EPSON

Epson RC+ 8.0 Option

# *Vibration Reduction Technology*

Rev.1

ENM247S6522F

Epson RC+ 8.0 Option  Vibration Reduction Technology  Rev.1

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Rev.1

# FOREWORD

Thank you for purchasing our robot products. This manual contains the information necessary for the correct use of Vibration Reduction Technology.
Please carefully read this manual and other related manuals when using this software.
Keep this manual in a handy location for easy access at all times.

The robot system and its optional parts are shipped to our customers only after being subjected to the strictest quality controls, tests, and inspections to certify its compliance with our high performance standards. Please note that the basic performance of the product will not be exhibited if our robot system is used outside of the usage conditions and product specifications described in the manuals.

This manual describes possible dangers and consequences that we can foresee. Be sure to comply with safety precautions on this manual to use our robot system safety and correctly.

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# TRADEMARK NOTIFICATION IN THIS MANUAL

Microsoft® Windows® 10 operating system
Microsoft® Windows® 11 operating system
Throughout this manual, Windows 10 and Windows 11 refer to above respective operating systems. In some cases, Windows refers generically to Windows 10 and Windows 11.

# NOTICE

No part of this manual may be copied or reproduced without authorization.
The contents of this manual are subject to change without notice.
Please notify us if you should find any errors in this manual or if you have any comments regarding its contents.

# MANUFACTURER

**SEIKO EPSON CORPORATION**

# CONTACT INFORMATION

For detailed contact information, see "SUPPLIER" of the manual below.
"Safety Manual"

# Before Use

Before using this manual, be sure that you understand the following information.
Installation of robots and robotic equipment should only be performed by qualified personnel in accordance with national and local codes. Please carefully read this manual and other related manuals when using this software.
Keep this manual in a handy location for easy access at all times.

## The Installation Folder for Epson RC+ 8.0

You can change the path for the installation folder for Epson RC+ 8.0 anywhere. This manual assumes that Epson RC+ 8.0 is installed in C:\EpsonRC80.

# 1. Overview

## 1.1 Vibration Reduction Technology

Vibration Reduction Technology (hereinafter referred to as VRT) is a function that reduces vibration due to robot motion.

VRT function is optional. VRT option's key is required to use.

The vibrations of the following targets are reduced by VRT function.

Robot
Hands
Base table that the robot is mounted
Image processing camera

Set VRT parameters by "VRT_Set" command or Epson RC+ GUI (up to 15 parameters)

VRT parameters are necessary for vibration reductions. The parameters need to be changed depending on the following situations change.

Robot orientations (e.g., arm stretching / bending orientations)

When the weight of hands or an object held by hand changes

Condition or state of the base table

"VRT_Set" command sets "enable" or "disable" of the VRT function.

If the VRT function is "enabled", robot motion is suppressed not to generate vibrations as much as possible. Therefore, robot motion path will be different depending on "enabled" or "disabled" of the VRT function. Also, motion time may take longer.

Note that the VRT function has the feature mentioned above. Make sure to "disable" the VRT function for motion that does not need to reduce vibrations.

When the VRT function is "enabled" and satisfying the following conditions, it will be "disabled" automatically. When the VRT function is not satisfying the "Conditions for disabling the VRT function" *1 as shown below, the VRT function will be "enabled" automatically.

| Conditions for disabling the VRT function and motion commands | Note |
|---|---|
| Power Low | |
| Move, TMove, BMove, FCSMove | *2 |
| Arc | |
| Arc3 | |
| CVMove | |
| Jump3 | |
| Jump3CP | |
| Continuous Jog | |
| Step Jog | |

*1 Following situations are when the VRT function is not satisfying the "Conditions for disabling the VRT function.":

- Switch from Power Low mode to Power High mode
- A motion command other than the command which automatically "disable" the VRT function is executed (e.g.: "Go" Command)

*2 When executing these commands, the VRT function is automatically “disabled” since path or speed requires high accuracy.
(If giving high priority to low vibration, “enable” the VRT function by “VRT_CPMOTION” command.)

When using conveyer tracking or force control function, the VRT function is “disabled” automatically and cannot be used.

## 1.2 VR (Vibration Reading) Unit

To use the VRT function effectively, you need to understand generated vibration conditions exactly and set proper VRT parameters.

VRT parameters are necessary for vibration reductions. The parameters need to be changed depending on the following situations change.

Robot orientations (e.g., arm stretching / bending orientations)

When the weight of hands or an object held by hand changes

Condition or state of the base table

You need to read the VRT parameters in the following situations:

When installing the robot newly

When changing the factory lines

When changing the factory layout

This option consists of software (VR software) and a vibration reading unit (VR unit) that is necessary for understanding vibration conditions. Understand the vibration conditions and provide the system to output VRT parameters.

You can read the VRT parameters by the following steps:

1. Install the VR unit directly to vibrating position.
2. Connect the VR unit to PC with USB cable.
3. Add “VRT_Trigger” command to the motion program which generates vibrations.
4. Activate the VR software.
5. Set to waiting for trigger condition.
6. Execute the program added “VRT_Trigger” command by Epson RC+.

You can check the improvement of the vibration conditions by the following steps.

1. Add VRT command to motion program by using parameter values read by VR software
2. Execute the program again and measure by the VR software.

Make sure to satisfy the following conditions to read the VRT parameters.

Connected to the robot controller (controller unit, drive unit)
(RC90, RC700, RC700DU, RC700-A, RC700DU-A, RC700-D, RC700-E, RC800-A)

The VR unit is connected to PC with USB cable.

VRT option is enabled.

“VRT_Trigger” command is added to the motion program which generates vibrations.

Vibration reduction of the VRT function effectively works to the vibration right after the robot stops. When reading the parameters, the robot automatically stops for 1.5 seconds after stopping at measurement position of the robot motion.

After the parameters are added, make sure to delete the added “VRT_Trigger” command. If you forget to delete it, the robot will not stop for 1.5 seconds in front of the measurement position unless the VR software will be waiting for trigger condition.

If you switch ON/OFF of waiting for trigger condition of VR software during execution of the robot motion wrote “VRT_Trigger” command, additional stop function (1.5 seconds) will ON/OFF.

## 1.3 Related Manuals

Refer to the following related manuals along with this manual for using VRT.

### Epson RC+ User's Guide

This manual contains information on using the Epson RC+ Robot Control System.

### SPEL+ Language Reference Manual

This manual contains a complete description of all commands for the SPEL+ language.

### Each Manipulator Manual

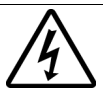
Each Manipulator manual contains information on our robots.

# 2. Safety

Please read this manual before using this option.
Keep this manual handy for easy access at all times and reread it when you find anything unclear.

## 2.1 Conventions

Important safety considerations are indicated throughout the manual by the following symbols. Be sure to read the descriptions shown with each symbol.

| | |
|---|---|
|  WARNING | This symbol indicates that a danger of possible serious injury or death exists if the associated instructions are not followed properly. |
|  WARNING | This symbol indicates that a danger of possible harm to people caused by electric shock exists if the associated instructions are not followed properly. |
|  CAUTION | This symbol indicates that a danger of possible harm to people or physical damage to equipment and facilities exists if the associated instructions are not followed properly. |

## 2.2 Safety Precautions

| | |
|---|---|
|  WARNING | ■ Do not use the product for the purpose to ensure safety.<br>■ The product must be used within the conditions described in this manual.<br>Using the product in an environment that exceeds the specified environmental conditions may not only shorten the life cycle of the product but may also cause serious safety problems. |

| | |
|---|---|
|  CAUTION | ■ Purchase VR unit and USB cables from our suppliers. Note that the VR unit and the USB cables of other manufacturers are not included in the warranty.<br>■ If executing “VRT_Trigger” command by VR software during waiting for trigger condition, the waiting time is added to normal motion. Click the [Stop] button of the VR software to cancel the wait condition and back to normal motion. |

## 2.3 Robot Safety

Whenever you are working with robots or other automation equipment, safety must be the top priority. Epson RC+ system has many safety features built in, such as E-Stop and a Safety Guard Input. These safety features should be used when designing the robot cell.

For safety information and guidelines, refer to the following manual.

*Safety Manual*
*Robot Controller Manual*
*Manipulator Manual*

# 3. VRT Command Options

VRT option license is set to the robot controller.

The following version is required for the VRT option of Epson RC+ 8.0.
Epson RC+ 8.0: Ver. 8.0.0 or later
Firmware: Ver.7.5.4.x or later

Included items when VRT option purchased:

1. VRT option license
2. EPSON RC+ 7.0 Robot Control System Installation DVD For VRT Option (The DVD is for RC+ 7.0 only. For Epson RC+ 8.0, the installer is included with Epson RC+ 8.0. When you order this version, DVD is not supplied as it is not required.)

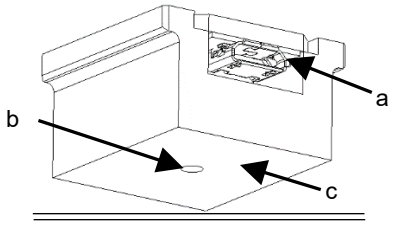
# 4. VR (Vibration Reading) Unit

VRT option license should be setup on the robot system controller that you want to read VRT parameters and enable VRT functions by using Vibration Reading unit (hereinafter referred to as VR unit).
If the VRT option license is not setup in the connected controller, the measurement by the VR unit is disabled.

The following version is required for the VR software.
Epson RC+ 8.0: Ver. 8.0.0 or later
Firmware: Ver.7.5.4.x or later

## 4.1 Included Items

1. VR unit

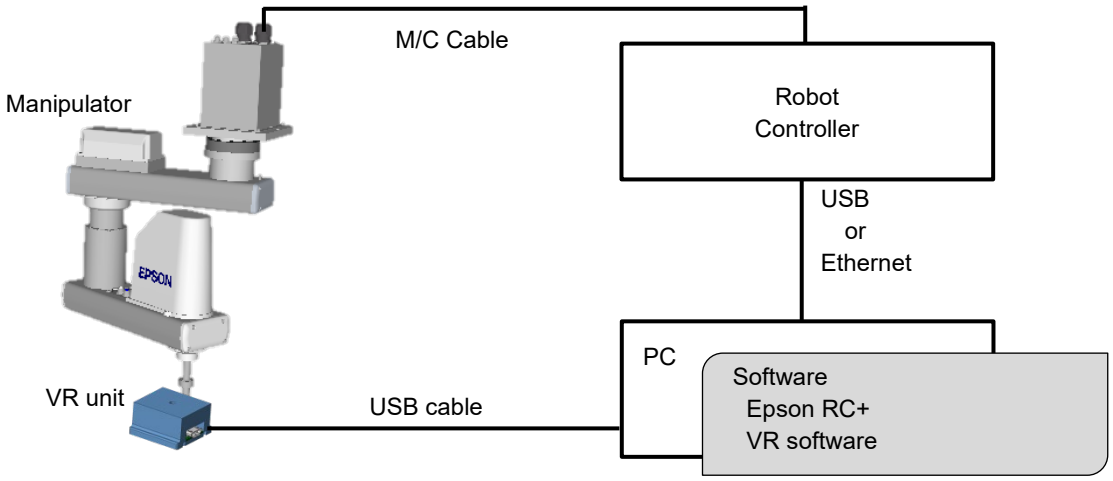



| Symbol | Name | Function |
|---|---|---|
| a | USB MicroB connector | Connector to connect with USB cable |
| b | Screw hole | Screw hole to install the VR unit |
| c | Installation surface | - |

2. VR unit screw (hexagon strut +nut/M3, M4×1 for each)
3. USB cable (4m)
4. EPSON RC+ 7.0 Robot Control System Installation DVD For VRT Option (The DVD is for RC+ 7.0 only. For Epson RC+ 8.0, the installer is included with Epson RC+ 8.0. When you order this version, DVD is not supplied as it is not required.)

## 4.2 Configuration

The illustration below shows the system configuration using the VR unit.




After reading the parameters and checking the effect of VRT, remove the VR unit and USB cable immediately. Do not operate the robot continuously with connecting the VR unit.
(It is not a flex resistance USB cable. Parameters cannot be read unlimitedly.)

## 4.3 System Requirements

### 4.3.1 Required software

Supported OS : Windows 10, Windows 11
Epson RC+ 8.0 Ver. 8.0.0 or later
VR software

### 4.3.2 Recommended specification

We recommend using PC that satisfies the following conditions:

| | |
|---|---|
| OS | Windows10 64 bit version (Version1607 or later)<br>Windows11 64 bit version<br>(Except Windows10S, Windows10 IoT Core and Windows11 SE) |
| CPU | Core i5 or higher<br>(Models released in 2017, 8th generation or later) |
| Memory | 8 GB or more |
| Graphic | DirectX 12 or later |
| Software | Microsoft .Net Frameworks 4.5 or more |

### 4.3.3 About Pre-required Software

When connecting the VR unit and PC with USB cable, USB driver manufactured by FTDI is necessary.

