INSTRUCTION MANUAL

1/3 Octave Real-time Analysis Program

VX-56RT
Organization of this manual

This manual describes functions and other operation principles of the 1/3 Octave Real-time Analysis Program VX-56RT.

The manual consists of the chapters listed below. You should also consult the documentation for the Tri-axial Groundborne Vibration Meter VM-56.

Outline
  Gives basic information on the functions of the VX-56RT.

Change the function to the VX-56RT
  Explains how to change to the function of the VX-56RT.

Reading the display
  Explains various items that appear on the display and menu screen.

Measurement
  Explains the basic procedures for measurement.

Store data format and file structure
  Explains the format of stored data and how the files are organized.

Card capacity and store time
  Explains the relationship between rated memory card capacity and store time.

Recall
  Explains screen and display settings of the recall data.

Default settings
  Lists the factory default settings of the VX-56RT.

Communication commands
  Explains additional commands that become available when the 1/3 octave real-time analysis program is loaded.
Reference information

Explains the 1/3 octave band filter characteristics and battery life etc.

Specifications

Lists the technical specifications of the VX-56RT.

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

<table>
<thead>
<tr>
<th>Important</th>
<th>Disregarding instructions printed here incurs the risk of program damage or data loss.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note</td>
<td>Denotes special information that is helpful in utilizing the capabilities of the program but that is not directly related to safety.</td>
</tr>
</tbody>
</table>
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Outline

This program card contains software that adds 1/3 octave band real-time analysis capability to the Tri-axial Groundborne Vibration Meter VM-56. Measurement data are displayed as graphs. Data are stored in CSV format, which allows processing on a computer, using general application software. A measurement data processing macro can be downloaded from the RION website. This makes it easy to import auto store data and display them in graph format. With regard to vibration acceleration level and frequency-weighted bands, 1/3 octave band analysis can be carried out for the following items. It is also possible to specify user weighting values for each band separately.

- Time-weighted instantaneous value Inst
- Time-averaged value Calc
- Time-weighted maximum value Calc Max

With the Auto Store, Timer Auto and Standard “General” settings, user-weighting can be applied to the effective instantaneous acceleration values for individual band data collected at 1/3 octave intervals, to measure the OA tri-axial synthesis “aw,i” value.

- Tri-axial synthesis value aw,i

For display on the main unit, the maximum value (aw) of “aw,i” during the overall measurement time is shown as the “Law” value, which is level-converted using the reference acceleration of 10^-6 m/s^2.

For details on the VM-56 including information on how to use the operation keys, please refer to the Instruction Manual of the VM-56. Analysis of recorded information on the VM-56 is not possible.

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use SD memory cards provided by Rion. The performance of other cards is not guaranteed.</td>
</tr>
</tbody>
</table>
Change the function to the VX-56RT

VX-56RT installation

Follow the procedure described in the separate “Optional program installation / uninstallation” to install the VX-56RT program in the VM-56 unit.

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never format the optional program card with SD memory card formatting software (such as SD Formatter, etc.). Otherwise the program data on the card will be erased and the respective functions can no longer be used. Restoration of the erased program is not warranted.</td>
</tr>
</tbody>
</table>

Upgrade the firmware of the VM-56 to the latest version before installing the optional program. The latest version firmware can be downloaded from “Software downloads” of Support Room on our web site (http://www.rian.co.jp/english/).

Switching to the VX-56RT function

On the menu list screen of the VM-56, select [Option] and press the MENU/ENTER key.

The option screen appears. Use the $\Delta/\n$ keys to move to the [VX-56RT 1/3 Octave Real-time Analysis Program] and press the MENU/ENTER key. When the message “Please wait” disappears, the function switching procedure is completed, and the unit shows the VX-56RT measurement screen.
Reading the display

Measurement screen

The measurement screen provides linear or decibel based indication. You can switch between the two display types using the [Display / I/O] screen accessed from the menu list screen. Measurement data are stored as linear values.

Graph (1 channel display and 3 channels display)
Law display

Note

“Law” is not shown when the measurement mode is SBR or when the store mode is “Manual”.

Analysis mode
Indicates the condition of the display screen. “1/3 OCT” indicates 1/3 octave band analysis.

Setting of output, etc
The selected output signal on the [Output▼] of the [Display / I/O] screen is shown here (see page 6).

Cursor
Selects frequency band in the currently displayed graph. Use the < / > keys to move the cursor in the following order:
[AP] ↔ [AP(W)] ↔ [1Hz] ↔ [1.25Hz] ↔ ... ↔ [315Hz] ↔ [AP] ↔ ... 

Frequency band level bars
Show the level value in each frequency band as a bar graph. For 1/3 octave analysis, 26 bands from 1 Hz to 315 Hz are shown.

Frequency indication
Indicators for 1 Hz and 315 Hz are shown here on a horizontal axis, as a guide to the frequencies of the level bar graph display. (There are 26 bands.)
AP level bar
The level of the AP is shown by this blue bar.

AP(W) level bar
The level of the AP(W) is shown by this green bar.

Level range
Indicators for lower to upper limit are shown here on a vertical axis, as a guide to the level graph display. The range can be changed using the LEVEL RANGE key on the control section.
The following two settings are available: [1], [10] (m/s²).
The following two settings are available: [0.0001 to 1], [0.001 to 10]

Calculation type of measured quantity
Shows the calculation type of measured quantity selected with the cursor (see page 14).

