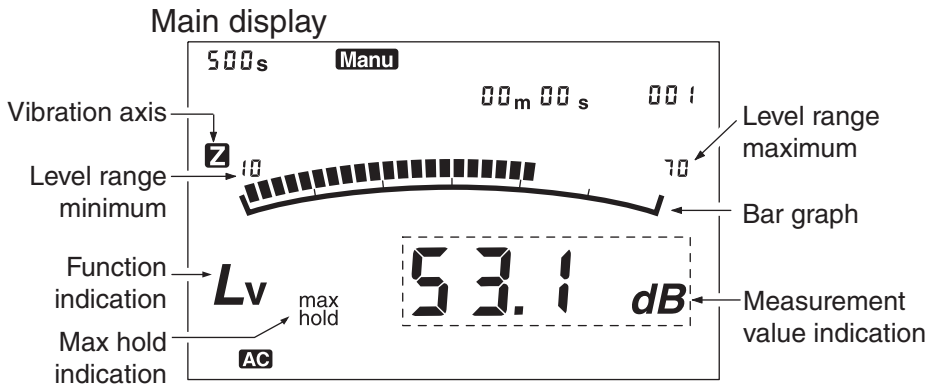
Maximum hold (Max Hold) measurement

You can hold the amplitude maximum value without time limitation.

1. Press the Power key to turn power to the unit on.
   (For information about the display function, see the section "Power-On/Off" on page 54.)
   The same settings that were selected when the unit was last turned off will be active again.
   The display shown below is only an example.

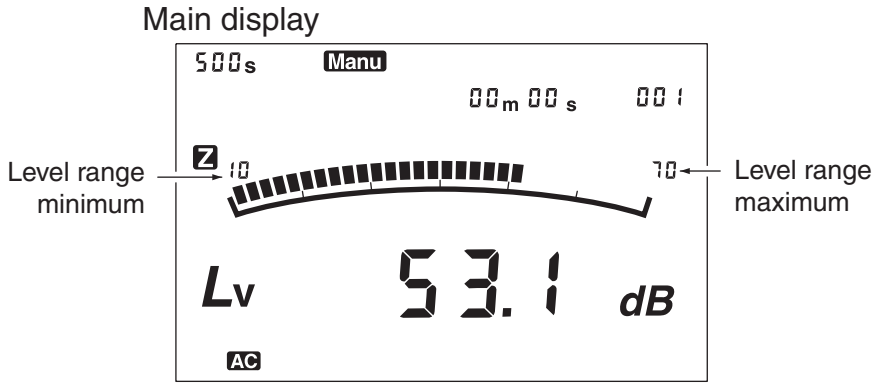


2. Select the "Lv" or "Lva" function with the Lv/Lva key.
3. Select the vibration axis with the X/Y/Z key.



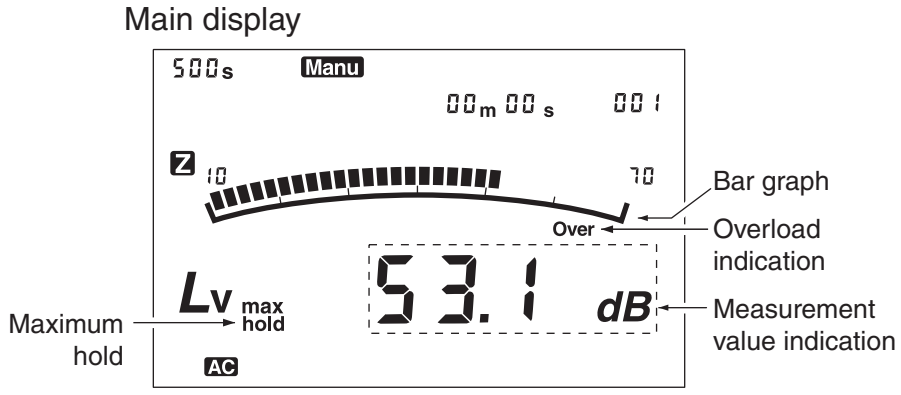
Vibration level measurement screen example

4. Select the level range with the Level Range keys.
   Make the setting so that the tip of the bar graph comes to about the center of the display.



Vibration level
measurement screen example

5. Press the Mode key and select maximum hold ("max hold") as processing type.
6. Press the Max Hold Reset key to reset the maximum hold data. The maximum hold measurement will then begin again from the current point. The measurement value indication on the display shows the maximum value. The bar graph functions normally.
   If an overload condition occurs at any point, "Over" appears on the display. This indicates that the maximum hold comprises overload data.
   If you change settings (such as the level range or Lv/Lva setting) during measurement, correct operation is not possible.
7. If you want to change the settings and start a new measurement, press the Max Hold Reset key.



Maximum hold (Max Hold)
measurement example

Store Operations

The VM-53/VM-53A has an internal memory that can be used to store measurement data (vibration level or vibration acceleration level instantaneous values, processing values such as power average and time percentile level, and measurement settings). This section describes how to store data in memory and how to recall stored data.

For the VM-53 model, all store operations are carried out using the internal memory.

The VM-53A model can store data either in the internal memory or on a memory card (Compact Flash card) which can hold more data.

There are three types of store modes which are outlined below.

Note
With the VM-53A, if a memory card is inserted, this automatically becomes the store target. Do not format the memory card in a computer.

Manual

In this mode, the operator stores measured vibration level or vibration acceleration level data or processing values manually in memory.

When the operator presses the Store key, the vibration level or vibration acceleration level (if maximum hold display is selected the maximum hold level) is stored in memory. At the same time, the processing values (L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}) as well as the measurement settings and time of measurement are also stored.

Data for three axes (X, Y, Z) are stored as one data set.

With the VM-53, the data are stored in the internal memory. With the VM-53A, the data are stored on a memory card or in the internal memory.

The maximum number of data that can be stored is 100 sets for the internal memory and 100 sets per file on a memory card, with multiple files allowed.

Auto1

This store function is convenient for saving vibration level waveform information.

The instantaneous value is automatically stored continuously, once every 100 milliseconds or every second.

The store operation is started by pressing the Store key.

When the internal memory is the store target, up to 86400 vibration level data or vibration acceleration level data can be stored.

For example, 86400 data correspond to 24 hours when single-axis (X or Y or Z) measurement is performed with a sampling time of 1 second. When 3-axis (X, Y, Z) measurement is performed, the time is 8 hours. The sampling time can be set to 100 milliseconds or 1 second.

With the model VM-53A, data can be stored on a memory card. The maximum time duration is 199 hours 59 minutes 59 seconds per file, can be created.

	Internal memory	Memory card
Number of store data or store time	Max. 86400 (3-axis measurement: 28800 × 3 axis)	Max. 199 h 59 m 59 s per file (subject to capacity of memory card)

Note
When the internal memory is used, existing data will be overwritten. At the point where the Store key is pressed, previous data are erased. When the memory card is used, the number of files that can be stored is subject to the capacity of the memory card.

Important
Always turn power off before inserting or removing a memory card.

Auto2

This store function continually stores all processing values (L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}) for a measurement as a set.

The store operation is started by pressing the Store key.

When the internal memory is the store target, up to 4500 data sets can be stored for single-axis (X or Y or Z) measurement and up to 1500 data sets for 3-axis (X, Y, Z) measurement.

With the model VM-53A, data can be stored on a memory card. Both for single-axis (X or Y or Z) and 3-axis (X, Y, Z) measurement, up to 4500 data sets can be stored per file, and multiple files can be created.

Note
When the internal memory is used, existing data will be overwritten. At the point where the Store key is pressed, previous data are erased.

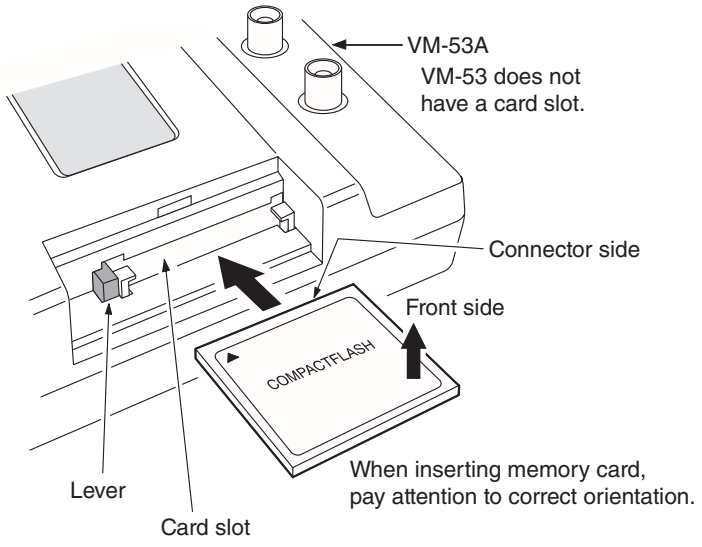
Important
Never turn power off or remove the memory card while a store operation is in progress. Otherwise stored data and internal data may be corrupted.

Manual store

Storing in memory

At the point where the Store key is pressed, the vibration level or vibration acceleration level instantaneous value (if maximum hold display is selected the maximum hold level) and the processing values are stored in memory.
Because no processing values exist immediately after power-on, 0.0 dB is stored for each value.
With the model VM-53, the store target is the internal memory.
With the model VM-53A, the store target is the internal memory if no memory card is inserted. If memory card is inserted, the store target is the memory card. The procedure for storing data in memory is as follows.

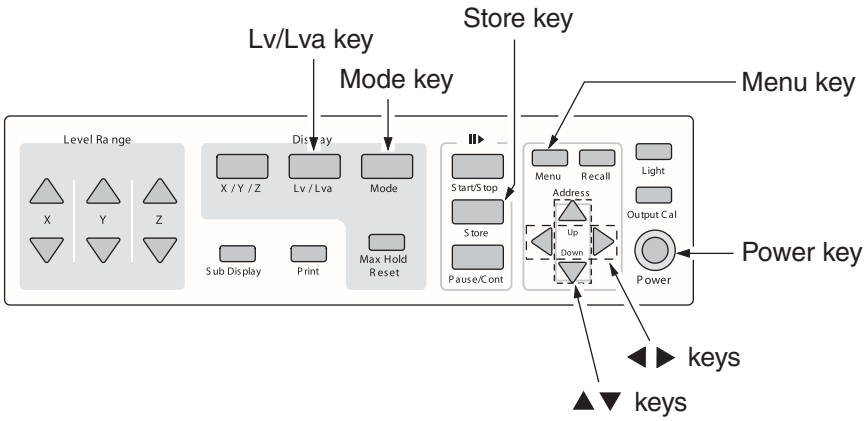
1. Select the store target.
   For the VM-53, this step is not necessary. Proceed directly to step 2.
   For the VM-53A, if you want to store data in the internal memory, verify that no memory card is inserted in the card slot. If you want to store data on a memory card, insert the memory card in the card slot.

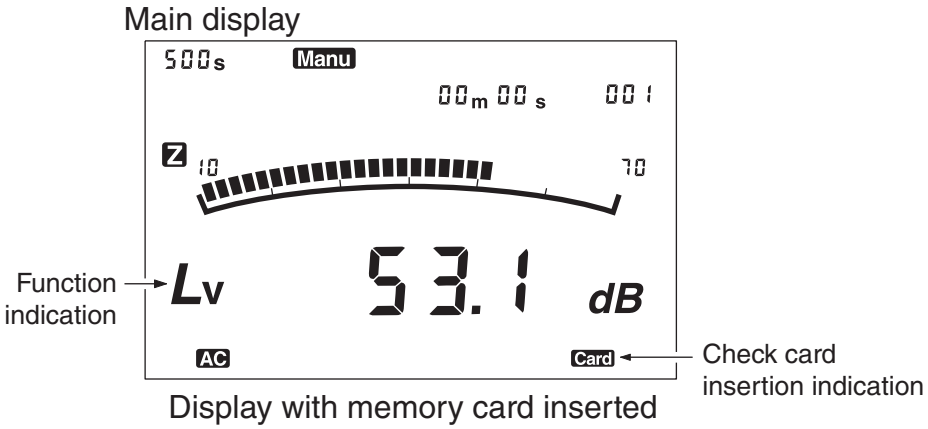


To remove the card, push the lever in.

Note
The model VM-53 does not use memory cards. Only the model VM-53A is equipped with a memory card slot as shown above.

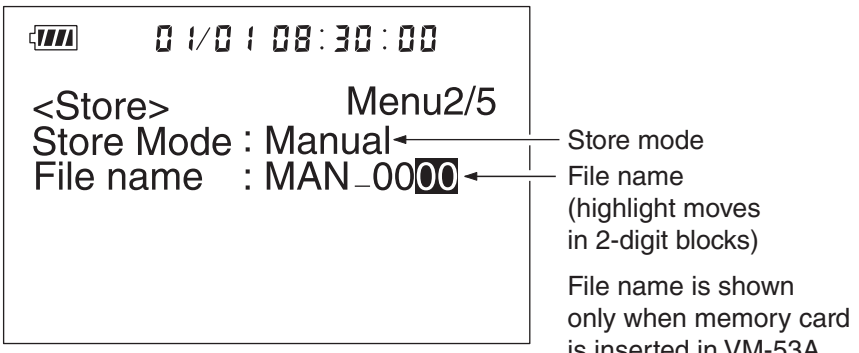
2. Press the Power key to turn the unit On.
   With the VM-53A, if a memory card was inserted in the card slot, the indication [Card] will appear on the main display.
3. Select the "Lv" or "Lva" function with the Lv/Lva key.





4. Use the Menu key to bring up the menu screen on the sub display.
5. Select menu screen 2/5 with the Menu key.
6. Set the Store mode to Manual.
   Use the ▲ and ▼ keys to highlight the "Store mode" item, and use the ◀ and ▶ keys to select "Manual".
   To store data in the internal memory, proceed to step 8.
7. To store data on a memory card, specify a file name (4-digit number).
   Use the ▲ and ▼ keys to highlight the "File name" item, and use the ◀ and ▶ keys to set the file name.

Sub display



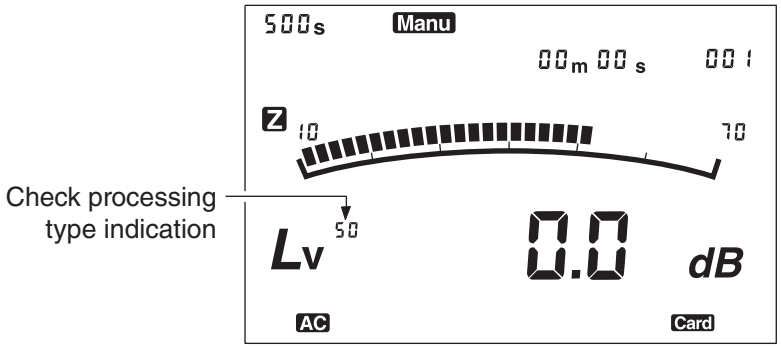
Menu screen 2/5

Note
The file name applies only when storing data on a memory card in the VM-53A. When storing data in the internal memory, no file name is shown and the item cannot be set.

8. Press the Menu key several times to return to the measurement screen.

9. Use the Lv/Lva key to select vibration level or vibration acceleration level.
   To store processing values, proceed to step 10.
   To store instantaneous values, proceed to step 11.
   To store the Max Hold value, use the Mode key to set the processing type indication to "max hold" and then proceed to step 11.

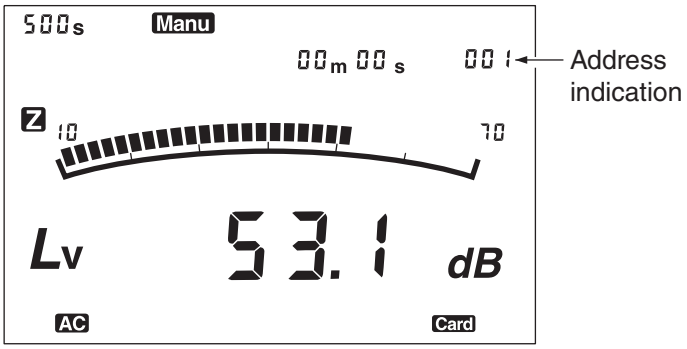
Main display



10. To store processing values, perform measurement as described in the preceding chapter.

11. Select the store address number.
    The address number can be set in the range from 1 to 100 using the ▲ and ▼ keys.
    If data are already stored in the selected address, these data will be overwritten. (The data are erased and replaced by the new data.)
    For information on how to check where data are stored, see the section "Reading data stored in internal memory" on page 93.

Main display



12. Press the Store key

    The vibration level or vibration acceleration level instantaneous value is stored. If the processing type indication is set to maximum hold (max hold), the maximum value is stored.

    If processing measurement was carried out in step 10, the various processing value data are also stored simultaneously. If processing measurement was not carried out, "0.0" is stored in place of processing value data.

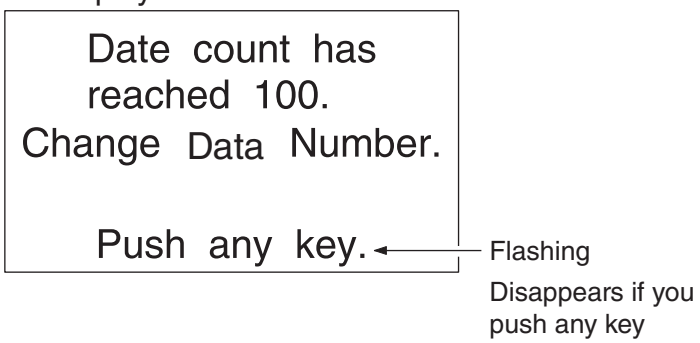
    The store process is completed after about one second, and the address number is incremented by one position. Pressing the Store key repeatedly will store data in subsequent address numbers.

    The stored data comprise the vibration level or vibration acceleration level instantaneous value data or maximum level data for all 3 channels. The date and time when the Store key was pressed and the processing start date/time, measurement time, and processing value data are also stored.

Note
When single axis data are stored, the reading stored for the other channels is 0.0 dB.
The unit does not check whether any actual data are present for storing. Every time the Store key is pressed, the measurement data in the currently displayed address number are rewritten.

Note
When the address number 100 is reached, the unit does not proceed to 101 or 1. When you press the Store key in this condition, the message shown below appears, and the key has no effect. Press any key to cancel the message and then use the ▲ and ▼ keys to change the address number. It then becomes possible to store data in the selected address.

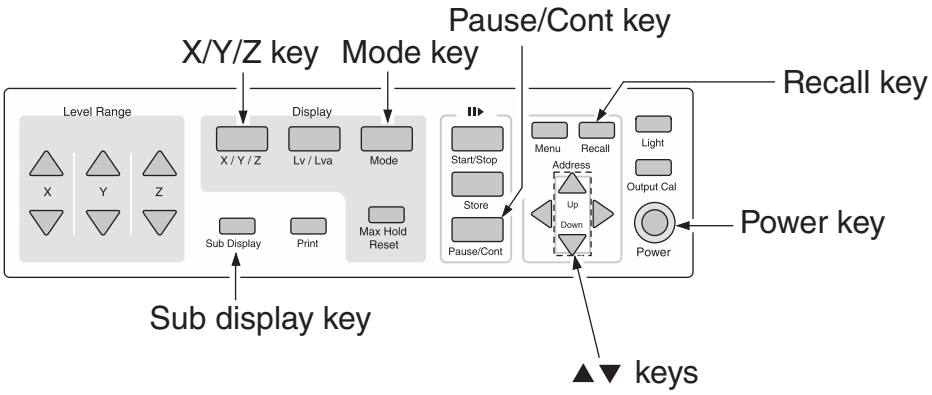
Sub display



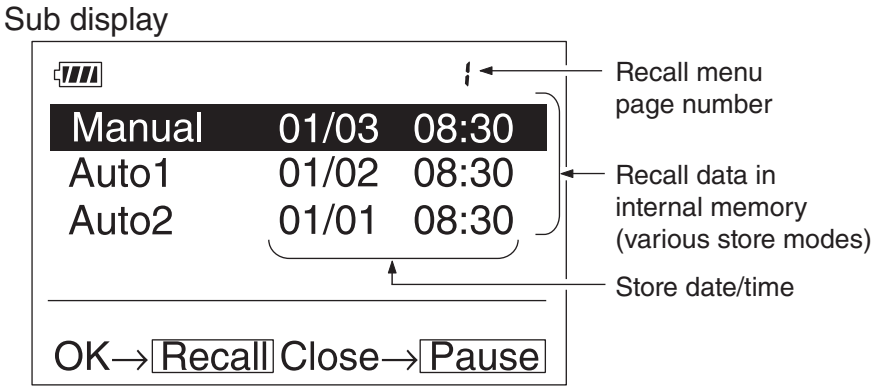
Reading data stored in internal memory

Data stored in the internal memory in Manual mode can be called up on the sub display as follows.

1. Press the Power key to turn power to the unit on.

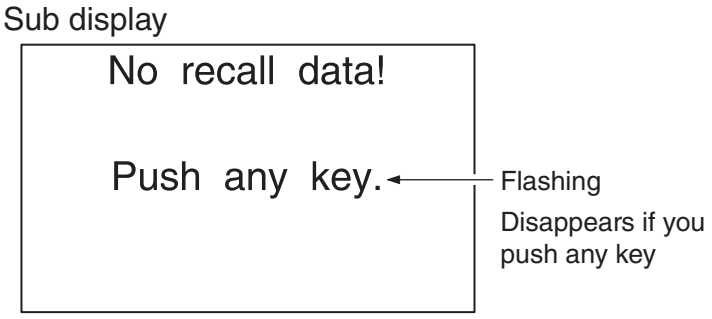


2. Press the Recall key to bring up the recall menu on the sub display.

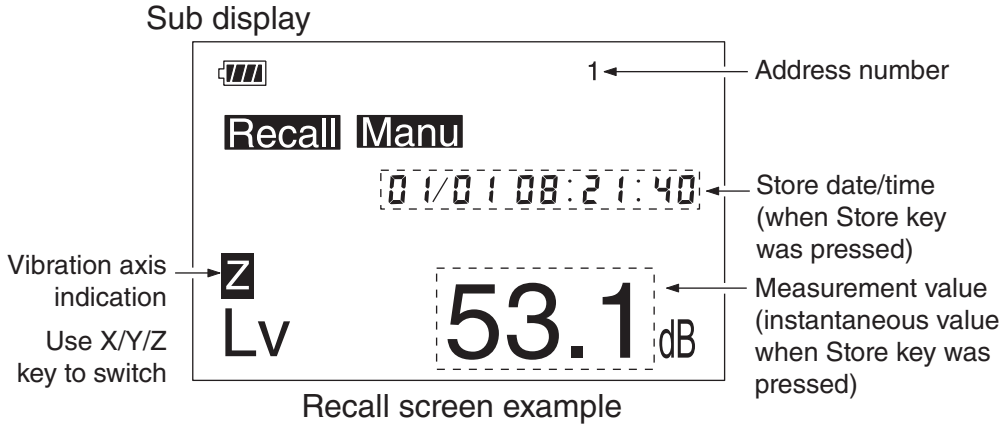


Recall menu screen example

Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.

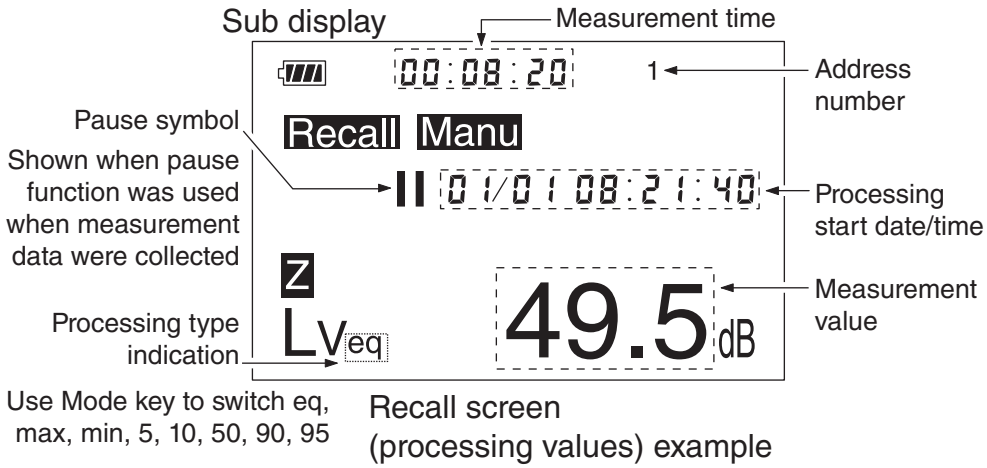


3. Use the ▲ and ▼ keys to select the desired recall data and press the Recall key.
   The selected recall data appear on the sub display.
4. Use the ▲ and ▼ keys to select the address number in which the desired data are stored.
   The stored measurement data appear on the sub display.
   If there are no data, "--.-" or "0.0" is shown.
5. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.



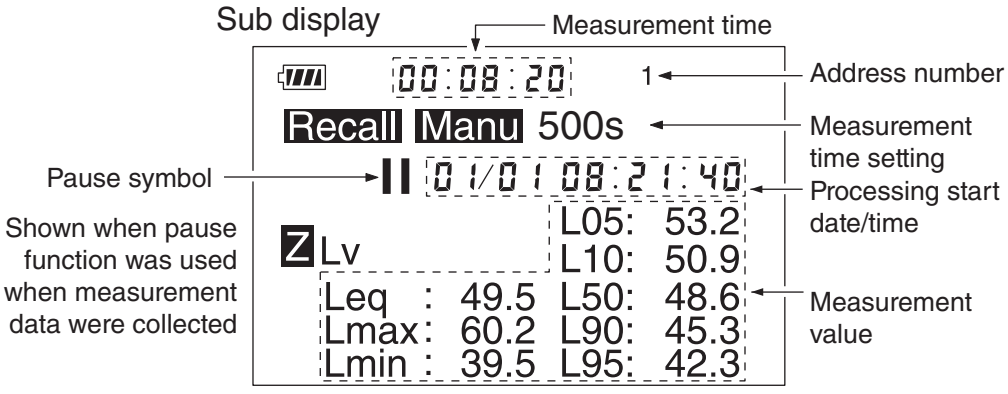
Recall screen example

6. With each push of the Mode key or Sub Display key the store data display is cycled through instantaneous value or maximum hold value → L_{eq} → L_{max} → L_{min} → L_5 → L_{10} → L_{50} → L_{90} → L_{95}.



Recall screen (processing values) example

By further pressing the Mode key or Sub Display key, you can call up the processing list display which shows all processing values simultaneously.



Recall screen (processing list) example

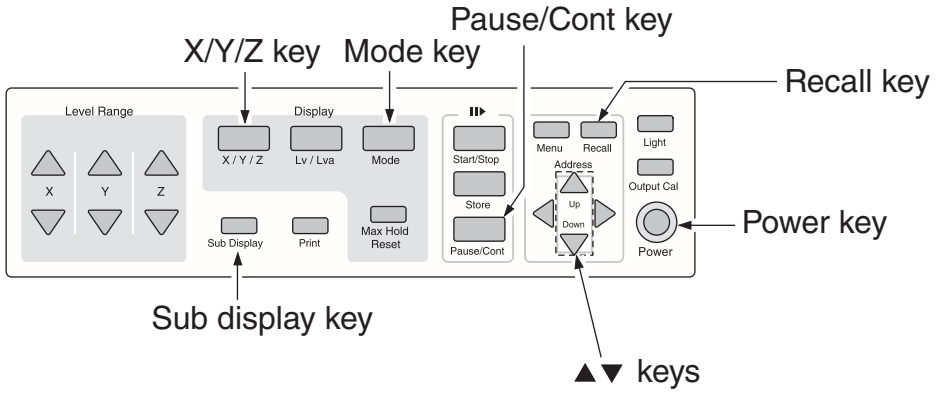
7. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.

Reading data stored on memory card (VM-53A only)

Data stored on the memory card in Manual mode can be called up on the sub display as follows.

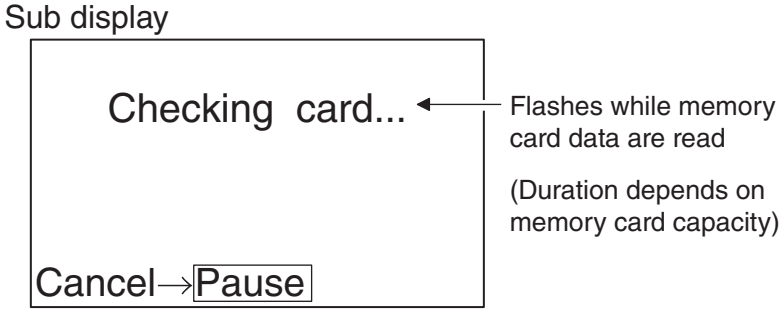
Make sure that a memory card is inserted.

1. Press the Power key to turn power to the unit on.



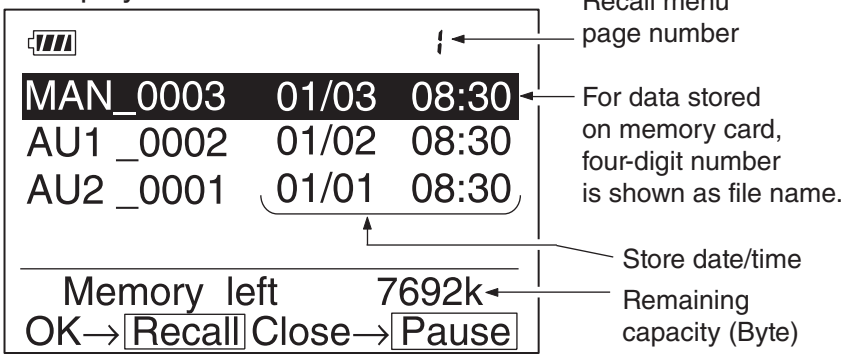
2. Press the Recall key.
   The message "Checking card" appears, and then the card recall menu is shown on the sub display.

3. Use the ▲ and ▼ keys or the Sub Display key to change the recall menu page number, until the page with the desired recall data is shown.



Note
The duration for which the above message is shown depends on the capacity of the memory card. In some cases, the message may only be shown very briefly.

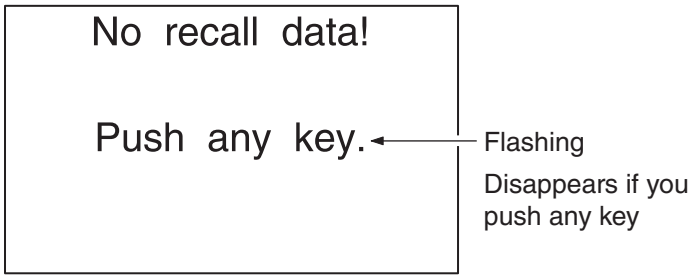
Sub display



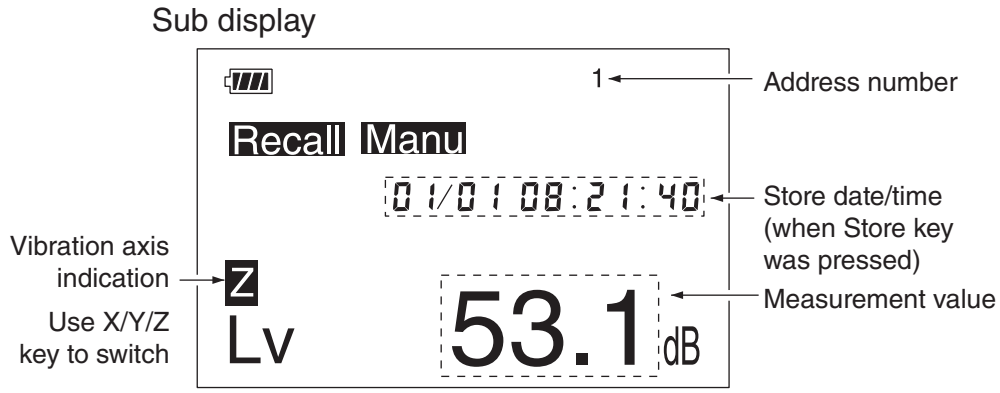
Memory card recall menu screen

Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.

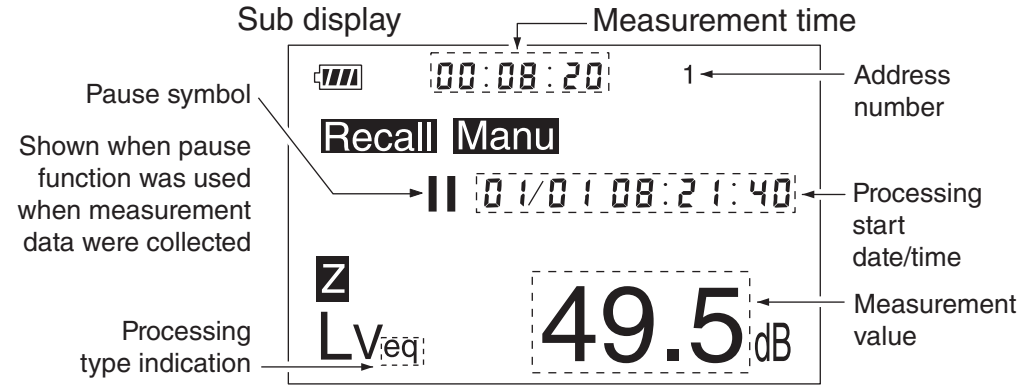
Sub display



4. Use the ▲ and ▼ keys to select the desired recall data (file name), and press the Recall key.
   The selected recall data are shown on the sub display.
5. Use the ▲ and ▼ keys to select the address number in which the desired data are stored.
   The stored measurement data appear on the sub display.
   If there are no data, "--.-" or "0.0" is shown.
6. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.
7. If processing measurement was carried out, use the Mode key to cycle the processing value display through eq → max → min → 5 → 10 → 50 → 90 → 95.