If you required the driver, install it in one of the following ways:

- Update the driver in at the Windows Device Manager (Automatically update drivers over the Internet is recommended.)
- Go to the FTDI Ltd. web site (www.ftdichip.com/Drivers/VCP.htm) then download and install the appropriate driver for your OS

## 4.4 Installing VR Unit

To read the VRT parameters accurately, install the VR unit to vibrating position to check the conditions. If the VR unit is installed on a position where generates little vibration, incorrect parameters will be output or output parameters will not be stable.

Use the following items to install the VR unit:
Double-Sided Tape
Screws

#### Installation by using double-sided tape

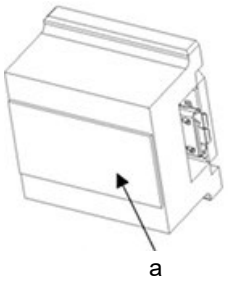
(1) Attach the double-sided tape directly to installation surface of VR unit.

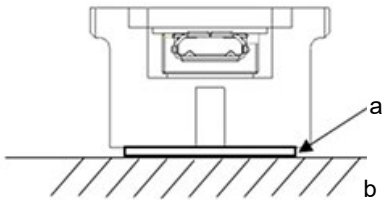
(2) Attach the VR unit directly to vibrating position (flat surface).

(3) Check that the attached unit does not move to both sides.

NOTE

If the adhesion of the double-sided tape is too weak, the measurement accuracy may decrease. Also, if it is too strong, the painted surface of the vibration object may be peeled. Make sure to check the adhesion before using the double-sided tape.
Use “normal type” of the double-sided tape for commercialized product.




| Symbol | Name |
|---|---|
| a | Double-sided tape |
| b | Installation surface |

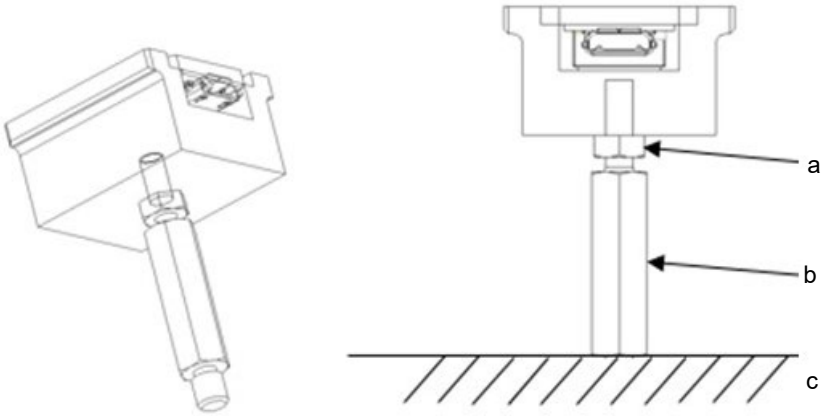
Installation by using screws

(1) Mount the screw* to the screw hole of the vibrating position. Firmly tightening it by using spanner.
*: Screws (M3, M4×1) are included. Use proper screw for your screw hole.

(2) Screw and fix the tightened screw at step (1) to the screw hole of the VR unit.

(3) Fix the VR unit tightly with the nut by using spanner.

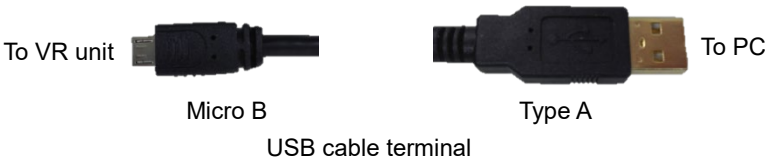
NOTE
Screw the VR unit approximately three times to the fixed screw at the step (1).
Make sure that the VR unit is stable and does not move or rotate.




| Symbol | Name |
|---|---|
| a | Nut |
| b | Screw (hexagon strut) |
| c | Installation surface |

## 4.5 Connection with PC and Wiring Cables

After installing the VR unit, connect the VR unit to PC with USB cable.
(Support for USB 3.0 , 2.0 , 1.1)




USB cable terminal

To read the VRT parameters accurately, make sure not to apply vibrations except generated vibrations. Fix the wirings at 150 to 200mm from the terminal by using the tape or cable tie.

| | |
|---|---|
| CAUTION | ■ To connect the VR unit with PC, you can use the general USB cables (Type A – Micro B) other than attached ones. However, be sure to use products complying with the industrial standards or noise resistant USB cable. If you use USB cable (office use product), it may cause communication error and may not offer the proper performance.<br>■ Make sure to use USB cable that can execute data transfer. Be careful since some of general USB cables are only for supplying power.<br>■ Target of the measurement is only one VR unit which set COM port by VR software. It is not possible to process more than one VR unit simultaneously.<br>■ After reading the parameters and checking the effect of VRT, remove the VR unit and USB cable immediately. Do not operate the robot continuously with connecting the VR unit. (It is not a flex resistance USB cable. Parameters cannot be read unlimitedly.) |

How to check USB COM port number of VR unit

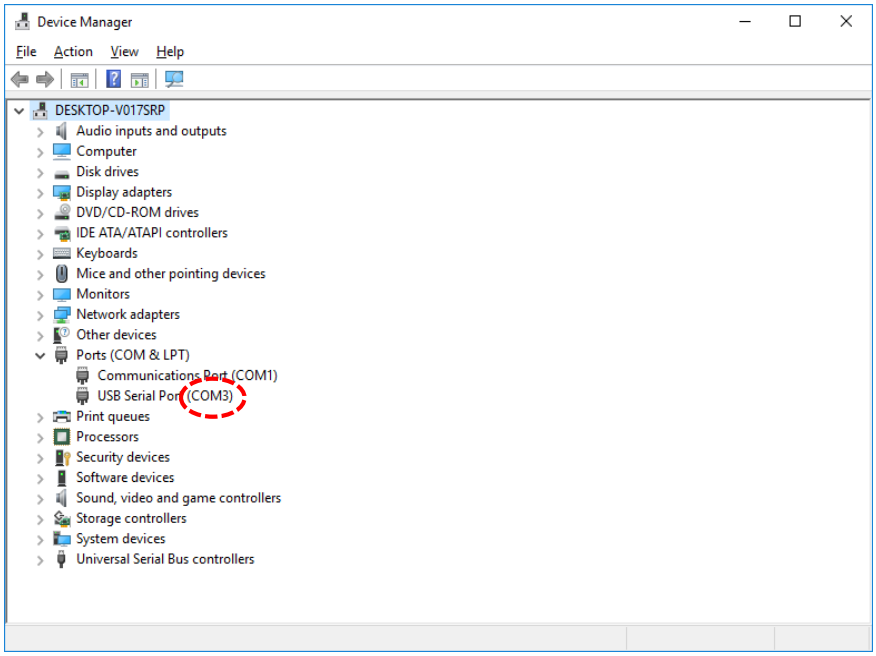
(1) Install the VR unit to vibrating position

(2) Connect the VR unit to PC with USB cable.

(3) Click Windows-[Start] menu-[Run].

(4) Input “devmgmt.msc” to the [Name] box.
Display the device manager.

(5) Expand the [Ports (COM & LPT)] tree.




COM port number of the VR unit is displayed after the COM.

If more than one port numbers are already displayed, disconnect and connect the USB cable of the VR unit and check the number.

## 4.6 Maintenance Parts List

Please contact us when you purchase maintenance parts described below.

| Name | Code | Note |
|---|---|---|
| Vibration Reading unit | 2193072 | Vibration Reading Unit |
| USB connection cable for Vibration Reading unit | 2193094 | USBC4M-TypeA-MicroB-01 |

# 5. Installing Software

VRT is paid option. Each controller needs 1 license.

When VRT option is installed to the control unit (RC700 / RC700-A), VRT will be available in robots (four robots at the maximum) connected to the drive unit (RC700DU).

You must have the authority of Windows Administrator to install VRT option.

When you purchased VRT option and enabled it, setting windows of VRT or options are displayed on Epson RC+. The following describes steps to install software and enable the option.

## 5.1 Check the Version of Epson RC+ and Firmware

Before using VRT option, make sure to check the version of Epson RC+ and controller firmware.

If the version of installed software is older than the following, refer to the manual to update the software.

Epson RC+ 8.0 Ver.8.0.0
Refer to: *Epson RC+ 8.0 User's Guide*
*Appendix B: Epson RC+ 8.0 Software*

Firmware of Controller Ver.7.5.4.x
Refer to: *Robot Controller RC700 series Maintenance Manual*
*- Firmware Update*

*Robot Controller RC700-D Manual*
*Installation - Firmware Update*

*Robot Controller RC700-E Manual*
*- Upgrading Firmware*

*Robot Controller RC90 series Maintenance*
*Manual - Firmware Update*

*Robot Controller RC800-A Manual*
*- Upgrading Firmware*

For detail information on system to use VRT option or software version, refer to the following.

VRT command option: *3. VRT Command Options*
VR (Vibration Reading) unit: *4.3 System Requirements*

# 5.2 Enable VRT Option

The procedure for enabling the VRT option differs depending on the Controller series.
For details, refer to the following manual:

Epson RC+ 8.0 User's Guide
- Installing Controller Options

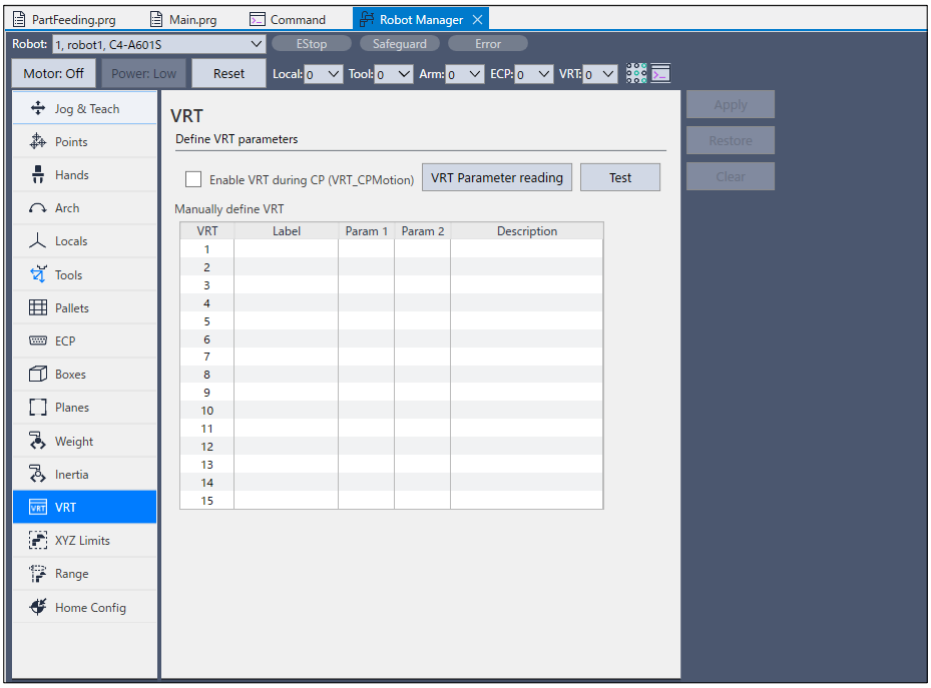
## 5.2.1 Confirm that VRT Option is Enabled

When VRT option is installed, you can edit VRT data on Epson RC+.

Follow the steps below and confirm that the option is installed properly.

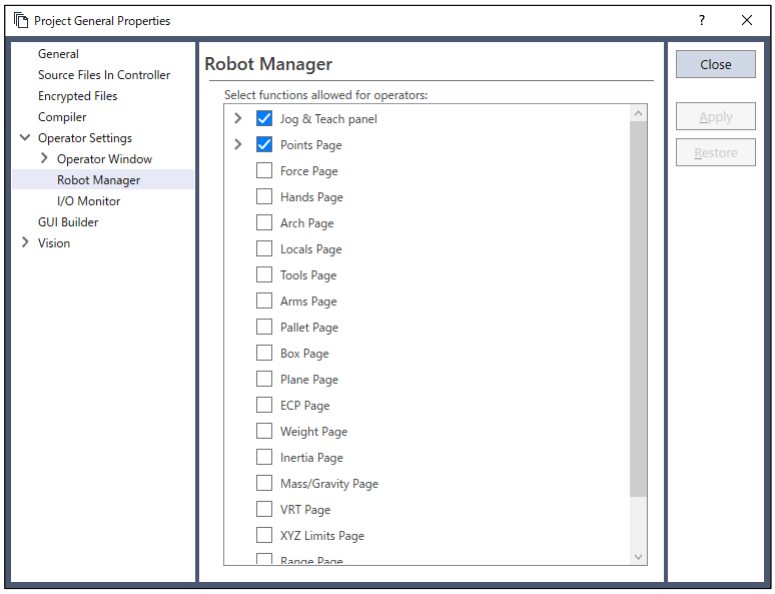
(1) Select Epson RC+ menu-[Tools]-[Robot Manager].