Center frequency
Shows the center frequency of the frequency band selected with the cursor.

Measurement in progress symbol
Flashes during measurement.

Level indicator
Shows the each frequency band level selected by the cursor. The display content differs depending on the channel display. During single channel display, the AP(W) bar graph level, AP bar graph level, and the calculation type selected with the frequency band measurement setting are shown. During 3-channel display, the level of each frequency band currently selected by the cursor for the 3 axes (XYZ) is shown.

Channel
Shows the selected channel.
Menu list screen

When the measurement screen is displayed, pressing the MENU/ENTER key brings up the menu list screen as shown below. Use the \( \Delta / \nabla \langle \rangle \rangle \) keys to select the desired menu and press the MENU/ENTER key. Pressing the PAUSE/CONT key or the START/STOP key switches back to the measurement screen.

Explanation of menu screen items

This section explains items on the various menu screens that are related to the VX-56RT function. For information on other items, please refer to the Instruction Manual of the VM-56.

Display / I/O

This screen sets the measurement calculation and other items displayed on the measurement screen. (See page 14)

Note

The vertical axis of the graph is always a linear unit, and dB is not reflected.
AC Output

This screen sets the type of output signal etc.
Selecting [AC Output] and pressing the MENU/ENTER key. The AC Output setting screen appears.

Note
The VM-56 has a measurement value comparator signal output function, but there is no comparator output function for VX-56RT measurement values.

AC Output
Select [Output] and press the MENU/ENTER key. The AC Output setting screen appears.
Use the △/▽ keys to select [ON] or [OFF] and press the MENU/ENTER key.
Frequency

Displays the screen to select the type of frequency weighting characteristic of the signal output from the AC Output connector of the unit. This item is shown when [AC Output] was set to [ON].

Select [Freq] and press the MENU/ENTER key. The frequency weighting characteristic setting screen appears.

Use the △/▽ keys to select the [Inter lock], [Non-Weighting] or [Band] setting and press the MENU/ENTER key.

If [Inter lock] was selected, the characteristics or band selected with the cursor on the measurement screen graph display will be output.

When [Band] is selected, the signal for the frequency band selected under [Band of output] is output.
Band of output

This setting is shown when [Band] is selected for the [Freq]. Selects the frequency band for which a corresponding signal is output at the output connector of the unit.

Select [Band of output] and press the MENU/ENTER key. The frequency band selection screen appears. Use the $\Delta/\nabla$ keys to select the frequency band and press the MENU/ENTER key.

The available settings are as follows: [1Hz], [1.25Hz], [1.6Hz], [2Hz], [2.5Hz], [3.15Hz], [4Hz], [5Hz], [6.3Hz], [8Hz], [10Hz], [12.5Hz], [16Hz], [20Hz], [25Hz], [31.5Hz], [40Hz], [50Hz], [63Hz], [80Hz], [100Hz], [125Hz], [160Hz], [200Hz], [250Hz], [315Hz].
Measure

Displays the screen to select the frequency weighting and time weighting for a frequency band.
Band frequency weighting characteristics

Sets the frequency weighting characteristics for a specific band.

Non-Weighting
The band limit filter as set by “Freq. Weighting for Acc” applies.
If the “Freq. Weighting for Acc” setting is “Non-Weighting”, the value will be the same as the AP and AP(W) value.

Weighting
The weighting characteristic as set by “Freq. Weighting for Acc” applies.

User Weighting
Selecting “User Weighting” brings up the “User Weighting (Band Only)” dialog box. Press the MENU/ENTER key to move to the setting screen.
Weighting values from +3.00 dB to -70.00 dB can be set freely for each of the 26 bands for the X, Y, Z axes.
Band time weighting characteristics

1 s (Slow) or 0.125 s (Fast) can be selected.

The time weighting setting is reflected in the Inst and Calc Max values, but not in the AP, AP(W), and Calc values.

Note

When user weighting is specified, the lower limit of the band limit filter is fixed to 0.5 Hz and the upper limit is sensor-dependent. The BAND output from AC OUT does not reflect the user weighting setting.
Measurement procedure

1. Press the POWER key to turn the unit on.
   After the power-on screen has been shown, the measurement screen appears.
   The measurement parameter settings that were active before the unit was turned off will show on the screen. Therefore the actual display may not always be the same.

2. To display the values as decibels, set the “dB display” item in the [Display / I/O] menu list screen to ON.

3. Set the required items under “Measure” in the menu list screen.

4. Using the [Store] item in the menu list screen, select the store mode and the measurement parameters.

5. Return to the measurement screen and press the START/STOP key to start the measurement.
   While the measurement is in progress, the symbol flashes and the elapsed time is displayed. In addition, the indicator LED flashes red.
   When the measurement time has elapsed, the measurement is terminated automatically.
   To terminate the measurement before the allocated time, press the START/STOP key.
During measurement, the PAUSE/CONT key can be used to pause and resume the measurement (only manual store mode). During pause, the pause symbol (II) is shown and the indicator LED flashes blue.

- Pressing the DISPLAY key during or after measurement switches the measured quantity shown on the display screen in the following order.


- While the graph display screen is shown during or after measurement, the < / > keys can be used to move the cursor that selects the center frequency to display. The frequency band under the cursor and its numeric value reading are shown at the lower left part of the screen. The center frequencies for the band level bar graphs are as follows.