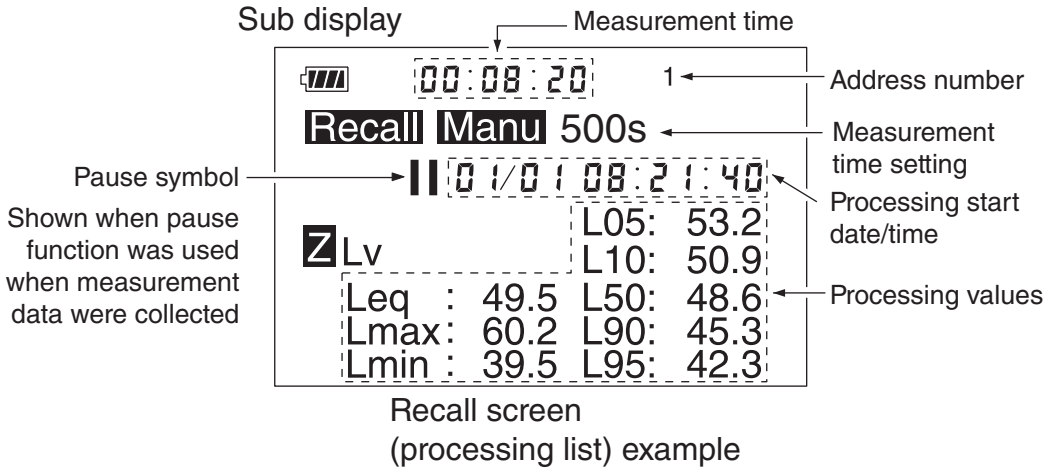


Recall screen example



Recall screen (processing values) example

By further pressing the Mode key, you can call up the processing list display which shows all processing values simultaneously.



Recall screen
(processing list) example

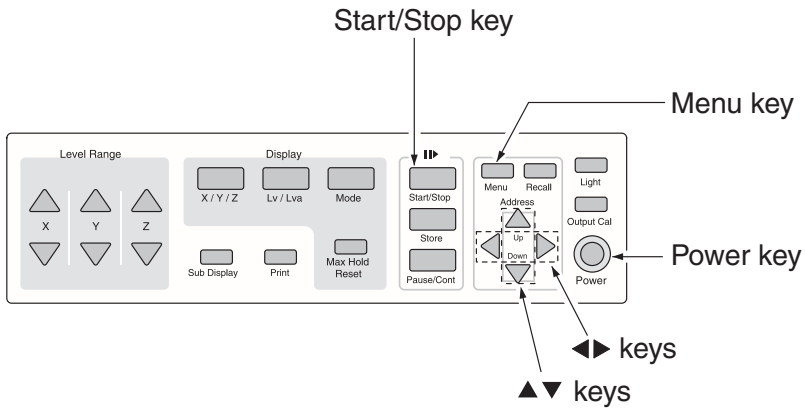
8. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.

Clearing data stored in internal memory

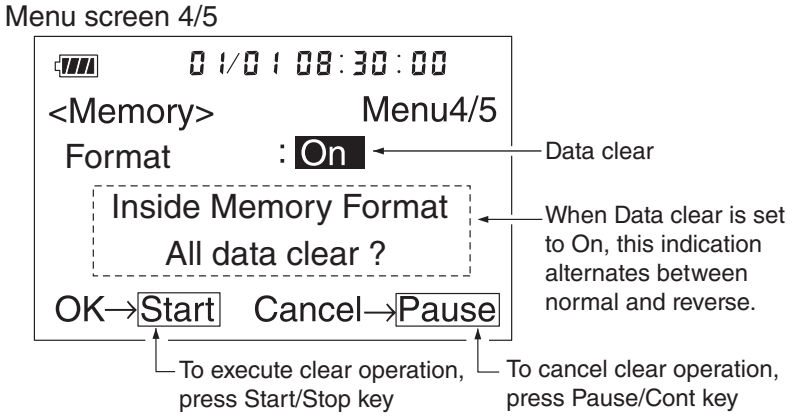
To clear all data stored in the internal memory of the unit, proceed as follows. When using the model VM-53A, make sure that no memory card is inserted in the card slot.

Note
It is not possible to clear only specified address data or specified store mode data. Only bulk clearing (formatting) of all data in the internal memory is possible.

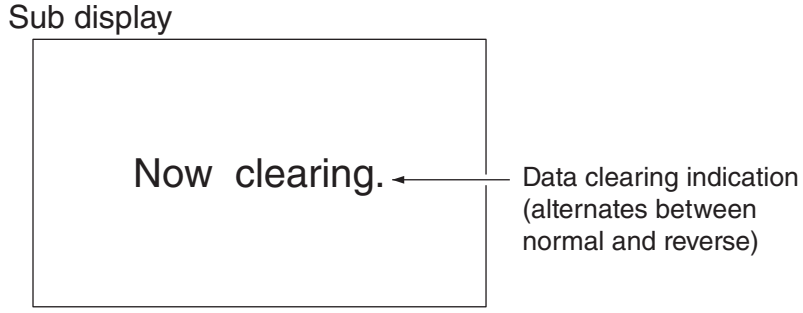
1. Press the Power key to turn power to the unit on.



2. Use the Menu key to bring up a menu screen on the sub display panel.
3. Use the Menu key to bring up menu screen 4/5.
4. Use the ◀ and ▶ key to set the "Format" item to "On".
   If it is OK to proceed with the data clearing process, press the Start/Stop key.



During the clear operation, the following message appears.



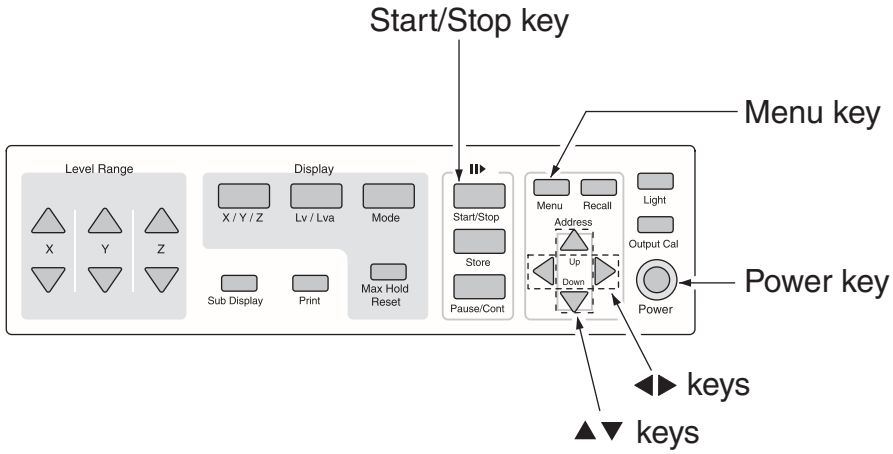
When the operation is completed, the message disappears and the "Format" item on menu screen 4/5 returns to "Off".

Clearing data stored on memory card (VM-53A only)

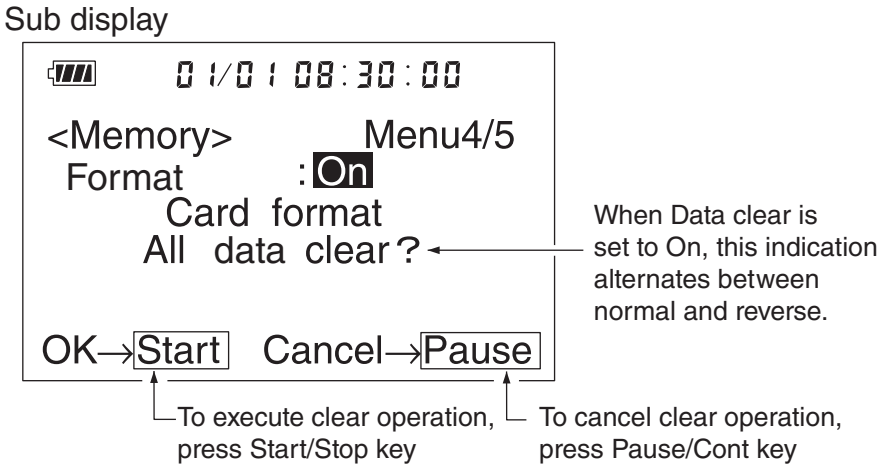
To clear all data stored on a memory card, proceed as follows.

Make sure that a memory card is inserted in the card slot.

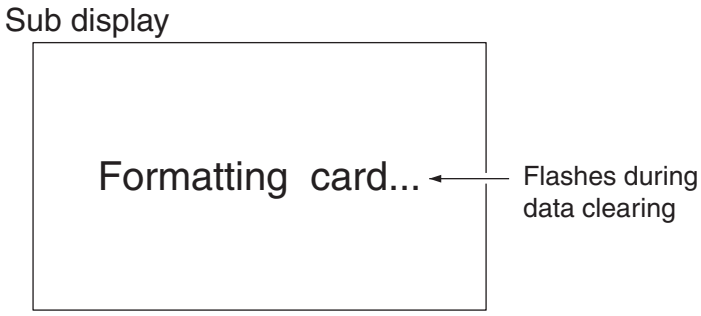
1. Press the Power key to turn power to the unit on.



2. Use the Menu key to bring up a menu screen on the sub display panel.
3. Use the Menu key to bring up menu screen 4/5.
4. Use the ◀ and ▶ key to set the "Format" item to "On".
   If it is OK to proceed with the data clearing process, press the Start/Stop key.



During the clear operation, the message shown below appears.



When the operation is completed, the message disappears and the "Format" item on menu screen 4/5 returns to "Off".

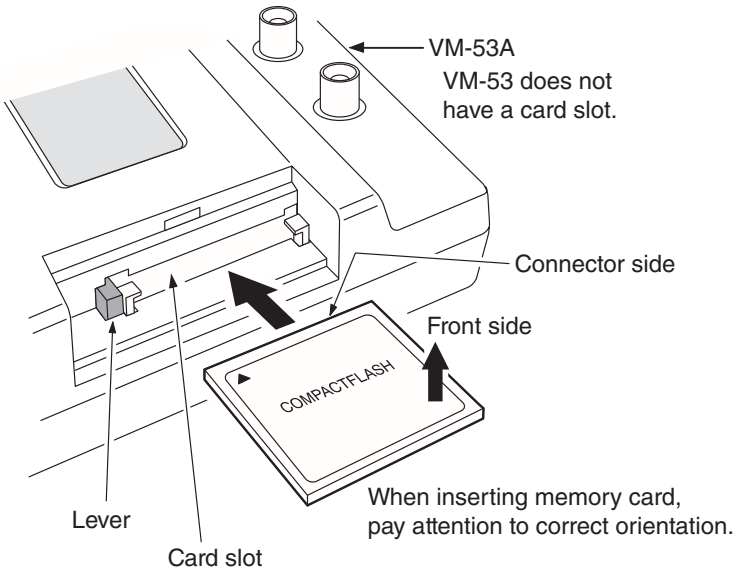
Note
It is not possible to clear only specified address data or specified file data. Only bulk clearing (formatting) of all data on memory card is possible.
This process does not perform a physical format.

Auto1

In this mode, the instantaneous value of the vibration level or vibration acceleration level is automatically stored continuously, once every 100 milliseconds or every second.
When the internal memory is the store target, up to 86400 data can be stored. With the model VM-53A, data can be stored on a memory card. The maximum time duration is 199 hours 59 minutes 59 seconds per file.

	Internal memory	Memory card
Number of store data or store time	Max. 86400 (3-axis measurement: 28800 × 3 axis)	Max. 199 h 59 m 59 s per file (subject to capacity of memory card)

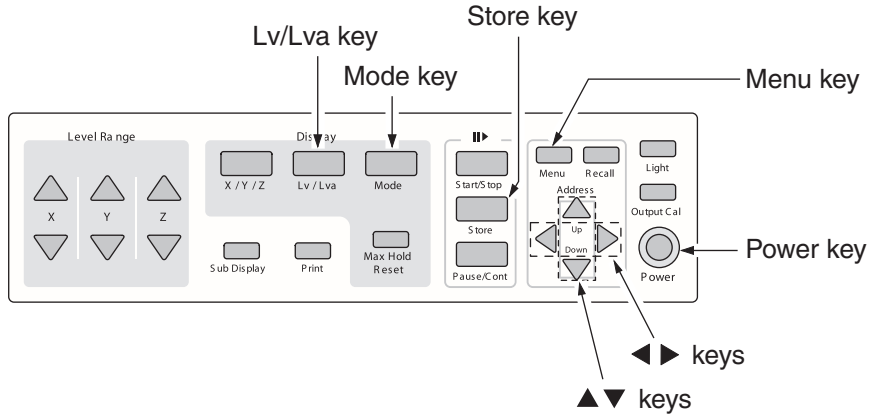
1. Select the store target.
   For the VM-53, this step is not necessary. Proceed directly to step 2.
   For the VM-53A, if you want to store data in the internal memory, verify that no memory card is inserted in the card slot. If you want to store data on a memory card, insert the memory card in the card slot.

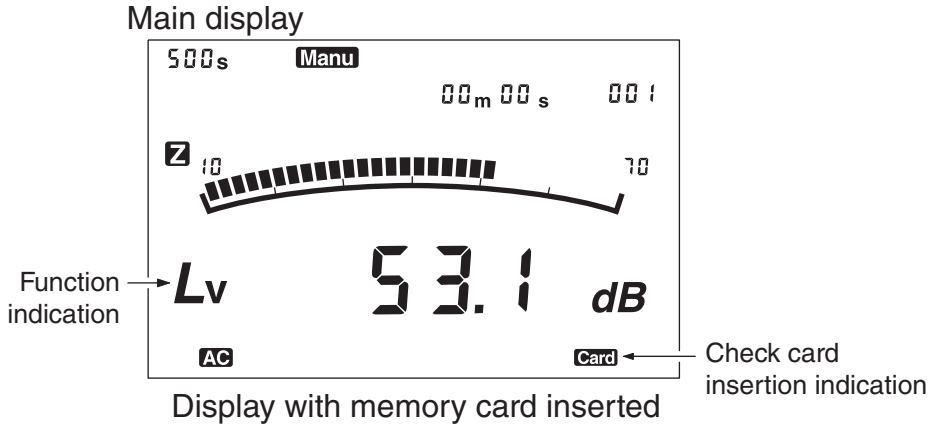


To remove the card, push the lever in.

Note
The model VM-53 does not use memory cards. Only the model VM-53A is equipped with a memory card slot as shown above.

2. Press the Power key to turn the unit On.
   With the VM-53A, if a memory card was inserted in the card slot, the indication [Card] will appear on the main display.
3. Select the "Lv" or "Lva" function with the Lv/Lva key.





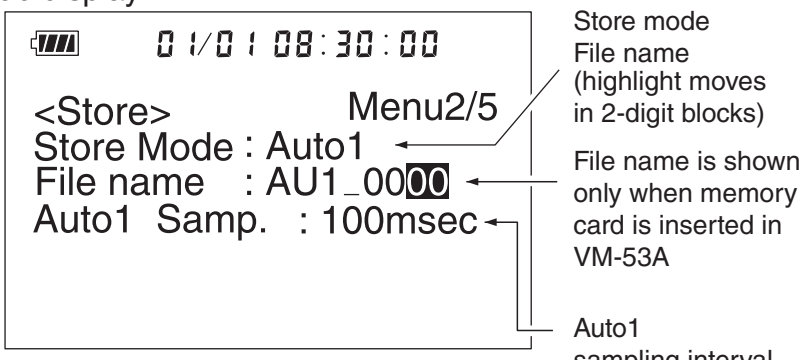
Display with memory card inserted

4. Use the Menu key to bring up the menu screen on the sub display.
5. Select menu screen 2/5 with the Menu key.
6. Set the Store mode to Auto1.
   Use the ▲ and ▼ keys to highlight the "Store mode" item, and use the ◀ and ▶ keys to select "Auto1".
   To use the timer mode, select "Timer Auto1".
   To store data in the internal memory, proceed to step 8.
7. To store data on a memory card, specify a file name (4-digit number).
   Use the ▲ and ▼ keys to highlight the "File name" item, and use the ◀ and ▶ keys to set the file name.

Note
The file name applies only when storing data on a memory card in the VM-53A. When storing data in the internal memory, no file name is shown and the item cannot be set.

8. Set the "Auto1 Samp." item. This setting determines the interval at which the vibration level or vibration acceleration level is sampled. Available settings are "100 msec" or "1 sec".
   When using the normal Auto1 store mode (not the timer mode), proceed to step 11.

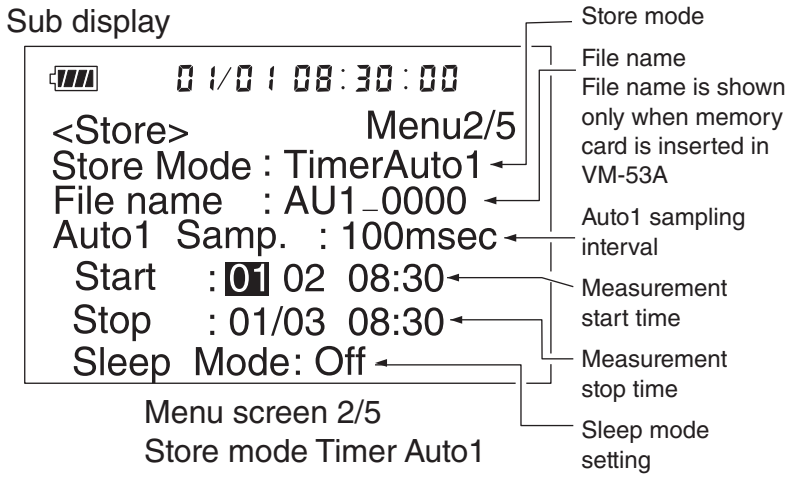
Sub display



Menu screen 2/5

9. When Timer Auto1 is selected, set the "Start" and "Stop" items. (Month, day, hours, minutes only. There is no year setting.)
   Use the ▲ and ▼ keys to highlight "Start" or "Stop" and use the ◀ and ▶ keys to set the date/time.

10. Make the Sleep mode setting.
    Use the ▲ and ▼ keys to highlight "Sleep Mode" and use the ▶ and ◀ keys to select "On" or "Off".
    When "On" is selected, the unit will be in power-save mode during timer standby. In this mode, the measurement is paused.

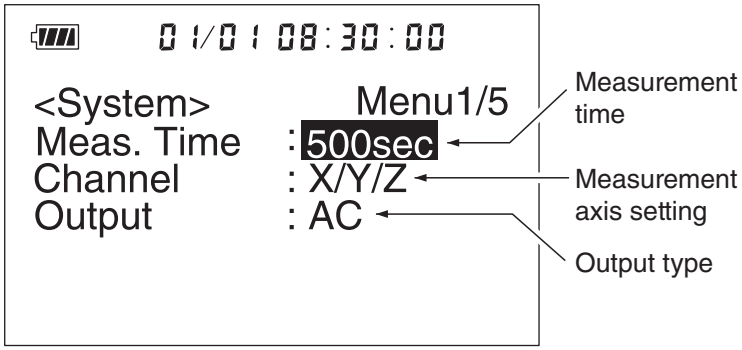


Note
In power-save mode, current consumption is reduced to about 1/2. If the Start/Stop key or Store key is pressed for about 1 second in power-save mode, the measurement is shut down. 30 seconds before the measurement start time, the unit automatically switches to the normal screen, and when the preset time is reached, the store operation starts. If the measurement start time and measurement end time settings are the same, no measurement is performed.

11. Press the Menu key to call up menu screen 1/5, and set the measurement time.
    Use the ▲ and ▼ keys to highlight the "Meas.Time" item and use the ◀ and ▶ keys to set the measurement time.
    Available settings are 500 s (seconds), 10 s, 1 m (minute), 5 m, 10 m, 15 m, 30 m, 1 h (hour), 4 h, 8 h, 24 h, and Manual.

12. Set the channel.
    Use the ▲ and ▼ keys to highlight the "Channel" item, and use the ◀ and ▶ keys to set the measurement direction.
    To save 3-axis (X, Y, Z) data, select "X/Y/Z".
    To save single-axis (X or Y or Z) data, select the desired axis.

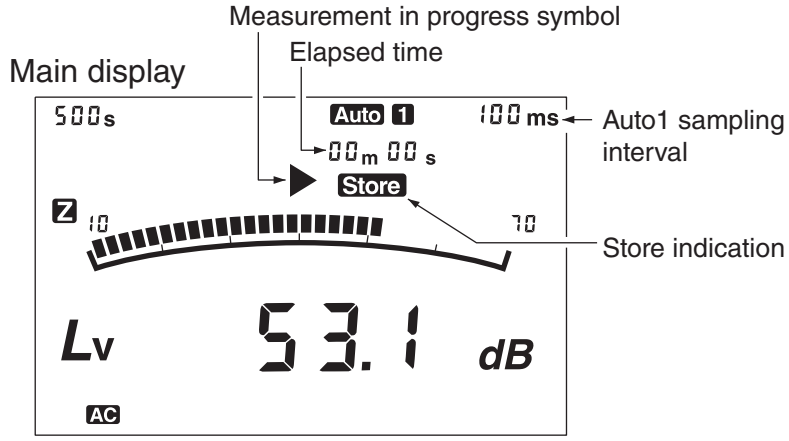
Sub display



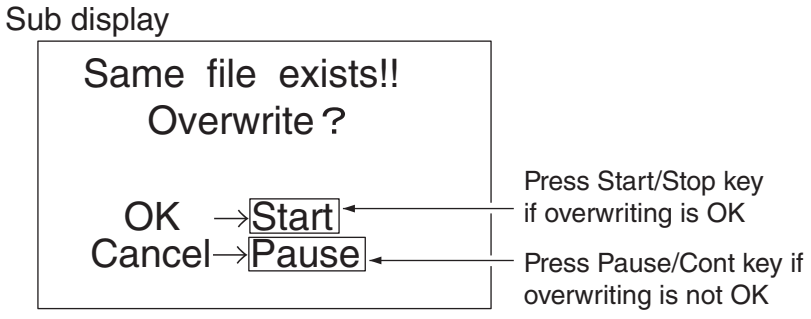
Menu screen 1/5

13. Press the Menu key several times to return to the measurement screen.

14. Press the Store key to start the Auto1 store operation/
    In Auto1 store mode, the measurement in progress symbol and the "Store" indication are flashing on the main display. The elapsed time is also shown.



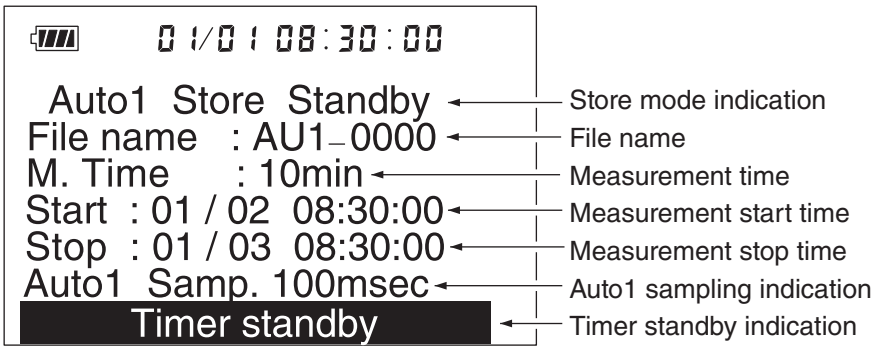
Note
When storing data in the internal memory, existing data will be overwritten. Previous store data are cleared when the new store operation starts (at the point where the Store key is pressed). When storing data on a memory card in the VM-53A, if you specify an existing file name, the message shown below appears. To overwrite, press the Start/Stop key. To cancel the operation, press the Pause key. Specify another file name with menu screen 2/5 and then repeat the store operation.



Note
When the Pause key is pressed during Auto1 storing (except for Timer Auto1), the subsequent data will contain a pause marker (P). This is not the same as normal pause.

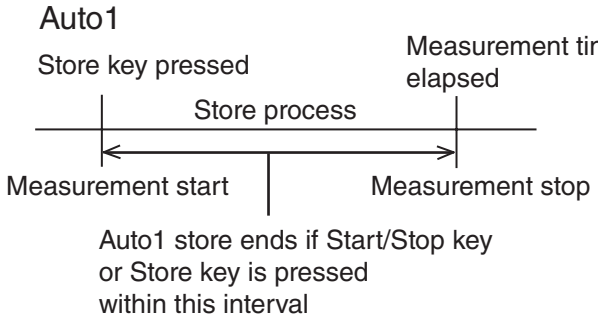
When the Timer Auto1 mode is used, the Auto1 standby screen appears, as shown below.

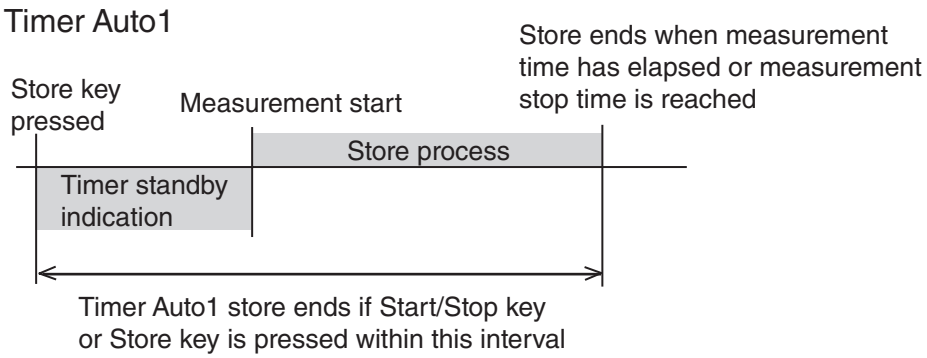
Sub display



Timer Auto1 standby screen example

15. In Auto1 store mode, the data store process will end when the preset measurement time has elapsed.
    To end the process before this point, press the Start/Stop key or the Store key.
    In Timer Auto1 store mode, the data store process will end when the preset measurement time has elapsed or when the preset measurement stop time is reached.

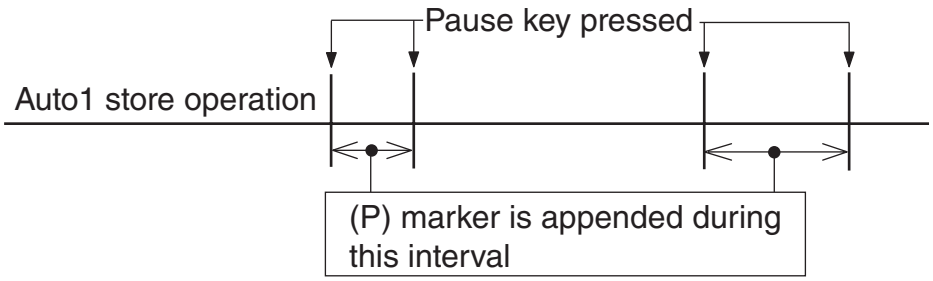




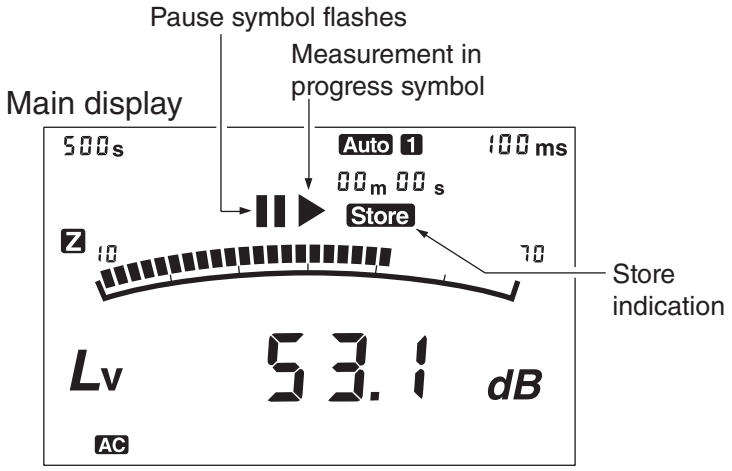
Pause key operation in Auto1 store mode

Note
During Auto1 store operation, the Pause key does not produce a normal pause.

When you press the Pause key during Auto1 store, the subsequent data will contain a pause marker (P). When you press the Pause key again, the (P) marker is turned off.



While the (P) marker is being appended, the pause symbol and measurement in progress symbol as well as the Store indication in the main display are flashing.

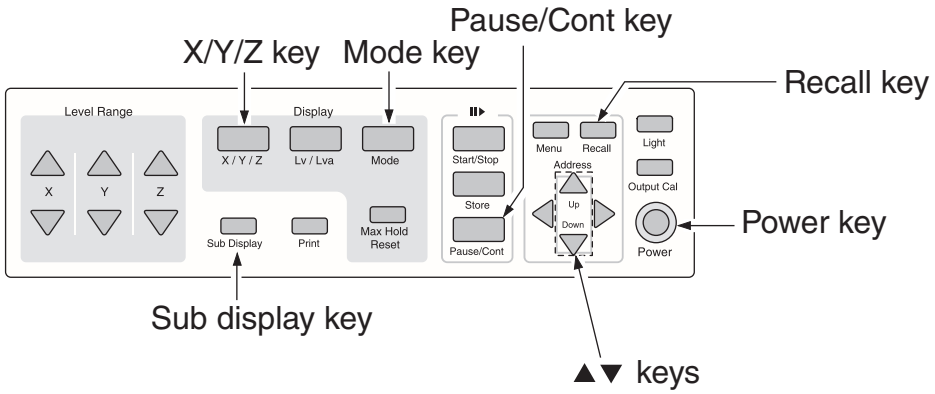


Note
In Timer Auto1 mode, the Pause key has no effect.

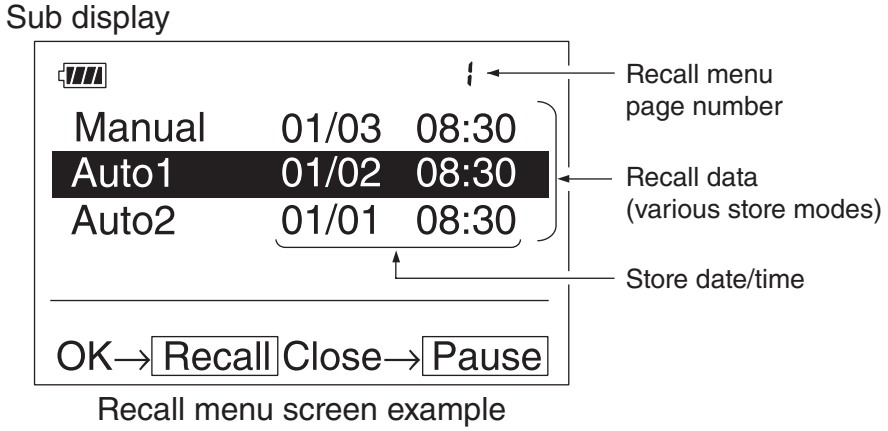
Reading stored data

Auto1 data stored in memory can be called up as follows.

1. Press the Power key to turn power to the unit on.

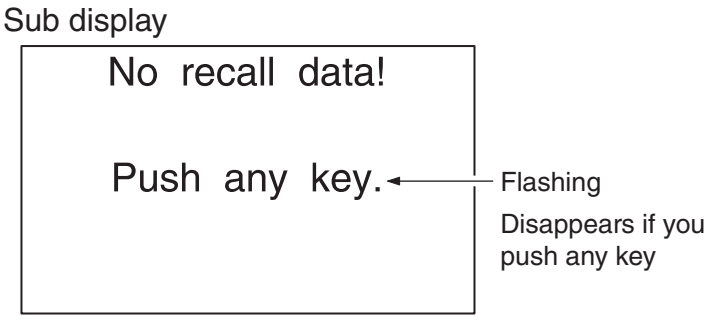


2. Press the Recall key to bring up the recall menu on the sub display.

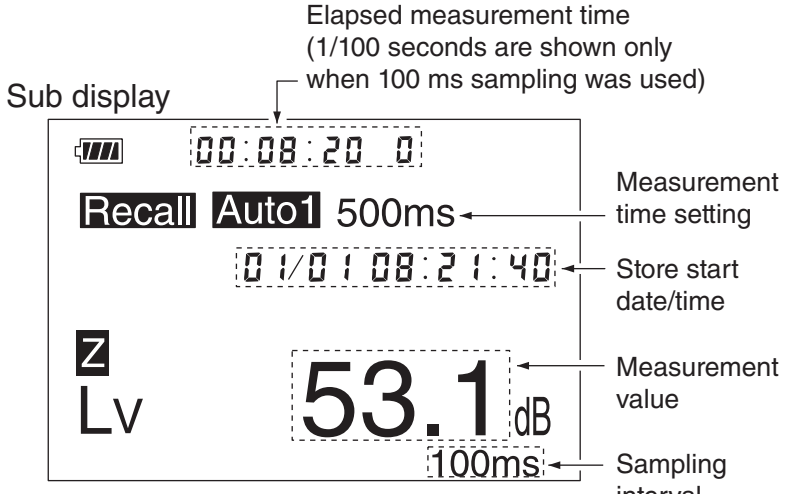


Recall menu screen example

Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.



3. Use the ▲ and ▼ keys to select the desired recall data and press the Recall key.
   The selected recall data appear on the sub display.
4. Use the ▲ and ▼ keys to select the elapsed measurement time point at which the desired data were stored.
   The stored measurement data appear on the sub display.
5. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.
   If the measurement was for a single axis, 0.0 dB will be shown for the other channels.