(2) Confirm the [VRT] tab.



If the [VRT] tab is not displayed, follow the steps below.

(1) Select Epson RC+ menu-[Project]-[Properties]-[Operator Settings]-[Robot Manager].




(2) Place a checkmark on [Select pages and options allowed for operators:]- [VRT Page].

(3) Confirm that the [VRT] tab is displayed on Robot Manager.

*(4)* If the [VRT] tab is still not displayed after performing the above steps, refer to the following sections.

*Epson RC+ 8.0 User's Guide - Installing Controller Options*

# 5.3 Installing VR Software

Install VR software and set references.

## 5.3.1 Installation Contents:

VR software has an installer. Following processes are operated automatically.

1. Install VR software
2. Install VR unit driver
3. Install evaluation software for VR unit
4. Create a folder : C:\EpsonRC80\projects\VRT

## 5.3.2 Installation Steps

(1) Save Epson RC+ 8.0 from the Epson Robot Software Installer.
For details, refer to the following manual:
*Epson Robot Software Installer*

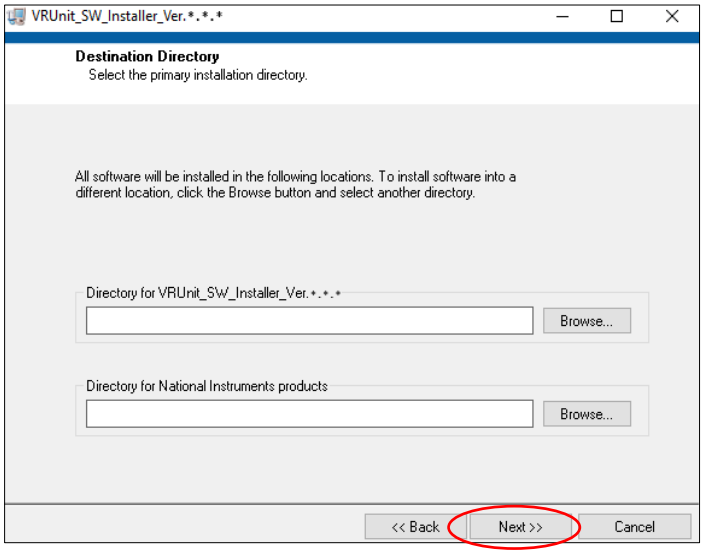
(2) Unzip the Zip folder and right-click the following file:
Epson_RC+****\VRSW\VRUnit_install.bat (****: RC+ version)

Select [Run as administrator].

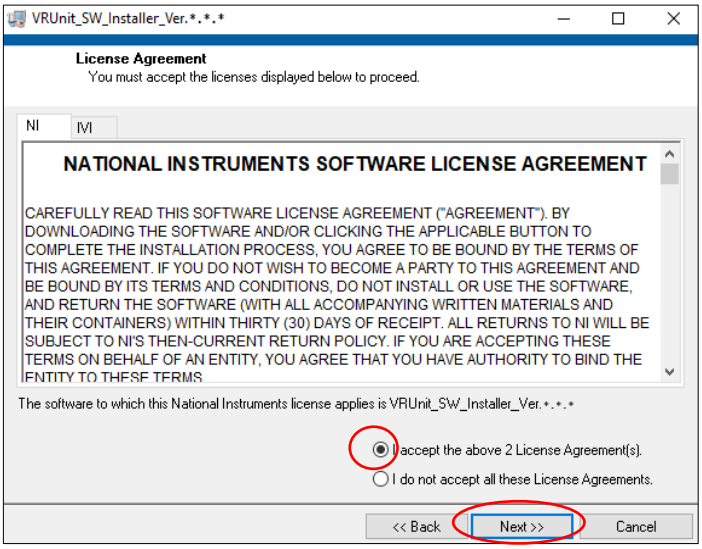
## 5.3.3 Installing VR Software

(1) When performing *"5.3.2 Installation Steps"*, the user account control window is displayed. Permission for changing the PC is asked on user account control window. Click the [Yes] button.

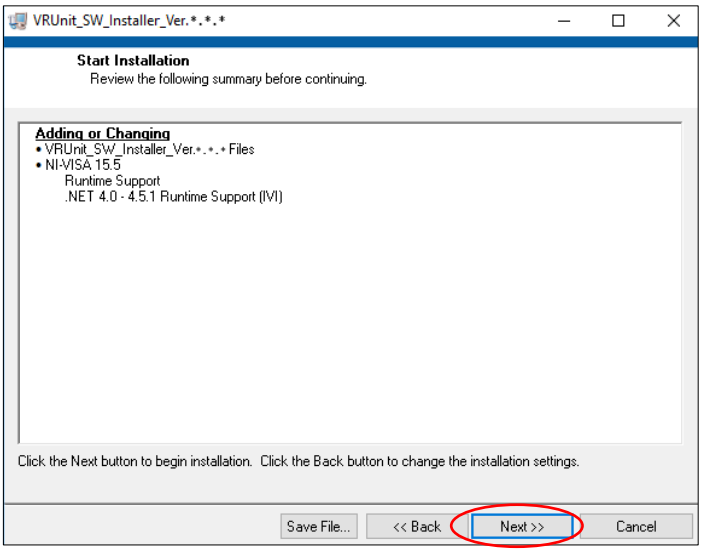
(2) The following window is displayed. Click the [Next] button without any changes.



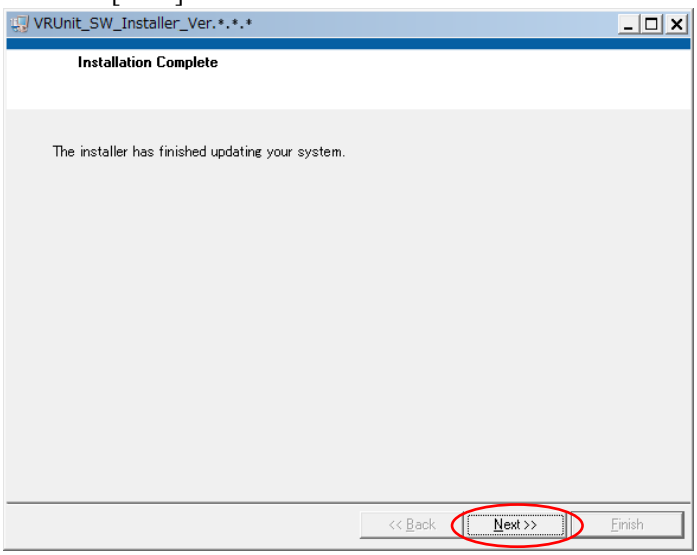
(3) License agreement for instrument driver technology of NATIONAL INSTRUMENTS and IVI (Interchangeable Virtual Instrument) is displayed.
Confirm the contents.
Select [I accept the above 2 License Agreement[s]] and click the [Next] button.



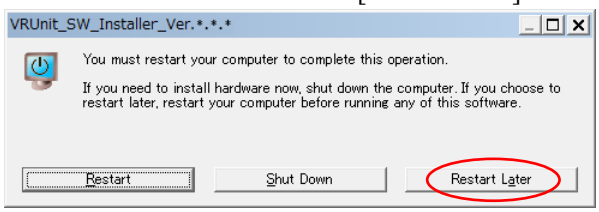

(4) Confirmation window of the installation contents is displayed.
Click the [Next] button.



(5) The following window is displayed.
Installation of VR software has completed.
Click the [Next] button.




(6) Window to request a restart of your computer is displayed.
Do not restart now. Click the [Restart Later] button.

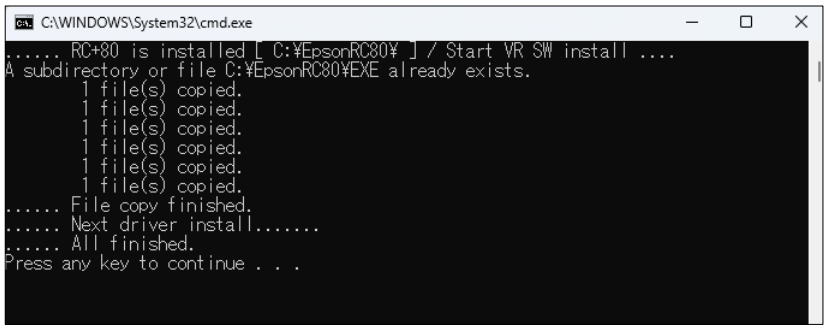


### 5.3.4 Other References

The following process is operated when "*5.3.3 Installing VR Unit Driver*" is completed.

- Create a folder: C:\EpsonRC80\projects\VRT

Then, as shown below, entering key is required. Press any key on the command window.




Now, installation has been completed. Then, restart your computer.

# 6. Read VRT Parameters and Confirm Vibration Reduction Effect

This chapter describes about the following contents:

- Steps to read VRT parameters
- Steps to set VRT parameters and realize vibration reduction

## 6.1 Change a Program

Identify the motion that generates vibrations. Then, add a measurement trigger command for reading parameter to the command generating vibrations.

(1) Identify the motion that generates vibrations in program.
(You can confirm the effect easily by extracting motions that you want to improve vibrations from the program.)

(2) Start Epson RC+ and display the sub window of the program.

(3) Add "VRT_Trigger" command to the row of vibrating command.

Specify number (integer number from 1 to 4) after VRT_Trigger.

VRT parameters are displayed on the tab (specified number) of VR software.

Command example:

```
Go P1  →  Go P1 VRT_Trigger 1
```

SPEL+ program example:

Add underlined command.

```
Function vibration_drive
   Motor On
   Power Low
   Weight 3
   Speed 10
   Accel 10, 10
   Go P1    'Start Point
   Wait 1
   Speed 100
   Accel 100, 100
   Power High
   Go P2 VRT Trigger 1
   Wait 3
   Power Low
Fend
```

(4) Execute the program added VRT_Trigger command and check that there are no errors.
Also, check the robot motion to decide how to install the VR unit.
(No change in motions since the VR unit is not installed.)

### VRT_Trigger Command and VR Software

VRT_Trigger has a function to send signals to VR software when the robot reaches to the destination point by the motion commands such as Go, Jump, and Move.
VR software measures residual vibrations. When "VRT_Trigger" command is added to the program, waiting time (1.5 seconds) is added automatically.

The functions of sending signals and adding the waiting time will be enabled when the following conditions are satisfied.

- Epson RC+ and robot are connected
- VR software is waiting for trigger condition

| | |
|---|---|
| CAUTION | ■ When releasing the waiting for trigger condition of VR software, VRT_Trigger command will be disabled. Additional waiting time will be reset and the robot operates normally. |

## 6.2 Preparation for VR Unit

Install the VR unit and check motions of the program changed in "*6.1 Change a Program*". Then, adjust cable length or installation position.

(1) Install the VR unit at position where you want to improve vibrations.
For details, refer to the following section.
*4.4 Installing VR Unit*

| Position to be improved (Installation position) | Measurement target |
|---|---|
| Robot hands | Hand (workpiece included), robot, base table |
| Camera | Camera, camera installation parts, base table |
| Sensors in equipment | Base table, sensors in equipment<br>Sensor installation parts in equipment |
| Base table | Base table |

(2) Display the [RUN] window of Epson RC+.
Operate the robot in forced low power and low speed motion.
At this time, consider how to wire the USB cable that connects the VR unit and PC.

(3) Connect the USB cable to VR unit.

(4) Fix the 150 to 200mm position from the connection terminal so that there is no influence of cables when measuring vibrations.

(5) Connect another terminal of USB cable to PC.

(6) Check the program motions again from Epson RC+ - [RUN] window.

Note the following since VR unit and PC is connected with cable.