  1 Hz, 1.25 Hz, 1.6 Hz, ..., 315 Hz

- While no measurement is in progress, pressing the PAUSE/CONT key will pause the vibration level displayed at that point. Press the PAUSE/CONT key again to cancel the display pause.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>After installation is complete, the SD memory card from which the VX-56RT program was installed can be used as a memory card for storing data.</td>
</tr>
<tr>
<td>Before using an SD card to store measurement data, it is recommended to first format it in a computer.</td>
</tr>
<tr>
<td>When the store mode is “Auto” and “Timer Auto” is selected, the measurement cannot be started if no SD card is inserted.</td>
</tr>
<tr>
<td>“Law” is used for display only and not stored as data. “aw,i” is stored as data. If the measurement mode is SBR or the store mode is Manual, “aw,i” is not stored and “Law” is not displayed on the screen.</td>
</tr>
<tr>
<td>The MAX HOLD key is not used in the VM - 56RT</td>
</tr>
</tbody>
</table>
Data stored on the SD memory card are in CSV format (.rnd). Various files and subfolders are created on the card. Folder and file names that are used for saving data differ, depending on the selected store mode.

**Store destination folder**

Files are saved in the store folder specified by store name. The store name specified on the menu screen is created as a 4-digit number under the sub-folder name. When a file with the same name exists in the same folder, it will always be overwritten.

**File name of recording data**

Recording files are named as shown below.

```
VM_001_OCT_MANU_0610_0000.rnd
```

<table>
<thead>
<tr>
<th>Index number</th>
<th>Store name</th>
<th>Partitioned file number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store mode:</td>
<td>The file name varies depending on the store mode.</td>
<td></td>
</tr>
<tr>
<td>Manual store:</td>
<td>MANU</td>
<td></td>
</tr>
<tr>
<td>Auto store:</td>
<td>Calc , Inst</td>
<td></td>
</tr>
<tr>
<td>Store name:</td>
<td>0000 to 9999</td>
<td></td>
</tr>
<tr>
<td>Partitioned file number:</td>
<td>Manual store is fixed to 0000</td>
<td></td>
</tr>
</tbody>
</table>

---

**Note**

The performance about the file after the 10,000th will not be guaranteed.

When a file with the same name exists in the same directory, it will always be overwritten.
A sample configuration is shown below.

```
VX-56RT
  │ Manual_0000
  │   │ VM_001_OCT_MANU_0000_0000.rnd
  │   │ WAVE
  │   │   │ VM_001_20150629_160041_0000_0001_ST0001.wave
  │  Auto_0000
  │     │ Auto_Inst
  │     │   │ VM_001_OCT_Inst_0000_0001.rnd
  │     │ Auto_Calc
  │     │   │ VM_001_OCT_Calc_0000_0001.rnd
  │     │ WAVE
  │     │   │ VM_001_20150629_154820_0000_0000_ST0001.wav
  │     │ Auto_0000.rnh
```

**Important**

Use SD memory cards provided by Rion. The performance of other cards is not guaranteed.

Note that we assume no responsibility for any damage or loss of stored measurement data. Data recommends to get a backup.
### Manual store file example

<table>
<thead>
<tr>
<th>Store mode, Address</th>
<th>Manual Store Address, 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement start time</td>
<td>Start Time, 2018/09/11 08:31:39</td>
</tr>
<tr>
<td>Measurement time</td>
<td>Measurement Time, 00:01:00.0</td>
</tr>
</tbody>
</table>

#### VM Mode Processed value

- **VM Mode Processed value heading (XYZ):**
  - **VM Mode Processed value:**
    - **BAND CALC:**
      - **BAND CALC MAX:**
        - **Minimum value:**
          - **Tri-axial composite value of the band OA:**
            - **Easy:**
              - **Underload (X):**
                - **X_Under, UN:**
              - **Overload (Y):**
                - **Y_Over,--:**
              - **Underload (Y):**
                - **Y_Under, UN:**
              - **Overload (Z):**
                - **Z_Over,--:**
              - **Underload (Z):**
                - **Z_Under, UN:**

#### Pause in measurement

- **Pause, -----**

#### Mode of analysis

- **Time Setting, 00:01:00.0**

#### Type of frequency weighting

- **Band Weighting (Freq., AP)**

#### Measurement time setting

- **Band Weighting (Time, S)**

#### Each frequency band heading of user weight

- **User weight value (X):**
  - **User weight value (Y):**
  - **User weight value (Z):**

#### Level range upper

- **Level range upper (X):**
  - **Level range upper (Y):**
  - **Level range upper (Z):**