Recall screen example

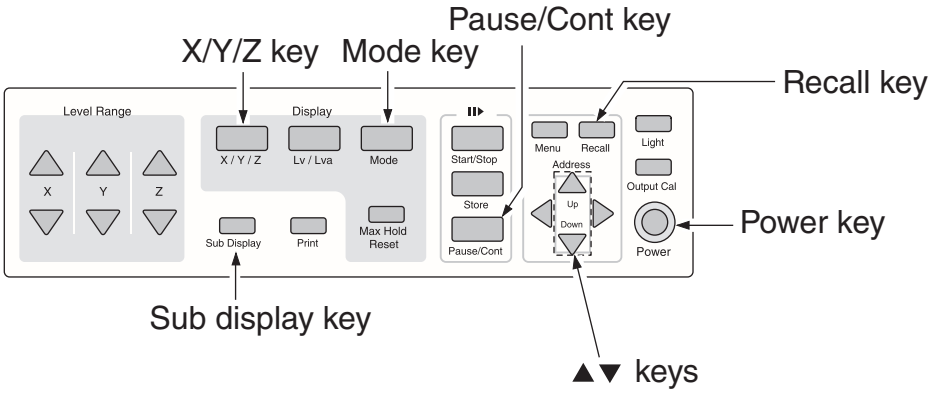
6. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.

Reading data stored on memory card (VM-53A only)

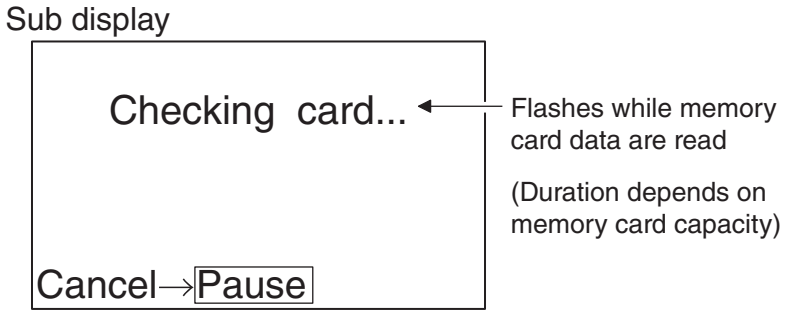
Data stored on the memory card in Auto1 mode can be called up on the sub display as follows.

Make sure that a memory card is inserted.

1. Press the Power key to turn power to the unit on.



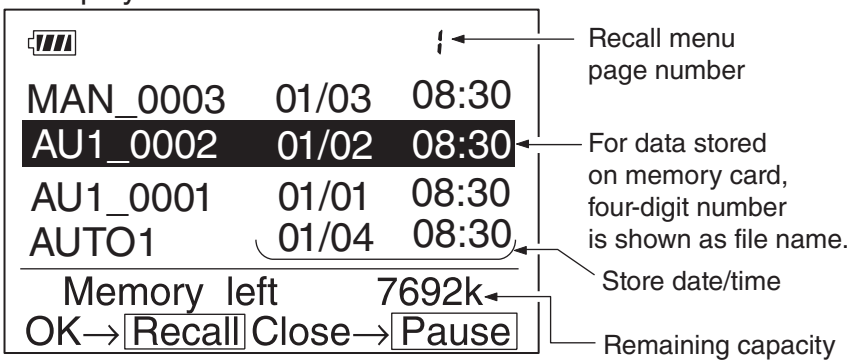
2. Press the Recall key.
   The message "Checking card" appears, and then the card recall menu is shown on the sub display.



3. Use the ▲ and ▼ keys or the Sub Display key to change the recall menu page number, until the page with the desired recall data is shown.

Note
The duration for which the above message is shown depends on the capacity of the memory card. In some cases, the message may only be shown very briefly.

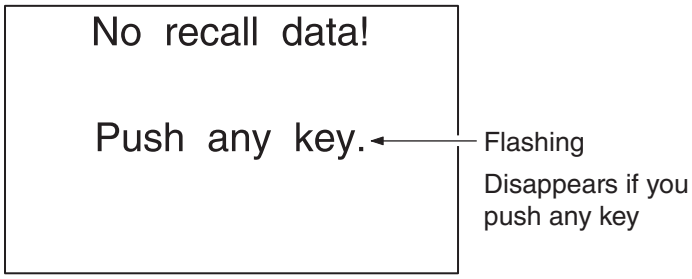
Sub display



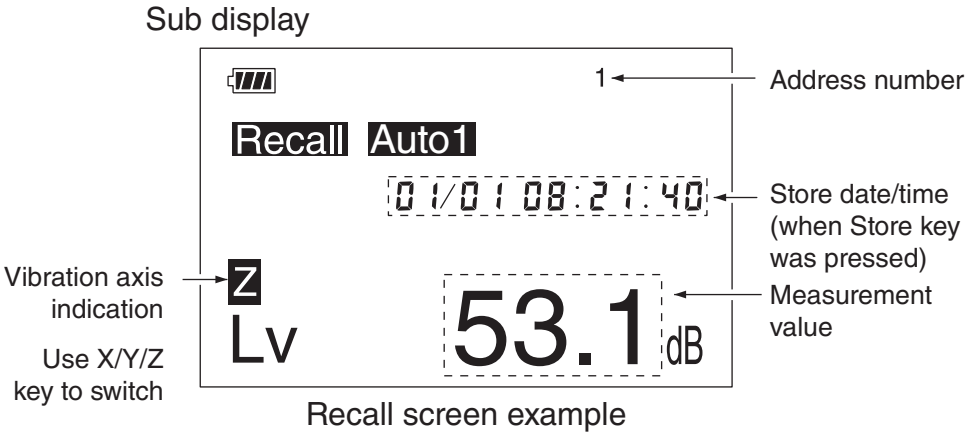
Memory card recall menu screen

Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.

Sub display



4. Use the ▲ and ▼ keys to select the desired recall data (file name), and press the Recall key.
   The selected recall data are shown on the sub display.
5. Use the ▲ and ▼ keys to select the address number in which the desired data are stored.
   The stored measurement data appear on the sub display.
6. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.
   If the measurement was for a single axis, 0.0 dB will be shown for the other channels.



Recall screen example

7. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.

Auto2

This store function continually stores all processing values (L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}) for a measurement as a set.

For example, when the measurement time is set to 1 minute, the processing values will be stored once every minute.

When the internal memory is the store target, up to 4500 data sets can be stored for single-axis measurement and up to 1500 data sets for 3-axis measurement (1500 sets × 3 axes).

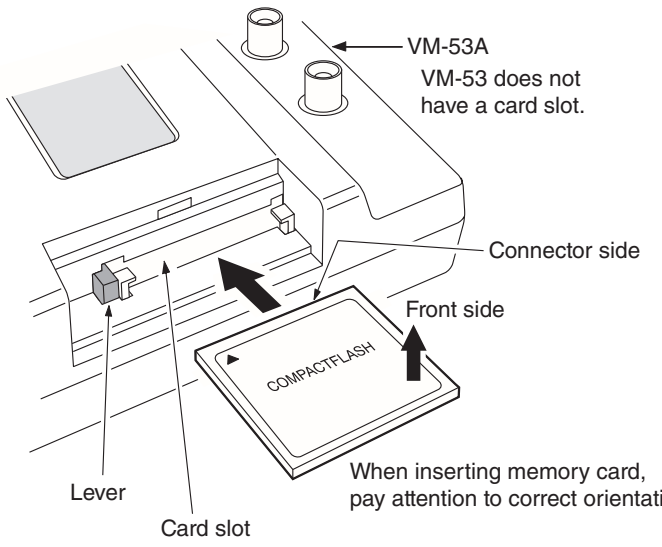
With the model VM-53A, data can be stored on a memory card. Both for single-axis and 3-axis measurement, up to 4500 data sets can be stored per file, and multiple files can be created (up to the capacity of the memory card).

	Internal memory	Memory card
Store count	max. 4500 sets Single-axis: 4500 3-axes: 1500	1 file max. 4500 sets Single-axis: 4500 3-axes: 4500

Storing in memory

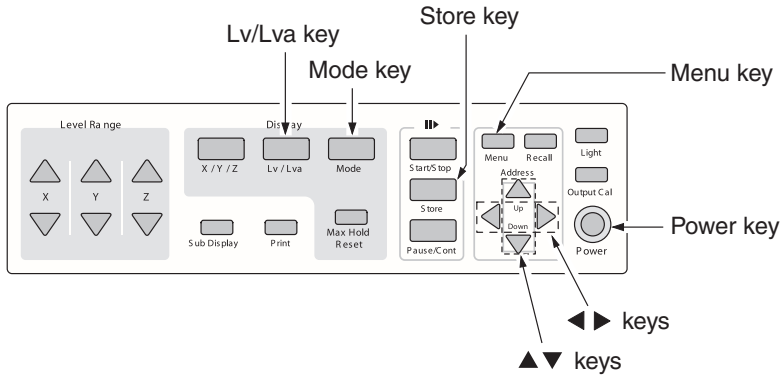
To store data in memory in Auto2 mode, proceed as follows.

1. Select the store target.
   For the VM-53, this step is not necessary. Proceed directly to step 2.
   For the VM-53A, if you want to store data in the internal memory, verify that no memory card is inserted in the card slot. If you want to store data on a memory card, insert the memory card in the card slot.

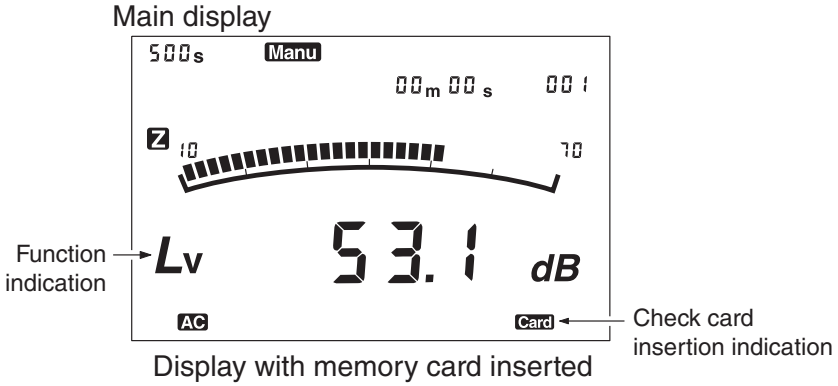


To remove the card, push the lever in.

2. Press the Power key to turn the unit On.
   With the VM-53A, if a memory card was inserted in the card slot, the indication [Card] will appear on the main display.



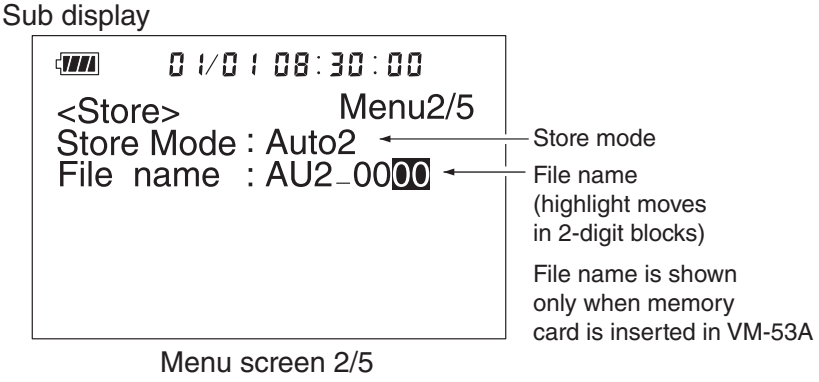
3. Select the "Lv" or "Lva" function with the Lv/Lva key.



Display with memory card inserted

4. Use the Menu key to bring up the menu screen on the sub display.

5. Select menu screen 2/5 with the Menu key.



Menu screen 2/5

6. Set the Store mode to Auto2.
   Use the ▲ and ▼ keys to highlight the "Store mode" item, and use the ◀ and ▶ keys to select "Auto2".
   To use the timer mode, select "Timer Auto2".
   To store data in the internal memory, proceed to step 8.

7. To store data on a memory card, specify a file name (4-digit number).
   Use the ▲ and ▼ keys to highlight the "File name" item, and use the ◀ and ▶ keys to set the file name.

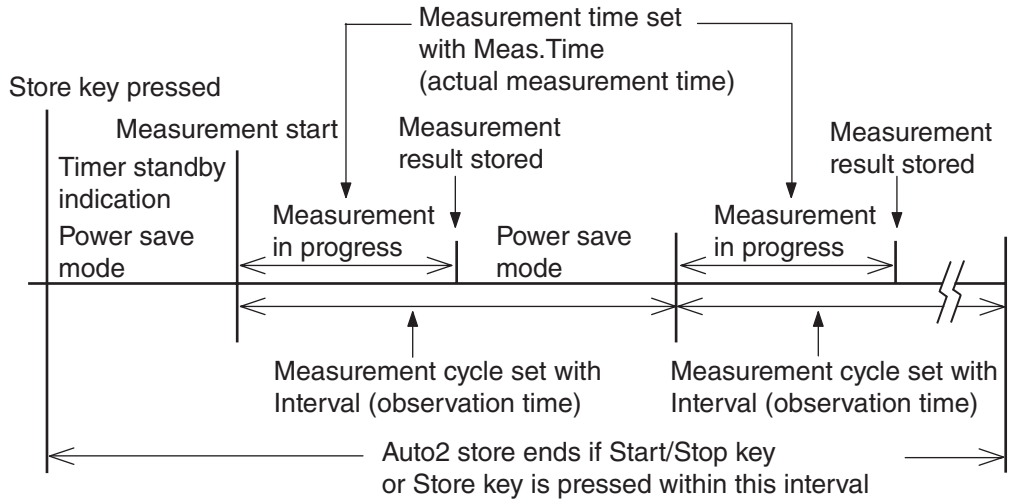
Note
The file name applies only when storing data on a memory card in the VM-53A. When storing data in the internal memory, no file name is shown and the item cannot be set.

   When using the normal Auto2 store mode (not the timer mode), proceed to step 11.

8. When Timer Auto2 was selected, set the "Start" and "Stop" items. (Month, day, hours, minutes only. There is no year setting.)
   Use the ▲ and ▼ keys to highlight "Start" or "Stop" and use the ◀ and ▶ keys to set the date/time.

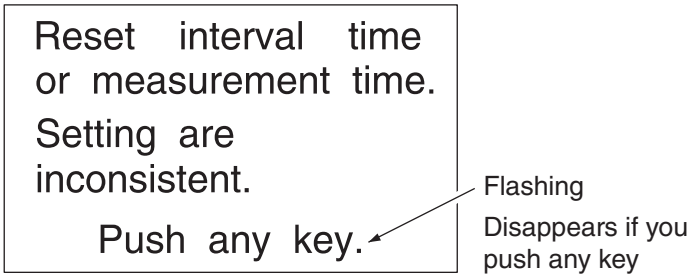
9. Make the interval setting.
   Use the ▲ and ▼ keys to highlight the "Interval" item and he ◀ and ▶ keys to select the setting.
   The available settings are Off, 5 min, 10 min, 15 min, 30 min, and 1 hour.
   When set to "Off", the processing and storing is carried out continuously in intervals determined by the "Meas.Time" setting.

Timer Auto2 (Interval On)



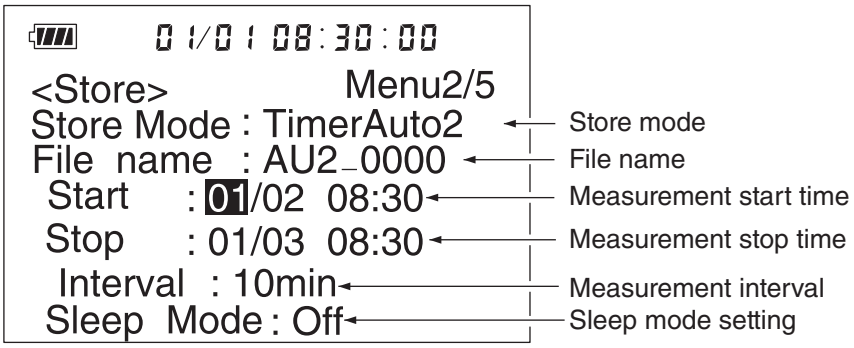
Note
When setting measurement parameters, the "Meas. Time" (actual measurement time) setting may not exceed the "Interval" (observation time) setting. If such a setting is attempted, the message shown below appears. If the measurement start time and measurement end time settings are the same, no measurement is carried out.

Sub display



10. Make the Sleep mode setting.
    Use the ▲ and ▼ keys to highlight "Sleep Mode" and use the ◀ and ▶ keys to select "On" or "Off".
    When "On" is selected, the unit will be in power-save mode during timer standby. In this mode, the measurement is paused.

Sub display



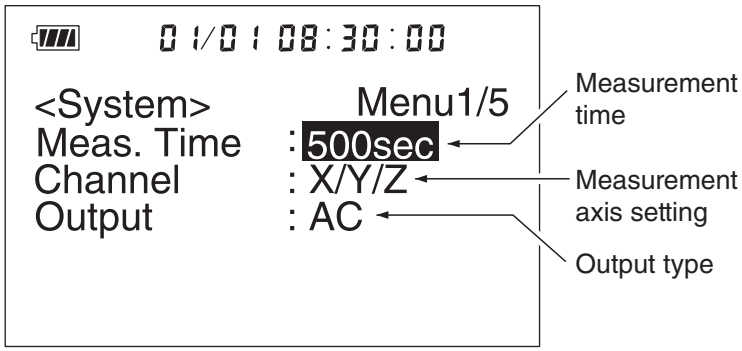
Menu screen 2/5 Store mode Timer Auto2

Note
In power-save mode, current consumption is reduced to about 1/2. If the Start/Stop key or Store key is pressed for about 1 second in power-save mode, the measurement is shut down. 30 seconds before the measurement start time, the unit automatically switches to the normal screen, and when the preset time is reached, the store operation starts. If the measurement start time and measurement end time settings are the same, no measurement is performed.

11. Press the Menu key to call up menu screen 1/5, and set the measurement time.
    Use the ▲ and ▼ keys to highlight the "Meas.Time" item and use the ◀ and ▶ keys to set the measurement time.
    Available settings are 500 s (seconds), 10 s, 1 m (minute), 5 m, 10 m, 15 m, 30 m, 1 h (hour), 4 h, 8 h, 24 h, and Manual.

12. Set the channel.
    Use the ▲ and ▼ keys to highlight the "Channel" item, and use the ◀ and ▶ keys to set the measurement direction.
    To save 3-axis (X, Y, Z) data, select "X/Y/Z".
    To save single-axis (X or Y or Z) data, select the desired axis.

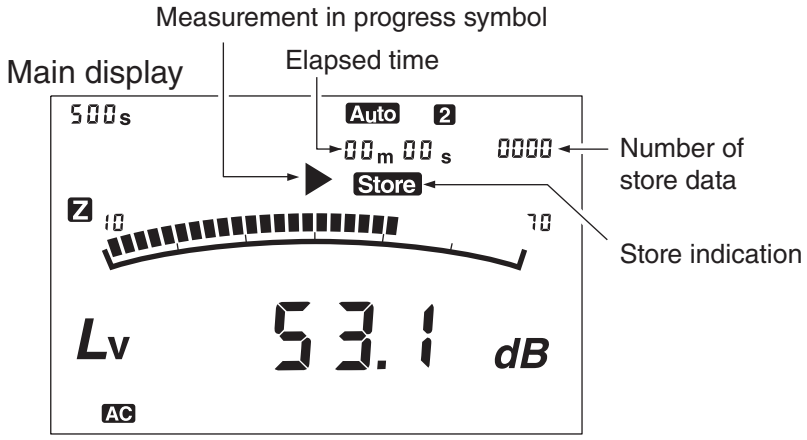
Sub display



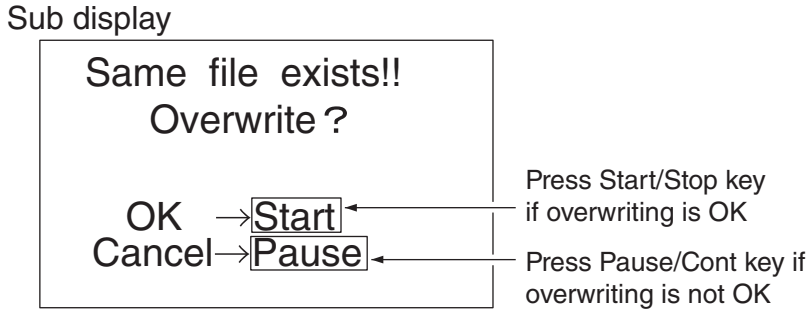
Menu screen 1/5

13. Press the Menu key several times to return to the measurement screen.

14. Press the Store key to start the Auto2 store operation.
    In Auto2 store mode, the measurement in progress symbol and the "Store" indication are flashing on the main display. The elapsed time is also shown.

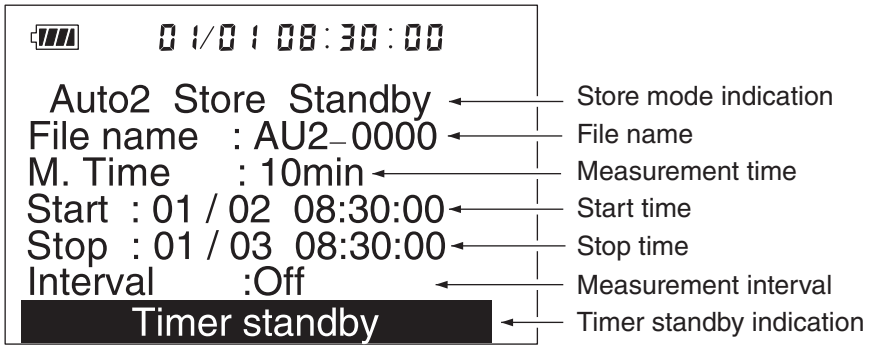


Note
When storing data in the internal memory, existing data will be overwritten. Previous store data are cleared when the new store operation starts (at the point where the Store key is pressed). When storing data on a memory card in the VM-53A, if you specify an existing file name, the message shown below appears. To overwrite, press the Start/Stop key. To cancel the operation, press the Pause key. Specify another file name with menu screen 2/5 and then repeat the store operation.



When the Timer Auto2 mode is used, the Auto2 standby screen appears, as shown below.

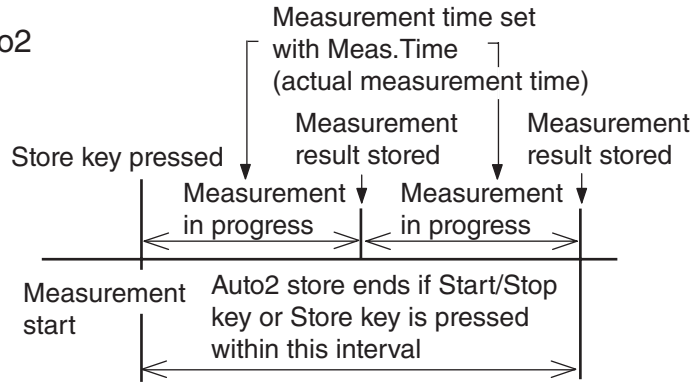
Sub display



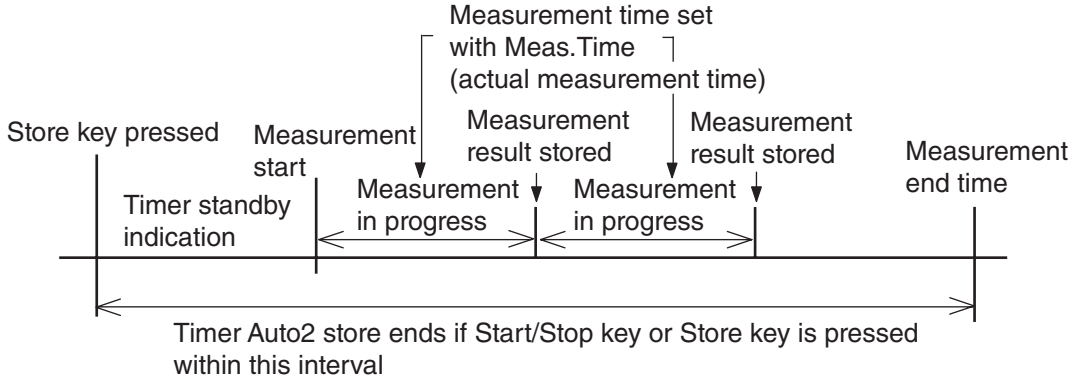
Timer Auto2 standby screen example

15. In Auto2 store mode, the data store process will end when 4500 data sets (for single-axis measurement) or 1500 data sets (for 3-axis measurement) have been stored.
    To end the process before this point, press the Start/Stop key or the Store key.
    In Timer Auto2 store mode, the data store process will end when the preset measurement stop time is reached.

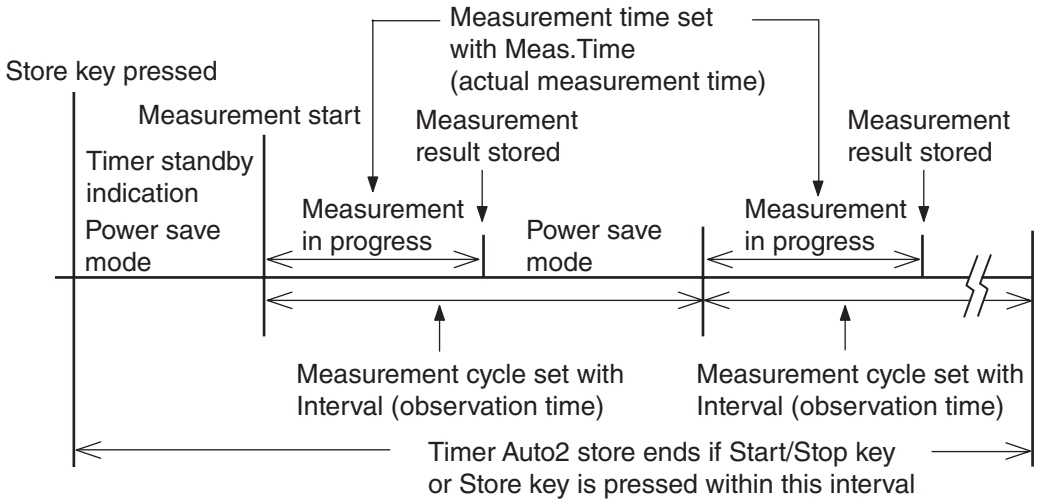
Auto2



Timer Auto2 (Interval Off)



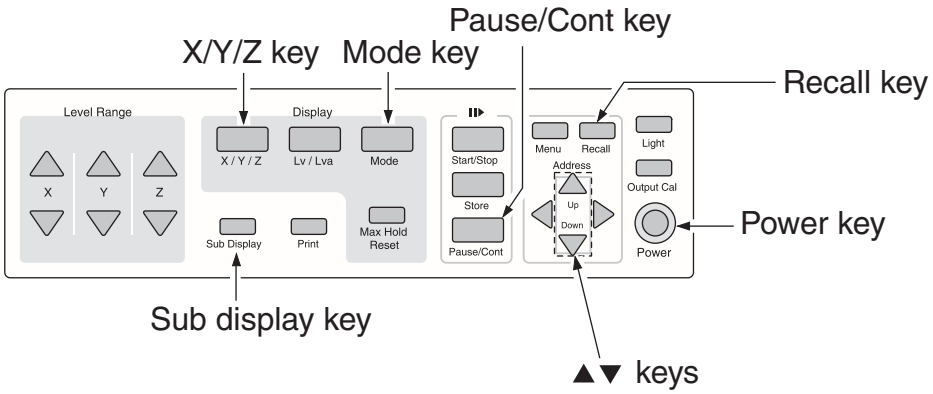
Timer Auto2 (Interval On)



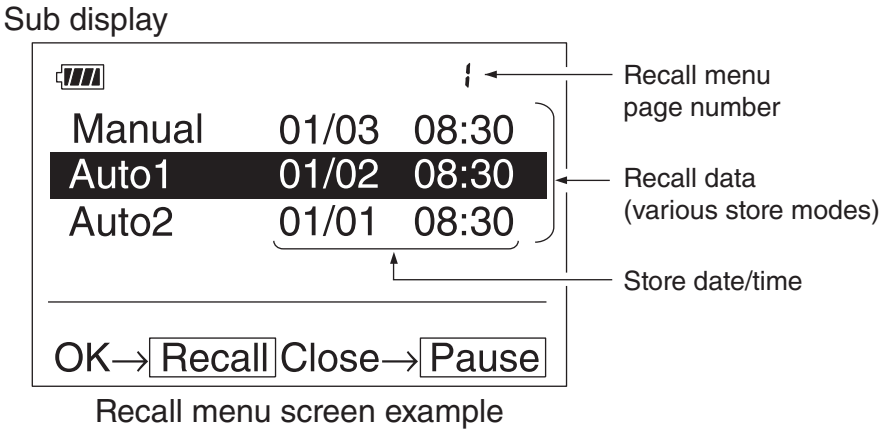
Reading stored data

Auto2 data stored in memory can be called up as follows.

1. Press the Power key to turn power to the unit on.

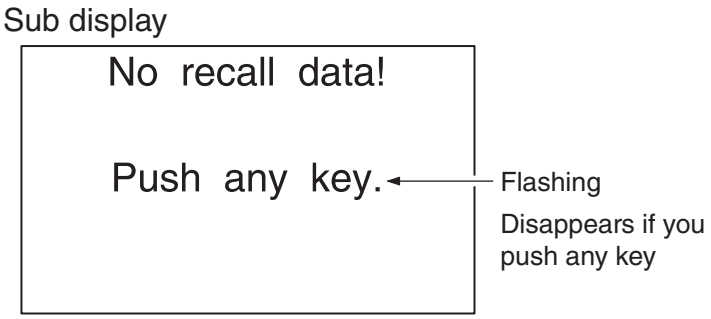


2. Press the Recall key to bring up the recall menu on the sub display.



Recall menu screen example

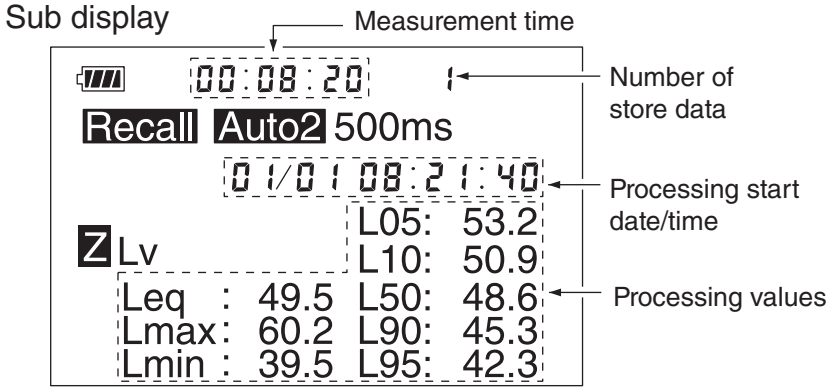
Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.



3. Use the ▲ and ▼ keys to select the desired recall data and press the Recall key.
   The selected recall data appear on the sub display.
4. Use the ▲ and ▼ keys to select the measurement time point at which the desired data were stored.
   The number of stored data is shown by the store data number indication.
5. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.
   If the measurement was for a single axis, 0.0 dB will be shown for the other channels.

6. Use the Mode key to switch the processing type display to eq → max → min → 5 → 10 → 50 → 90 → 95 and read the respective data. By further pressing the Mode key, you can call up the processing list display which shows all processing values simultaneously.

7. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.



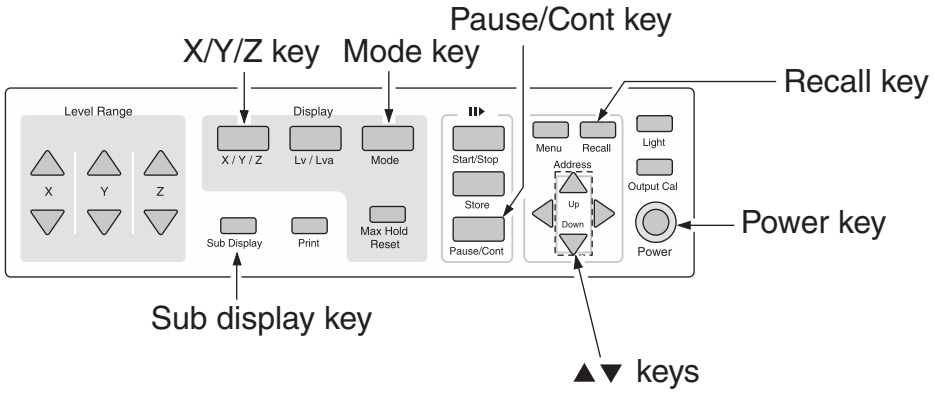
Recall screen
(processing list) example

Reading data stored on memory card (VM-53A only)

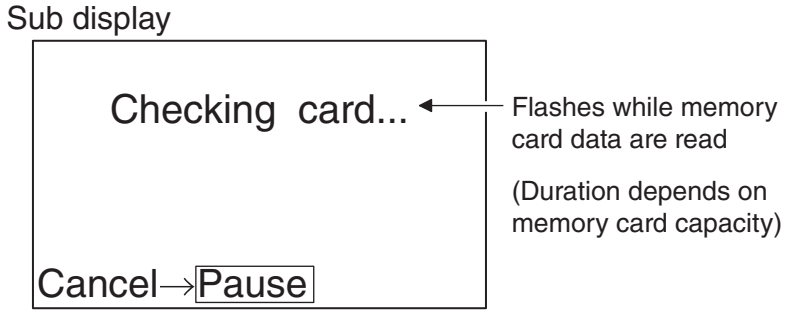
Data stored on the memory card in Auto1 mode can be called up on the sub display as follows.

Make sure that a memory card is inserted.