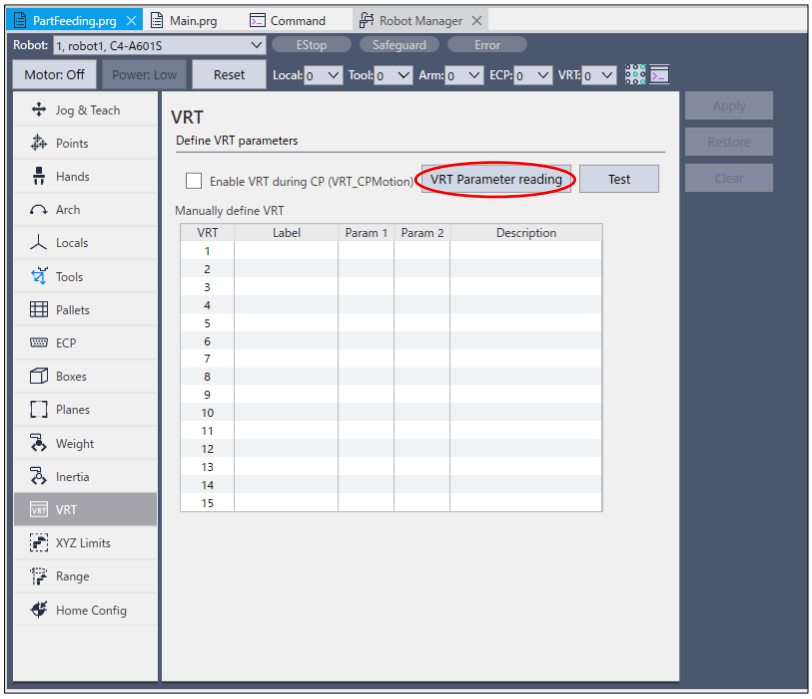
- Operate the robot in forced low power and low speed motion.
- Make sure that the emergency stop switch can be held down immediately to stop the robot in case of emergency.

## 6.3 Read VRT Parameters

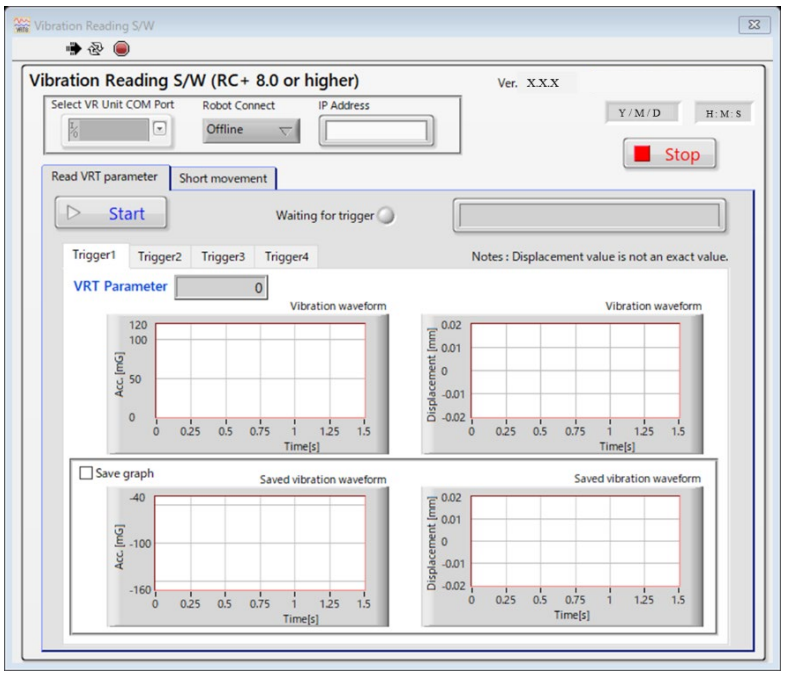
When you can confirm that the USB cable is wired properly during the robot motion, keep the connection with Epson RC+ without any change.

(1) Activate the VR software by either way.

- With Epson RC+ 8.0, click the [Robot Manager]-[VRT]- [VRT Parameter reading] button.
- Activate “C: \EpsonRC80\exe\VR_SW.exe”




Start from Epson RC+ 8.0

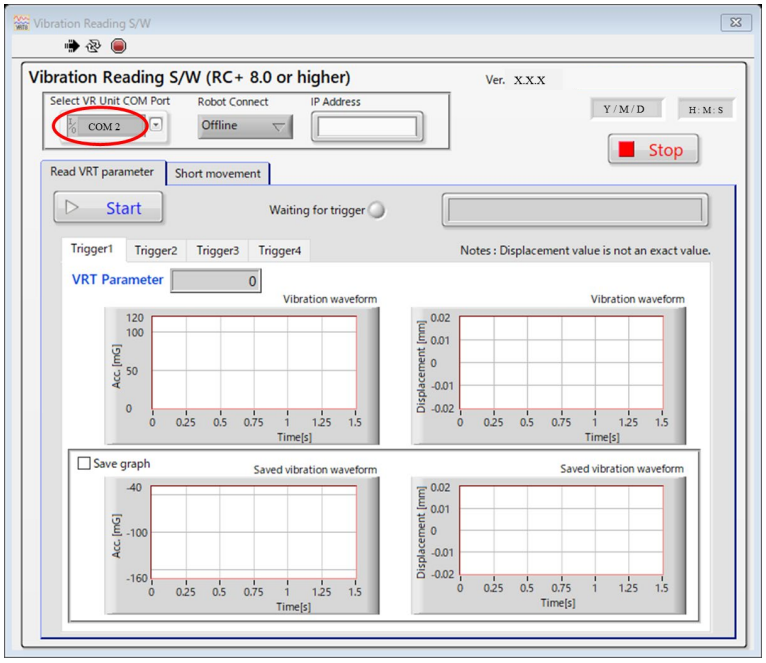



Start from VR software

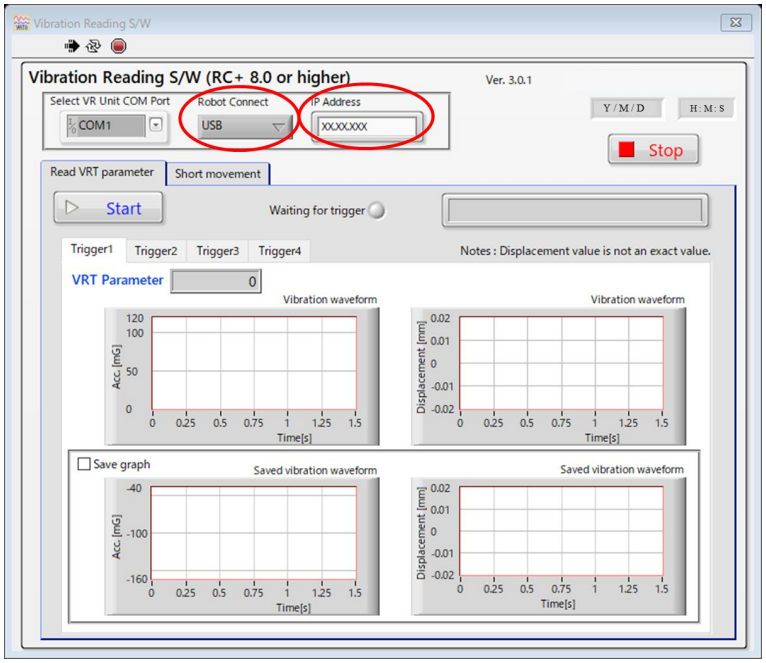
(2) Select the port number of USB connection port that connects VR unit.
Refer to the following to check COM port number.

*4.5 Connection with PC and Wiring Cables:*

*How to check USB COM port number of VR unit*

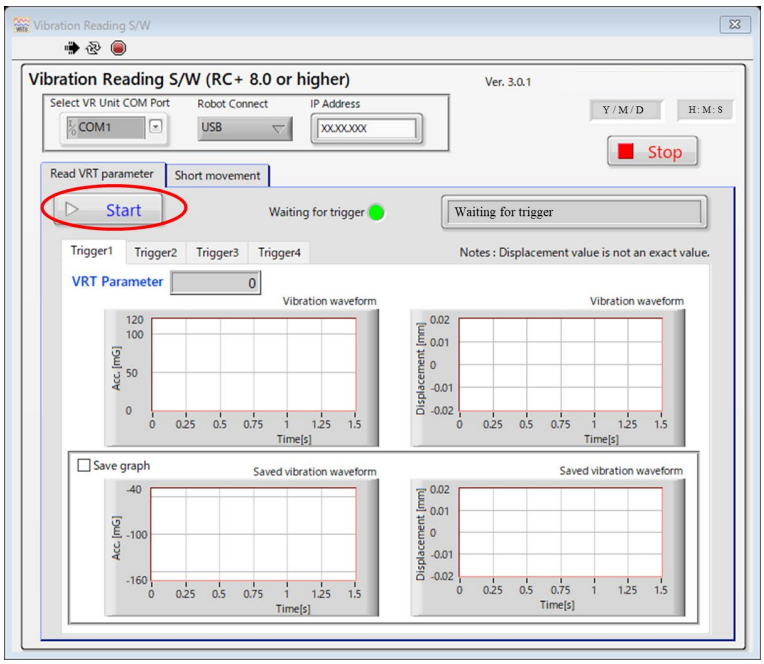



(3) Specify how to connect the running Epson RC+ and the robot.
Ethernet connection:
input IP address.
USB connection:
input to IP address part is not required.



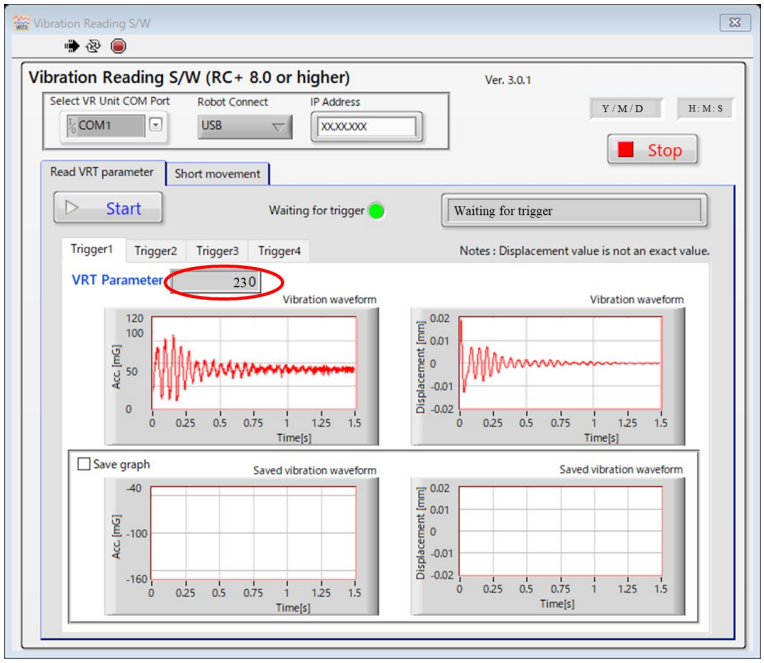

Now, setting has completed.

(4) To read VRT parameters, set the condition to waiting for trigger.
Click the [Start] button to enable “VRT_Trigger” command of Epson RC+.
Also, [Waiting for trigger] will be lighted up in green.




(5) Confirm that the [Waiting for trigger] is lighted up in green and execute the program by Epson RC+. The program to be executed is the program that added “VRT_Trigger” command according to the following steps.
*6.1 Change a Program*

(6) When the robot reaches to the specified point of motion command that added “VRT_Trigger” command, the VR software measures vibration and output calculated VRT parameter values.
Write down the value showed on [VRT Parameter].

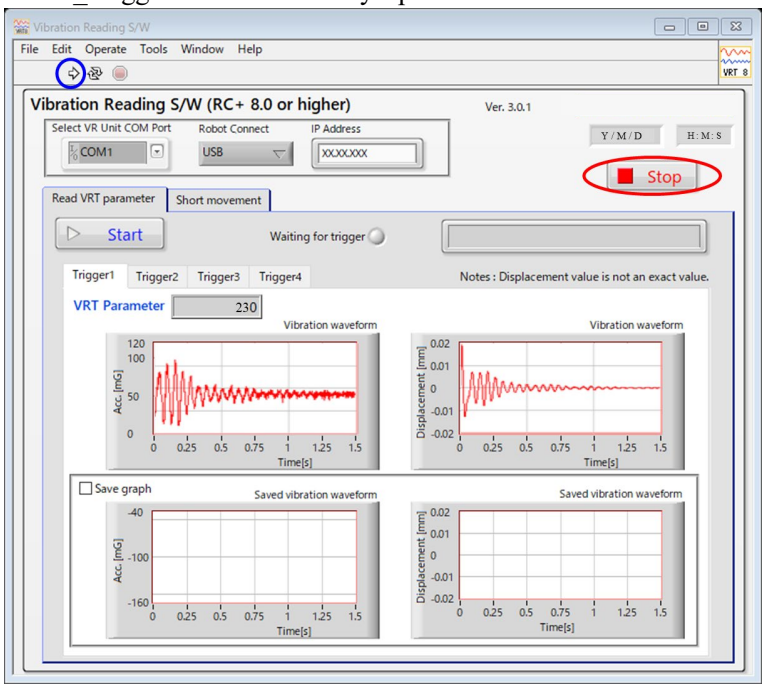



Now, VRT parameter value has read.

### When executing program with adding more than one “VRT_Trigger” commands:

Every time program execution reaches to “VRT_Trigger” command, measurement is performed and parameters are calculated

Click the [Stop] button to stop the trigger for reading. When the [Stop] button is clicked, “VRT_Trigger” command set by Epson RC+ will be disabled.