#### Measurement standard

- **Standard, General**

#### Freq. range for Vel. And Disp. (building Damage) Lower limit (XYZ)

- **Freq. range for Vel. And Disp. (Building Damage) Lower limit, 1Hz**

#### Freq. range for Vel. And Disp. (building Damage) Upper limit (XYZ)

- **Freq. range for Vel. And Disp. (Building Damage) Upper limit, 100Hz**

#### Freq. range for Vel. (Human Exposure) Lower limit (XYZ)

- **Freq. range for Vel. (Human Exposure) Lower limit, 1Hz**

#### Freq. range for Vel. (Human Exposure) Upper limit (XYZ)

- **Freq. range for Vel. (Human Exposure) Upper limit, 80Hz**

#### Freq. Weighting for Acc. (X)

- **Freq. Weighting for Acc. (Y)**
  - **Freq. Weighting for Acc. (Z)**

#### Freq. Range for Acc. Lower limit (XYZ)

- **Freq. Range for Acc. Lower limit, 1Hz**

#### Freq. Range for Acc. Upper limit (XYZ)

- **Freq. Range for Acc. Upper limit, 80Hz**

#### Delay time

- **Delay Time, Off**

#### Display channel setting

- **Display Channel Setting, XYZ**
### Auto store (Inst) file example

**Address, Start Time, X_AP, X_APW, X_1 Hz, X_1.25 Hz, X_1.6 Hz, X_2 Hz, X_2.5 Hz, X_3.15 Hz, X_4 Hz, X_5 Hz, X_Over, X_Under, Y_AP, Y_APW, Y_1 Hz, Y_1.25 Hz, Y_315 Hz, Y_Over, Y_Under, Z_AP, Z_APW, Z_1 Hz, Z_1.25 Hz, Z_1.6 Hz, Z_2 Hz, Z_2.5 Hz, Z_315 Hz, Z_Over, Z_Under**

<table>
<thead>
<tr>
<th>Address, Start Time, X_AP, X_APW, X_1 Hz, X_1.25 Hz, X_1.6 Hz, X_2 Hz, X_2.5 Hz, X_3.15 Hz, X_4 Hz, X_5 Hz, X_Over, X_Under, Y_AP, Y_APW, Y_1 Hz, Y_1.25 Hz, Y_315 Hz, Y_Over, Y_Under, Z_AP, Z_APW, Z_1 Hz, Z_1.25 Hz, Z_1.6 Hz, Z_2 Hz, Z_2.5 Hz, Z_315 Hz, Z_Over, Z_Under</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018/09/10 19:48:21.4, 0.00036, 0.00011, 0.00003, 0.00007, 0.00002, 0.00003, 0.00000</td>
</tr>
<tr>
<td>2018/09/10 19:48:21.5, 0.00056, 0.00019, 0.00003, 0.00007, 0.00003, 0.00003, 0.00000</td>
</tr>
<tr>
<td>2018/09/10 19:48:21.6, 0.00041, 0.00016, 0.00003, 0.00007, 0.00003, 0.00003, 0.00004</td>
</tr>
</tbody>
</table>

### Auto store (Calc) file example

**File format**

- CSV

**Address**

- Address, 1

**Measurement start time**

- Start Time, 2018/09/10 19:48:21

**Measurement time**

- Measurement Time, 00d 00:00:01.0

**VM Mode Processed value hearing (XYZ)**

- X_PPV, X_DF, X_Disp, X_Acc, X_CF, X_VDV, X_MTVV, X_KBFT, X_veff, X_max, 30°, X_Over, X_Under, Z_Over, Z_Under, P.V.S.,

**VM Mode Processed value**

- X_PPV, X_DF, X_Disp, X_Acc, X_CF, X_VDV, X_MTVV, X_KBFT, X_veff, X_max, 30°, X_Over, X_Under, Z_Over, Z_Under, P.V.S.,

**Processed value, each frequency band level heading (XYZ)**

- X_AP, X_APW, X_1 Hz, X_1.25 Hz, X_1.6 Hz, X_2 Hz, X_2.5 Hz, X_3.15 Hz, X_4 Hz, X_5 Hz, X_Over, X_Under, Y_AP, Y_APW, Y_1 Hz, Y_1.25 Hz, Y_315 Hz, Y_Over, Y_Under, Z_AP, Z_APW, Z_1 Hz, Z_1.25 Hz, Z_1.6 Hz, Z_2 Hz, Z_2.5 Hz, Z_315 Hz

**Average value**

- AVE, --, --

**Maximum value**

- MAX, --, --

**Tri-axial composite value of the band OA**

- aw, --, --

**Overload (X)**

- X_Over,--

**Underload (X)**

- X_Under,--

**Overload (Y)**

- Y_Over,--

**Underload (Y)**

- Y_Under,--

**Overload (Z)**

- Z_Over,--

**Underload (Z)**

- Z_Under,--
Card capacity and store time

The measurement duration for which data can be stored on an SD memory card depends on the capacity of the inserted card. Approximate times are listed below.

Using auto store

1/3 Octave band analysis

Only Inst store interval set

<table>
<thead>
<tr>
<th>SD memory card capacity</th>
<th>512 MB</th>
<th>2 GB</th>
<th>32 GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inst store interval 100 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store time</td>
<td>Approx. 15 hours</td>
<td>Approx. 60 hours</td>
<td>Approx. 960 hours</td>
</tr>
</tbody>
</table>

Only Calc store interval set

<table>
<thead>
<tr>
<th>SD memory card capacity</th>
<th>512 MB</th>
<th>2 GB</th>
<th>32 GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calc store Interval 30 s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store time</td>
<td>Approx. 600 sets</td>
<td>Approx. 2,400 sets</td>
<td>Approx. 38,400 sets</td>
</tr>
</tbody>
</table>

Number of bytes per header file

About 1 KB per file.
When performing waveform recording (when the VX-56WR is installed)

Using auto store, Inst. store interval 100 ms

<table>
<thead>
<tr>
<th>Bit length</th>
<th>SD memory card capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>512 MB</td>
</tr>
<tr>
<td>16 bit</td>
<td>Approx. 5 hours</td>
</tr>
<tr>
<td>24 bit</td>
<td>Approx. 4 hours</td>
</tr>
</tbody>
</table>

The duration of recording with 24 bit becomes shorter than that with 16 bit because the data volume of 24 bit is about 1.5 times more.
Recall

Use the Recall item in the menu list screen to check saved measurement data (see the VM-56 Instruction Manual).