1. Press the Power key to turn power to the unit on.



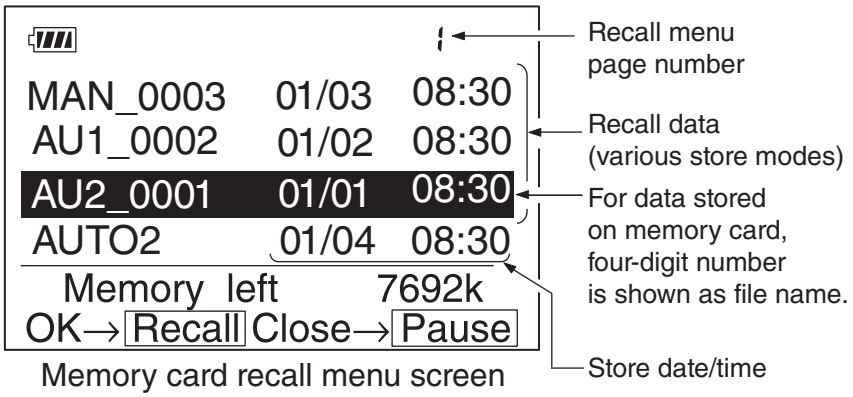
2. Press the Recall key.
   The message "Checking card" appears, and then the card recall menu is shown on the sub display.
3. Use the ▲ and ▼ keys or the Sub Display key to change the recall menu page number, until the page with the desired recall data is shown.



Note
The duration for which the above message is shown depends on the capacity of the memory card. In some cases, the message may only be shown very briefly.

The data are listed in descending order of date/time, with the most recent at the top.

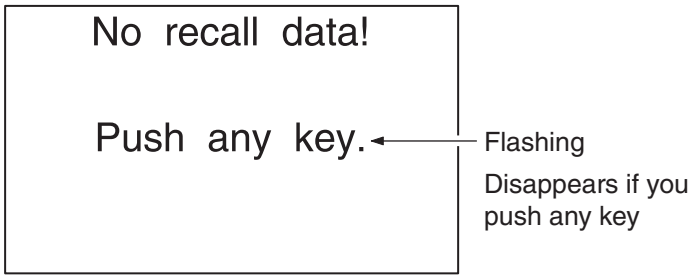
Sub display



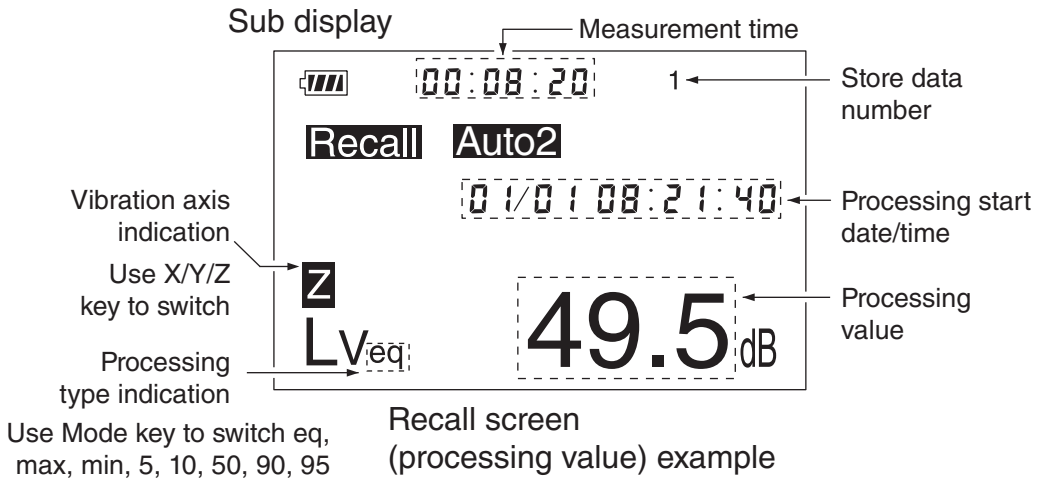
Memory card recall menu screen

Note
When there are no data that can be recalled, the message shown below appears. Press any key to cancel the message.

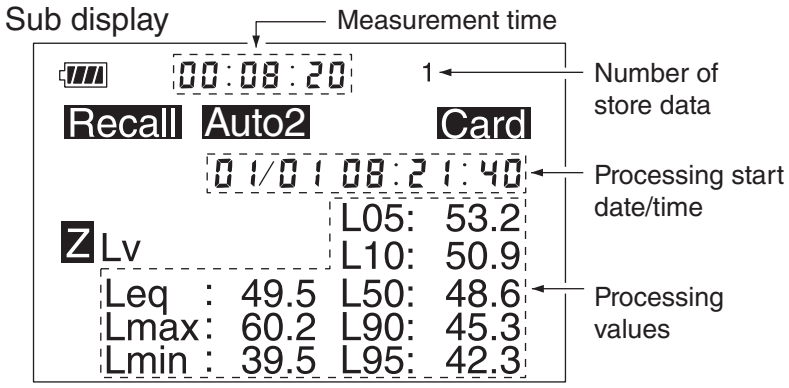
Sub display



4. Use the ▲ and ▼ keys to select the desired recall data (file name), and press the Recall key.
   The selected recall data are shown on the sub display.
5. Use the ▲ and ▼ keys to select the address number in which the desired data are stored.
   The stored measurement data appear on the sub display.
6. Press the X/Y/Z key to switch the vibration axis and read the various measurement data.
   If the measurement was for a single axis, 0.0 dB will be shown for the other channels.
7. Use the Mode key to switch the processing type display to eq → max → min → 5 → 10 → 50 → 90 → 95 and read the respective data.
   By further pressing the Mode key, you can call up the processing list display which shows all processing values simultaneously.



8. To terminate the Recall mode, press the Recall key once more or press the Pause key.
   On the recall menu screen, press the Pause key.



Recall screen
(processing list) example

Comparator

Comparator operation

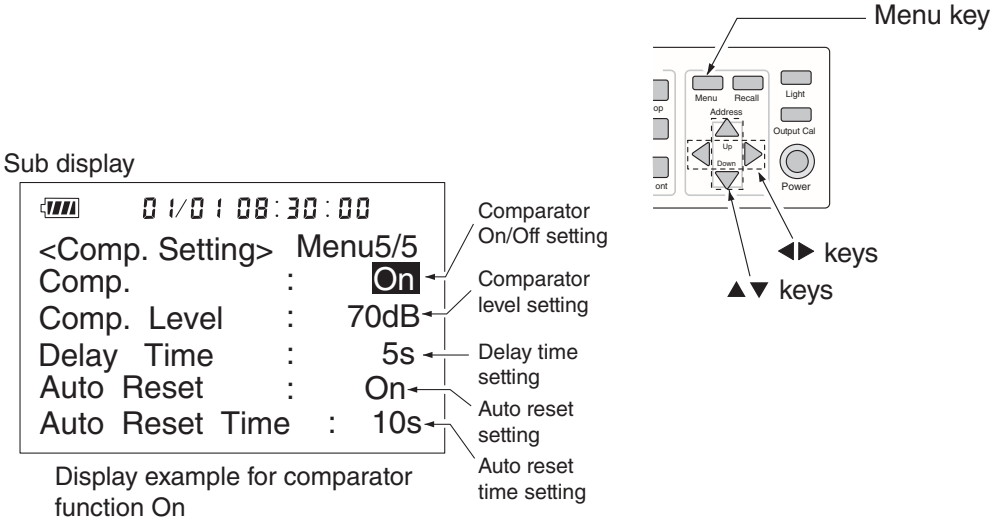
The comparator works by constantly monitoring the measured vibration level (converted rms value) and comparing it to a preset reference level (comparator level). If the comparator level is exceeded, the comparator output (open collector circuit) becomes active and an indication flashes on the display.
Settings for the comparator function are made with menu screen 5/5, and the channel shown on the main display is used as source for the comparator.
The comparator output does not operate during processing, storing, calibration, menu operation, or recall.

Settings

When the comparator is set to On with menu screen 5/5, the following settings are shown.

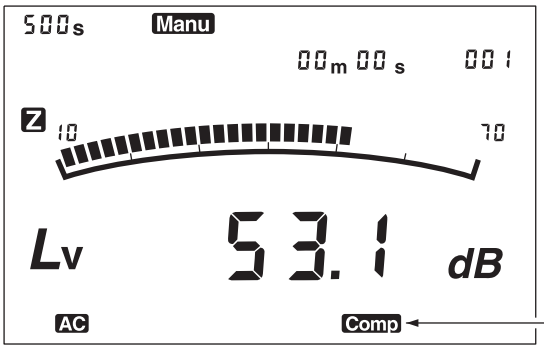
Comparator level: 30 to 120 dB, 1-dB steps
Delay time: 0 to 9 seconds in 1-second steps
Auto reset: On/Off
Auto reset time: 0 to 90 seconds in 1-second steps

To make a setting, use the Menu key to bring up menu screen 5/5 on the sub display. Then use the ▲ and ▼ keys to select the menu item and use the ◀ and ▶ keys to change the setting.



Display example for comparator function On

When the comparator has been set to On, the comparator indication is shown.

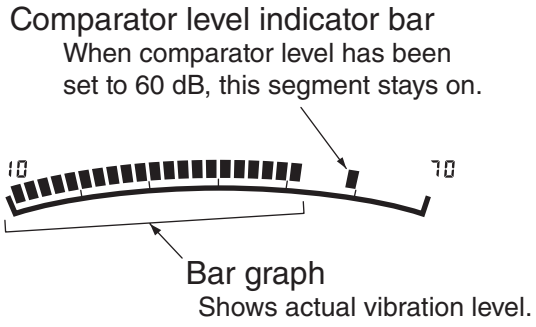


Instantaneous value measurement example

Comparator level

The comparator level is the level at which the comparator output becomes active.

For example, when the comparator level has been set to "60 dB", the threshold level is 60 dB, and the segment of the bar graph corresponding to this level is permanently on.



Delay time

When the vibration level exceeds and stays above the comparator level, the comparator output becomes active after a delay set with this item.

The setting range is 0 to 90 seconds in 1-second steps.

Auto reset

When this function is set to On and the vibration level has fallen below the comparator level, the comparator output will automatically be reset (turned off) after the auto reset time has elapsed.

When the function is set to Off, the comparator output remains active until the Max Hold Reset key is pressed, or until the comparator function is turned off from menu screen 5/5.

Auto reset time

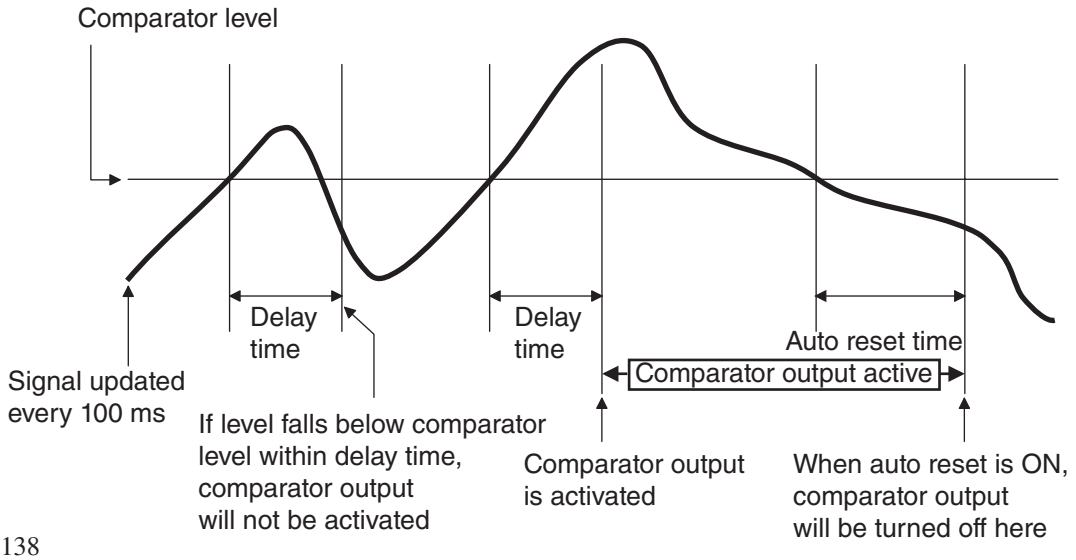
When the vibration level has fallen below the comparator level, the comparator output will automatically be reset (turned off) after the time set with this item has elapsed.

The setting range is 0 to 90 seconds in 1-second steps.

This setting is valid only when the auto reset function has been set to On.

Note
If a setting is changed while the comparator is active, the comparator output may be triggered.

Operation description



Reset operation

When the comparator output was activated, it can be reset in three ways.

(1) Auto reset

As described on page 138, when auto reset is On, the comparator output will be turned off automatically after activation when the auto reset time has elapsed.

(2) Max Hold Reset key

Pressing the Max Hold Reset key on the front panel immediately resets the comparator output. This function is independent of the auto reset On/Off setting.

(3) Menu screen 5/5

Setting the comparator function to Off on menu screen 5/5 resets the comparator output.

* With methods (1) and (2), the comparator function remains On also after reset. With method (3), the unit returns to normal measurement.

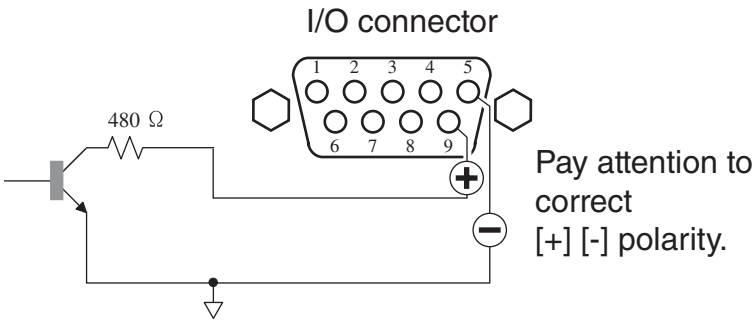
Comparator output

The comparator triggers two actions.

(1) Display flashes.

The measurement value indicator section flashes in 0.5 second intervals.

(2) An open collector circuit operates, causing pins 5 and 9 of the I/O connector to close.



Maximum applied voltage: 24 V DC

Maximum drive current: 50 mA DC (applied voltage 24 V)
25 mA DC (applied voltage 12 V)
10 mA DC (applied voltage 5 V)

Memory Card (VM-53A only)

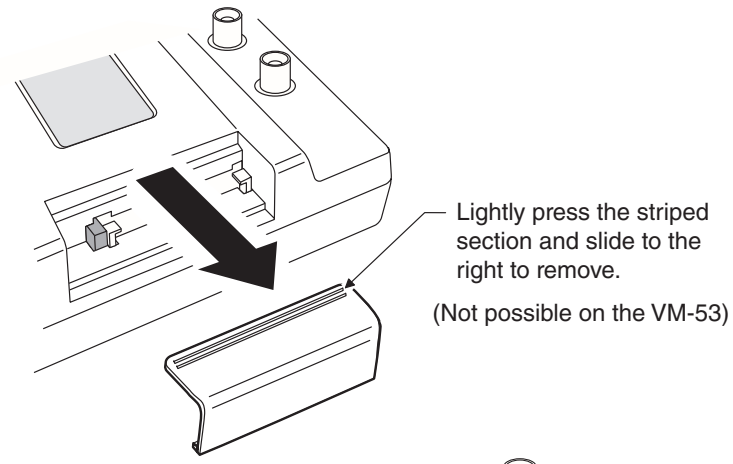
Memory card

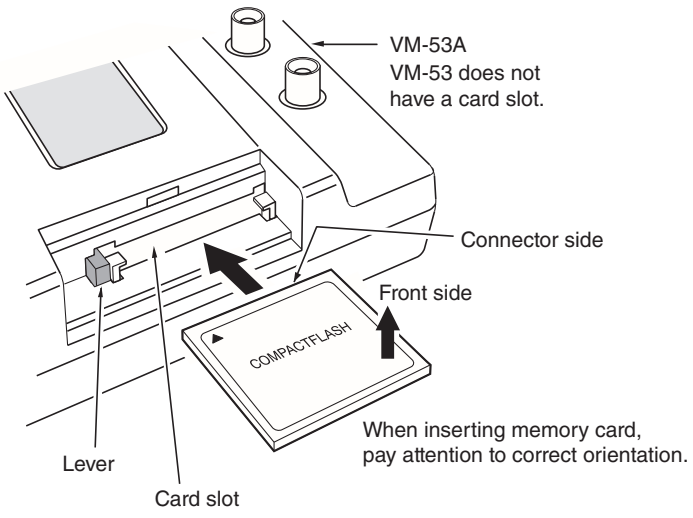
Card insertion and removal

Open the lid of the card slot and insert the memory card into the unit.

To remove the card, press the eject button.

Important
Always turn the power off before inserting or removing a memory card.





To remove the card, push the lever in.

Data size information

Data space requirements for Auto1 store mode are shown below.

Measurement time	Data size (MByte)	
	Sampling interval 100 ms	Sampling interval 1 s
1 hour	1.5	0.15
8 hours	12	1.2
24 hours (1 day)	35	3.5
3 days	104	10.4
7 days	242	24.2
Manual (199 h 59 m 59 s)	288	28.8

Measurement time and required data space

For example, when performing a measurement for 8 hours using a sampling time of 100 milliseconds, the data size will be 12 megabytes, as shown in the above table. Therefore a 16 MByte memory card can be used for measurement.

Auto2 store

When using Auto2 store, 240 Bytes are required for 1 data set. For example, when measurement is carried out continuously for one week with a 10 minute measurement time, there will be 1008 data sets, requiring 1008 × 240 = approx. 242 kBytes.

Manual store

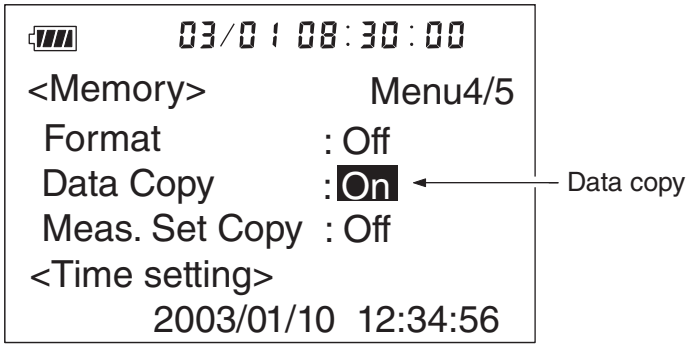
When performing manual store, one file (100 data sets) requires about 25 kBytes. Because the file size is the same regardless of how many data sets there are in the file, space requirements are the same for saving 1 data set or 100 data sets.

Data copy function

Data stored in the internal memory of the unit can be copied to a memory card. The following description assumes that data have been stored in the internal memory.

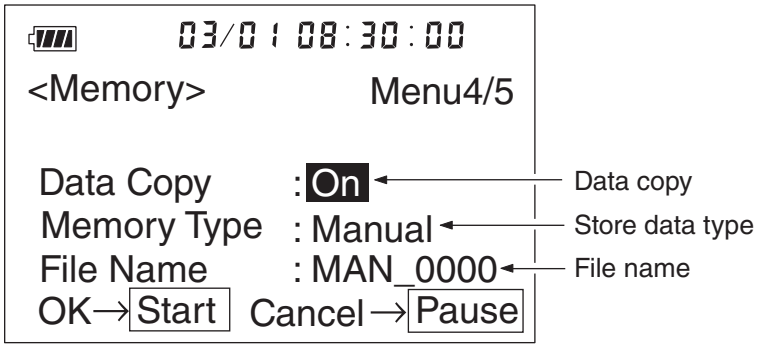
1. Insert a memory card and turn the power on.
2. Use the Menu key to bring up menu screen 4/5.
3. Set Data Copy to On.

Menu screen 4/5



4. Select the type of store data to be copied to the memory card (Manual/Auto1/Auto2).
5. When the file name has been set, pressing the Start/Stop key will start the copy process.

Menu screen 4/5



About memory card

For this unit, you should use optional memory card that we can offer you.

The type of memory card used in the VM-53A is called CompactFlash™ card.

* Compact Flash™ is a registered trademark of SanDisk Corporation.

Memory cards even from the same manufacturer and of the same type can differ in specifications. Some memory cards may therefore not function properly in the VM-53A.

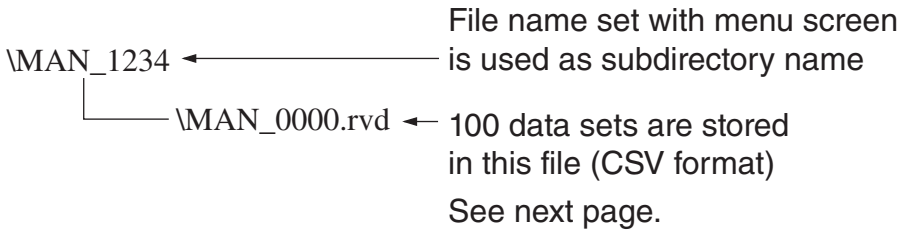
Note
When wanting to use data saved on memory card in spreadsheet applications and other software running on a computer, the file names on the memory card sometimes may not be read correctly. In such a case, you should first change the file name using the extension "txt" (for example "AU1-0001.txt") or another extension that will be recognized by the software application as denoting a text file.
Do not format the memory card in a computer.

Memory card store data format

The data stored on the memory card are in CSV format. A structure of subdirectories and files is created on the memory card.

Manual store mode

The file name as set with the menu screen is used as the last four characters of the subdirectory name.



See next page.

Inst/Max Hold, Frequency-weight, Center/High pass filter cutoff, Low pass filter cutoff,

Address,	Inst/M-	Freq-	Time -weight,	Filter,	Center/Hi-	Low pass	Store time,	X_Range,	X,
1	Inst,	Lv,	0.63s,	,	,	,	2003/1/ 1, 8:30,	70,	42.3,
2	Inst,	Lv,	0.63s,	,	,	,	2003/1/ 1, 9:10,	70,	48.7,
3	Inst,	Lva,	0.63s,	,	,	,	2003/1/ 1, 9:50,	110,	43.2,
4	Inst,	Lv,	0.63s,	,	,	,	2003/1/10,10:05,	70,	65.8,
5	Inst,	Lv,	0.63s,	,	,	,	2003/1/10,10:30,	80,	56.2,
6	Inst,	Lv,	0.63s,	,	,	,	2003/1/11, 8:30,	70,	0,
7	Inst,	Lva,	0.63s,	,	,	,	2003/1/11, 8:42,	100,	55.8,
8	Inst,	Lva,	0.63s,	,	,	,	2003/1/12,11:05,	70,	46.7,

Address

Vibration level related store information

Over,	Under,	Y_Range,	Y,	Over,	Under,	Z_Range,	Z,	Over,	Under,
,	,	70,	38.9,	,	,	70,	45.7,	,	,
,	,	80,	44.8,	,	,	120,	55.1,	,	Under,
,	Under,	70,	55.5,	,	,	70,	53.5,	,	,
Over,	,	70,	56.7,	,	,	70,	54.9,	,	,
,	,	70,	62.2,	Over,	,	70,	57.8,	,	,
,	,	0,	45.1,	,	,	70,	58.5,	Over,	,
,	,	90,	51.1,	,	,	80,	3.3,	,	Under,
,	,	70,	47.3,	,	,	70,	48.6,	,	,

Vibration level related store information

Frequency-weight, Center/High pass filter cutoff, Low pass filter cutoff, Measurement time,

Freq,	Time-weight,	Filter,	Center/Hi-	Low pass	Beginning time,	Time setting,	Measur.
Lv,	0.63s,	,	,	,	2003/1/ 1, 0:00,	500sec,	0:00:00,
Lv,	0.63s,	,	,	,	2003/1/ 1, 9:00,	500sec,	0:08:20,
Lva,	0.63s,	,	,	,	2003/1/ 1, 9:30,	500sec,	0:08:20,
Lv,	0.63s,	,	,	,	2003/1/ 1, 0:00,	1min,	0:00:00,
Lv,	0.63s,	,	,	,	2003/1/ 1, 0:00,	1hour,	0:00:00,
Lv,	0.63s,	,	,	,	2003/1/11, 8:00,	10min,	0:10:00,
Lva,	0.63s,	,	,	,	2003/1/ 1, 0:00,	1min,	0:00:00,
Lva,	0.63s,	,	,	,	2003/1/12, 0:00,	Manual,	0:01:40,

Processing value related store information

X_Range,	X_Leq,	X_Lmax,	X_Lmin,	X_L5,	X_L10,	X_L50,	X_L90,	X_L95,
100,	0,	0,	0,	0,	0,	0,	0,	0,
70,	48.5,	55.9,	36.9,	53.1,	50.5,	46.3,	40.3,	39.5,
70,	47.3,	55.4,	37.8,	52.9,	49.6,	45.5,	41.1,	39.8,
90,	0,	0,	0,	0,	0,	0,	0,	0,
70,	0,	0,	0,	0,	0,	0,	0,	0,
70,	0,	0,	0,	0,	0,	0,	0,	0,
70,	0,	0,	0,	0,	0,	0,	0,	0,
80,	64.2,	72.1,	52,	69.5,	67.2,	62.1,	54.6,	52.9,

Processing value related store information

Over,	Under,	Y_Range,	Y_Leq,	Y_Lmax,	Y_Lmin,	Y_L5,	Y_L10,	Y_L50,
,	,	90,	0,	0,	0,	0,	0,	0,
,	,	70,	46.1,	54.8,	35.7,	51.1,	49.2,	45.5,
,	,	70,	47.2,	52.5,	35.9,	50.8,	48.3,	45.1,
,	,	70,	0,	0,	0,	0,	0,	0,
,	,	70,	0,	0,	0,	0,	0,	0,
,	,	70,	0,	0,	0,	0,	0,	0,
,	,	70,	0,	0,	0,	0,	0,	0,
Over,	,	100,	65.8,	70.9,	54.5,	67.5,	65.9,	64.1,

Processing value related store information

Y_L90,	Y_L95,	Over,	Under,	Z_Range,	Z_Leq,	Z_Lmax,	Z_Lmin,	Z_L5,
0,	0,	,	,	100,	0,	0,	0,	0,
41.1,	38.7,	,	,	70,	50.3,	59.6,	42.9,	57.6,
42.8,	37.9,	,	,	70,	52.2,	57.8,	41,	56.8,
0,	0,	,	,	80,	0,	0,	0,	0,
0,	0,	,	,	90,	0,	0,	0,	0,
0,	0,	,	,	70,	46.3,	49.8,	28.7,	47,
0,	0,	,	,	70,	0,	0,	0,	0,
58.2,	55.6,	,	,	100,	67.8,	71.8,	59.8,	69.8,

Processing value related store information

Z_L10,	Z_L50,	Z_L90,	Z_L95,	Over,	Under,	Pause
0,	0,	0,	0,	,	,	
55.5,	49.5,	45.3,	44.1,	,	,	
54.2,	50.8,	45.8,	43.2,	,	,	Pause
0,	0,	0,	0,	,	,	
0,	0,	0,	0,	,	,	
46.8,	45,	38.1,	30.5,	,	,	
0,	0,	0,	0,	,	,	
69,	66.2,	62.3,	60.5,	,	,	

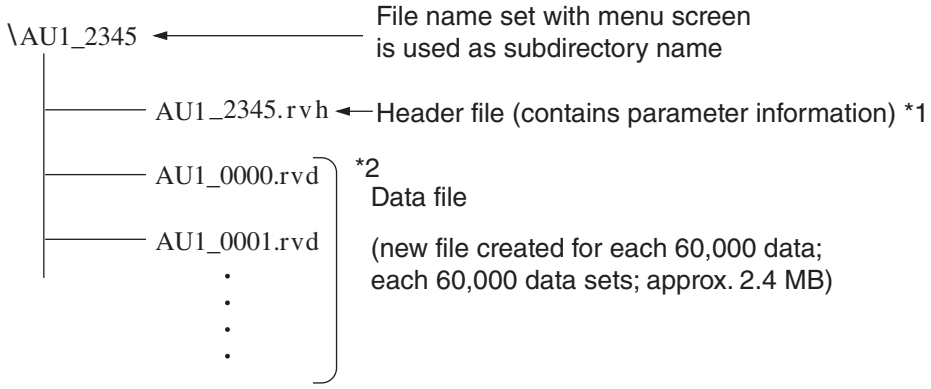
Processing value related store information

Note

Fields for which there are no measurement data are padded with 0.

Auto1 store

The file name as set with the menu screen is used as the last four characters of the subdirectory name and the header file name.



*1 Auto1 store header file example

```
File name,          AU1_0000 ──► File name set with menu screen
File number,        1        ──► Total number of files
Data number,        254      ──► Total number of data
X_Range,            70       ──► X-axis level range
Y_Range,            70       ──► Y-axis level range
Z_Range,            80       ──► Z-axis level range
Frequency-weight,   Lva      ──► Frequency weighting characteristic
Time-weight,        0.63s    ──► Time weighting characteristic
Filter,             -        ──► Option filter type
Center/High pass filter cutoff, - ──► Filter center frequency/high-pass filter cutoff frequency
Low pass filter cutoff, -     ──► Low-pass filter cutoff frequency
Time setting,       1min     ──► Measurement time setting
Measurement time,   0:00:25  ──► Actual measurement time
Sampling,           0.1      ──► Sampling interval
Start Time,         2003/1/10,10:00 ──► Measurement start time
Stop Time,          2003/1/10,10:00 ──► Measurement end time
```

*2 Auto1 file description

```
X,Over,Under,Pause,Y,Over,Under,Pause,Z,Over,Under,Pause,
13.8,  ,U,  ,22.3,  ,  ,  ,18.4,  ,U,  ,
13.7,  ,U,  ,22.3,  ,  ,  ,18.4,  ,U,  ,
13.7,  ,U,  ,22.4,  ,  ,  ,18.4,  ,U,  ,
13.6,  ,U,  ,22.4,  ,  ,  ,18.5,  ,U,  ,
13.6,  ,U,  ,22.5,  ,  ,  ,18.5,  ,U,  ,
13.4,  ,U,  ,22.6,  ,  ,  ,18.6,  ,U,  ,
13.3,  ,U,  ,22.7,  ,  ,  ,18.6,  ,U,  ,
13.2,  ,U,  ,22.7,  ,  ,  ,18.7,  ,U,  ,
13.0,  ,U,  ,22.8,  ,  ,  ,18.8,  ,U,  ,
12.9,  ,U,  ,22.9,  ,  ,  ,18.8,  ,U,  ,
  .
  .
  .
```

→ Vibration level, overload information, underload information, pause information

Auto1 store header file example

The data file contains vibration level, overload ("O"), underload ("U"), and pause (marker) information ("P") in CSV format.

The line end code is <CR><LF>.

One file can hold up to 60000 data. When this number is exceeded, a new file is created. Up to 120 files (199 h 59 m 59 s at 100 ms sampling interval) can be created.

Auto2 store

The file name as set with the menu screen is used as the last four characters of the subdirectory name and the header file name.

```
\AU2_3456  <------------  File name set with menu screen
 |                        is used as subdirectory name
 |
 |------ AU2_3456.rvh  <--  Header file (contains parameter information) *1
 |
 |------ AU2_0000.rvd  )  *2
 |                     )  Data file
 |------ AU2_0001.rvd  )
 |
```

*1 Auto2 store header file example

File name,	AU2_0000	→ File name set with menu screen
Data number,	80	→ Total number of data
X_Range,	70	→ X-axis level range
Y_Range,	70	→ Y-axis level range
Z_Range,	70	→ Z-axis level range
Frequency-weight,	Lva	→ Frequency weighting characteristic
Time-weight,	0.63s	→ Time weighting characteristic
Filter,	-	→ Option filter type
Center/High pass filter cutoff,	-	→ Filter center frequency/high-pass filter cutoff frequency
Low pass filter cutoff,	-	→ Low-pass filter cutoff frequency
Time setting,	10sec	→ Measurement time setting
Start Time,	2003/1/10,20:53	→ Measurement start time
Stop Time,	2003/1/10,21:05	→ Measurement end time
Interval,	Off	→ Measurement interval

*2 Auto2 file description

```
Address,Time,Measurement Time,
  1,2020/11/30,20:53:32, 0:00:10,
  2,2020/11/30,20:53:42, 0:00:10,
  3,2020/11/30,20:53:52, 0:00:10,
  4,2020/11/30,20:54:02, 0:00:10,
  5,2020/11/30,20:54:12, 0:00:10,
  6,2020/11/30,20:54:22, 0:00:10,
```

```
X_Lvaeq, X_Lvamax, X_Lvamin, X_Lva5, X_Lva10, X_Lva50, X_Lva90, X_Lva95,Over,Under,
  27.9,  32.6,  24.4,  32.5,  32.2,  26.5,  24.6,  24.4,    ,    ,
  71.4,  81.5,  24.4,  80.1,  77.8,  51.4,  24.7,  24.4,Over,    ,
  32.9,  39.1,  28.7,  38.5,  37.2,  30.6,  28.9,  28.8,    ,    ,
  74.7,  83.2,  31.5,  82.9,  81.6,  56.4,  33.8,  32.4,Over,    ,
  55.2,  63.3,  33.4,  60.8,  58.8,  54.0,  39.5,  36.3,Over,    ,
  79.3,  85.9,  27.7,  85.4,  84.5,  71.6,  28.2,  27.9,Over,    ,
```

```
Y_Lvaeq, Y_Lvamax, Y_Lvamin, Y_Lva5, Y_Lva10, Y_Lva50, Y_Lva90, Y_Lva95,Over,Under,
  28.5,  30.1,  27.6,  30.0,  29.9,  28.3,  27.7,  27.7,    ,    ,
  71.5,  81.6,  27.8,  79.9,  77.7,  51.2,  28.2,  27.9,Over,    ,
  76.7,  83.6,  29.2,  83.4,  83.0,  33.6,  29.3,  29.3,Over,    ,
  56.8,  83.0,  33.3,  79.7,  76.4,  51.2,  34.3,  33.8,Over,    ,
  54.7,  62.0,  34.0,  59.8,  58.1,  53.9,  38.7,  36.4,    ,    ,
  32.5,  38.4,  29.3,  37.5,  35.8,  31.0,  29.7,  29.4,    ,    ,
```

```
Z_Lvaeq, Z_Lvamax, Z_Lvamin, Z_Lva5, Z_Lva10, Z_Lva50, Z_Lva90, Z_Lva95,Over,Under,Pause,
  22.4,  24.4,  21.4,  24.3,  24.2,  22.0,  21.5,  21.4,    ,    ,
  73.4,  82.8,  21.6,  81.9,  79.8,  34.2,  21.7,  21.6,Over,    ,
  38.6,  65.7,  26.2,  62.2,  58.8,  37.3,  27.2,  26.5,    ,    ,
  30.3,  38.1,  22.8,  37.4,  35.8,  27.4,  23.4,  23.3,    ,    ,
  54.6,  61.9,  29.1,  59.7,  58.0,  53.9,  38.3,  35.7,    ,    ,
  29.8,  37.5,  23.6,  36.8,  34.8,  26.3,  24.0,  23.8,    ,    ,
```

The data file size is 240 bytes per data set.