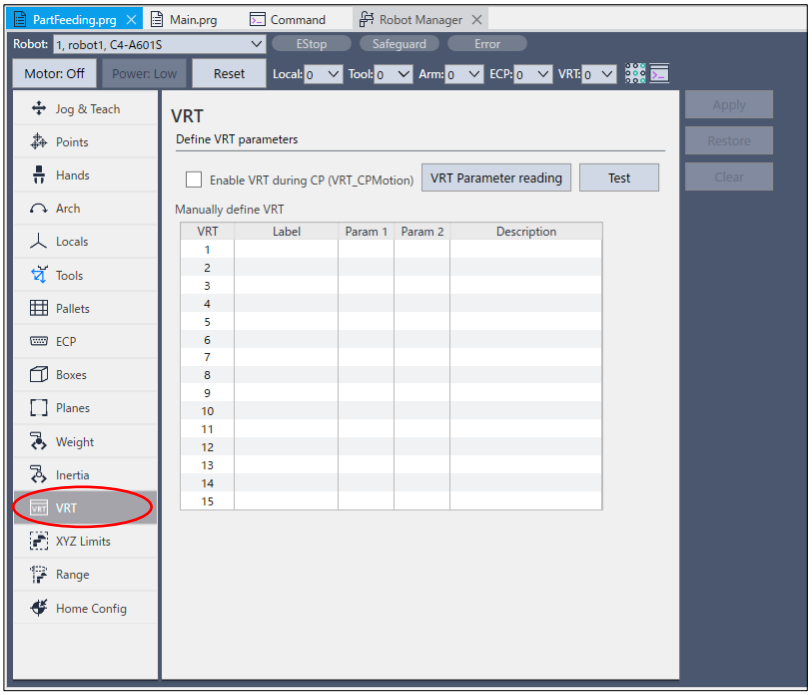

### How to measure again

Click an arrow icon (blue circle) on upper left and click the [Start] button. Condition will be the trigger start condition and measurement will start again.

## 6.4 Setting for VRT Parameters

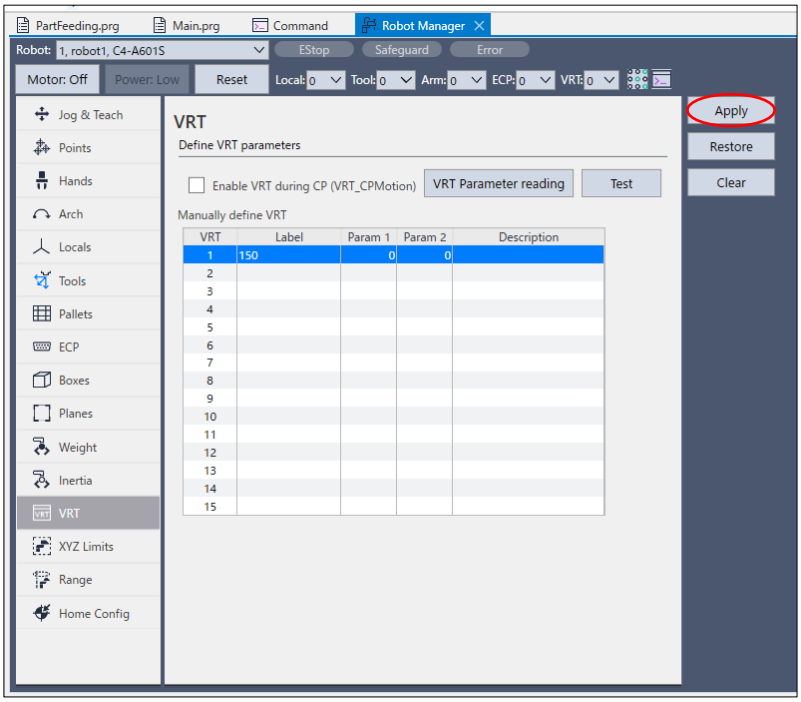
(1) Select [Tools]-[Robot Manager] on Epson RC+ menu and start Robot Manager.

(2) Select the [VRT] tab.




(3) Select row [1] in column [VRT].

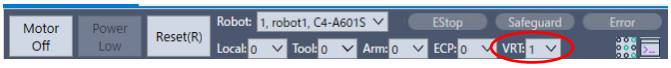
(4) Set the parameter read in *6.3 Read VRT Parameters* to [Param1].




If the target motion (motion that you want to reduce vibration) is CP motion, place a checkmark on the [Enable VRT during CP] box.

(5) Click the [Apply] button and wait for a few seconds.
Read parameter is set in [VRT 1].

(6) Change the [VRT] of [Robot Manager]to “1”.




By this operation, VRT 1 is applied to subsequent programs.

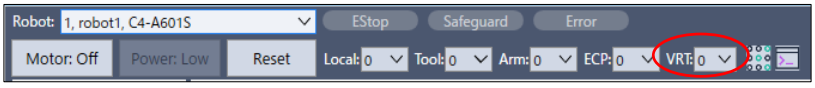
Now, settings of VRT parameters have completed.

## 6.5 Confirmation of Vibration Reduction Effect

You can confirm the VRT effect by using VR software.

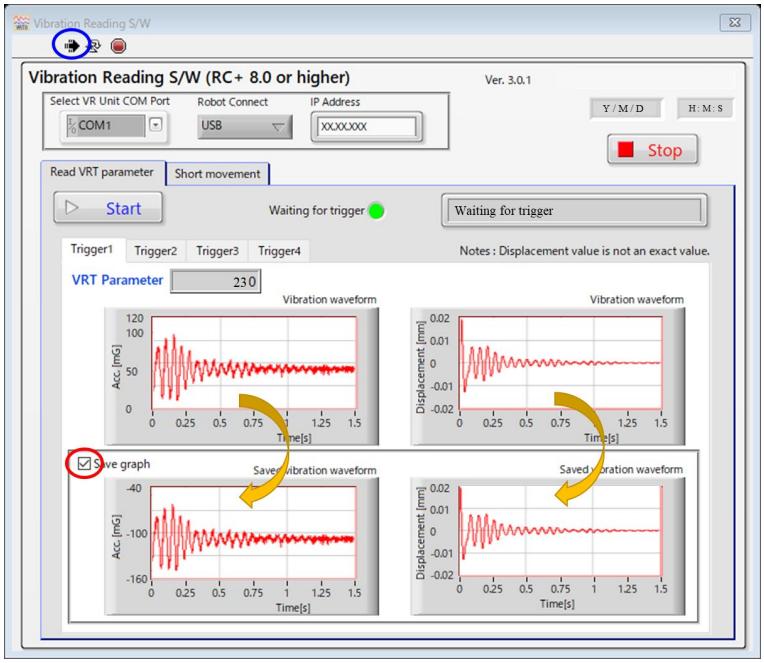
Measure the same motion with enabling VRT and disabling VRT in *6.4 Setting for VRT Parameters*, then compare the results.

(1) Change the [VRT] of [Robot Manager] to “0”.
VRT function will be disabled.




(2) Read parameters.
For details, refer to *6.3 Read VRT Parameters*.

(3) Place a checkmark on the [Save graph] checkbox (red circle).
Upper graph is copied to the lower one.

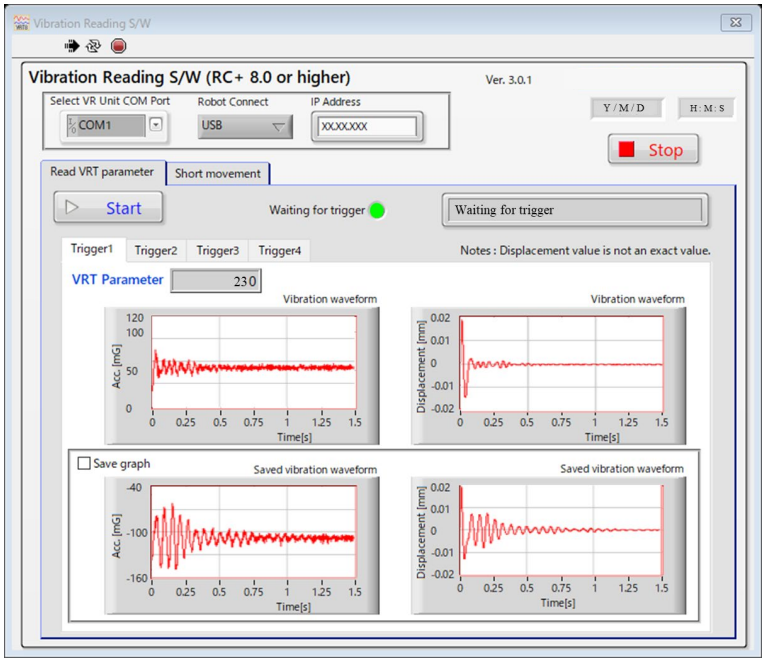



(4) Confirm that the graph is copied to the lower graph.
Remove the checkmark on the [Save graph] checkbox.

(5) Change [VRT] of [Robot Manager] to “1”.
VRT function will be enabled.

(6) Click an arrow icon (blue circle) on upper left and click the [Start] button. Condition will be the trigger start condition and measurement will start again.

(7) Vibration results of enabling VRT are displayed on upper stage.




From the above operation steps, you can check the improvement effects of vibration when enabling VRT.

Displacement on the graph is calculated by values measured in acceleration. It is not precise value

To measure precise value, use dedicated measurement equipment.

Use displacement value output from this function as rough guide to check VRT function.

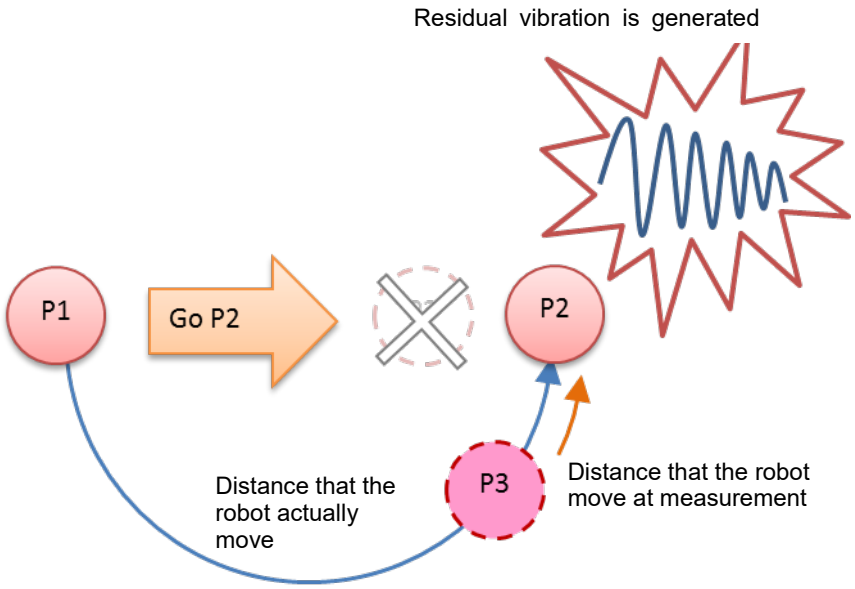
If the improvement is not enough, add the values of read VRT parameter to Epson RC+ menu- [Robot Manager] – [VRT] tab – [Param 2] and click the [Apply] button. Then check the improvement again.

You can set two VRT parameters simultaneously.

## 6.6 Steps to read VRT parameters when wiring is difficult

If it is difficult to wire the USB cable between VR unit and PC due to reasons such as equipment layout, you can read parameters by shortening the robot moving distance.

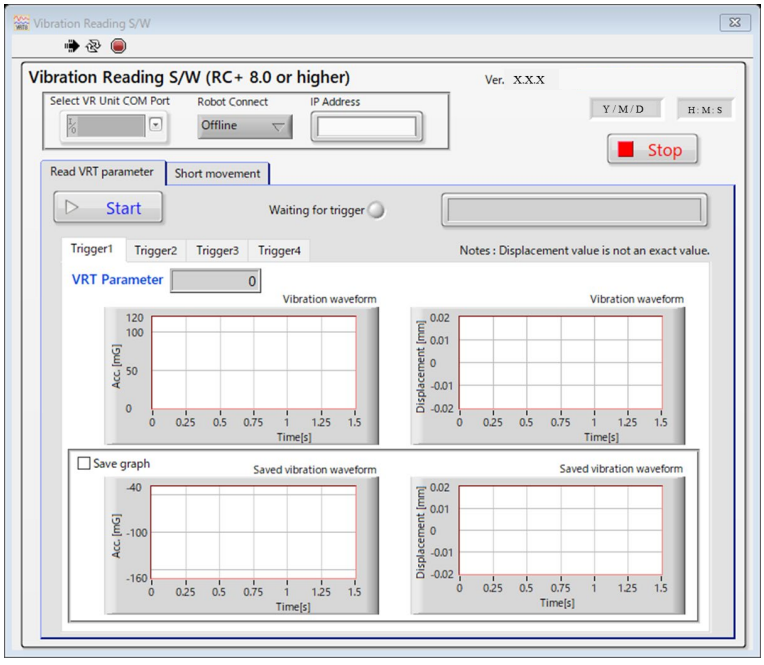
As shown below, you can change the path P1→P2 to P3→P2 to measure.