Menu list screen
The factory default settings of the unit are listed below.

**Displayed channel** .................................................... Z axis
**Range** ....................................................................... 0.001 m/s² to 10 m/s²

**[System]**
- **Backlight Auto Off** .................................................. 30 s
- **Backlight brightness**................................................. 2
- **LCD Auto off at Auto Store** ..................................... OFF
- **Battery Type** ............................................................ Alkaline
- **Index** ........................................................................ 1
- **Eco Setting** .............................................................. OFF

**[Store]**
- **Store mode**............................................................... Manual
- **Store name**............................................................... 0000
- **Measurement Time** .................................................. 10 min

**[Display / I/O]**
- **Time-Level graph Time Scale** ................................. 20 s
- **AC Output**............................................................... Acc. Inter lock
- **Comparator** .............................................................. OFF
- **Communication Interface** ......................................... OFF
- **dB display** ............................................................... ON

**[Measure]**
- **Band Weighting (Freq.)** ............................................ Non-Weighting
- **User Weighting (Band Only)(When Band Weighting(Freq.) is User Weighting)** ................................. 0.00 dB
- **Band Weighting (Time)** ............................................ 1 s
- **Freq. Weighting for Acc** .......................................... Wm
- **Freq. Range for Vel. and Disp. (Building Damage)** ............................................................... 1 Hz to 100 Hz
- **Freq. Range for Vel. (Human Exposure)** .................. 1 Hz to 80 Hz
- **Dominant Frequency Line** ........................................ No Line
- **Delay Time** .............................................................. OFF
- **Standard** ................................................................. General

**[WR] (When installing VX-56WR)**
- **Wave Rec Mode** .......................................................... OFF

When you turn power to the unit on while holding down the START/STOP key, the unit will be initialized to the above settings. When wishing to set the unit to the factory default values, select [menu list] ➔ [System – Read/Save Setup File] ➔ [Load Default Settings] and then press the MENU/ENTER key (please refer to the chapter “Setup Files” of the VM-56 instruction manual). The time, language and store data are not initialized.
This section lists commands that are added to the Tri-axial Groundborne Vibration Meter VM-56 when the 1/3 octave real-time analysis program function is installed. For information on other commands, please refer to the instruction manual of the VM-56.

### List of commands

S: Setting command (for making VX-56RT settings)
R: Request command (for obtaining information on VX-56RT status and the measurement results)

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>See page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Band</td>
<td>Output band characteristic (S/R) ....25</td>
<td></td>
</tr>
<tr>
<td>Output Band Frequency</td>
<td>Output band frequency (S/R) ............25</td>
<td></td>
</tr>
<tr>
<td>Output Band Offset</td>
<td>Output band frequency offset (S/R) ..26</td>
<td></td>
</tr>
<tr>
<td>DOD</td>
<td>Output displayed value (R) ............27</td>
<td></td>
</tr>
<tr>
<td>DOD Calc</td>
<td>Output calcration value (R) ............29</td>
<td></td>
</tr>
</tbody>
</table>
Command description

Output Band

Output frequency characteristic

Setting output frequency characteristic

Setting command: Output Band, p1

Parameter: p1 = “not-weighted”
(In the case of VEL: Building Damage)

p1 = “Interlock”
(In the case of VEL: Human Exposure)

p1 = “Band”
(only RT mode)

Request command: Output Band?
Response data: d1
Returned value: Same as for setting command

Output Band Frequency

Output band frequency

Setting frequency band for BAND output of AC signal

Setting command: Output Band Frequency, p1

Parameter:
- p1 = “1Hz”
- p1 = “2Hz”
- p1 = “4Hz”
- p1 = “8Hz”
- p1 = “16Hz”
- p1 = “31Hz”
- p1 = “63Hz”
- p1 = “125Hz”
- p1 = “250Hz”

Request command: Output Band Frequency?
Response data: d1
Returned value: Same as for setting command
Output Band Offset

Output band frequency offset

Setting output band offset
Divides the frequency of the output band into three values

Example: When the output band is set to “16Hz”, “Low” will be 12.5 Hz, “Center” 16 Hz, and “High” 20 Hz.

<table>
<thead>
<tr>
<th>Setting command</th>
<th>Output Band Offset, p1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>p1= “Low”</td>
</tr>
<tr>
<td></td>
<td>p1= “Center”</td>
</tr>
<tr>
<td></td>
<td>p1= “High”</td>
</tr>
<tr>
<td>Request command</td>
<td>Output Band Offset?</td>
</tr>
<tr>
<td>Response data</td>
<td>d1</td>
</tr>
<tr>
<td>Returned value</td>
<td>Same as for setting command</td>
</tr>
</tbody>
</table>
## DOD

### Output displayed value

**Getting displayed value**

Send the request command at one second interval or longer.