Default Settings

The ex-factory default settings of the VM-53/VM-53A are as shown below.

Main display	:	Instantaneous value measurement screen
Sub display	:	Level/time single-axis screen
L_v/L_{va}	:	L_v
Level range	:	120 dB (all channels)
Menu 1/5		
Meas.Time	:	500s
Channel	:	X / Y /Z
Output	:	AC
Menu 2/5		
Store Mode	:	Manual
File name	:	MAN_0000
Menu 3/5		
LCD Contrast	:	*****--
Serial	:	Off
Baud Rate	:	19200
Meas. Print	:	Off
Index	:	1
Menu 5/5		
Comp	:	Off

If you hold down the Start/Stop key while turning on the power, the unit starts up with the above settings.
The internal clock and the memory contents are not affected by this.

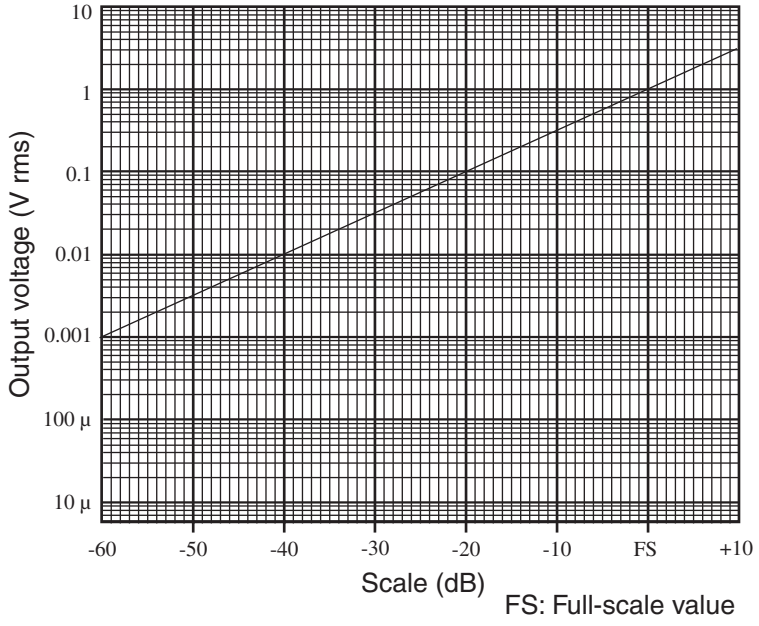
Output Connectors

AC Output

This connector provides an AC output signal. To use the AC output, set the "Output" item in menu screen 1/5 to "AC".
To do this, use the Menu key to bring up menu screen 1/5, use the ▲ and ▼ keys to highlight the "Output" item, and use the ◀ and ▶ keys to select "AC".

Output voltage:	1 Vrms ±20 mVrms (at range full-scale)
Output impedance:	600 Ω
Load impedance:	10 kΩ or higher
Output connector type:	BNC
Suitable cable:	BNC-BNC cable NC-39A (1.5 m), option

The relationship between the display reading of the VM-53/VM-53A and the output voltage is as shown below.



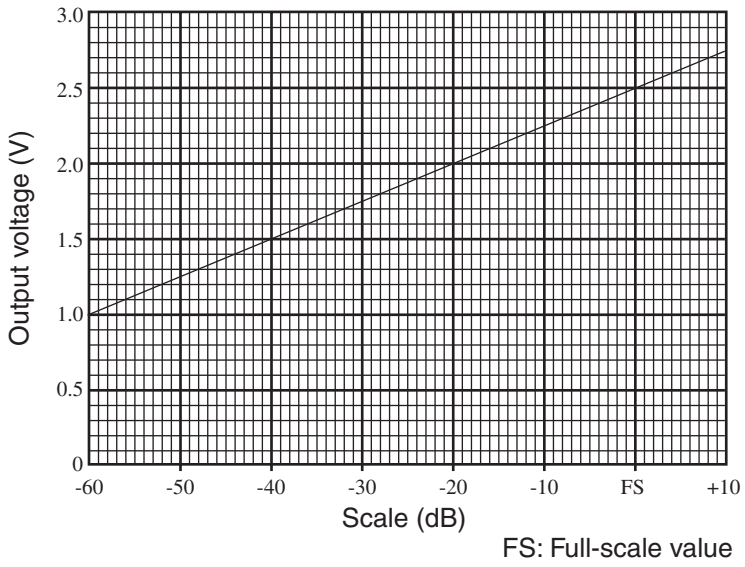
The output in calibration mode is 31.5 Hz, 1.0 Vrms.

DC Output

This connector provides a DC output signal. To use the DC output, set the "Output" item in menu screen 1/5 to "DC".
To do this, use the Menu key to bring up menu screen 1/5, use the ▲ and ▼ keys to highlight the "Output" item, and use the ◀ and ▶ keys to select "DC".

Output voltage:	2.5 ±30 mV (at range full-scale), 0.25 V/10 dB
Output impedance:	600 Ω
Load impedance:	10 kΩ or higher
Output connector type:	BNC
Suitable cable:	BNC-BNC cable NC-39A (1.5 m), option

The relationship between the display reading of the VM-53/VM-53A and the output voltage is as shown below.



The output in calibration mode is 2.5 V.

I/O connector

The I/O connector allows data output, comparator output, and parameter control over a serial link.

The specifications for the connection cable are listed below.

Connection to printer

Cable:	Generic straight serial cable
Connector on VM-53/VM-53A:	D-sub 9-pin male
Connector on printer:	D-sub 25-pin female (for DPU-414, using connector supplied with DPU-414)
Compatible printers:	DPU-414, CP-11, CP-10 (option)

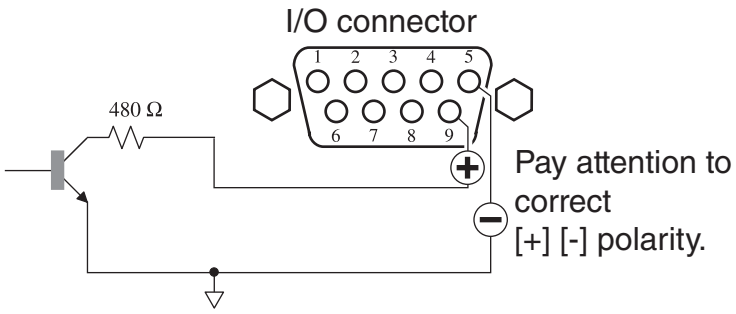
Connection to computer

Cable:	Generic cross-wired serial cable (null modem)
Connector on VM-53/VM-53A:	D-sub 9-pin male

Comparator output (for details, see section "Comparator" on pages 136 to 139)

Open collector output

A wiring diagram for the comparator output is shown below.



Maximum applied voltage:	24 V DC
Maximum drive current:	50 mA DC (applied voltage 24 V) 25 mA DC (applied voltage 12 V) 10 mA DC (applied voltage 5 V)

Accessories

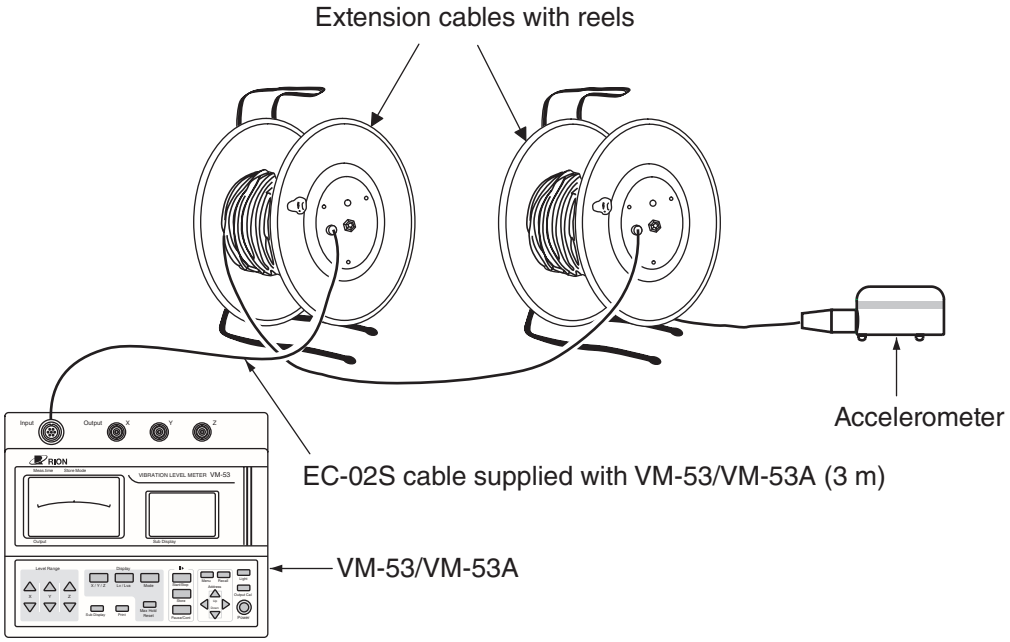
Extension cable

If the accelerometer is to be positioned at a distance from the main unit, you can use the following extension cable(s).

10 m	EC-02SB
50 m (with reel)	EC-02SD
100 m (with reel)	EC-02SE

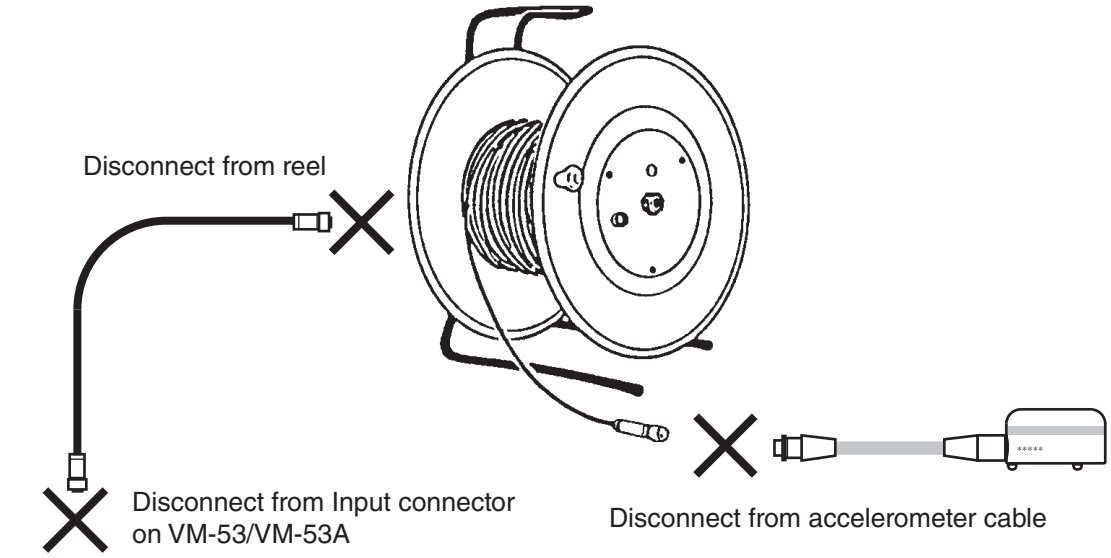
Extension cables with reels can be joined.

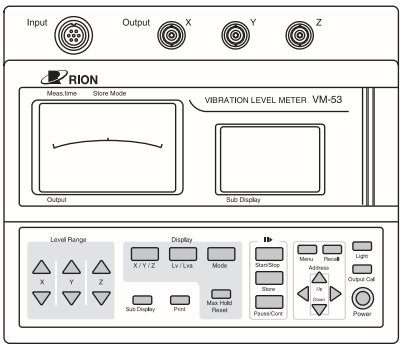
* Extension cables without reel cannot be joined.



Precautions for using extension cable with reel

Important
When installing or dismantling a system, always make sure that all connection cables are disconnected from the cable reel. Otherwise cable breaks due to twisting may occur.



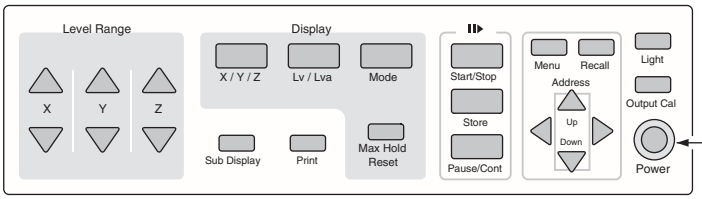


Printer

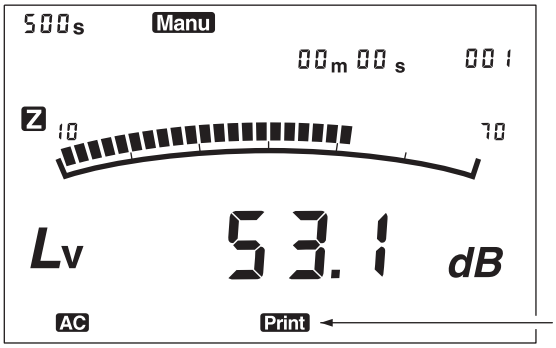
The optional printer models DPU-414, CP-11, or CP-10 can be connected to the unit to produce hard copy of measurement values.
The instantaneous value data (every five seconds except during store), processing result data (L_{veq} or L_{vaeq}, L_5, L_{10}, L_{50}, L_{90}, L_{95}, L_{max}, L_{min}), recall data, and sub display content data can be sent to the printer.
For details on using the printer, please refer to the documentation of the respective model. A general explanation is given below. This assumes that preparations as described in the chapter "Preparations" have been completed.

Printing instantaneous value data every 5 seconds and processing result data

1. Turn power to the printer on and set it to the online state.
2. Press the Power key of the VM-53/VM-53A to turn the unit on.
3. Use the Menu key to bring up menu screen 4/5, and set the "Meas. Print" item to "On".
4. Perform processing measurement as described in the section "Measurement" starting on page 65.
5. When processing measurement starts, the instantaneous value data are printed every 5 seconds. When processing is completed, the processing results are printed.

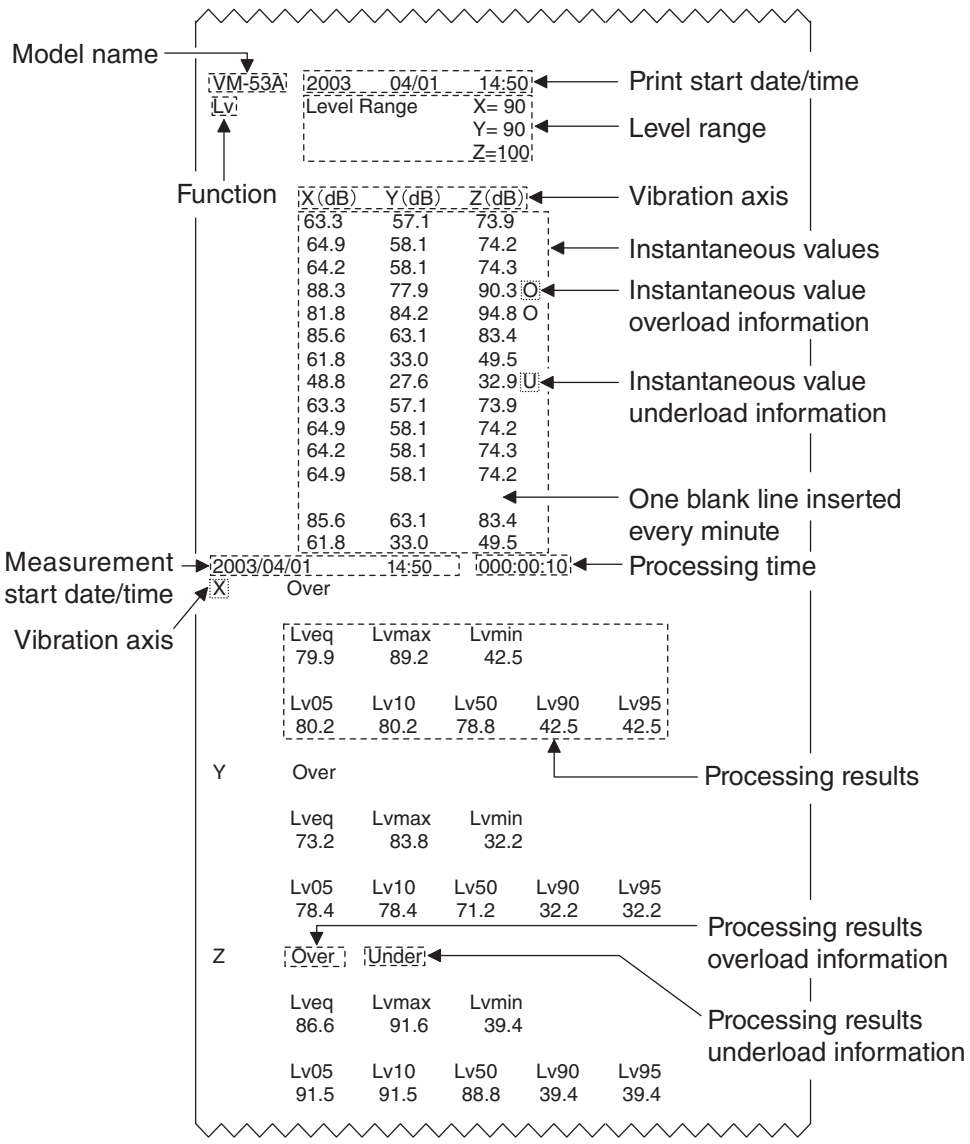


Main display



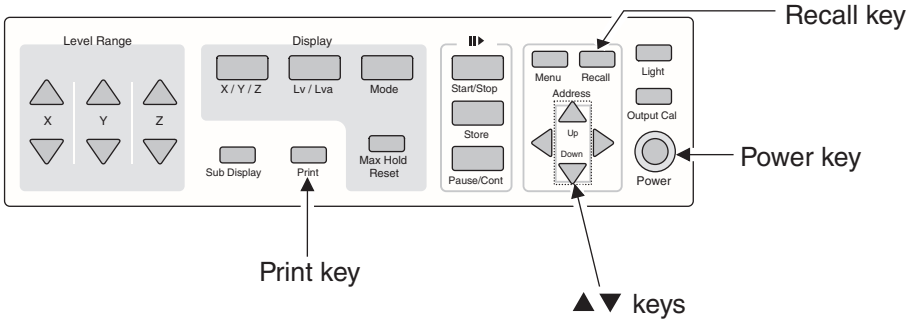
Screen example when
using print function

Sample printout

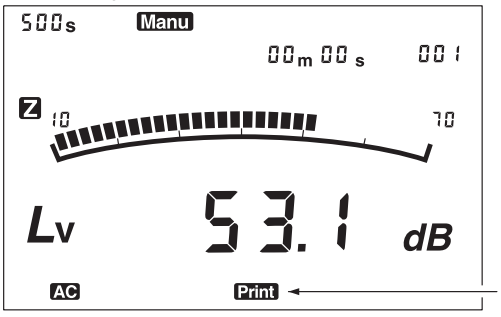


Printing stored data

1. Turn power to the printer on and set it to the online state.
2. Press the Power key of the VM-53/VM-53A to turn the unit on.
3. Press the Recall key and use the ▲ and ▼ keys to select the stored data. When wishing to print data stored on a memory card with the model VM-53A, insert the memory card into the card slot of the unit before turning power on.
4. Use the ▲ and ▼ keys to bring up the data that you want to print.
5. Press the Print key to start printing.
   If the data were stored with Manual store, the data for one address are printed.
   If the data were stored with Auto1 store, 100 data sets are printed, starting with the currently displayed data.
   If the data were stored with Auto2 store, 50 data sets are printed, starting with the currently displayed data. If you press the Print key again, printing continues from data set 51.

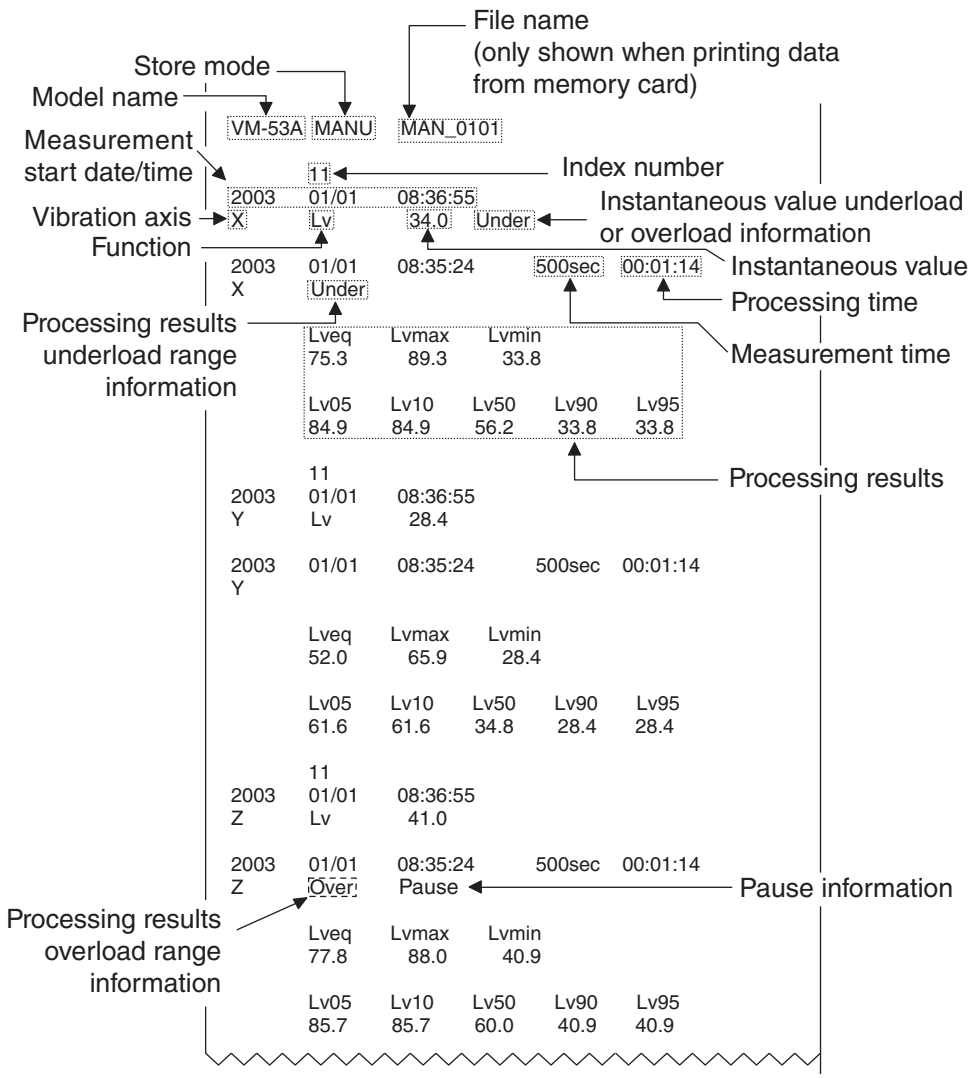


Main display

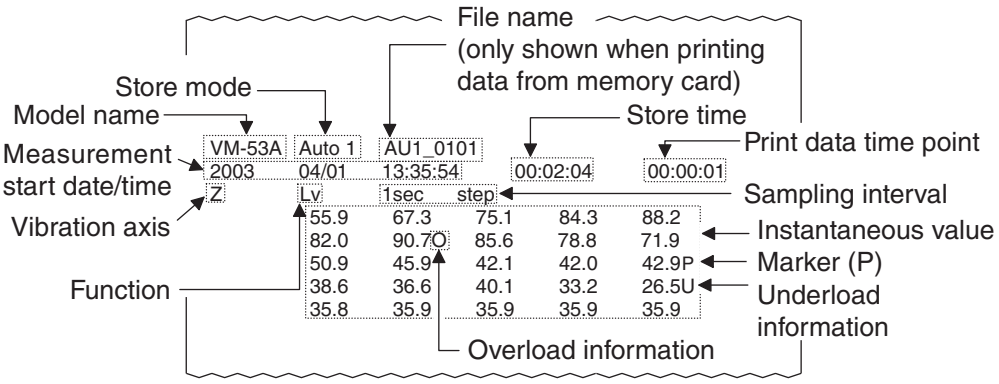


Screen example when using print function

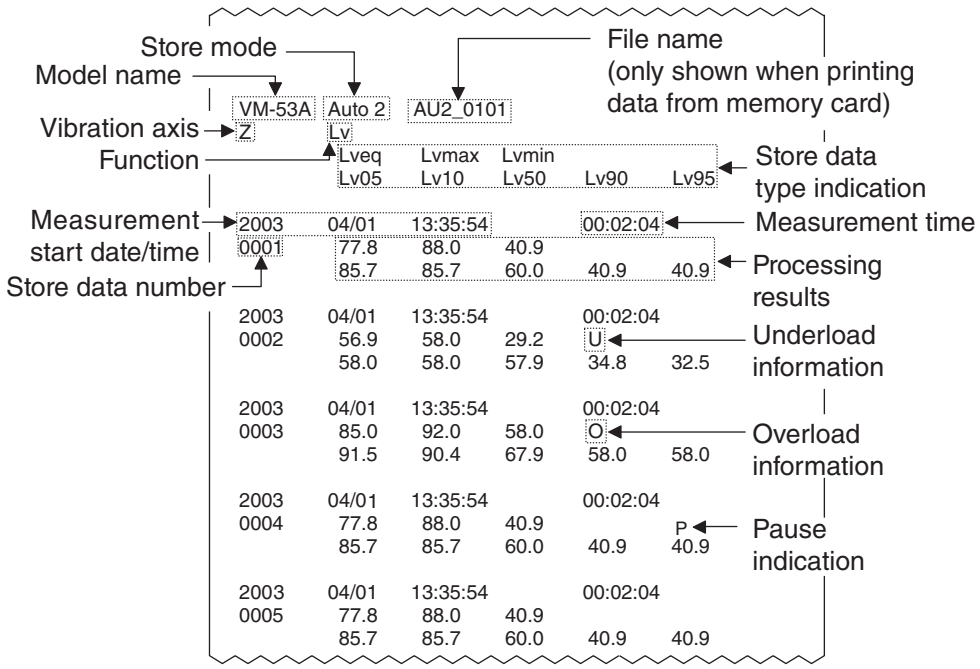
Sample printout for Manual store



Sample printout for Auto1 store

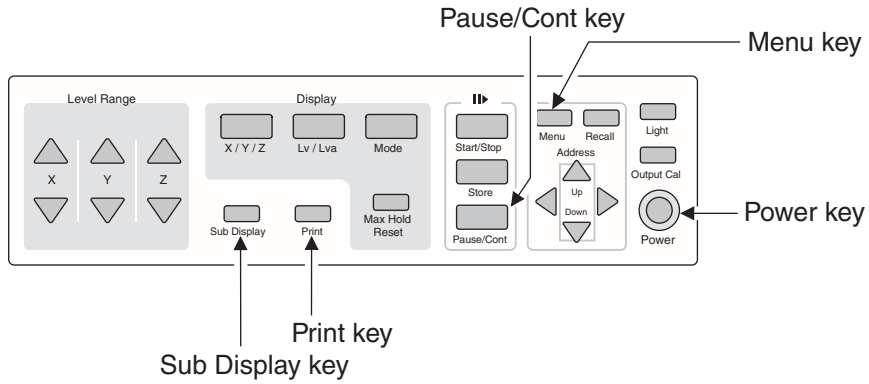


Sample printout for Auto2 store

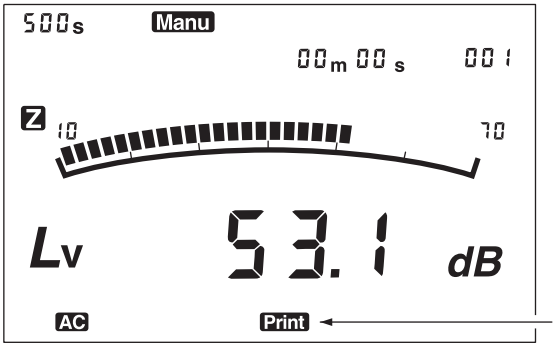


Sub display hard copy

1. Turn power to the printer on and set it to the online state.
2. Press the Power key of the VM-53/VM-53A to turn the unit on.
3. Press the Sub Display key to bring up the sub display screen you want to print.
   You can select either the single-axis level/time graph, 3-axis level/time graph, bar graph, processing list, or parameter setting check screen. If you want to print the menu screen, press the Menu key to bring up the menu screen.
4. Press the Pause/Cont key to set the unit to pause mode.
   If the menu screen is displayed, this step is not necessary.
5. Press the Print key to produce a hard copy of the sub display screen.

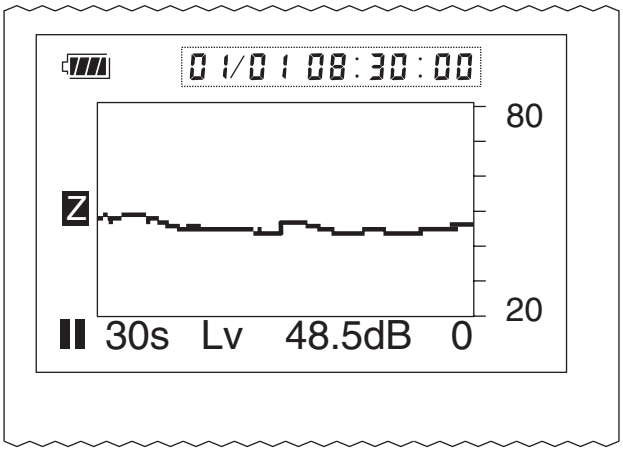


Main display

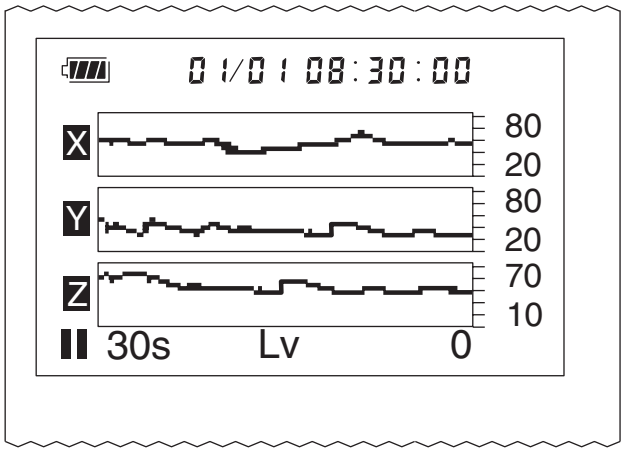


Screen example when using print function

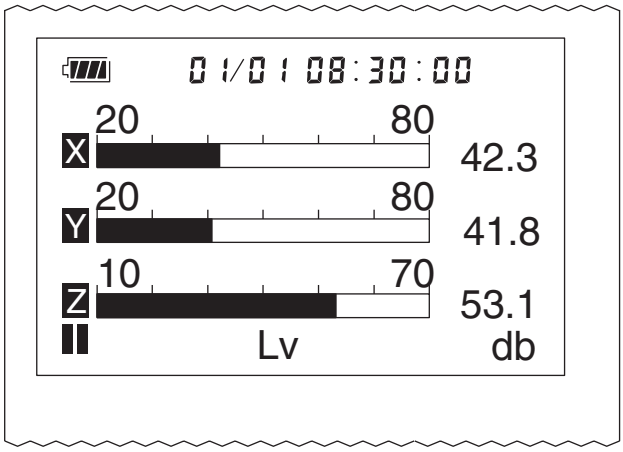
Sub display sample printouts



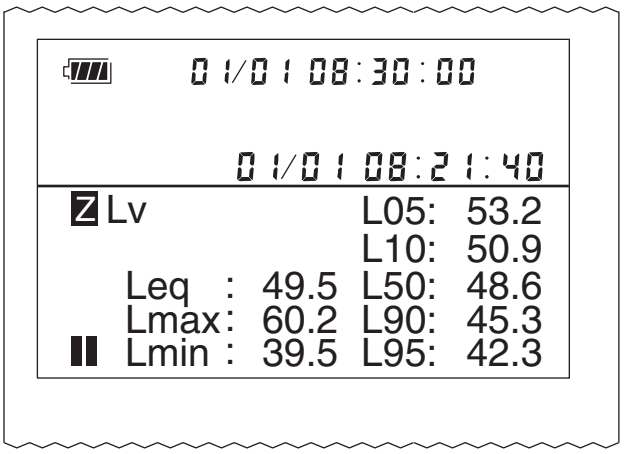
Single-axis level/time graph



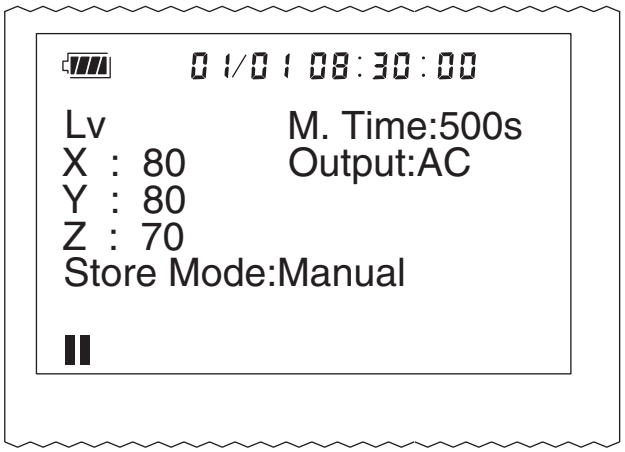
3-axis level/time graph



3-axis bar graph screen



Processing list screen



Parameter setting check screen

Level recorder LR-06/LR-07/LR-04/LR-20A

A level recorder can be used in conjunction with the VM-53/VM-53A, to record vibration level or vibration acceleration level changes over time.