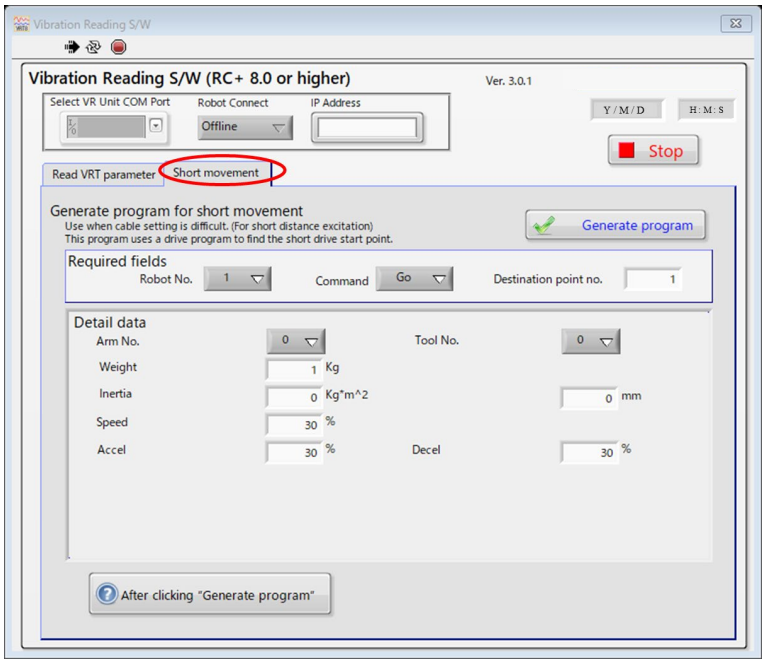

Program that shortened the robot moving distance for reading parameters can be create by VR software.

(1) Start Epson RC+ and connect to the robot.

(2) Activate the VR software by either way.
- With Epson RC+ 8.0, click the [Robot Manager]-[VRT]- [VRT Parameter reading] button.
- Activate “C: \EpsonRC80\exe\VR_SW.exe”

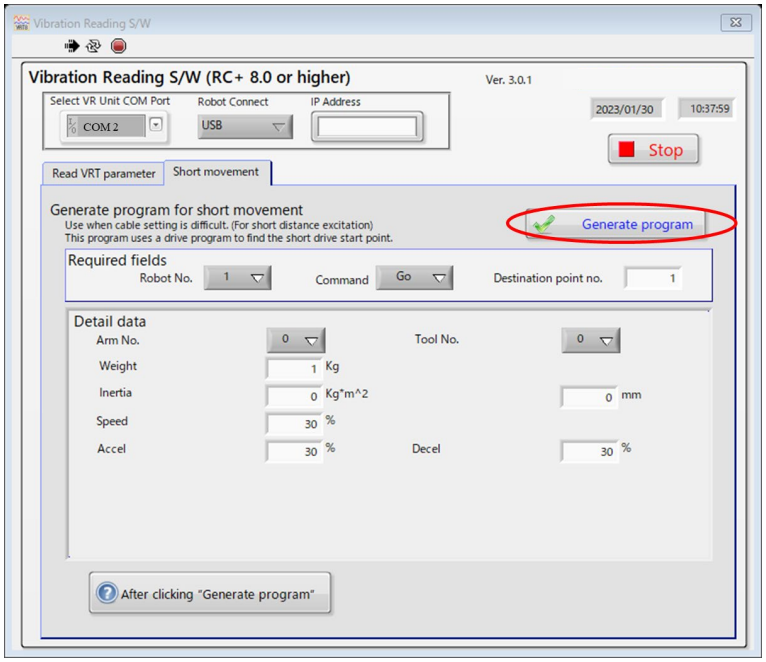


(3) Select the [Short movement] tab.



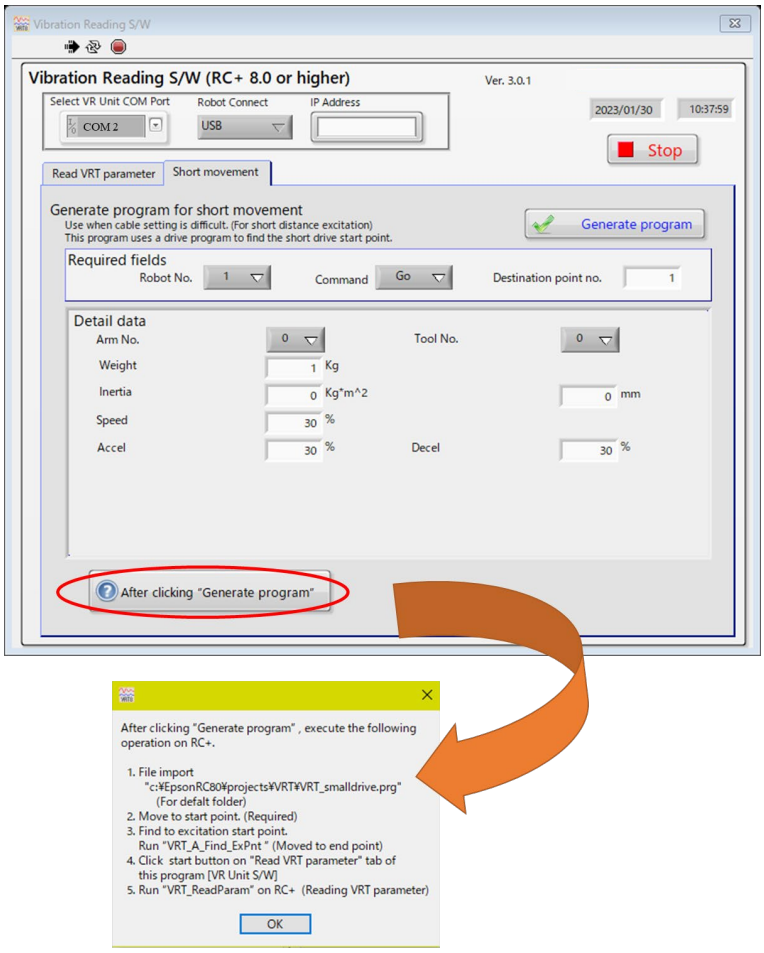

(4) Input point number, motion command, speed, and acceleration of the destination point of vibration generated motion to all items of [Require fields] and [Detail data].

(5) Click the [Generate program] button.
Program that shortened the robot moving distance is created.

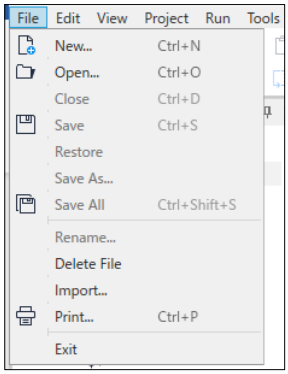



At this time, do not install VR unit.  Also, do not wire by USB cable.

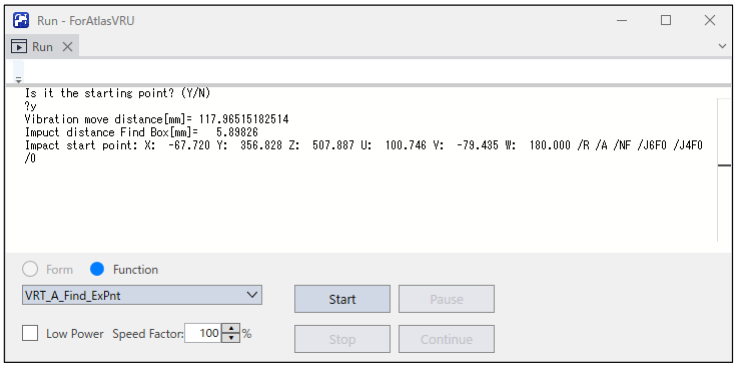
(6) Click the [After clicking “Generate program”] button to check the steps to create a program.




(7) Click Epson RC+ menu- [File] - [Import..] to import the program file created in step (5).
C:\EpsonRC80\projects\VRT \VRT_smalldrive.prg



(8) After do the [Project]-[Build], Select “VRT_A_Find_ExPnt” on the [Run] window and click the [Start] button.
Search the start position of motion that read parameters (motion that generates vibrations).

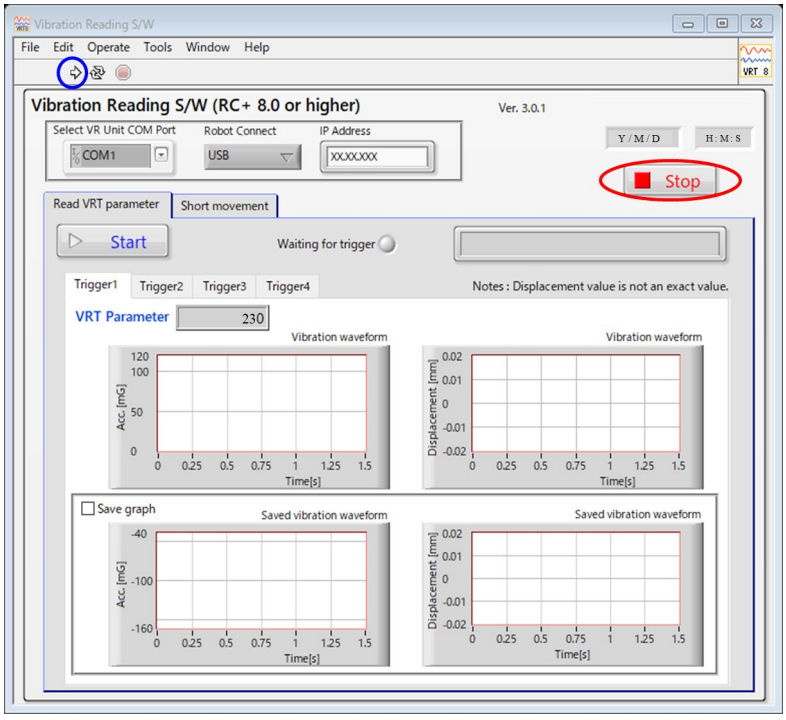



After confirming that the robot moves to the start position (P1 on the first figure of this section), click the [Start] button.

(9) When clicking the [Start] button, a question whether the robot is at the start position is asked.
If the robot is at the start position, click [Y]. If the robot is not at the start position, click [N].
The program is halted if the robot is not at the start position. Move the robot to the start position and perform the step (8).
Search a point that is 5% from the destination point for the motion distance when vibration is generated. When the motion distance is 1mm or less, the point is 1mm position.
When the program ends, the setting has completed.

(10) Refer to the following and install VR unit. Then, connect it to PC with USB cable.
*6.2 Preparation for VR Unit*

(11) Click the [Stop] button to be the waiting for Trigger condition.




(12) Click an arrow icon (blue circle) on upper left and execute software again.

(13) Set the [Select VRU COM Port], [Robot Connect], and [IP Address].
For details, refer to the following:
*6.3 Read VRT Parameters*

(14) Select the [Read VRT parameter] tab.

(15) Click the [Start] button and set to be waiting for trigger condition.
The [Waiting for trigger] is lighted up in green.

(16) The robot is at end position (P2) since VRT_A_Find_ExPnt is executed.
Select "VRT_ReadParam" on the [Run] window. After confirming that the robot is at the end position (P2), click the [Start] button. Read parameters.

## 6.7 Restrictions

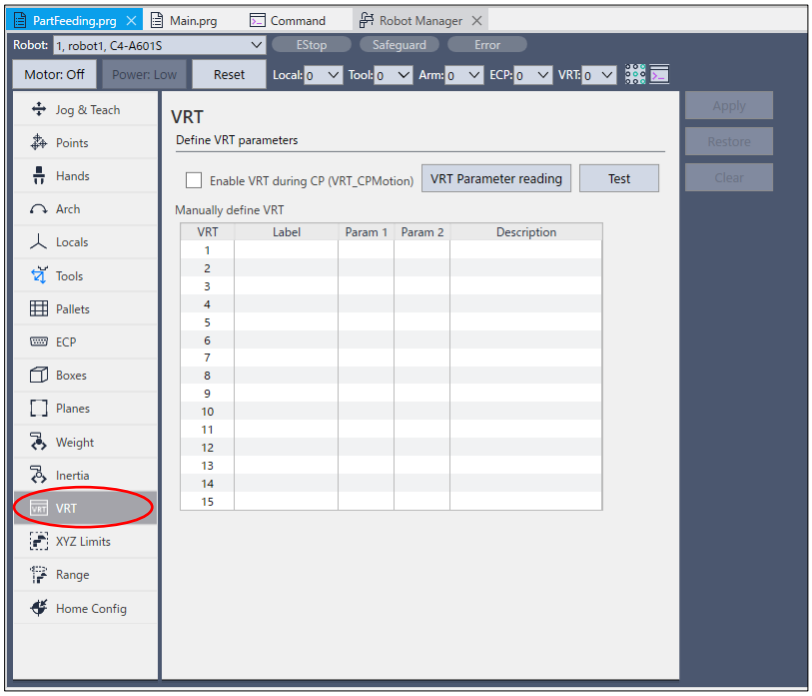
After reading VRT parameters and confirming effect, make sure to delete the "VRT_Trigger" command from the program immediately. "VRT_Trigger" command is disabled unless the trigger of reading VRT parameters will be wait condition. However, delete the command to prevent unnecessary commands from being executed.