<table>
<thead>
<tr>
<th>Request command</th>
<th>DOD?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response data</td>
<td>d1, d2, ..., d320</td>
</tr>
<tr>
<td>Returned value</td>
<td>d1 = “xxx.x” Acc. of X channel (Inst value)</td>
</tr>
<tr>
<td></td>
<td>d2 = “xxx.x” P.P.V. of X channel (Inst value)</td>
</tr>
<tr>
<td></td>
<td>d3 = “xxx.x” D.F. of X channel (Inst value)</td>
</tr>
<tr>
<td></td>
<td>d4 = “xxx.x” Disp. of X channel (Inst value)</td>
</tr>
<tr>
<td></td>
<td>d5= 0 or 1 Inst Overload information (1: Yes, 0: No)</td>
</tr>
<tr>
<td></td>
<td>d6= 0 or 1 Inst Under-range information (1: Yes, 0: No)</td>
</tr>
<tr>
<td></td>
<td>d7 = “xxx.x” Acc. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d8 = “xxx.x” P.P.V. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d9 = “xxx.x” D.F. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d10 = “xxx.x” Disp. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d11= 0 or 1 Max hold Overload information (1: Yes, 0: No)</td>
</tr>
<tr>
<td></td>
<td>d12= 0 or 1 Max hold Under-range information (1: Yes, 0: No)</td>
</tr>
<tr>
<td></td>
<td>d13 = “xxx.x” P.P.V. of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d14 = “xxx.x” D.F. of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d15 = “xxx.x” Disp. of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d16 = “xxx.x” Acc. of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d17 = “xxx.x” C.F. of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d18 = “xxx.x” MTVV of X channel (Calc value)</td>
</tr>
<tr>
<td></td>
<td>d19 = “xxx.x” VDV of X channel (Calc value)</td>
</tr>
</tbody>
</table>
Communication commands

\[ d_{20} = \text{"xxx.x"} \quad \text{KBFT or veff,max,30 of X channel (Calc value)} \]
(General Mode:KBFT value , SBR Mode: veff,max,30 value)

\[ d_{21} = 0 \text{ or } 1 \quad \text{Calc Overload information} \]
(1: Yes, 0: No)

\[ d_{22} = 0 \text{ or } 1 \quad \text{Calc Under-range information} \]
(1: Yes, 0: No)

\[ d_{23} \text{ to } d_{44} : \quad \text{Y channel information} \]
(Same format as X channel)

\[ d_{45} \text{ to } d_{66} : \quad \text{Z channel information} \]
(Same format as X channel)

\[ d_{67} = \text{"xxx.x"} \quad \text{P.V.S.} \]
(Tri axial combine value for P.P.V.)

\[ d_{68} = \text{"xxx.x"} \quad \text{AP of X channel (Inst value)} \]
\[ d_{69} = \text{"xxx.x"} \quad \text{AP of X channel (Calc value)} \]
\[ d_{70} = \text{"xxx.x"} \quad \text{AP of X channel (Max value)} \]
\[ d_{71} = \text{"xxx.x"} \quad \text{AP(W) of X channel (Inst value)} \]
\[ d_{72} = \text{"xxx.x"} \quad \text{AP(W) of X channel (Calc value)} \]
\[ d_{73} = \text{"xxx.x"} \quad \text{AP(W) of X channel (Max value)} \]
\[ d_{74} = \text{"xxx.x"} \quad \text{1 Hz of X channel (Inst value)} \]
\[ d_{75} = \text{"xxx.x"} \quad \text{1.25 Hz of X channel (Inst value)} \]

\[ \text{•} \]

\[ d_{99} = \text{"xxx.x"} \quad \text{315 Hz of X channel (Inst value)} \]
\[ d_{100} = \text{"xxx.x"} \quad \text{1 Hz of X channel (Calc value)} \]
\[ d_{101} = \text{"xxx.x"} \quad \text{1.25 Hz of X channel (Calc value)} \]

\[ \text{•} \]

\[ d_{125} = \text{"xxx.x"} \quad \text{315 Hz of X channel (Calc value)} \]
\[ d_{126} = \text{"xxx.x"} \quad \text{1 Hz of X channel (Max value)} \]
\[ d_{127} = \text{"xxx.x"} \quad \text{1.25 Hz of X channel (Max value)} \]
Communication commands

- d151= “xxx.x” 315 Hz of X channel (Max value)
- d152 to d235 : Y channel information (Band)
- d236 to d319: Z channel information (Band)
- d320= “xxx.x” aw,i

* “xxx.x” is fixed at 5 digit length. Higher digits are padded with spaces as required.

There is no setting command.

DOD Calc

Output calculation value
Send the request command at one second interval or longer.

<table>
<thead>
<tr>
<th>Request command</th>
<th>DOD Calc?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response data</td>
<td>d1, d2, ..., d320</td>
</tr>
<tr>
<td>Returned value</td>
<td>d1 = “xxx.x” Acc. of X channel (Inst value)</td>
</tr>
<tr>
<td></td>
<td>d2 = “xxx.x” P.P.V. of X channel (Inst value)</td>
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</tr>
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</tr>
<tr>
<td></td>
<td>d7 = “xxx.x” Acc. of X channel (Max hold value)</td>
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<td>d8 = “xxx.x” P.P.V. of X channel (Max hold value)</td>
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<td></td>
<td>d9 = “xxx.x” D.F. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d10 = “xxx.x” Disp. of X channel (Max hold value)</td>
</tr>
<tr>
<td></td>
<td>d11= 0 or 1 Max hold Overload information (1: Yes, 0: No)</td>
</tr>
</tbody>
</table>
Communication commands

\[ d_{12} = 0 \text{ or } 1 \]
Max hold Under-range information
(1: Yes, 0: No)

\[ d_{13} = \text{"xxx.x"} \]
P.P. of X channel (Calc value)

\[ d_{14} = \text{"xxx.x"} \]
D.F. of X channel (Calc value)

\[ d_{15} = \text{"xxx.x"} \]
Disp. of X channel (Calc value)

\[ d_{16} = \text{"xxx.x"} \]
Acc. of X channel (Calc value)

\[ d_{17} = \text{"xxx.x"} \]
C.F. of X channel (Calc value)

\[ d_{18} = \text{"xxx.x"} \]
MTVV of X channel (Calc value)

\[ d_{19} = \text{"xxx.x"} \]
VDV of X channel (Calc value)

\[ d_{20} = \text{"xxx.x"} \]
KBFT or veff,max,30 of X channel (Calc value)