Using a level recorder

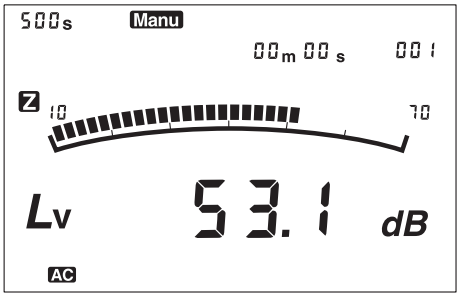
Turn power to the VM-53/VM-53A and the level recorder on.

Preparations as described in the chapter "Preparations" are assumed to have been completed.

For details on using the level recorder, please refer to the documentation of the respective model. A general explanation is given below.

1. Use the Menu key to bring up menu screen 1/5, and set the "Output" item to "AC".

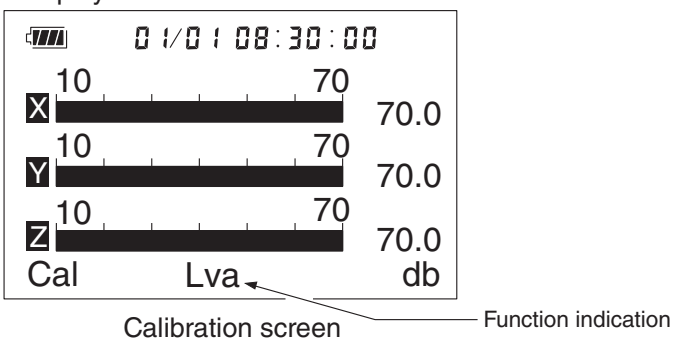
Main display



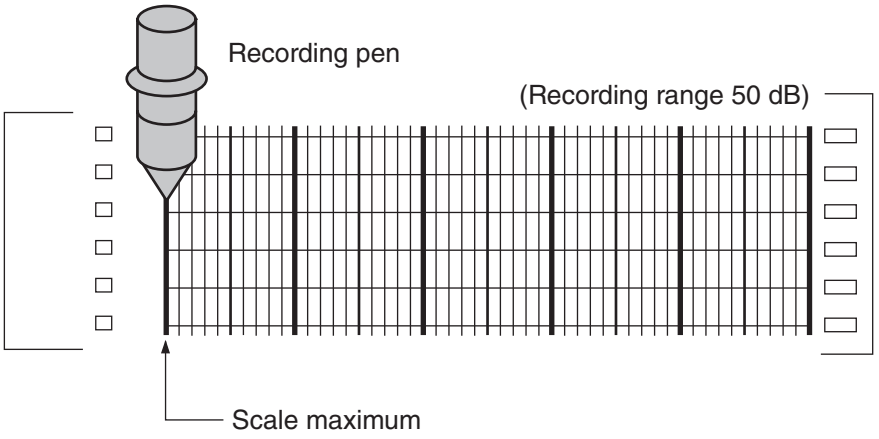
2. Press the Menu key to return to the measurement screen and press the Output Cal key.

   During calibration, the function is automatically set to Lva.

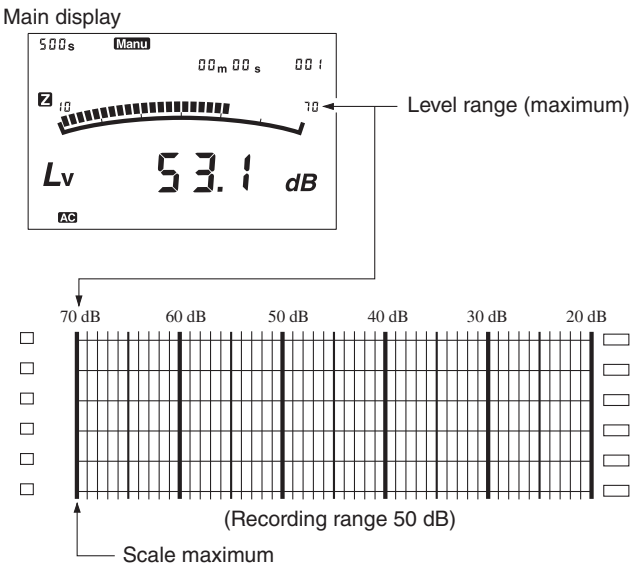
Sub display



3. Activate paper feed and pen recording at the level recorder to start recording.
4. Use the Level Adj control so that the recording pen is at the maximum position of the paper.



5. Press the Output Cal key on the VM-53/VM-53A again to set the unit to the measurement mode.
6. Select the function with the Lv/Lva key.
7. Use the Level Range keys to set the level range. Make the setting so that "Over" or "Under" is not displayed.
   The maximum value of the selected level range becomes the scale maximum of the level recorder.

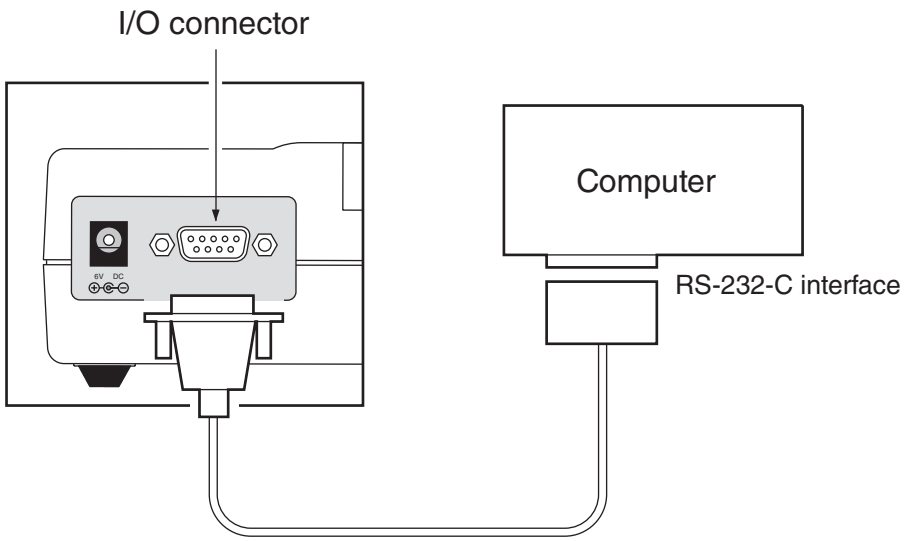


Serial Interface

The Vibration Level Meter VM-53 and VM-53A incorporate a serial interface. This interface allows the use of a computer to make measurement parameter settings and to control the measurement. It is also possible to send measurement results (current results as well as data stored in the memory of the vibration level meter) to the computer for further processing.

Connection to a computer

The illustration below shows how to connect the I/O connector on the right side of the VM-53/VM-53A to the RS-232-C interface on a computer, using a cross-wired serial cable.



Connector on VM-53/VM-53A: D-sub 9-pin male

Transfer Protocol and Transfer Procedure

Transfer Protocol

Transfer principle:	full duplex
Sync principle:	asynchronous
Baud rate:	4800 / 9600 / 19200 bps
Data word length:	8 bit
Stop bits:	1 bit
Parity check:	none
Flow control:	Xparameter
Maximum block size:	256 bytes
Command flow control:	yes / no (selectable)

Local Mode / Remote Mode

Operation mode	Key operation	Communication
Remote	Disabled	Enabled
Local	Enabled	Enabled

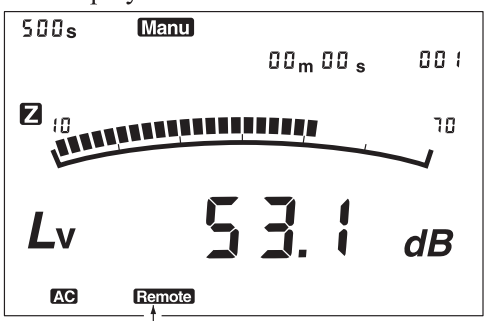
Local Mode

VM-53/VM-53A is operated with the controls on the unit. This is the default mode after power-on.

Remote mode

In this condition, the controls on the unit are inactive, and the unit only carries out communication with the computer. The indication "Remote" appears on the display.

Main Display



Remote indication

Remote mode screen example

Local mode/remote mode switching

Switching between local mode and remote mode is carried out by a command.

Key operation in remote mode

The power key or pause key is active. All other keys are disabled.

Transfer Codes

The following codes are used for communication with the unit.

Control codes

Code	Hex notation	Meaning
<ENQ>	05H	Enquire
<ACK>	06H	Acknowledge
<NAK>	15H	Not acknowledge
<STX>	02H	Start block
<ETX>	03H	End block
<CR>	0DH	Terminator (1st character)
<LF>	0AH	Terminator (2nd character)
<SUB>	1AH	Stop
<DC3>	13H	Pause
<DC1>	11H	Restart

Special codes

ATTR	Control code or special code	Block attribute
ID	01H to FFH	Other/own station ID
BCC	00H to FFH	Block check code

Commands, parameters, data

ASCII codes 20H to 7EH

Transfer Format

Command block: Command from computer

<STX>	ID	ATTR	Command	Parameter	<ETX>	BCC	<CR>	<LF>	
1	1	1	M	N	1	1	1	1	byte

* ATTR = 'C'

If there are two or more parameters, they are separated by single spaces.

Data response block: Data from vibration level meter (response data in ASCII)

<STX>	ID	ATTR	Response data	<ETX>	BCC	<CR>	<LF>	
1	1	1	N	1	1	1	1	byte

* ATTR = 'A' or 'Q'

If there are two or more data, they are separated by commas.

Acknowledgment block: Computer or vibration level meter

<STX>	ID	ATTR	<ETX>	BCC	<CR>	<LF>	
1	1	1	1	1	1	1	byte

* ATTR = <ACK>

Negative Acknowledgment block: Computer or vibration level meter

<STX>	ID	ATTR	Error code	<ETX>	BCC	<CR>	<LF>	
1	1	1	4	1	1	1	1	byte

* ATTR = <NAK>

Verify other station block: Computer

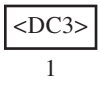
<STX>	ID	ATTR	<ETX>	BCC	<CR>	<LF>	
1	1	1	1	1	1	1	byte

* ATTR = <ENQ>

Stop request code: Computer

<SUB>
1

Pause request with X parameter control: Computer



1

Restart request with X parameter control: Computer

1

ID Number

Outline

When multiple units are connected, ID numbers are used to distinguish between individual units. The ID number range is 1 to 255 (01H to FFH). Numbers are expressed in binary notation. In strings sent out by the computer, the ID selects the unit to be controlled. In strings sent out by the vibration level meter, the ID identifies the data source. Setting for the ID number is made with menu screen 3/5.

Broadcasting

In commands sent from the computer, the ID 00 (00H) has a special meaning. It selects all units (broadcast command).

Vibration level meter response

The vibration level meter responds only to a communication block that contains its own ID. Other blocks are disregarded.

When the ID is 00H, setting commands are processed but no response is returned. Request commands are not processed and no response is returned.

ATTR Block Attribute

The block attribute information is added by the sender, to facilitate processing of the block at the receiving end.

Code		Meaning
<ACK>	06H	Acknowledge block
<NAK>	15H	Not acknowledge block
<ENQ>	05H	Enquiry block
<SUB>	1AH	Stop request block
<EOT>	03H	End-of-transmission block
'C'	43H	Command block
'A'	41H	Data response block (last block)
'Q'	51H	Data response block (intermediate block)

BCC Block Check Code

The BCC is calculated by the sender. The receiver applies checksum processing to the same range to verify the block.

Calculation range: From STX to ETX

Calculation method: Exclusive OR sum of range

If the computer sends a block where BCC is set to 00H (NULL), the vibration level meter omits block check processing.

This is to allow simple sending from the computer.

Block Reception Processing

For reception processing, the unit is initially in the <STX> wait (standby) mode, except during a sequence while waiting for response from the computer.
In the idling state, any data received by the vibration level meter except for <STX> are disregarded.

Command Types

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

Setting command

This type of command serves for changing the vibration level meter status or measurement parameters. Only some commands of this type will produce a response from the vibration level meter. The response consists of status information returned after the setting command has been processed.

Request command

This type of command serves for getting information about unit settings and for obtaining measurement data including display data and stored data. The vibration level meter returns the requested data.

Error Processing

Transmission errors

Transmission errors can be detected in the following categories.

Error item	Contents	Measure
Framing error	Character level framing error	Disregard character and wait for next character
Block reset	<STX> received after incomplete block (excluding ID number)	Start block again from that point

Command processing errors

Block format is correct, but command interpretation or processing has resulted in an error.

Error item	Contents	Measure
Undefined command	Command problem	Return error code 0001
Parameter error	Parameter number or value not correct	Return error code 0002
Processing error	Processing cannot be carried out in current state	Return error code 0003
Processing timeout	Timeout interval has elapsed	Return error code 0004

Flow Control

The vibration level meter implements X parameter when XON = 1, the X parameter is used to perform control.

X parameter control mode

In the send sequence for multiple blocks, the next block is sent after the computer returns an acknowledge code.

To interrupt, restart, or stop the transfer, the respective code must be sent from the computer.

RTS/CTS control is not possible.

Transfer Sequence

The transfer sequences are as follows.

[Check other station] sequence

[Setting command without response] sequence

[Setting command with response] sequence

[Request] sequence

[Continuous request] sequence

[Error] sequence

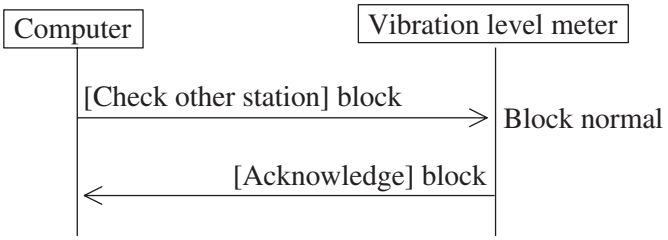
The setting sequence can be selected to have a response or not.

The sample sequences shown below generally assume that the block from the computer comprises the ID of the vibration level meter.

[Check other station] sequence

An acknowledge block is returned in response to the [check other station] block.

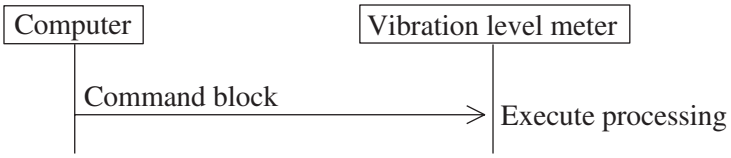
This is an independent sequence. It does not need to come before a command sequence.



[Setting command without response] sequence

This type of command is executed without producing a response. Because it corresponds to an error code request, the processing result (including error) of the last command is retained.

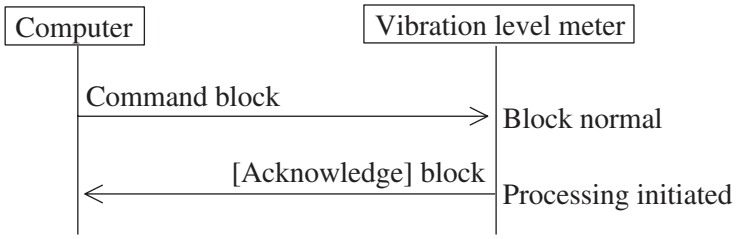
The "RET0" command activates this sequence.



[Setting command with response] sequence

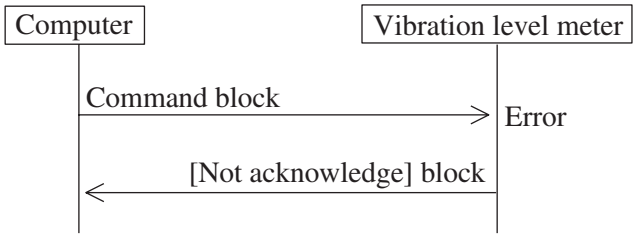
Normal processing

An [acknowledge] response is returned after command processing was initiated. "Initiated" means that for example execution of the "Store" command was started. It does not mean that the store process was completed.



Error processing

When an error has occurred during block or command processing, a [not acknowledge] response is returned.

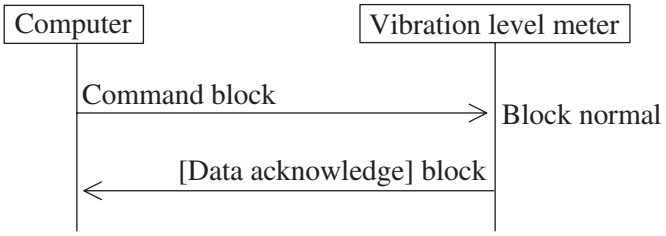


The "RET1" command activates this sequence.

[Request] sequence (1 block)

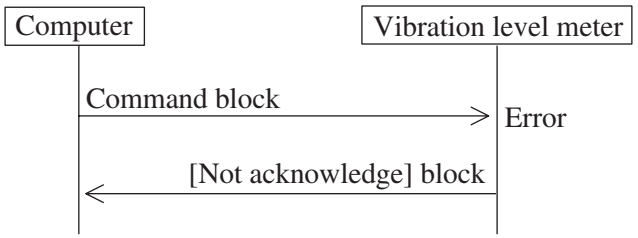
Normal processing

A response is returned immediately to the request command.



Error processing

When an error has occurred during block or command processing, a [not acknowledge] response is returned.



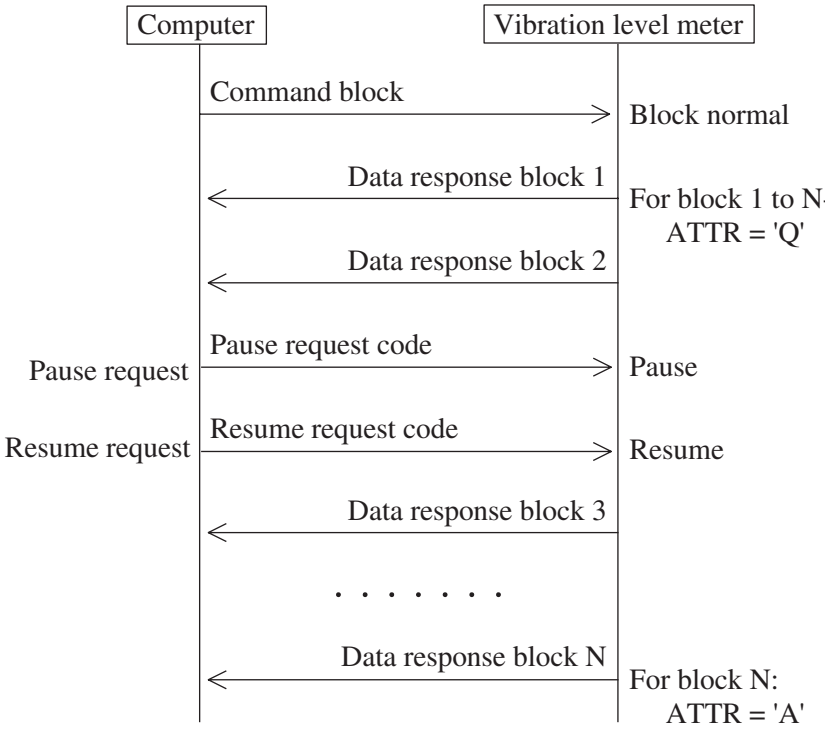
[Request] sequence (multiple blocks)

X parameter flow control

Normal processing

In general, there is no need for returning response codes from the computer. The vibration level meter sends blocks continuously.

The computer can send a pause request code to pause the transmission, a resume code to resume the transmission, or a stop code to stop the transmission. The vibration level meter disregards any other codes that are received. (Processing is not carried out also after stop.)



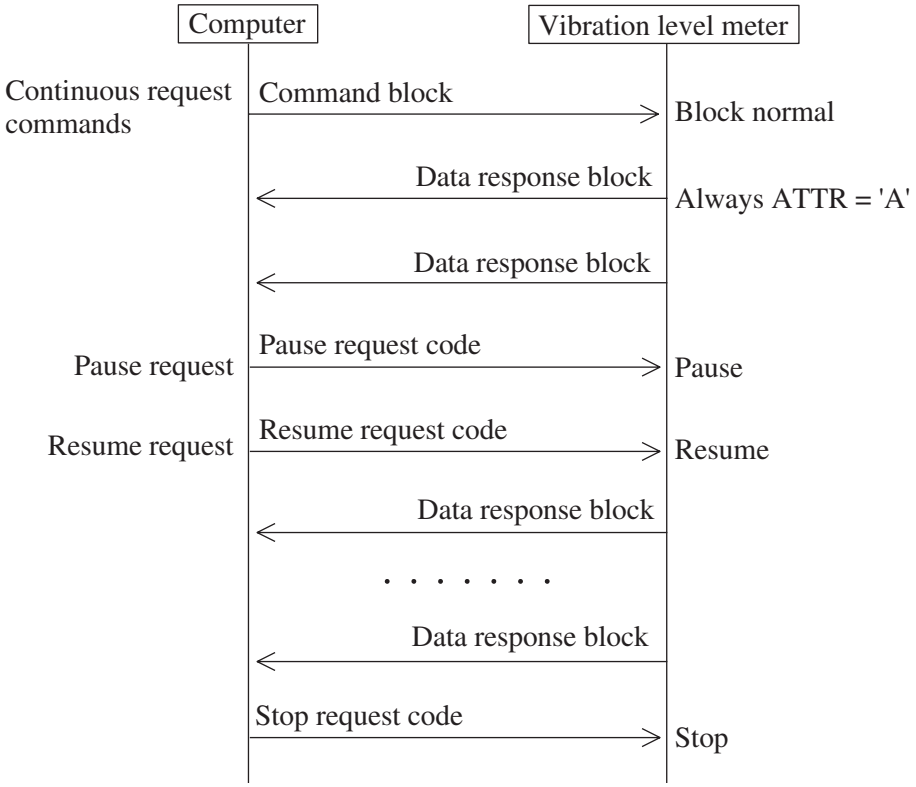
Continuous request sequence

This sequence uses only commands to periodically request measurement data.

X parameter flow control

In general, there is no need for returning response codes from the computer. The vibration level meter sends blocks periodically.

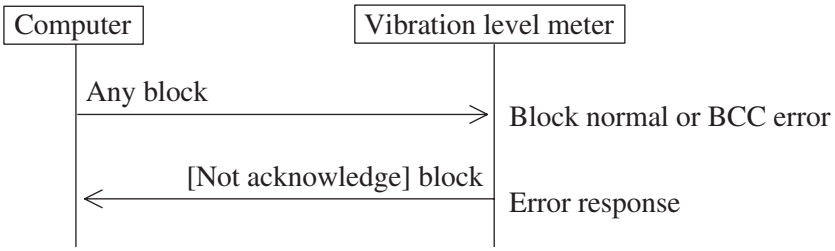
The computer can send a pause request code to pause the transmission, a resume code to resume the transmission, or a stop code to stop the transmission. The vibration level meter disregards any other codes that are received. (Processing is not carried out also after stop.)



Error response

When an error has occurred at the block level, the following error sequence occurs.

After an error response, the unit returns to the idling state and does not continue to send multiple blocks etc.



Communication Cutoff

Power Save Mode

When power save mode is enabled, the unit enters the sleep state after the current block has been sent. In the sleep state, the vibration level meter does not send or accept commands.

The power save mode can be set for Timer Auto1 and Timer Auto2.

Power Off

During power off processing, communication is terminated after the current block was sent.

Auto Shutdown

Same as power off.

Ratings

Guaranteed Values

Case	Rating	Remarks
Sound level meter response time	Max. 3 s	Processing timeout error response if due to processing reasons
Send character interval	Max. 100 ms	—
Time interval from end of sending data until start of idling state	Max. 200 ms	—

Rated Values

Case	Rating	Remarks
Multiple block request sequence ACK wait	10 s	Pause sequence and go into idling state
Send timeout with flow control	3 s	Pause sequence and go into idling state
Block generation wait time after receiving <STX>	No limit	—
Receive character interval	No limit	—

Multiple Unit Operation

These specifications also include cases where communication includes several vibration level meters of the same type or compatible type. The X parameter and stop request code are received without ID by all units, but during a request sequence, only one unit is supposed to be active and all others are in the idling state, so that processing is carried out normally only by one unit.

When multiple units are connected, observe the following points.

- Do not broadcast request commands. These will be disregarded.
- Do not send a request command sequence simultaneously to multiple units. Wait until processing of a request command sequence at one unit has finished before sending other request commands.

Commands

Command list

Command format

In this manual, 1 character is represented as "□", a space as "_", parameters as "p1,p2,...", and response data as "d1,d2,...". Parameters and response data may be more than 1 character long.

Commands consists of three letters which are not case-sensitive (upper-case or lower-case can be used).

□□□

When a command has one parameter, the parameter follows the command. It can be appended to the command either directly or with a separating space.

□□□p1 Acceptable

□□□_p1 Acceptable

When a command has several parameters, the parameters must be separated by a space.

□□□p1_p2 Acceptable

□□□p1p2 Not acceptable

Note
One command block can only contain one command. Do not include several commands in a block.

A request command consists of the command, any required parameter, and a "?". The command and "?" or parameter and "?" may be separated by a space.

□□□? Acceptable

□□□_? Acceptable

□□□p1? Acceptable

□□□p1_? Acceptable

Unless specified otherwise, parameters and response data are of variable length. Depending on the value range, the length of the parameter will differ. There is no need for padding with spaces or other measures.

□□□_1 Acceptable

□□□_10 Acceptable

□□□_01 Not acceptable

Command send example

To set frequency weighting to "C"

<STX>	01	C	WGT	1	<ETX>	00	<CR><LF>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1) Start of transfer data and command

(2) ID number (hexadecimal). The ID number range is 0 to 255. In a command string, this is expressed as 01 (= ID number 1) to FF (= ID number 255).

Note
ID number should be expressed by binary code "01" not by ASCII code "1"

(3) Attribute ("C" for command)

(4) Command

(5) Parameter (corresponds to p1, p2, etc. in command description section of the manual)

(6) Command end

(7) BCC (Entering 00 disables BCC checking for (1) to (6).)

(8) Transfer data end

Command Description

For details on the transfer format, please refer to page 172.

Basic settings and display related commands

DIR

Set display channel

Dirp1

p1 = 0: X p1 = 1: Y

p1 = 2: Z

Transfer format: command block

Get display channel setting

DIR?

Response data from VM-53/VM-53A to DIR? command

Response data d1

d1: corresponding to p1

Transfer format: response block

RNX

Set level range for X channel

RNXp1

p1 = 7: 10 to 70 p1 = 8: 20 to 80

p1 = 9: 30 to 90 p1 = 10: 40 to 100

p1 = 11: 50 to 110 p1 = 12: 60 to 120

Transfer format: command block

Get level range setting for X channel

RNX?

Response data from VM-53/VM-53A to RNX? command

Response data d1

d1: corresponding to p1, if X channel is OFF, d1 = 0

Transfer format: response block

RNY

Set level range for Y channel

RNYp1

p1 = 7: 10 to 70 p1 = 8: 20 to 80
p1 = 9: 30 to 90 p1 = 10: 40 to 100
p1 = 11: 50 to 110 p1 = 12: 60 to 120

Transfer format: command block

Get level range setting for Y channel

RNY?

Response data from VM-53/VM-53A to RNY? command

Response data d1

d1: corresponding to p1, if Y channel is OFF, d1 = 0

Transfer format: response block

RNZ

Set level range for Z channel

RNZp1

p1 = 7: 10 to 70 p1 = 8: 20 to 80
p1 = 9: 30 to 90 p1 = 10: 40 to 100
p1 = 11: 50 to 110 p1 = 12: 60 to 120

Transfer format: command block

Get level range setting for Z channel

RNZ?

Response data from VM-53/VM-53A to RNZ? command

Response data d1

d1: corresponding to p1, if Z channel is OFF, d1 = 0

Transfer format: response block

MTI

Set measurement time

MTIp1

p1 = 0:	500 s	p1 = 1:	10 s
p1 = 2:	1 m	p1 = 3:	5 m
p1 = 4:	10 m	p1 = 5:	15 m
p1 = 6:	30 m	p1 = 7:	1 h
p1 = 8:	4 h	p1 = 9:	8 h
p1 = 10:	24 h	p1 = 11:	Manual

Transfer format: command block

Get measurement time setting

MTI?

Response data from VM-53/VM-53A to MTI? command

Response data d1

d1: corresponding to p1

Transfer format: response block

WGT

Set Lv/Lva function

WGTp1

p1 = 0:	Lv	p1 = 1:	Lva

Transfer format: command block

Get Lv/Lva function setting

WGT?

Response data from VM-53/VM-53A to WGT? command

Response data d1

d1: corresponding to p1

Transfer format: response block

CHS

Set measurement channel

CHSp1

p1 = 0: X/Y/Z 3-channel measurement

p1 = 1: X-channel measurement only

p1 = 2: Y-channel measurement only

p1 = 3: Z-channel measurement only

Transfer format: command block

Get measurement channel

CHS?

Response data from VM-53/VM-53A to CHS? command

Response data d1

d1: corresponding to p1

Transfer format: response block

STS?

Get unit status

STSp1_p2_p3_p4_p5_p6_p7?

p1, p2: Returns reserved area 0

p3: corresponding to RNX?

p4: corresponding to RNY?

p5: corresponding to RNZ?

p6: corresponding to WGT?

p7: corresponding to TMC?

Transfer format: command block

DSP

Set measurement value for main display

DSPp1

p0 = 0: instantaneous value p1 = 1: Max Hold
p1 = 2: Leq p1 = 3: Lmax
p1 = 4: Lmin p1 = 5: L5
p1 = 6: L10 p1 = 7: L50
p1 = 8: L90 p1 = 9: L95

Transfer format: command block

Get measurement value setting for main display

DSP?

Response data from VM-53/VM-53A to DSP? command

Response data d1

d1: corresponding to p1

Transfer format: response block

DSS

Set measurement value for sub display

DSSp1

p1 = 0: parameter setting check screen
p1 = 1: level-time single-axis screen
p1 = 2: level-time 3-axis screen
p1 = 3: 3-axis bar graph screen
p1 = 4: processing list screen

Transfer format: command block

Get measurement value setting for sub display

DSS?

Response data from VM-53/VM-53A to DSS? command

Response data d1

d1: corresponding to p1

Transfer format: response block

Operation related commands

SRT

Control processing measurement start/stop

SRTp1

p1 = 0: stop processing measurement

p1 = 1: start processing measurement

Transfer format: command block

Get processing measurement start/stop status

SRT?

Response data from VM-53/VM-53A to SRT? command

Response data d1

d1: 1 = processing measurement in progress

0 = processing measurement not in progress

Transfer format: response block

Note
This command does not start the memory store process.

PSE

Pause/restart measurement or mark store data during auto store (Auto1/Auto2)

PSEp1

p1 = 0: restart measurement

p1 = 1: pause measurement (mark store data)

Transfer format: command block

Get measurement pause status

PSE?

Response data from VM-53/VM-53A to PSE? command

Response data d1

d1: 1 = paused

0 = not paused

Transfer format: response block

STO

Start memory store

STOp1

If Manual store is selected

p1 = 1: carry out memory store (data number is incremented by one count)

If Auto1 or Auto2 store is selected

p1 = 1: start memory store

(Use SRT0 to end)

Transfer format: command block

Get memory store status

STO?

Response data from VM-53/VM-53A to STO? command

Response data d1

d1 = 0: Store not executed

d1 = 1: Store executed

Transfer format: response block

RST

Reset Max Hold value or comparator

Transfer format: command block

Memory and store function related commands

ADR

Set address

In current mode, this command is valid only when Manual store is selected.

In recall mode, the address for the respective store mode is set.

Address setting

ADRp1

p1 = any address

Transfer format: command block

Get address setting

ADR?

Response data from VM-53/VM-53A to ADR? command

Response data d1

d1: Selected address number (address number shown on display)

Transfer format: response block

CDR?

Get remaining card capacity

Response data from VM-53A to CDR? command

Response data d1

d1: Remaining capacity in kilobytes

Transfer format: response block

CDV?

Get card insertion status

Response data from VM-53A to CDV? command

Response data d1

d1 = 0: No card inserted

d1 = 1: Card inserted

Transfer format: response block

FMT

Delete all files on memory card

No parameters

Transfer format: command block

MCL

Clear internal memory

MCLp1

p1 = 0: clear all data

p1 = 1: clear Manual store data

p1 = 2: clear Auto1 store data

p1 = 3: clear Auto2 store data

Transfer format: command block

PLP

Set Auto1 store sampling interval

PLPp1

p1 = 0: Auto1 sampling interval 100 msec

p1 = 1: Auto1 sampling interval 1 sec

Transfer format: command block

Get Auto1 store sampling interval setting

PLP?

Response data from VM-53/VM-53A to PLP? command

Response data d1

d1: corresponding to p1

Transfer format: response block

RCL

Toggle recall mode

Recall screen is shown immediately when command is issued.