Only one VR unit can be connected. When you want to measure more than one robot or other vibrating positions, re-install the unit to measure.

# 7. Software Window Layout

## 7.1 Epson RC+ GUI (VRT Tab)

Select Epson RC+ menu-[Tools]-[Robot Manager]-[VRT] tab to display the following window. Set VRT parameters.



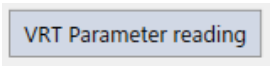
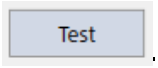

When selecting the [VRT] tab, all VRT parameter values that user can define are displayed.

If the [VRT] tab is not displayed, the VRT option's key is not set. Refer to the following section to set the option's key.

*5.2 Enable VRT Option*

Values set by Robot Manager are saved if the controller is turned OFF.

| Items | Descriptions |
|---|---|
| Enable VRT during CP (VRT_CPMotion) | Set enable/disable of VRT function. (During CP motion)<br>Default: disable |
| Label | Set labels of the selected VRT number (optional) |
| Param1 | Set value of VRTParam1.<br>Setting range: 100 to 500 |
| Param2 | Set value of VRTParam2.<br>Setting range: 100 to 500<br>VRTParam2 value should be ±10% or more than VRTParam1. |
| Description | Set descriptions of the selected VRT number (optional) |
| Apply | Set the current value.<br>Processes take a few seconds. |
| Restore | Restore to previous value. |

| Items | Descriptions |
|---|---|
| Clear | Delete all selected values. |
| Select VRT number<br>  | When selecting the number set VRT parameter, VRT function of the number is applied to subsequent robot motion.<br>However, if VRT command is executed during the motion, the setting takes priority<br>0: VRT OFF |
| VRT Parameter reading<br>  | Start the VR software.<br>Installing the VR software is necessary. |
| Test<br>  | Start the VR Unit Check (Software).<br>You can check if VR unit is not malfunctioning with VR Unit Check. Refer to following for more information.<br>10.3 VR Unit Confirmation<br>Installing the VR software is necessary. |

## 7.2 VR Software

The following items are necessary to use VR software.

Epson RC+ 8.0 Ver. 8.0.0 or later

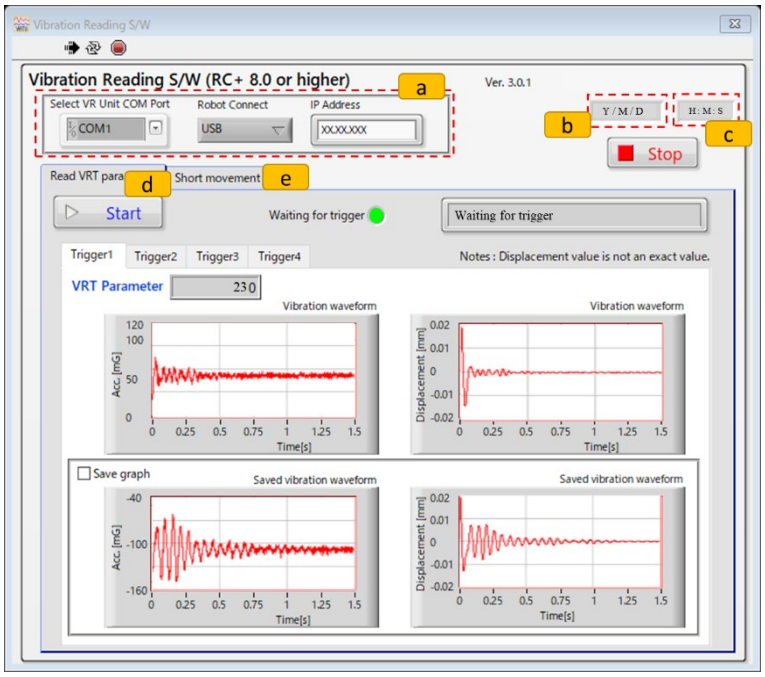
VRT option

VR unit

### 7.2.1 How to Activate

Use either way to activate VR software.

- With Epson RC+ 8.0, click the [Robot Manager]-[VRT]- [VRT Parameter reading] button.
- Activate: C: \EpsonRC80\exe \VR_SW.exe




a: Common part

b: Start date of activation

c: Start time of activation

d: Read parameters [Read VRT Parameter]
Receive signals from VRT_Trigger command and calculate VRT parameter by results of vibration measurement by VR unit.

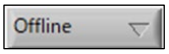
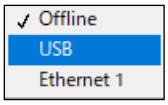
e: Create short movement
[Short movement]
When the wring is difficult, create a program to measure with short moving distance.

NOTE

If the VR software does not start properly, refer to the following section and troubleshoot the error.

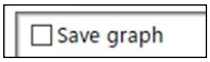
*10.2 Troubleshooting VR Software Errors*

### 7.2.2 Common part

| Items | Descriptions |
|---|---|
| During execution  Not in execution  | Show the program conditions. The following buttons are enabled during the program execution: Start button Generate program button |
| Pause  | Pause the program execution. Pause the program (waiting for trigger). (Same function as the Stop button.) |
| Select VR Unit COM Port  | Select and set COM Port number. COM Port number is set when connecting VR unit and PC with USB cable. |
| Robot Connect   | Select the connection of Epson RC+ and robot from below.   |
| IP Address  | Set IP address. Setting is required when selecting “Ethernet 1” on [Robot Connect]. |
| Stop   | Release the waiting for trigger condition. (Same function as the Pause button.) |

### 7.2.3 [Read VRT Parameter] Tab

Receive signals from VRT_Trigger command and calculate VRT parameter by results of vibration measurement by VR unit.

| Items | Descriptions |
|---|---|
| Start   | Start the waiting for trigger condition. |
| VRT Parameter   | Show VRT parameter values.<br>Parameters are calculated by vibration measurement. |
| Trigger* tab   | Show the measurement result.<br>*: Support the value (1 to 4) specified by “VRT_Trigger” command. |
| Trigger condition display   | Show the trigger condition.<br>Display is lighted up in green while waiting for trigger. Execute the robot motion program that added VRT_Trigger while the display is lighted up. |
| Condition display   | Show the execution condition of VR software.<br>In preparation<br>Waiting for trigger<br>Reading the vibration data..<br>Calculating VRT parameter..<br>Reading parameter was completed!!<br>Stop program!<br>Stop clicked |
| Save graph   | Place a checkmark ：<br>Display, save, and output the graph of vibration measurement result on [Saved vibration waveform].<br>Latest measurement result is overwritten.<br>Do not place a checkmark:<br>Measured results are not displayed, saved, and overwritten. |

Graph


Show history of the measured values.

1. Acceleration after reaching the destination point.
   (Vertical axis: Accel mG , Horizontal axis: Time sec)
2. Displacement after reaching the destination point.
   (Vertical axis: Displacement mm , Horizontal axis: Time sec)
3. Acceleration history that measured after placing a checkmark on [Save graph]
4. Displacement history that measured after placing a checkmark on [Save graph]

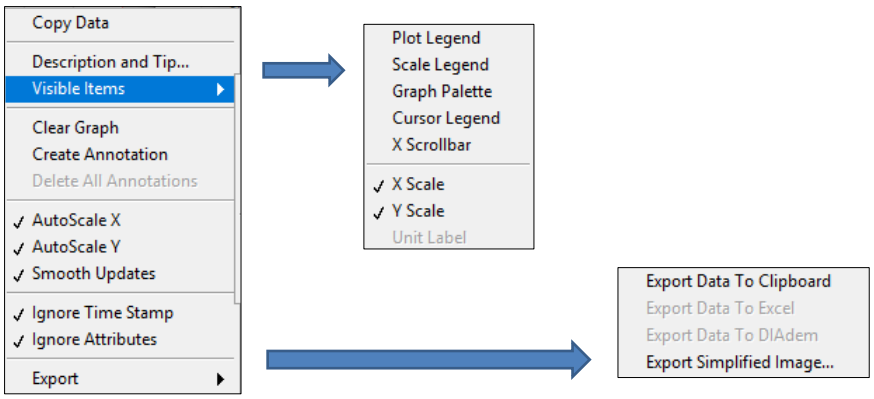
Displacement on the graph is calculated by values measured in acceleration. It is not precise value

To measure precise value, use dedicated measurement equipment.

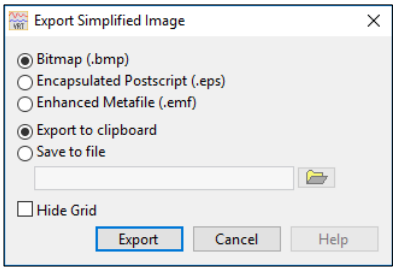
Use displacement value output from this function as rough guide to check VRT function.

## Graph extension function:

Right-click inside the graph to display the menu as shown below:




To use the graph data, select [Export]-[Export Data to Excel]. You can use the data in Excel etc.,.

| Items | Descriptions | |
|---|---|---|
| Copy data | Copy the image(s) of selected graph | |
| Description and Tip… | Graph descriptions | |
| Visible Items | Plot Legend : Show the plot name | |
| | Scale Legend : Show legend of each axis scale. | |
| | Graph Palette : Show the palette for operating graph. | |
| | Cursor Legend : Show cursor legend. | |
| | X Scrollbar : Show scroll bar of X-axis | |
| | X Scale : Show X-axis values | |
| | Y Scale : Show Y-axis values | |
| | Unit Label : Show unit | |
| Clear Graph | Clear the displayed graph | |
| Create Annotation | Create annotations in the graph. | |
| Delete All Annotations | Delete all annotations created in [Create Annotation]. | |
| AutoScale X | Auto scaling X value | |
| AutoScale Y | Auto scaling Y value | |
| Smooth Updates | Reduce to generate flicker when plotting a graph (Speed will be slow.) | |
| Ignore Time Stamp | Ignore time stamp of X value | |
| Ignore Attributes | Ignore the attributes of plot name and graph scale. | |
| Export | Export Data to Clipboard | Copy the data to clipboard. Use “Paste” to output the data. |
| | Export Data to Excel | Copy the data to Excel. Excel is started automatically. |
| | Export Simplified image.. | Export the image in the following format.  |



How to change the Y-axis scale:

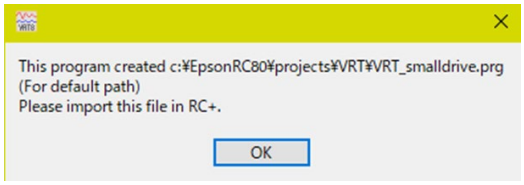
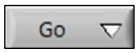
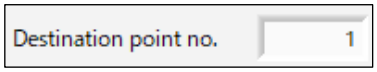
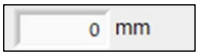
Y-axis scale can be changed by either of the following ways:

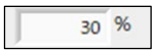
Right-click on the graph and remove a checkmark on [AutoScale Y].

Double-click the values on the graph and change it directly.