(General Mode: KBFT value, SBR Mode: veff,max,30 value)

\[ d_{21} = 0 \text{ or } 1 \]
Calc Overload information
(1: Yes, 0: No)

\[ d_{22} = 0 \text{ or } 1 \]
Calc Under-range information
(1: Yes, 0: No)

\[ d_{23} \text{ to } d_{44} : \]
Y channel information
(Same format as X channel)

\[ d_{45} \text{ to } d_{66} : \]
Z channel information
(Same format as X channel)

\[ d_{67} = \text{"xxx.x"} \]
P.V.S.
(Tri axial combine value for P.P.V.)

\[ d_{68} = \text{"xxx.x"} \]
AP of X channel (Inst value)

\[ d_{69} = \text{"xxx.x"} \]
AP of X channel (Calc value)

\[ d_{70} = \text{"xxx.x"} \]
AP of X channel (Max value)

\[ d_{71} = \text{"xxx.x"} \]
AP(W) of X channel (Inst value)

\[ d_{72} = \text{"xxx.x"} \]
AP(W) of X channel (Calc value)

\[ d_{73} = \text{"xxx.x"} \]
AP(W) of X channel (Max value)

\[ d_{74} = \text{"xxx.x"} \]
1 Hz of X channel (Inst value)

\[ d_{75} = \text{"xxx.x"} \]
1.25 Hz of X channel (Inst value)

\[ \cdot \]

\[ d_{99} = \text{"xxx.x"} \]
315 Hz of X channel (Inst value)
d100 = “xxx.x” 1 Hz of X channel (Calc value)
d101 = “xxx.x” 1.25 Hz of X channel (Calc value)

•

•

d125 = “xxx.x” 315 Hz of X channel (Calc value)
d126 = “xxx.x” 1 Hz of X channel (Max value)
d127 = “xxx.x” 1.25 Hz of X channel (Max value)

•

•

d151 = “xxx.x” 315 Hz of X channel (Max value)
d152 to d235: Y channel information (Band)
d236 to d319: Z channel information (Band)
d320 = “xxx.x” aw,i
1/3 Octave band filter characteristics

The characteristics of the octave and 1/3 octave band filter in the VX-56RT correspond to the IEC 61260: 2014 class 1.

1/3 Octave band filter characteristics

The graph below shows the allowable attenuation tolerance according to IEC, and the actual characteristics of the octave band filter in the VX-56RT.

Frequency ratio $f/fc$ ($f$: Frequency, $fc$: Center frequency at 31.5 Hz)
Attenuation tolerance according to IEC 61260:2014 class 1 and 1/3 octave band filter characteristics of VX-56RT
Noise floor

Indicates the residual noise of the unit.
Band limit filter is 0.5 ~ sensor-dependent.
The result of using the octave band-pass filter for frequency analysis is shown below.

Freq. range for Acc.
Lower limit: 0.5 Upper limit: Sensor dependent
Range: 1
Battery life

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery life varies depending on the setting of this unit.</td>
</tr>
</tbody>
</table>

Examples of the battery life when measuring continuously 20 hours

Operating condition:
- The PV-83D is connected to the VX-56RT
- Eco setting is ON
- Inst store interval is OFF
- Calculation interval is 1 min
Specifications

Compatible model  Tri-axial Groundborne Vibration Meter VM-56
Applicable standards  IEC 61260-1: 2014 (0.5 Hz ~ Sensor dependent only)
                       CE marking
Media  SD memory card 512 MB
Measurement function
        Tri-axis simultaneous measurement supported
Frequency range  1 Hz to 315 Hz (26 bands)
Residual noise (AP value)
        Vibration acceleration 0.0001 m/s² or less Range 1
        (1 m/s² range, no weighting, measurement frequency range 1 Hz to 80 Hz)
Frequency correction  No weighting (Common band limit filter for ISO and DIN / SBR band limit filter)
        VM-56 (Vibration acceleration/velocity/displacement):
        No weighting, Wb, Wd, Wm characteristics
        VX-56RT (acceleration only): No weighting, Wb, Wd,
        Wm characteristics, user weighting (band limits fixed
to 0.5 Hz ~ sensor-dependent)
1/3 octave band analysis
        Time weighting Calc
        Maximum acceleration value Calc Max
        Band OA tri-axial synthesis value (linear value) aw,i
        aw,i maximum value hold Law
* “Law” is for display only, not stored as data
Measurement range  2 switchable ranges, separate for 3 axes:
        0.001 m/s² to 10 m/s²
        0.0001 m/s² to 1 m/s²
Specifications