RCLp1_p2

p1 = 0: cancel recall state

p1 = 1: enter recall state

p2 = 0: internal memory Manual store recall

p2 = 1: internal Auto1 store recall

p2 = 2: internal Auto2 store recall

p2 = file name (example: AU1_0001): Recall specified file (AU and MAN must be uppercase)

p2 is disregarded if p1 = 0

· When recall state is canceled with RCL0

For internal memory data recall, "MANUAL", "AUTO1", "AUTO2" is returned. For other card recall states, the store name is returned.

Transfer format: command block

Get recall mode status

RCL?

Response data from VM-53/VM-53A to RCL? command

Response data d1

d1 = 0: recall mode not active

d1 = 1: recall mode active

Transfer format: response block

SMD

Set auto store mode (Manu, Auto1, Auto2)

SMDp1

p1 = 0: Manual p1 = 1: Atuo1

p1 = 2: Auto2 p1 = 3: Timer Auto1

p1 = 4: Timer Auto2

Transfer format: command block

Get auto store mode setting

SMD?

Response data from VM-53/VM-53A to SMD? command

Response data d1

d1: corresponding to p1

Transfer format: response block

SNR?

Get store name shown on recall menu

- No parameters
- Response data format

  Example: AU1_0001 etc.

If there are two or more store data, these are returned as separate blocks.

Transfer format: response block

SNS

Set store file name

The store mode setting is made with the SMD command.

To store data on a memory card, specify a file name (4-digit number)

SNSp1

p1 = 0000 to 9999

A 4-digit integer is accepted.

If not a 4-digit number, an error (0002) is returned.

Transfer format: command block

Get store file name

SNS?

d1 = p1

Example: 0010 ("0010" part of "AU1_0010" is returned)

Transfer format: response block

TMT

Set timer mode time

TMTp1_p2_p3_p4_p5_p6_p7_p8_p9_p10

p1: start month
p2: start day
p3: start hours
p4: start minutes
p5: end month
p6: end day
p7: end hours
p8: end minutes
p9: interval time
p9 = 0: Off
1: 5 min
2: 10 min
3: 15 min
4: 30 min
5: 1 hour
p10: sleep mode
p10 = 0: Sleep Mode Off
p10 = 1: Sleep Mode On

Transfer format: command block

Get timer mode time

TMT?

Response data from VM-53/VM-53A to TMT? command

Response data d1

Transfer format: response block

Calibration commands

CAL

Toggle calibration mode

CALp1

p1 = 0: cancel calibration mode
p1 = 1: activate calibration mode

Transfer format: command block

Get calibration mode status

CAL?

Response data from VM-53/VM-53A to CAL? command

Response data d1

d1: corresponding to p1

Transfer format: response block

Setting and information related commands

BAT?

Get battery status

BAT?

Response data from VM-53/VM-53A to BAT? command

Response data d1

d1 = 0: battery indicator is flashing

d1 = 1: 

d1 = 2: 

d1 = 3: 

d1 = 4: 

Transfer format: response block

CLK

Set current year/month/day/hours/minutes/seconds

CLKp1_p2_p3_p4_p5_p6

p1:	year (4 digits)	p2:	month
p3:	day	p4:	hours
p5:	minutes	p6:	seconds

01 and 1 are both accepted.

Transfer format: command block

Get current year/month/day/hours/minutes/seconds setting

CLK?

Response data from VM-53/VM-53A to CLK? command

Response data d1, d2, d3, d4, d5, d6

d1 to d6: corresponding to p1 to p6

"1" setting is returned as "01".

Transfer format: response block

CMP

Set comparator function to On/Off

CMPp1

p1 = 0: comparator Off

p1 = 1: comparator On

Transfer format: command block

Get comparator function On/Off status

CMP?

Response data from VM-53/VM-53A to CMP? command

Response data d1

d1: corresponding to p1

Transfer format: response block

CML

Set comparator level

CMLp1

p1: 30 to 120 dB in 1-dB steps

Transfer format: command block

Get comparator level setting

CML?

Response data from VM-53/VM-53A to CML? command

Response data d1

d1: corresponding to p1 (comparator level setting value)

Transfer format: response block

CMS

Set comparator delay time/auto reset

CMSp1_p2_p3

p1: set delay time (p1 = 0 to 9, 1-s steps)

p2 = 0: auto reset Off

p2 = 1: auto reset On

p3: set auto reset time (p3 = 0 to 90, 1-s steps)

Transfer format: command block

Get comparator delay time/auto reset setting

CMS?

Response data from VM-53/VM-53A to CMS? command

Response data d1,d2,d3

d1 to d3: corresponding to p1 to p3 (comparator level setting value)

Transfer format: response block

DCL

Initialize unit (to factory defaults) (see page 151)

- Clock is not reset
- Manual memory contents are not erased
- Communication remains On
- No parameters

Transfer format: command block

LTI?

Get elapsed time from measurement start or memory store start

LTI?

Response data from VM-53/VM-53A to LTI? command

Response data d1, d2, d3

d1: hours

d2: minutes

d3: seconds

Maximum allowable setting is 199:59:59

Transfer format: response block

OUT

Toggle BNC output between AC and DC

OUTp1

p1 = 0: AC OUT

p1 = 1: DC OUT

Transfer format: command block

Get BNC output AC/DC setting

OUT?

Response data from VM-53/VM-53A to OUT? command

Response data d1

d1: corresponding to p1

Transfer format: response block

VER?

Get version information

VER?

Response data from VM-53/VM-53A to VER? command

Response data d1, d2

d1: vibration level meter model

Example: VM-53A

d2: software version

Example: 1.00

Transfer format: response block

Measurement data related commands

DOD?

Get measurement value

DODp1_p2?

p1: select channel

p1 = 0: X/Y/Z all channels p1 = 1: X

p1 = 2: Y p1 = 3: Z

p2: select measurement type

p2 = 0: instantaneous value

p2 = 1: Max Hold value

p2 = 2: processing values (selected channel only, L_{eq} to L_{95} up to 8 types)

p1 and p2 not supplied: get data shown on main display

Response data d1,d2,d3,d4,d5,d6,d7,d8,d9,d10 • • •

Single-axis data (p1 not = 0), p2 not = 2

d1 to d2 only

d1: measurement value in selected channel

d2: overload/underload in selected channel

d2 = O: overload

d2 = U: underload

d2 = W: overload and underload

When instantaneous value display is selected, this applies to instantaneous value overload/underload. When Max Hold display is selected, this applies to hold value overload.

When processing display is selected, this applies to overload/underload in processing values.

3-axis data (p1 = 0), p2 not = 2

d1 to d6 only

d1: X channel measurement value

d2: X channel overload/underload

d3: Y channel measurement value

d4: Y channel overload/underload

d5: Z channel measurement value

d6: Z channel overload/underload

Single-axis data (p1 not = 0), p2 = 2

d1 to d8:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of selected channel

d9: overload/underload of selected channel

3-axis data (p1 = 0), p2 = 2

d1 to d8:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of X channel

d9: overload/underload of X channel

d10 to d17:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of Y channel

d18: overload/underload of Y channel

d19 to d26:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of Z channel

d27: overload/underload of Z channel

Transfer format: response block

DOF

Output instantaneous value or Max Hold value

During processing measurement, this command initiates instantaneous value or Max Hold value (when main display is switched to Max Hold) output in 100 ms or 1 s intervals, in non-protocol (streaming) mode. The 100 ms interval setting is available only when baud rate is 19200 bps.

DOFp1_p2

p1: select channel

p1 = 0: X/Y/Z all channels

p1 = 1: X p1 = 2: Y p1 = 3: Z

p2: 100 ms or 1 s setting

p2=0: 100 ms p2 = 1: 1s

1) Response data d1, d2, d7 (single-axis data)

d1 to d2, d7 only

d1: measurement value in selected channel

d2: overload/underload in selected channel

d2 = O: overload

d2 = U: underload

d2 = W: overload and underload

d7: counter

Output data appear in d7 in the following sequence: 1 → 2 → 3... → 9 → 0 → 1...

2) Response data d1, d2, d3, d4, d5, d6, d7 (3-axis data)

d1 to d7

d1: X channel measurement value

d2: X channel overload/underload

d3 to d4: Y channel measurement value and overload/underload

d5 to d6: Z channel measurement value and overload/underload

When measurement is single-axis only, other data are set to 00.0 dB.

d7: counter

Output data appear in d7 in the following sequence: 1 → 2 → 3··· → 9 → 0 → 1···

DOF stop request is performed by <SUB>.

MDH?

Get memory data header

Response data

For Manual store

Header information for address specified with ADR is returned

d1: instantaneous value or Max Hold value store date (year/month/day)

d2: instantaneous value or Max Hold value store time (hours/minutes/seconds)

d3: X channel level range (response data correspond to RNX?)

d4: Y channel level range (response data correspond to RNY?)

d5: Z channel level range (response data correspond to RNZ?)

d6: frequency weighting (instantaneous value or Max Hold Lv/Lva)

d6 = 0: Lv d6 = 1: Lva

d7: time weighting characteristics (reserved). Returns 0.

d8: instantaneous value or Max Hold

d8 = 0: instantaneous value d8 = 1: Max Hold

d9: Filter (reserved)

d10: 1/1 oct or 1/3 oct center frequency (reserved)

d11: LPF cutoff frequency (reserved)

d12: processing values store start date (year/month/day)

d13: processing values store start time (hours/minutes/seconds)

d14: X channel processing level range (response data correspond to RNX?)

d15: Y channel processing level range (response data correspond to RNY?)

d16: Z channel processing level range (response data correspond to RNZ?)

d17: frequency weighting (processing values Lv/Lva)

d17 = 0: Lv d17 = 1: Lva

d18: time weighting characteristics

VM-53/VM-53A (reserved)

d19: M.Time (response data correspond to MTI?)

d20: measurement time

d21: filter (reserved)

d22: 1/1 oct or 1/3 oct center frequency (reserved)

d23: LPF cutoff frequency (reserved)

For Auto1 store

Response contents

d1: store start date (year/month/day)

d2: store start time (hours/minutes/seconds)

d3: store end date (year/month/day)

d4: store end time (hours/minutes/seconds)

d5: number of data 7 digits (max. 199 h 59 m 59 s)

d6: X channel level range (response data correspond to RNX?)

d7: Y channel level range (response data correspond to RNY?)

d8: Z channel level range (response data correspond to RNZ?)

d9: frequency weighting (instantaneous value or Max Hold Lv/Lva)

d9 = 0: Lv d9 = 1: Lva

d10: time weighting characteristics (reserved)

d11: M. Time (response data correspond to MTI?)

d12: filter (reserved)

d13: reserved area

d14: LPF cutoff frequency (2 digits, currently reserved)

d15: AUTO1 sampling

d15 = 0: 100 ms d15 = 1: 1 s

d16: measurement time

For Auto2 store

Response contents

d1: store start date (year/month/day)

d2: store start time (hours/minutes/seconds)

d3: store end date (year/month/day)

d4: store end time (hours/minutes/seconds)

d5: number of data 4 digits (max. 4500)

d6: X channel level range (response data correspond to RNX?)

d7: Y channel level range (response data correspond to RNY?)

d8: Z channel level range (response data correspond to RNZ?)

d9: frequency weighting (instantaneous value or Max Hold Lv/ Lva)

d9 = 0: Lv d9 =1: Lva

d10: time weighting characteristics (reserved)

d11: M.Time (response data correspond to MTI parameter, 0 to 11)

d12: Interval (response data correspond to p9 of TMT parameter, 0 to 5)

d13: filter (reserved)

d14: 1/1 oct or 1/3 oct center frequency (reserved)

d15: LPF cutoff frequency (reserved)

DOR?

Get memory data

DORp1_p2_p3?

p1: select channel

p1 = 0: X/Y/Z all channels p1 = 1: X

p1 = 2: Y p1 = 3: Z

p2: select number of data

p3: Auto2 data format (Valid only for Auto2. Disregarded for Manual and Auto1. Taken as 0 if p3 is not specified for Auto2.)

Transfer format: command block

1) For manual data (valid only if p1 = 0)

p1 = 1/2/3 results in error for this command

p2 sets the number of data to receive

p2 = 1 to 100

d1: address number

d2: instantaneous value or Max Hold value store start date (year/month/day)

d3: instantaneous value or Max Hold value store start time (hours/minutes/seconds)

d4: processing measurement date (year/month/day)

d5: processing measurement time (hours/minutes/seconds)

d6: X channel instantaneous value (returns 0.0 if no instantaneous value store data are present)

d7: X channel Max Hold value (returns 0.0 if no Max Hold store data are present)

d8: X channel overload/underload

When instantaneous value is selected, this applies to instantaneous value overload/underload.

When Max Hold is selected, this applies to hold value overload.

d9 to d17:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of X channel, overload/underload of processing values

d18: Y channel instantaneous value (returns 0.0 if no instantaneous value store data are present)

d19: Y channel Max Hold value (returns 0.0 if no Max Hold store data are present)

d20: Y channel overload/underload

When instantaneous value is selected, this applies to instantaneous value overload/underload.

When Max Hold is selected, this applies to hold value overload.

d21 to d29:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of Y channel, overload/underload of processing values

d30: Z channel instantaneous value (returns 0.0 if no instantaneous value store data are present)

d31: Z channel Max Hold value (returns 0.0 if no Max Hold store data are present)

d32: Z channel overload/underload

When instantaneous value is selected, this applies to instantaneous value overload/underload.

When Max Hold is selected, this applies to hold value overload.

d33 to d41:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of Z channel, overload/underload of processing values

d42: pause information (processing value pause information)

1: pause present 0: no pause

2) For Auto1 store (valid only for selected channel data)

p1 = 0: return error for this command

p2: Specify number of data to get 1 to 7199990

Response data

d1_d2_d3

d1: measurement value

d2: overload/underload

d3: marker 1: marker present 0: no marker

25 data are sent as one block.

3) For Auto2 store (valid only for selected channel data)

p1 = 0: return error for this command

Channel (X/Y/Z) selection makes p1 = 1 to 3 valid

p2: Specify number of data to get 1 to 4500

p3: select response data format

p3 = 0: return all response data d1 to d14

p3 = 1: return response data d5 to d14 (omit d1 to d4 with measurement start date information etc.)

Response data

d1_d2_d3

d1: address number (1 to 4500)

d2: measurement start date (year/month/day)

d3: measurement start time (hours/minutes/seconds)

d4: measurement time

d5 to d12:

L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95} of X or Y or Z channel

d13: overload/underload

d14: marker 1: marker present 0: no marker

Transfer format: response block

Communications related commands

BRT

Set baud rate

BRTp1

p1 = 2 : 4800 bps p1 = 3 : 9600 bps

p1 = 4 : 19200 bps

Changes the transfer speed after a confirmation response.

Transfer format: command block

Get baud rate setting

BRT?

Response data from VM-53/VM-53A to BRT? command

Response data d1

d1: corresponding to p1

Transfer format: response block

EST?

Get error status

EST?

Response data from VM-53/VM-53A to EST? command

Response data d1

d1: error processing, command processing error (see p. 177)

indicated 4-digit error code

Transfer format: response block

IDX

Set index number

IDXp1

p1 = 1 to 255, default: 1

Transfer format: command block

Get index number setting

IDX?

Response data from VM-53/VM-53A to IDX? command

Response data d1

d1: corresponding to p1 (selected index number)

Transfer format: response block

RET

Set command response

RETp1

p1 = 0: response processing disabled

p1 = 1: response processing enabled

Transfer format: command block

Get command response setting

RET?

Response data from VM-53/VM-53A to RET? command

Response data d1

d1: corresponding to p1

Transfer format: response block

RMT

Toggle local/remote mode

RMTp1

p1 = 0: enable local mode

p1 = 1: enable remote mode (no key operation possible during communication)

Transfer format: command block

Get local/remote mode status

RMT?

Response data from VM-53/VM-53A to RMT? command

Response data d1

d1: corresponding to p1

Transfer format: response block

XON

Select control mode

XONp1

p1 = 0: disable X parameter control

p1 = 1: enable X parameter control

Transfer format: command block

Get control mode status

XON?

Response data from VM-53/VM-53A to XON? command

Response data d1

d1: corresponding to p1

Transfer format: response block

Examples for Control Via External Commands

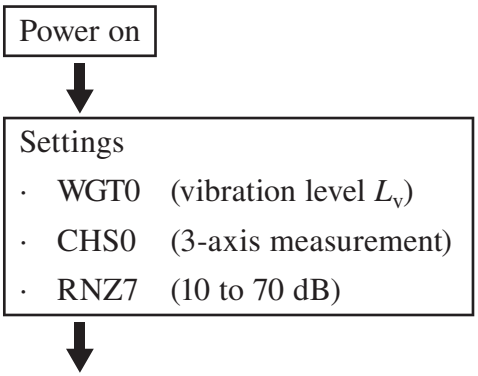
This section contains several examples for controlling operation of the vibration level meter via commands. Some initial steps are common to all operations.

- Check baud rate setting
- Check index number
- Enable or disable response sequence (with RET command)

To check whether a setting was made properly, using a request command after sending a setting command is recommended.

Example for getting vibration level (single) data

(Lv/Lva: L_v characteristics, measurement direction: 3-axis, level range: 10 to 70 dB)



Establish the above settings to prepare for obtaining vibration level data from the unit.

DOD? (Get measurement value)

Example for getting vibration level (continuous, 1-s intervals) data

(Lv/Lva: L_v characteristics, measurement direction: Z axis, measurement value: instantaneous value, level range: 10 to 70 dB)

Power on

↓

Settings
- WGT0 (vibration level L_v)
- CHS3 (3-axis measurement)
- RNZ7 (10 to 70 dB)

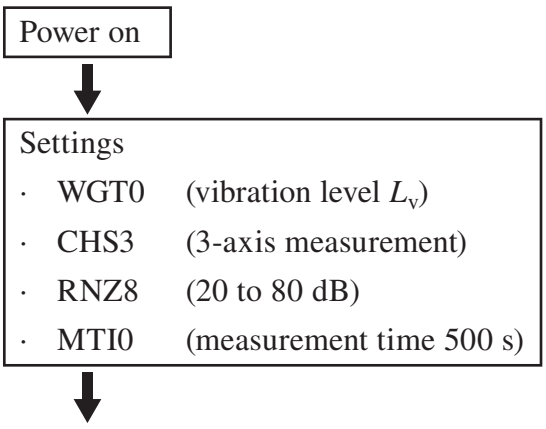
Establish the above settings to prepare for obtaining vibration level data from the unit (Z axis instantaneous value data every second).

↓

DOF3_1? (Stop with <SUB>)

Example for getting processing value (L_{eq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}) data

(Lv/Lva: L_v characteristics, measurement direction: Z axis, measurement value: processing values, level range: 20 to 80 dB, measurement time: 500 s)



SRT1 (processing start)
(wait until processing end or use stop command SRT0)

DOD3_2? (Get Z axis processing values)

Manual store example

(Lv/Lva: L_{va} characteristics,
file name: MAN_0001 [for VM-53A card store],
measurement time: 10 minutes, measurement direction: 3-axis,
level range: 40 to 100 dB)

Power on (for VM-53A and memory card store, insert memory card first)

↓

Settings

- CDV? (check for card insertion; not used for VM-53 or for VM-53A with internal memory store)
- WGT1 (vibration level L_{va})
- CHS0 (3-axis measurement)
- RNX10 (X channel level range 40 to 100 dB)
- RNY10 (Y channel level range 40 to 100 dB)
- RNZ10 (Z channel level range 40 to 100 dB)
- MTI4 (measurement time 10 m)
- SMD0 (enable Manual store mode)
- SNS0001 (specify file name; not used for VM-53 or for VM-53A with internal memory store)

Establish the above settings to prepare for Manual store.

↓

SRT1 (processing start)

↓ (wait until processing end or use stop command SRT0)

STO1 (perform store and increment address by one count)

Auto1 store example

(Lv/Lva: L_v characteristics,
file name: AU1_0001 [for VM-53A card store], store interval: 1 s,
measurement time: 1 h, measurement direction: X axis,
level range: 60 to 120 dB)

Power on (for VM-53A and memory card store, insert memory card first)

Settings

- CDV? (check for card insertion; not used for VM-53 or for VM-53A with internal memory store)
- WGT0 (vibration level L_v)
- CHS1 (X axis measurement)
- RNX12 (60 to 120 dB)
- MTI7 (measurement time 1 h)
- SMD1 (enable Auto1 store mode)
- SNS0001 (specify file name; not used for VM-53 or for VM-53A with internal memory store)
- PLP1 (store interval 1 s)

Establish the above settings to prepare for Auto1 store.

STO1 (store start)

(store operation is stopped automatically when measurement time has elapsed)

SRT0 (to stop measurement/store beforehand)

Timer Auto1 store example

(Lv/Lva: L_v characteristics, file name: AU1_0001 [for VM-53A card store],
store interval: 1 s, measurement time: 24 h,
measurement direction: X axis, level range: 60 to 120 dB,
measurement start date/time: 04/01 6:00,
measurement end date/time: 04/02 8:00,
interval time: not applicable to Auto1 therefore OFF, sleep mode: ON)

Power on (for VM-53A and memory card store, insert memory card first)

↓

Settings

- CDV? (check for card insertion; not used for VM-53 or for VM-53A with internal memory store)
- WGT0 (vibration level L_v)
- CHS1 (X axis measurement)
- RNX12 (60 to 120 dB)
- MTI10 (measurement time 24 h)
- SMD3 (enable Timer Auto1 store mode)
- SNS0001 (specify file name; not used for VM-53 or for VM-53A with internal memory store)
- PLP1 (store interval 1 s)
- TMT4_1_6_00_4_2_8_0_0_1 ("_" represents a space) (make timer mode and sleep mode settings)

Establish the above settings to prepare for Timer Auto1 store.

↓

STO1 (store start)

Note
When sleep mode is On, no communication commands are received during timer standby.

Auto2 store example

(Lv/Lva: L_v characteristics, file name: AU2_0001 [for VM-53A card store],
measurement time: 500 s, measurement direction: 3-axis,
level range: X channel 10 to 70 dB, Y channel 20 to 80 dB,
Z channel 30 to 90 dB)

Power on (for VM-53A and memory card store, insert memory card first)

↓

Settings
- CDV? (check for card insertion; not used for VM-53 or for VM-53A with internal memory store)
- WGT0 (vibration level L_v)
- CHS0 (3-axis measurement)
- RNX7 (X channel level range 10 to 70 dB)
- RNY8 (Y channel level range 20 to 80 dB)
- RNZ9 (Z channel level range 30 to 90 dB)
- MTI0 (measurement time 500 s)
- SMD2 (enable Auto2 store mode)
- SNS0001 (specify file name; not used for VM-53 or for VM-53A with internal memory store)

Establish the above settings to prepare for Auto2 store.

STO1 (store start)

↓ (store operation is stopped automatically when measurement time has elapsed)

SRT0 (to stop measurement/store beforehand)

Timer Auto2 store example

(Lv/Lva: L_v characteristics, file name: AU2_0001 [for VM-53A card store],
measurement time: 500 s, measurement direction: 3-axis,
level range: X channel 10 to 70 dB, Y channel 20 to 80 dB,
Z channel 30 to 90 dB, measurement start date/time: 04/01 8:00,
measurement end date/time: 04/10 20:00, interval time: 1 hour,
sleep mode: ON)

Power on (for VM-53A and memory card store, insert memory card first)

↓

Settings

- CDV? (check for card insertion; not used for VM-53 or for VM-53A with internal memory store)
- WGT0 (vibration level L_v)
- CHS0 (3-axis measurement)
- RNX7 (X channel level range 10 to 70 dB)
- RNY8 (Y channel level range 20 to 80 dB)
- RNZ9 (Z channel level range 30 to 90 dB)
- MTI0 (measurement time 500 s)
- SMD4 (enable Timer Auto2 store mode)
- SNS0001 (specify file name; not used for VM-53 or for VM-53A with internal memory store)
- TMT4_1_8_0_4_10_20_0_5_1 ("_" represents a space) (make timer mode and sleep mode settings)

Establish the above settings to prepare for Timer Auto2 store.

↓

STO1 (store start)

Note
When sleep mode is On, no communication commands are received during timer standby.

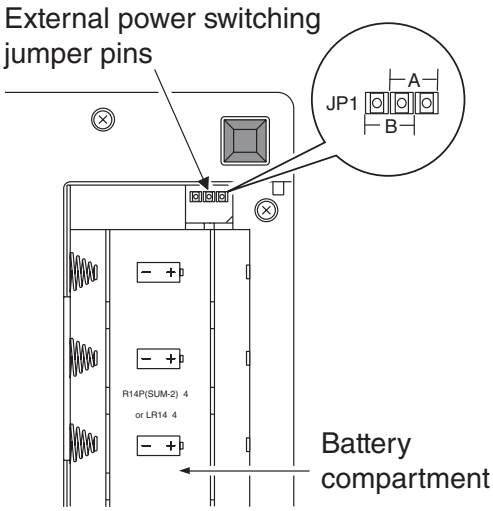
Reference Information

About the external power switching jumper pins

The VM-53/VM-53A is turned on by holding down the Power key for at least one second, but the on/off status can also be controlled by an external power supply without using the Power key.

Changing the setting of the external power switching jumper pins

1. Disconnect the AC adapter or remove the batteries so that power is off.
2. Open the battery compartment lid on the bottom panel.
3. Change the position of the jumper on the external power switching jumper pins from position A to position B.



Jumper pin position

Side A: Normal position (unit on/off is controlled by Power key)

Side B: Unit operates in conjunction with external power supply.

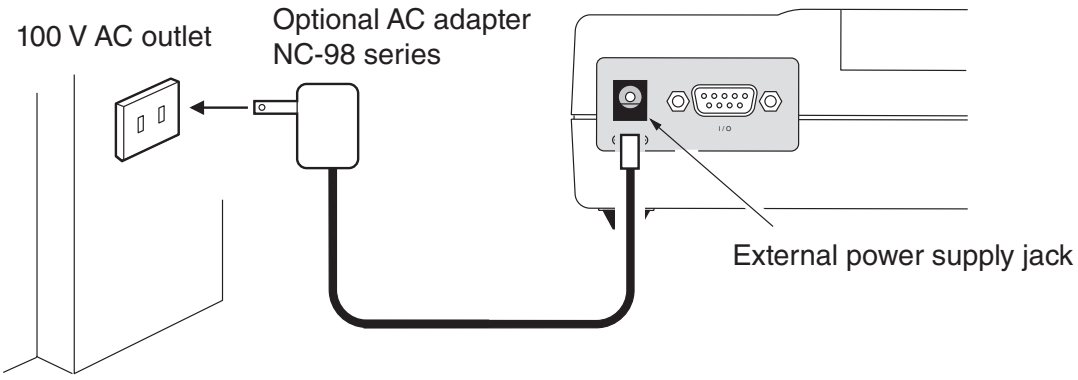
⚠ Caution

The external power switching jumper pins are small and pointed. Take care not to hurt your fingers.

Important

Never connect any equipment to the external power switching jumper pins. Otherwise damage can occur.

4. When you connect the AC adapter (option) and thereby supply power to the VM-53/VM-53A, the unit will automatically be turned on.



Important
When the external power switching jumper pins are set to the “B” position, use an AC adapter of the NC-98 series (option).

Note
The optional AC adapter NC-98 series is for 100 to 240 V AC.

Measurement setting information copy (Meas.Set Copy) (VM-53A only)

This function lets you store settings made with the menus of the unit on a memory card.

Such settings can then later be read back into the VM-53A at power-up. In a system with multiple VM-53A units, this makes it easy you to set all units to the same condition. It also helps to save time and prevent setup mistakes.

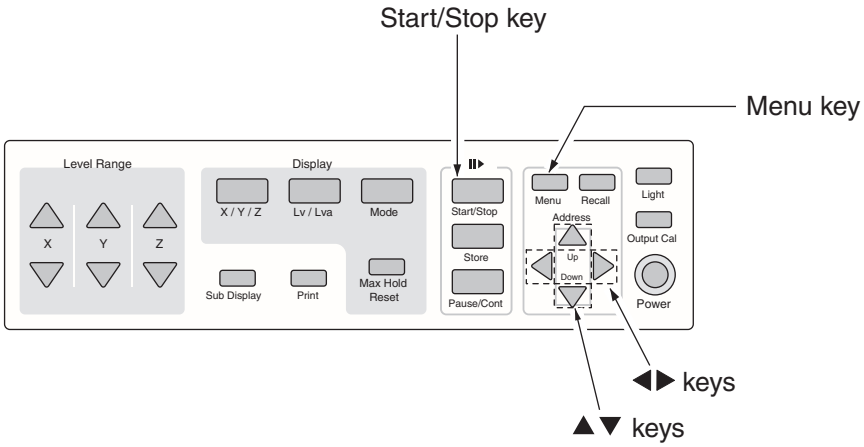
A stored set of settings can be used at a later time to establish the same condition as when a measurement was made. Setting information saved during use of the unit in the field can be stored and managed centrally on a computer.

Settings stored on memory card:

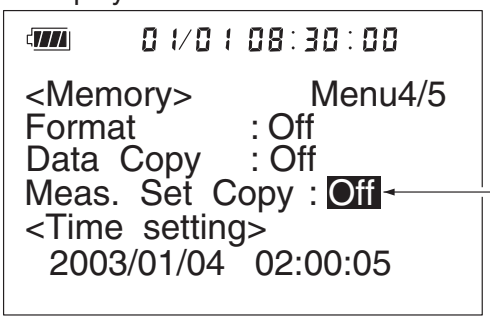
- Display channel
- Vibration level (Lv)/vibration acceleration level (Lva)
- Level range X
- Level range Y
- Level range Z
- Sub display screen selection
- Measurement time (Meas.Time)
- Measurement channel
- Output AC/DC selection
- Serial interface on/off
- Baud rate
- Store mode (Manual/Auto1/Auto2/Timer Auto1/Timer Auto2)
- Auto1 sampling setting (valid when store mode is Auto1 or Timer Auto1)
- Timer start time (valid when store mode is Timer Auto1 or Timer Auto2)
- Timer end time (valid when store mode is Timer Auto1 or Timer Auto2)
- Sleep mode (valid when store mode is Timer Auto1 or Timer Auto2)
- Interval (valid when store mode is Auto2 or Timer Auto2)

How to store settings on a memory card

1. Set up the parameters listed on the page 233 as desired.
2. Use the Menu key to bring up menu screen 4/5.
3. Use the ▲ and ▼ keys to highlight the "Meas.Set Copy" item.

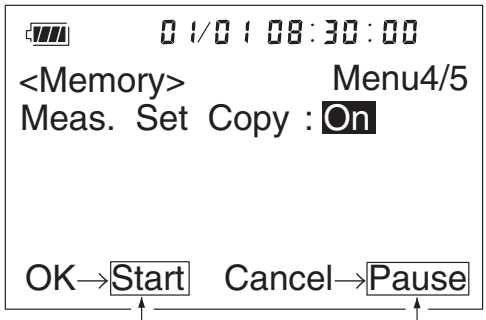


Sub display

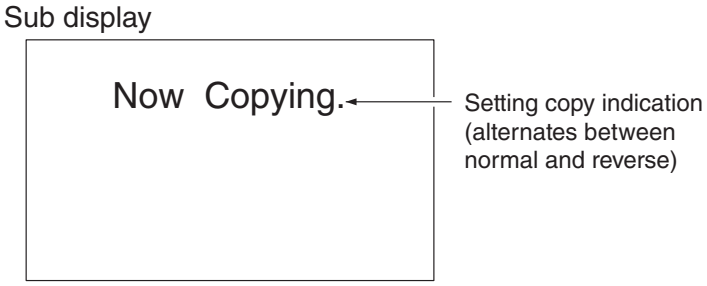


4. Use the ◀ and ▶ keys to set the item to "On".

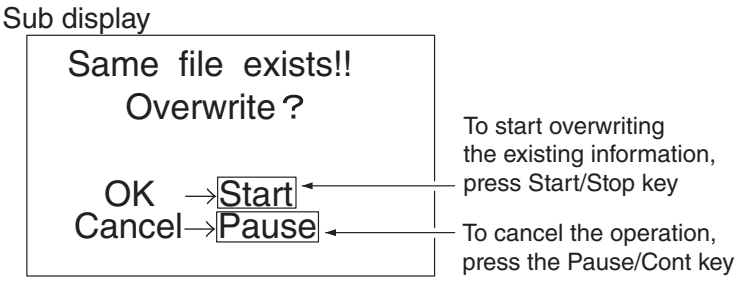
Sub display



5. When you press the Start/Stop key, the current setting information is copied to the memory card.

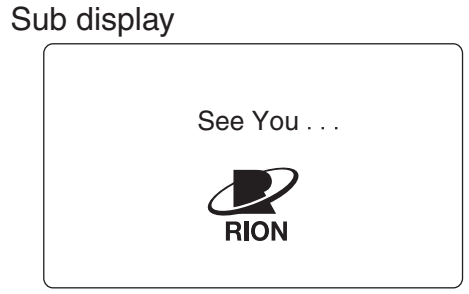


Note
When you attempt to copy setting information to a memory card where setting information already exists, the following message appears. To overwrite the existing information, press the Start/Stop key. To cancel the operation, press the Pause/Cont key.

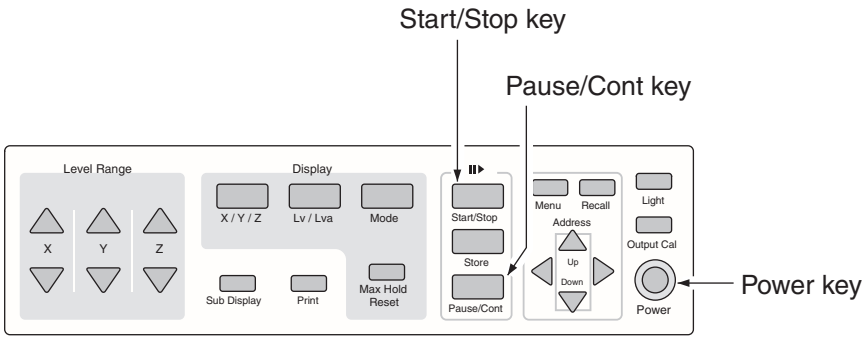


Loading settings stored on a memory card

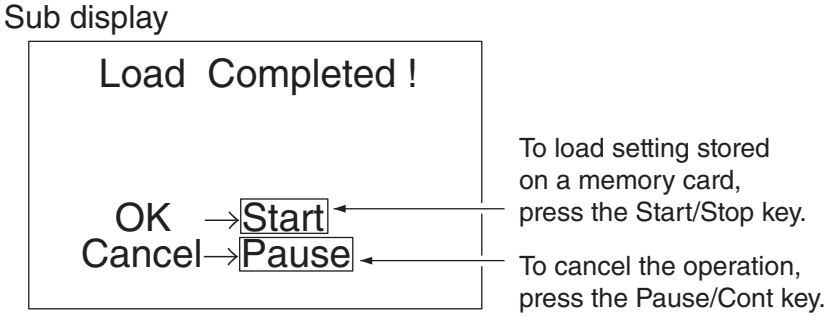
1. Press the Power key to turn the unit off.



2. Insert the memory card with the desired setting information.
3. Press the Power key while holding down the Pause/Cont key.



4. When the indication shown below appears, press the Start/Stop key.



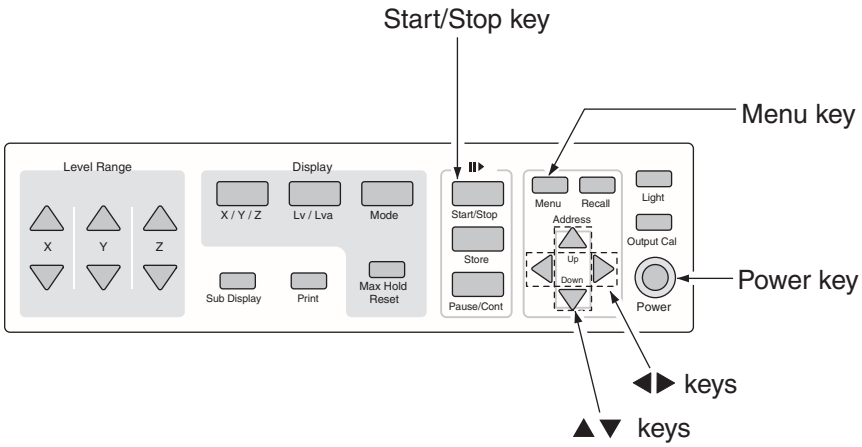
5. After the initialization screen is shown, the unit will start up with the stored settings.

Initialization screen

Data copy function (VM-53A only)

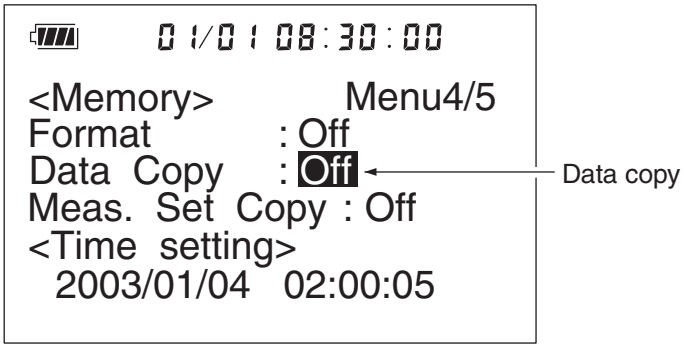
You can copy data stored in the internal memory to a memory card.
The following explanation assumes that data are already stored in the internal memory of the unit.

1. Insert a memory card into the card slot.
2. Press the Power key to turn the unit on.

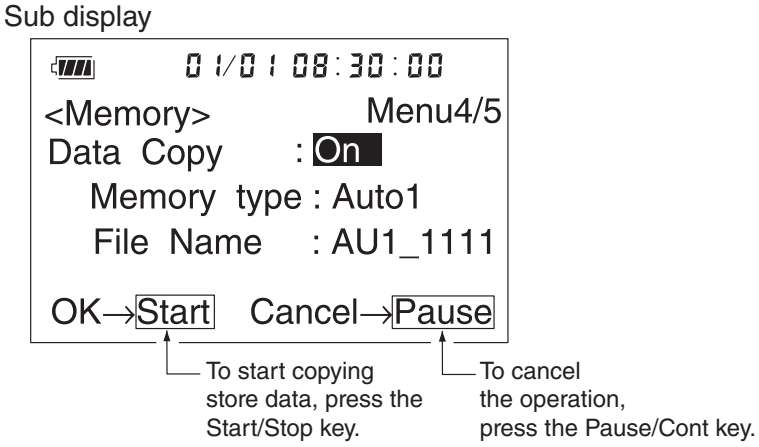


3. Use the Menu key to bring up menu screen 4/5.

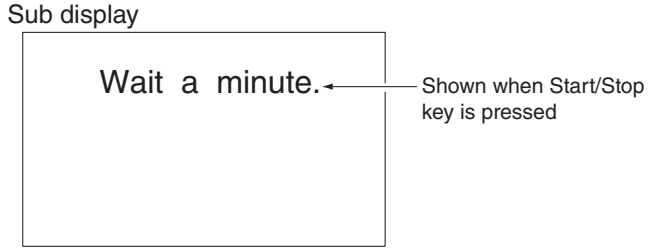
Sub display

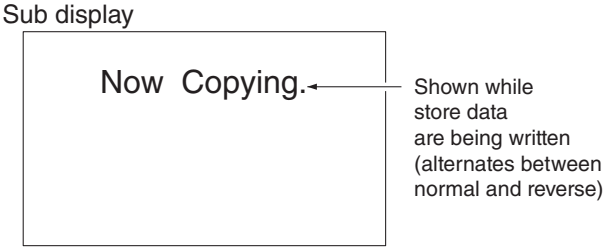


4. Use the ▲ and ▼ keys to highlight the "Data Copy" item, and use the ◀ and ▶ keys to set the item to "On".



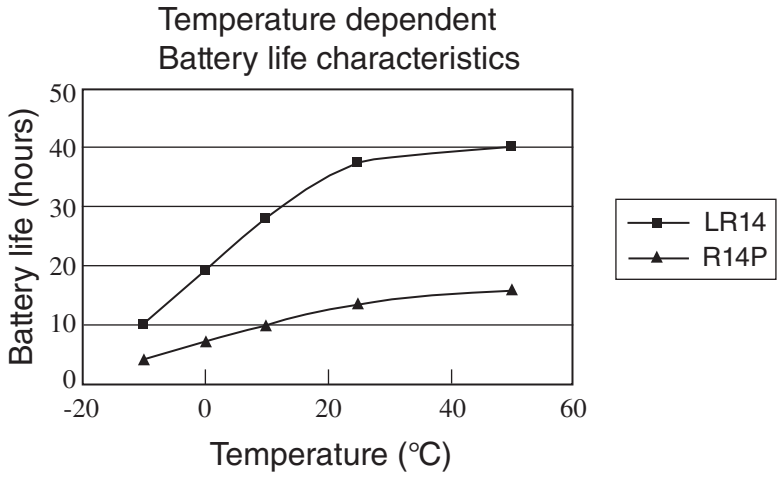
5. Use the ▲ and ▼ keys to highlight the "Memory Type" item, and use the ◀ and ▶ keys to select the type of store data to be copied to the memory card (Manual/Auto1/Auto2).
6. Use the ▲ and ▼ keys to highlight the "File Name" item, and use the ◀ and ▶ keys to specify a file name.
7. If everything is as desired, press the Start/Stop key.
   The copy process starts.





VM-53/VM-53A battery life

Important
Information on battery life refers to normal room temperature, but battery life will differ, depending on the battery type, the date/month/year of manufacture, usage conditions, ambient conditions, and other factors. An example using two types of Japan-manufactured batteries for continuous measurement is shown below.



Continuous use time with alkaline and manganese batteries

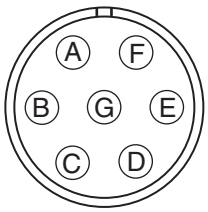
Operation conditions

VM-53/VM-53A with PV-83C connected

L_v, 3-axis measurement, AC output, backlight OFF, communications OFF, level range 100 dB

Input connector

The input connector is a Tajimi Electronics connector PRC03-23A10-7F wired as shown below.

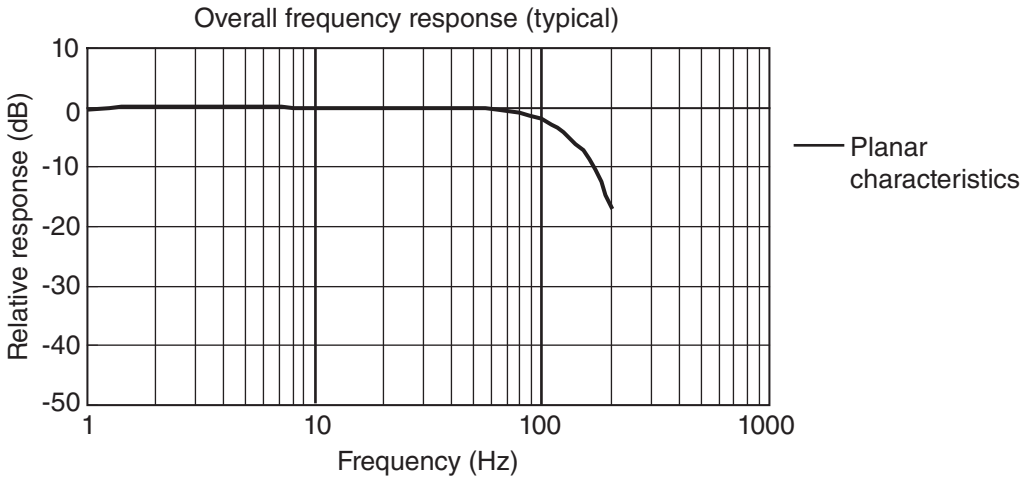


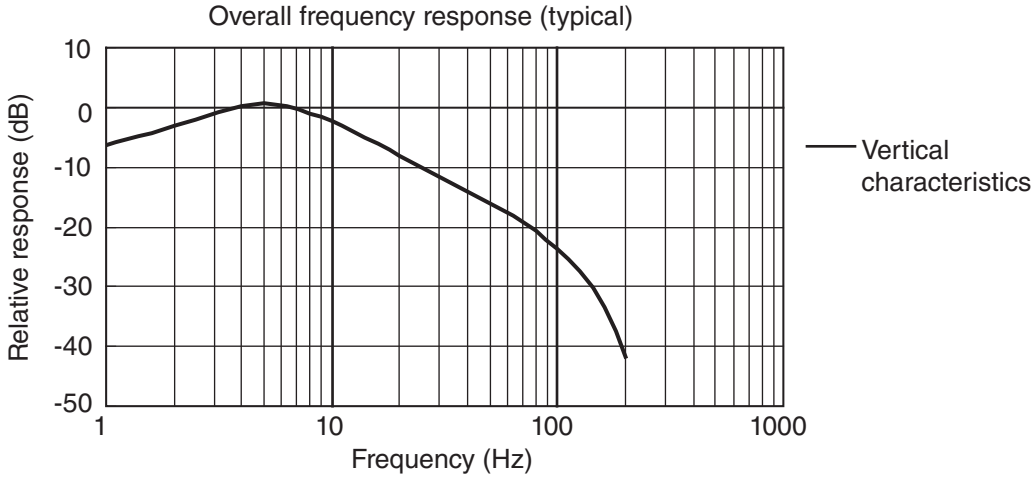
Top view

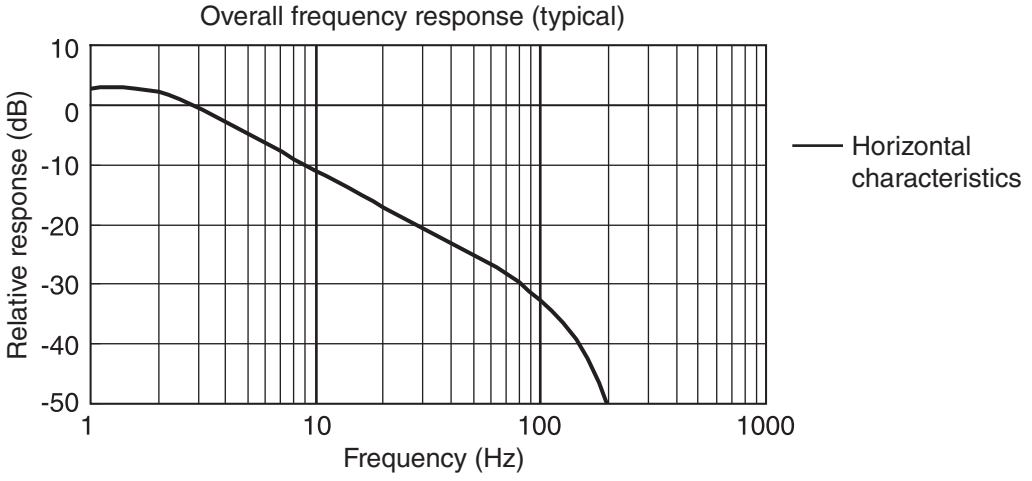
A: Pickup power supply
B: X channel signal input
C: Y channel signal input
D: Z channel signal input
E: Ground
F: Ground
G: Power supply output from unit (AC adapter or batteries)

Important
Do not connect anything else besides the supplied 3-axis accelerometer PV-83C or optional extension cable EC-02S to this connector. Otherwise damage may occur.

Frequency characteristics

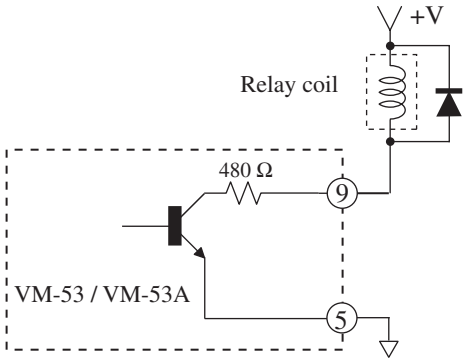






Comparator output circuit example

A sample circuit for controlling a relay using the comparator output of the VM-53/VM-53A is shown below.



The voltage applied to the relay when the comparator output is ON can be calculated using the following equation.

$$Vr = (Rr / (Rr + 480)) \times V$$

Where

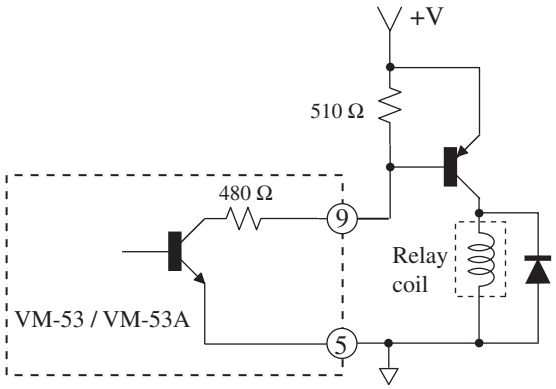
Vr: Applied voltage at relay (V)

Rr: Coil resistance of relay (Ohm)

V: Power supply voltage (V)

Provided that the coil resistance of the relay is sufficiently high in relation to the internal resistance of the VM-53/VM-53A (480 ohms), almost the full voltage of the power supply will be applied to the relay.

If the coil resistance is not significantly higher than the internal resistance of the VM-53/VM-53A, the power supply voltage will be divided by the internal resistance, which may result in a situation where the required operation voltage of the relay is not achieved. To prevent this possibility, a circuit configuration such as shown below must be used, which will eliminate the influence of the internal resistance of the VM-53/VM-53A.



Backup Battery

This unit incorporates a backup battery (rechargeable) for clock data back-up.

The battery is recharged automatically while power to the unit is on. While the unit is off, the battery is not being charged. It takes about 12 hours to reach a full charge.
With a full charge, data will be retained for about 1.5 months. If this period is exceeded, clock data will be lost. It is therefore recommended to ensure that the battery is charged.

The service life of the backup battery is limited. You should have the battery replaced about once every five years. Please contact your supplier.

Important
A full charge is achieved by leaving power to the VM-53/VM-53A on for 12 hours.

Note
When the backup battery is old, the data retention period will be shorter.

Specifications

Applicable standards
Weight and Measure Act (vibration level meters) of Japan
JIS C 1510: 1995 (JIS C 1510: 1976)

Measurement functions
Vibration level (L_v)
Vibration acceleration level (L_{va})
Maximum value hold of vibration level or vibration acceleration level
Processing measurement
Power average of vibration level or vibration acceleration level (L_{veq} or L_{vaeq})
Time percentile level of vibration level or vibration acceleration level (L_5, L_{10}, L_{50}, L_{90}, L_{95})
Maximum value (L_{max}), Minimum value (L_{min}) of vibration level or vibration acceleration level
Single-axis or 3-axis can be selected.

Measurement frequency range
Vibration level: 1 to 80 Hz
Vibration acceleration level: 1 to 80 Hz

Measurement level range
Vibration level, vertical: 25 to 120 dB
Vibration level, horizontal: 30 to 120 dB
Vibration acceleration level: 30 to 120 dB
dB (re. 10^{-5} m/s^2)

Inherent noise
Vibration level, vertical: 19 dB or less
Vibration level, horizontal: 24 dB or less
Vibration acceleration level: 24 dB or less

Frequency weighting

	Vertical characteristics:	according to Weight and Measure Act or JIS
	Horizontal characteristics:	according to JIS
	Planar characteristics:	according to JIS

Level range: 10-dB steps, 6 ranges switchable, 3-axis independent

- 10 to 70 dB
- 20 to 80 dB
- 30 to 90 dB
- 40 to 100 dB
- 50 to 110 dB
- 60 to 120 dB

Linearity range: 70 dB

Measurement time: Processing measurement in preset time possible

10 seconds, 500 seconds, 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 4 hours, 8 hours, 24 hours, Manual (max. 199 h 59 m 59 s)

RMS detection circuit: Digital processing

Time weighting: 0.63 s

Processing: Digital processing

Sampling time: 100 ms (L_x) [L_x 5 seconds for measurement time 500 s]

VM-53: 120 µs (power average, L_{max}, L_{min}, max. hold)

VM-53A: 78 µs (power average, L_{max}, L_{min}, max. hold)

Memory card functions (VM-53A only)

Data store capability on memory card (Compact Flash card)

Extended functions implemented by optional software on memory card supported

Store functions: Manual store, Auto1 store, Auto2 store

VM-53 in internal memory, VM-53A in internal memory or memory card. Dedicated store areas in internal memory backed up for approx. 1.5 months by backup battery

Manual store

Vibration level (L_v) or vibration acceleration level (L_{va}) at store point and processing values (L_{veq} or L_{vaeq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95}) are saved at store point. When measurement mode is Max Hold, maximum hold level and processing values are saved.

VM-53

Store location	Number of store data
Internal memory	max. 100 sets of 3-axis data

VM-53A

Store location	Number of store data
Memory card	Multiple files, with up to 100 data sets per file (up to capacity of memory card)
Internal memory	max. 100 sets of 3-axis data

Auto1 store

VM-53

Continuous store of vibration level (L_v) or vibration acceleration level (L_{va}) instantaneous values, up to 86400 data

Store sampling 100 ms or 1 s, selectable

Start/end of Auto1 store can also be timer controlled.

Store location	Number of store data	
Internal memory	Single-axis measurement:	max. 86400
	3-axis (X/Y/Z) measurement:	max. 86400 (28800 × 3)

Approximate store time:

Single-axis measurement, store sampling 1 s: max. 24 h

3-axis measurement, store sampling 1 s: max. 8 h

VM-53A

Continuous store of vibration level (L_v) or vibration acceleration level (L_{va}) instantaneous values, up to 86400 data on memory card or in internal memory. Multiple files can be stored, with data for max. 199 h 59 m 59 s per file.

Store sampling 100 ms or 1 s, selectable

Start/end of Auto1 store can also be timer controlled.

Store location	Number of store data	
Memory card	Multiple files, with up to 199 h 59 m 59 s data per file (up to capacity of memory card)	
Internal memory	Single-axis measurement:	max. 86400
	3-axis (X/Y/Z) measurement:	max. 86400 (28800 × 3)

Approximate store time for internal memory

Max. 24 h for single-axis measurement, store sampling 1 s

Max. 8 h for 3-axis measurement, store sampling 1 s

Auto2 store

Continuous store of processing values (L_{veq} or L_{vaeq}, L_{max}, L_{min}, L_5, L_{10}, L_{50}, L_{90}, L_{95})
Start/end of Auto2 store can also be timer controlled.
Approximate store count
(with measurement time 500 s [5 s, 100 times] and measurement every 10 minutes)
Single-axis measurement: 4500 data sets corresponding to approx. 31.25 days
3-axis measurement: 1500 data sets corresponding to approx. 10.4 days

VM-53

Store location	Number of store data	
Internal memory	Single-axis measurement	max. 4500
	3-axis (X/Y/Z) measurement	max. 1500

VM-53A When storing on memory card, multiple files are possible.

Store location	Number of store data	
Memory card	Single-axis measurement	Multiple files, with up to 4500 data per file
	3-axis (X/Y/Z) measurement	Multiple files, with up to 4500 data per file
Internal memory	Single-axis measurement	max. 4500
	3-axis (X/Y/Z) measurement	max. 1500

Pause function

During instantaneous value measurement and processing measurement, pause/resume is possible
During Auto1 store (except timer measurement) pause functions as marker

Comparator function — Vibration level or vibration acceleration level based comparator. Output activated when setting level (30 to 120 dB, 1-dB steps) is exceeded.

Supported channels

Single-axis channel selected for main display

Comparator output

Interface connector

Open-collector output

Max. applied voltage

24 V

Max. drive current — 50 mA DC (applied voltage 24 V)
25 mA DC (applied voltage 12 V)
10 mA DC (applied voltage 5 V)

Comparator settings

Delay time	0 to 9 s in 1-s steps
Auto reset	ON/OFF selectable
Auto reset time	0 to 90 s in 1-second steps

Clock functions — Time stamping of store data, timer controlled processing measurement (Auto1 and Auto2) with start time/end time setting

Calibration output signal

Built-in oscillator (31.5 Hz, sinusoidal wave) for calibration of external equipment

AC/DC output — BNC output, 3 separate channels

AC or DC selected by menu

Output impedance:

600 Ω

Load impedance: 10 kΩ or higher

AC output: 1 Vrms (full-scale)

DC output: 2.5 V (full-scale, 0.25 V/10 dB)

Printer output — Instantaneous values every 5 seconds during processing (except during store), processing results, recall data, sub display screen contents during pause

Interfaces	Serial interface
Connector:	D-sub 9-pin male
Baud rate:	4800 bps, 9600 bps, 19200 bps
Transfer principle:	asynchronous, full-duplex
Data word length:	8 bit
Stop bits:	1 bit
Parity check:	none
Flow control:	X parameter Allows external parameter setting control and output of data to a computer
Displays	Segment type × 1 and 128 × 64 dot matrix type × 1 With backlight
Display modes	Segment type Single-axis instantaneous value (1-second update cycle) and bar graph (100 ms update cycle) always shown Dot matrix type Mode and screen switching provides access to the following information Setting information display 3-axis measurement value display Level/time display Processing value display Recall data display Menu display
Switch type	Rubber contact push switches
Side panel	EXT DC (6V) connector, interface connector (D-sub 9-pin male)

Power supply: Optional AC adapter or IEC R14 (size "C") battery × 4

Suitable AC adapters:

NC-98 series (100 to 240 V AC) (CE-mark)

NC-34 (100 V AC)

Battery life: Approx. 35 hours (alkaline batteries LR14, at room temperature, 3-axis instantaneous value measurement, backlight OFF, communications OFF, AC output, VM-53A option OFF)

Approx. 12 hours (manganese batteries R14P, at room temperature, 3-axis instantaneous value measurement, backlight OFF, communications OFF, AC output, VM-53A option OFF)

Approx. 100 hours (optional battery pack BP-21 with four alkaline batteries LR20 is used together with four alkaline batteries LR14 held in the unit, at room temperature, continuous operation, 3-axis instantaneous value measurement, backlight OFF, communications OFF, AC output, VM-53A option OFF)

Current consumption

Approx. 120 mA (at 6 V DC)

Approx. 5.5 VA (NC-98 series, at 100 V AC)

Approx. 3.5 VA (NC-34, at 100 V AC)

Ambient conditions: Main unit: -10 to +50ºC, max. 90% RH (no condensation)

Accelerometer: -10 to +50ºC (no condensation)

Dimensions and Weight

Main unit

Approx. 56 (H) × 203 (W) × 175 (D) mm

Approx. 1 kg (including batteries)

Accelerometer

Approx. 67 (ϕ) × 41 (H) mm (excluding connection cable)

Approx. 335 g

Accelerometer 3-axis accelerometer PV-83C

Reference sensitivity: 60 mV/(m/s^2)

Ambient conditions: -10 to +50ºC (no condensation)

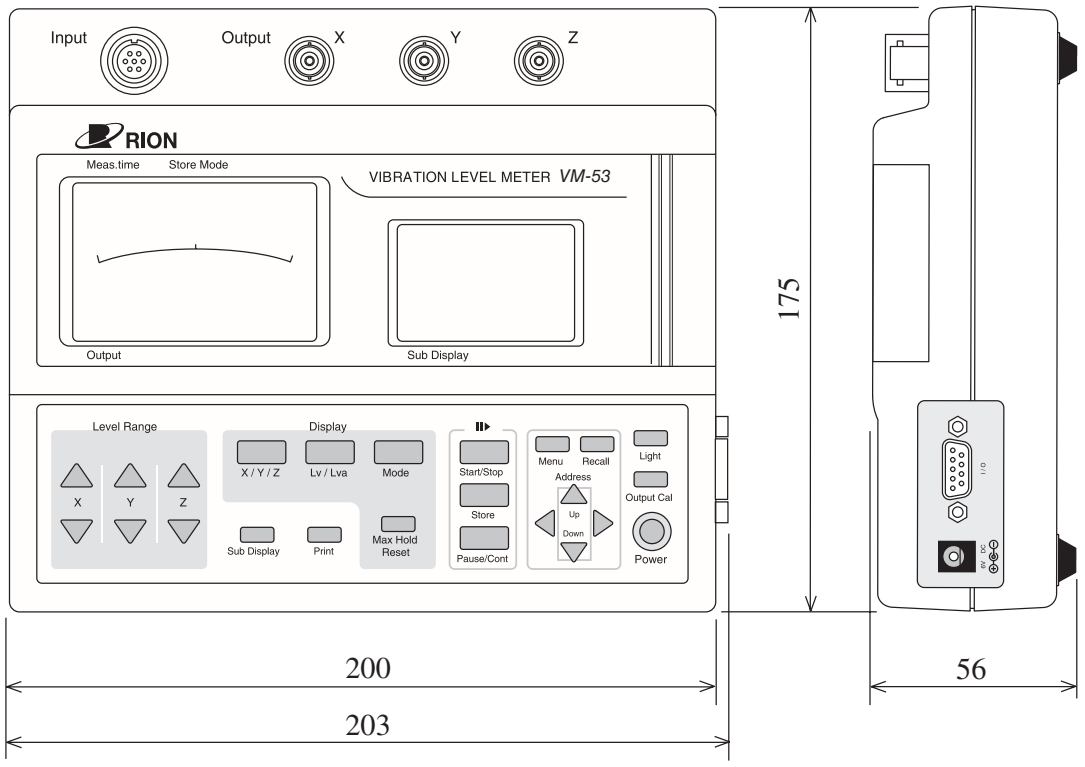
Waterproofing specifications: JIS C 0920, class7 (sealed)

Supplied accessories

Extension cable EC-02S (3 m)	1
IEC R14 (size "C") battery	4
I/O connector cover	1
BNC connector cover	3
Instruction manual	1
Simple operation guide	1
Inspection certificate	1
Carrying case	1
CompactFlash card (VM-53A only)	1

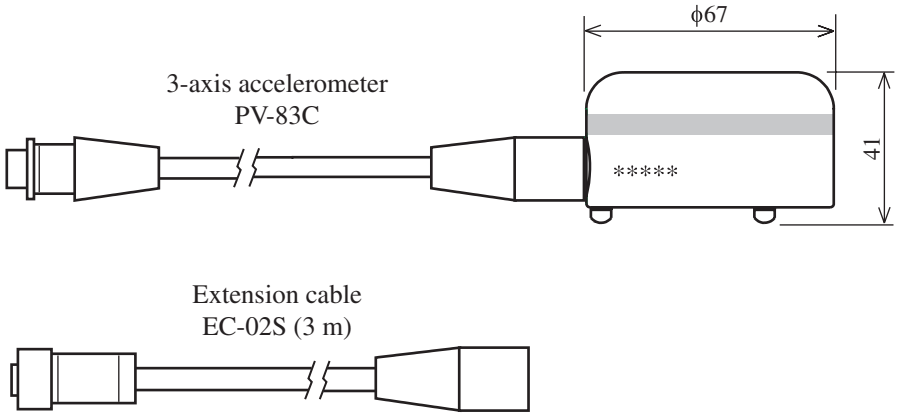
Optional accessories

AC adapter	NC-98 series (100 to 240 V AC) (CE-mark) NC-34 (100 V AC)
Extension cables	EC-02S series
VM-53 management software	VM-53PA1 (Windows) Japanese version
Level recorder	LR-07, LR20A
Printer	DPU-414
Battery pack	BP-21
VM-53A analysis card	VX-53RT (for 1/1 octave and 1/3 octave band analysis)



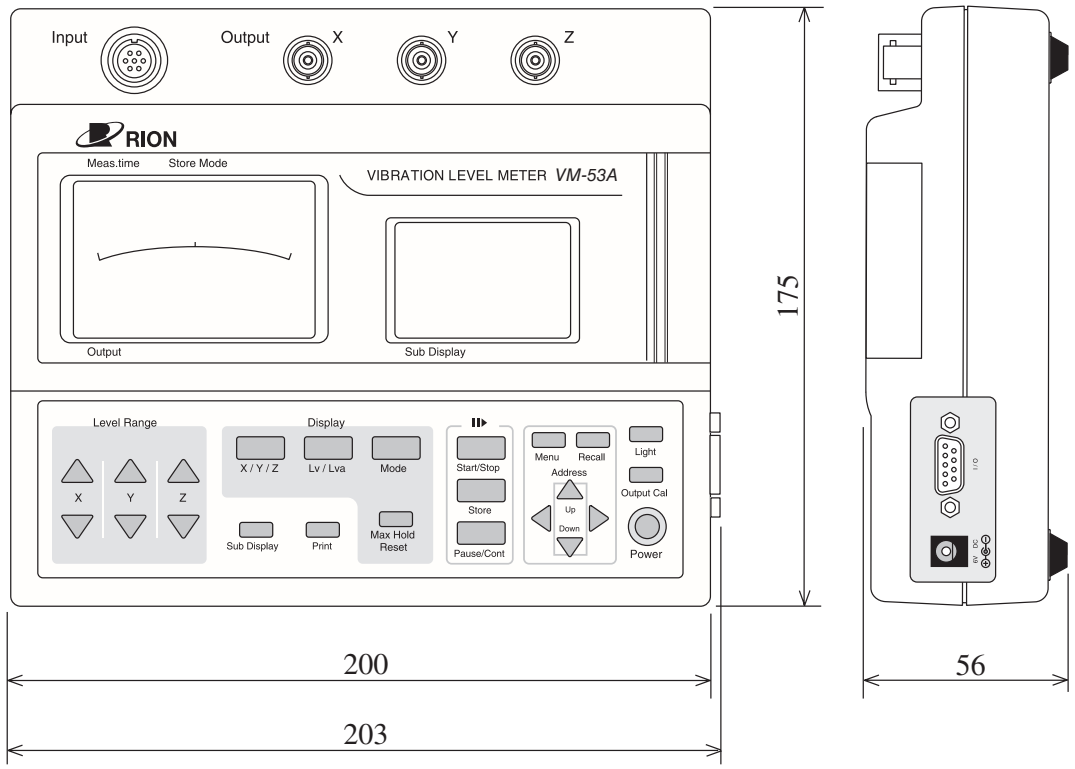
Unit: mm

Dimensional drawing of Vibration Level Meter VM-53



Unit: mm

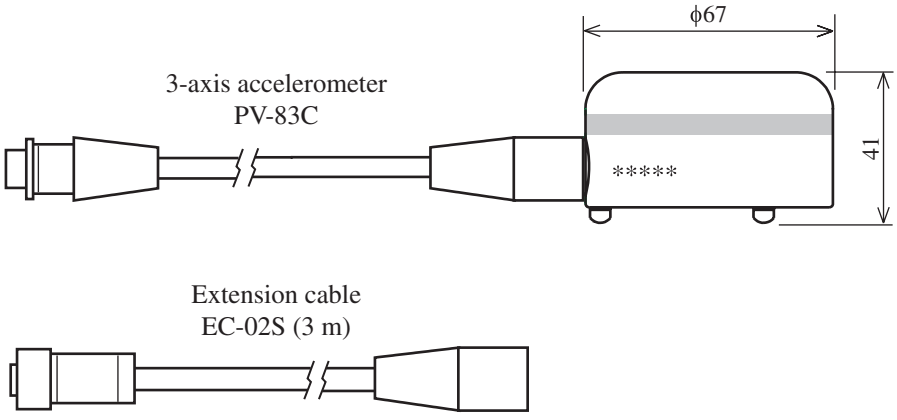
Dimensional drawing of 3-axis accelerometer PV-83C



Top view Side view

Unit: mm

Dimensional drawing of Vibration Level Meter VM-53A



Unit: mm

Dimensional drawing of 3-axis accelerometer PV-83C

No. 35621 09-05