RMS detection circuit
- Digital processing method
- Time constant 1 s, 125 ms
- Band time constant can be selected from menu
- Time constant setting affects band values but not AP, AP(W) values. Time constant cannot be set individually for bands (affects all bands)

Sampling frequency
- 2 kHz

Store mode
- Three store modes: Manual, Auto, and Timer Auto
  - Manual: Measurement results stored with measurement start time in one memory address
  - Data stored either in internal memory or on SD card
  - Internal memory allows storage of up to 1,000 data sets (data for 3 axes are one set). Number of data sets that can be stored on SD card depends on card capacity

Processing value store
- Various processing values obtained in manual mode are stored

Auto
- Continuous storing of various types of processing results for each calculation cycle
- Data stored on SD card (Internal memory cannot be used)
- Available store types are instantaneous store and calculation store
- For instantaneous store, Acc.rms data are stored every 100 ms. For calculation store, various evaluation values are stored for every calculation cycle

Timer auto
- Various calculated values are continuously recorded for each store cycle at the set measurement start / stop time
- Sleep function (power save mode until measurement start) available
- Data stored on SD card (Internal memory is not used)
- Available store types are instantaneous store and calculation store
For instantaneous store, Acc.rms data are stored every 100 ms. For calculation store, various evaluation values are stored for every calculation cycle.

**Measurement time (for manual store mode)**

Processing measurement in preset time possible 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 1 h, 8 h, 24 h.
User setting (1 s to 59 s, 1 m to 59 m, 1 h to 24 h)
Up to 24 h

**Total measurement time (for Auto / Timer Auto mode)**

Processing measurement in preset time possible 10 s, 1 min, 5 min, 10 min, 15 min, 30 min, 1 h, 8 h, 24 h.
User setting (1 s to 59 s, 1 m to 59 m, 1 h to 24 h)

* For KBfT and $v_{eff,max,30}$, the $v_{eff-max,30}$ calculation cycle is fixed to 30 seconds, and user settings are not displayed

**Data recall**

Store data name and time browsing, and waveform yes/no check are possible

**Setting memory**

Up to 5 sets of settings can be stored in internal memory and on SD card, for later recall. VX-56RT provides a setting memory function separate from VM-56.

Startup with settings stored in a file on the SD card is possible

**Signal output**

2.5 mm dia. output jacks, 3 separate channels

**AC output**

Output impedance: 600 Ω
Load impedance: 10 kΩ or more

AC output: 1 Vrms (full-scale)

Frequency weighting for instantaneous value display and for AC output can be set separately

Frequency range: 0.5 Hz to 315 Hz

AC OUT available for VM-56 or for one specified band (same for 3 axes).

Band selection range: 1 Hz to 315 Hz (in 1/3 octave steps)

* User-weighted output not supported
<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>User weighting</td>
<td>User weighting possible for any band from 1 Hz to 315 Hz</td>
</tr>
<tr>
<td></td>
<td>Weighting can be specified individually for 3 axes</td>
</tr>
<tr>
<td></td>
<td>Weighting range: +3.00 dB to -70.00 dB</td>
</tr>
<tr>
<td></td>
<td>Measurement target is acceleration only</td>
</tr>
<tr>
<td></td>
<td>When user weighting is selected, bandwidth is fixed as follows</td>
</tr>
<tr>
<td></td>
<td>Lower limit: 0.5 Hz</td>
</tr>
<tr>
<td></td>
<td>Upper limit: sensor-dependent (to prevent duplicated band limitation)</td>
</tr>
<tr>
<td>Power requirements</td>
<td>Eight AA batteries or external power supply</td>
</tr>
<tr>
<td></td>
<td>When both are available, external power supply has priority</td>
</tr>
<tr>
<td>Battery life</td>
<td>At least 20 hours of continuous operation</td>
</tr>
<tr>
<td></td>
<td>When using auto store: LCD off, AC OUT off</td>
</tr>
<tr>
<td></td>
<td>* Calculation cycle: 10 min</td>
</tr>
<tr>
<td>AC adapter</td>
<td>NC-98 series (100 V to 240 V AC)</td>
</tr>
<tr>
<td></td>
<td>* NC-98C or later</td>
</tr>
<tr>
<td></td>
<td>Factory default settings: approx. 8 VA (using NC-98C at 220 V AC)</td>
</tr>
<tr>
<td>External power supply</td>
<td>5 V to 7 V (rated voltage 6 V)</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Approx 100 mA (12 V DC, Eight batteries)</td>
</tr>
<tr>
<td></td>
<td>With factory default settings</td>
</tr>
<tr>
<td></td>
<td>AC OUT: ON</td>
</tr>
<tr>
<td>Ambient conditions for use</td>
<td>-20°C to +50°C, 90 % RH or less (no condensation)</td>
</tr>
<tr>
<td>Ambient conditions for storage</td>
<td>-20°C to +50°C, 90 % RH or less (no condensation)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>32 mm (H) × 24 mm (W) × 2.1 mm (D) (maximum)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 5 g</td>
</tr>
<tr>
<td>Supplied accessories</td>
<td>Inspection certificate 1</td>
</tr>
</tbody>
</table>
INSTRUCTION MANUAL
1/3 Octave Real-time Analysis Program
VX-56RT

RION CO., LTD.
3-20-41 Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan
http://www.rion.co.jp/english/

This product is environment-friendly. It does not include toxic chemicals on our policy.
No. 63450 18-11

Recycled papers are used for this manual.