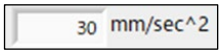
### 7.2.4 [Short movement] Tab

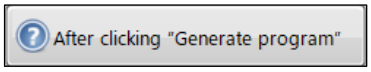
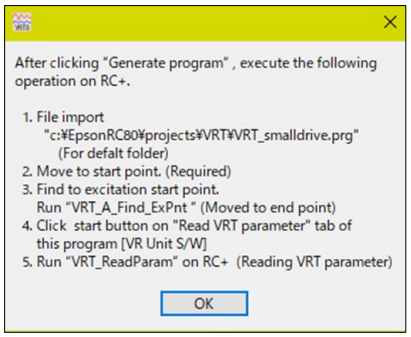
When the wring is difficult, create a program to measure with short moving distance.

| Items | Descriptions |
|---|---|
| Generate program<br>  | Generate SPEL+ program for short distance motion.<br>Click the button when all settings have completed.<br>Generated program:<br>C:\EpsonRC80\projects\VRT\VRT_smalldrive.prg<br>Click the button to pause the software.<br>The following message is displayed.<br>  |
| Robot No.<br>  | Specify the robot number to measure vibrations (install VR unit).<br>Setting values: 1 to 16 |
| Move instruction<br>  | Select move instruction (motion command) to measure vibration.<br>Options: Go , Move , Jump |
| Point number of destination point<br>  | Input a point number of the end point (destination point) (motion that has been vibrating).<br>Setting value: integer number |
| Arm No.<br>  | Set additional arm number of the robot that measures vibration.<br>Setting value: 0 to 15 |
| Tool No.<br>  | Set robot tool number of the robot that measures vibration.<br>Setting value: 0 to 15 |
| Weight<br>  | Set the weight of hand that the arm is installed.<br>Unit: kg |
| Innertia<br>(Left)  | Left: Set inertia moment around the center of the tip joint including hand and workpiece. (inertia)<br>Unit: kgm^2 |
| (Right)  | Right: Set distance from the center of inertia of hand and workpiece of the center of the tip joint.<br>Unit: mm |

| Go, Jump: Items | Descriptions |
|---|---|
| Speed<br>  | Specify as a percentage of maximum motion speed.<br>Setting value: integer number from 1 to 100<br>Unit:% |
| Accel<br>  | Specify as a percentage of maximum acceleration.<br>Setting value: integer number 1 or more<br>Unit: % |
| Decel<br>  | Specify as a percentage of maximum deceleration.<br>Setting value: 1 or more<br>Unit: % |

| Jump: Items | Descriptions |
|---|---|
| Departure Speed<br>  | Set speed of departure motion.<br>Setting value: integer number from 1 to 100<br>Unit: % |
| Approach Speed<br>  | Set speed of approach motion.<br>Setting value: integer number from 1 to 100<br>Unit: % |
| Departure Accel<br>  | Set acceleration of departure motion.<br>Setting value: integer number 1 or more<br>Unit: % |
| Approach Accel<br>  | Set acceleration of approach motion.<br>Setting value: integer number 1 or more<br>Unit: % |
| Departure Decel<br>  | Set deceleration of departure motion.<br>Setting value: integer number 1 or more<br>Unit: % |
| Approach Decel<br>  | Set deceleration of approach motion.<br>Setting value: integer number 1 or more<br>Unit: % |

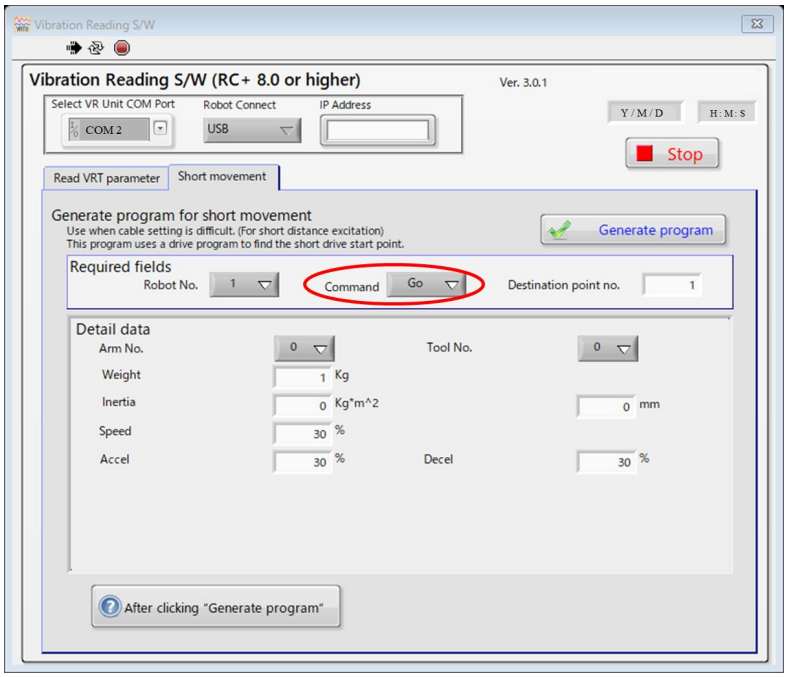
| Move: Items | Descriptions |
|---|---|
| SpeedS<br>  | Set speed in real number.<br>Unit: mm/sec |
| AccelerationS<br>  | Set acceleration in real number.<br>Unit: mm/sec^2 |
| DecelerationS<br>  | Set deceleration in real number.<br>Unit: mm/sec^2 |

| Item | Description |
|---|---|
| Operation step after generating a program<br>  | Steps after clicking the [Generate program] button are displayed.<br>  |

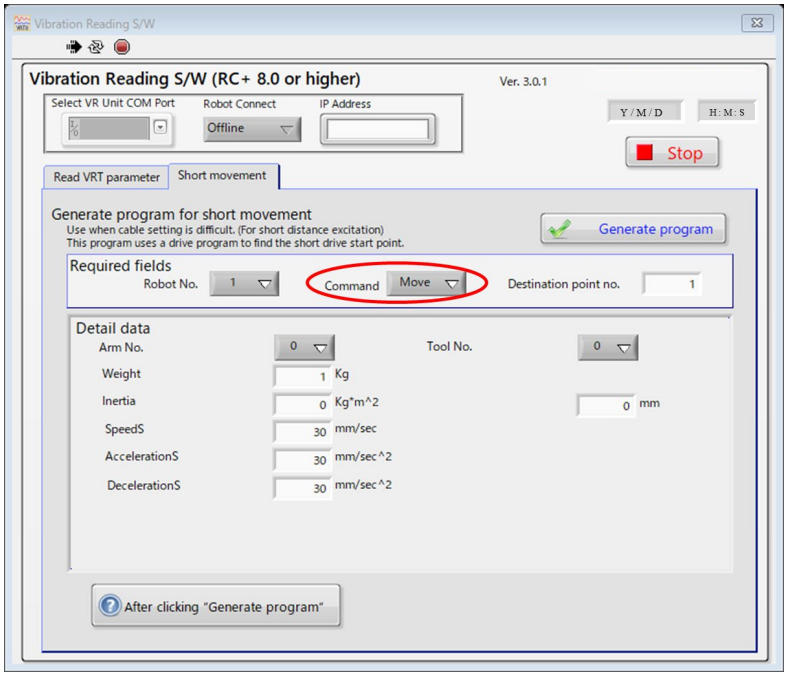
### 7.2.5 Input Window for Motion Command

Items displaying on [Detail data] differ depending on specified command on [Required fields]-[Move instruction].

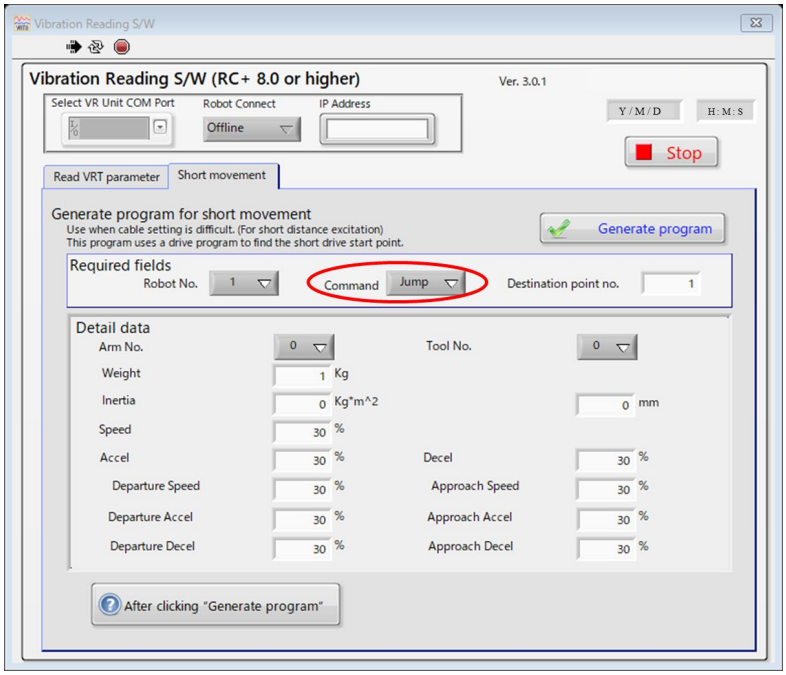
#### Go



## Move


Vibration Reading S/W
Vibration Reading S/W (RC+ 8.0 or higher)
Ver. 3.0.1
Select VR Unit COM Port
Robot Connect
Offline
IP Address
Y / M / D
H : M : S
Stop
Read VRT parameter
Short movement
Generate program for short movement
Use when cable setting is difficult. (For short distance excitation)
This program uses a drive program to find the short drive start point.
Generate program
Required fields
Robot No.
1
Command
Move
Destination point no.
1
Detail data
Arm No.
0
Tool No.
0
Weight
1
Kg
Inertia
0
Kg*m^2
0
mm
SpeedS
30
mm/sec
AccelerationS
30
mm/sec^2
DecelerationS
30
mm/sec^2
After clicking "Generate program"

## Jump


Vibration Reading S/W
Vibration Reading S/W (RC+ 8.0 or higher)
Ver. 3.0.1
Select VR Unit COM Port
Robot Connect
Offline
IP Address
Y / M / D
H : M : S
Stop
Read VRT parameter
Short movement
Generate program for short movement
Use when cable setting is difficult. (For short distance excitation)
This program uses a drive program to find the short drive start point.
Generate program
Required fields
Robot No.
1
Command
Jump
Destination point no.
1
Detail data
Arm No.
0
Tool No.
0
Weight
1
Kg
Inertia
0
Kg*m^2
0
mm
Speed
30
%
Accel
30
%
Decel
30
%
Departure Speed
30
%
Approach Speed
30
%
Departure Accel
30
%
Approach Accel
30
%
Departure Decel
30
%
Approach Decel
30
%
After clicking "Generate program"

# 8. SPEL+ Command Reference

| | |
|---|---|
| VRT | Select VRT number or display the selected VRT number. |
| VRT Function | Returns the current VRT number. |
| VRT_ Clr | Clear the setting of VRT function. |
| VRT_CPMotion | Specifies whether enable or disable VRT function during CP motion. |
| VRT_CPMotion Function | Returns enable or disable VRT function during CP motion. |
| VRT_Def Function | Returns setting status of selected VRT number. |
| VRT_Description | Define a description for selected VRT number |
| VRT_Description$ Function | Returns description of selected VRT number |
| VRT_Label | Define a label to selected VRT number. |
| VRT_Label$ Function | Returns label of selected VRT number. |
| VRT_Number Function | Returns VRT number that corresponding VRT label. |
| VRT_Set | Define VRTParam1 and VRTParam2 of VRT function for each VRT number. |
| VRT_Set Function | Returns setting value of VRTParam1 and VRTParam2 that is set for each VRT number. |
| VRT_Trigger | Output measurement trigger to VR software. |

# VRT

Select VRT number or display the selected VRT number.

### Syntax

(1) RT VRT number||VRT label
(2) VRT

### Parameters

| | |
|---|---|
| VRT number | Specify VRT number (total is 16: integer from 0 to 15) to use. |
| VRT label | Specify VRT label. |

### Return Values

When parameters are omitted, the current VRT number is displayed.

### Description

VRT function reduces vibration due to robot motion by using VRT parameters that are set for each VRT number. Also, VRT function is disabled when VRT number is “0”.

Note

### Effect on VRT number when Power OFF

Selected VRT number does not change if turning OFF the power.

### See Also

VRT_Set, VRT_CPMotion

### VRT Example

```
VRT 1
Go XY(200, 200, 0, 0)
```

# VRT Function

Returns the current VRT number.

### Syntax

VRT

### Return Values

Returns VRT number by the integer.

### See Also

VRT

### VRT Example

```
Print VRT
```

# VRT_Clr

Clear the definition of VRT function.

### Syntax

VRT_Clr VRT number||VRT label

### Parameters

| | |
|---|---|
| VRT number | Integer expression specifying VRT number to clear.<br>(VRT number 0 is default. Cannot clear.) |
| VRT label | Specify VRT label to clear. |

### See Also

VRT_Set, VRT_CPMotion

### VRT_Clr Example

```
VRT_Clr 1
```

# VRT_CPMotion

Specifies whether enable or disable VRT function during CP motion.

### Syntax

(1) VRT_CPMotion {On|Off}
(2) VRT_CPMotion

### Parameters

On|Off On: Enable VRT function during CP motion.
Off: Disable VRT function during CP motion.

### Return Values

When parameters are omitted, the current VRT_CPMotion definitions are displayed.

### Description

VRT function is only available for PTP motion. You need to turn On the VRT_CPMotion to function in CP motion. For details of motion commands that VRT function can perform, refer to the table below.

Motion commands that VRT function can function and cannot function.

| Motion command | VRT_CPMotion OFF | VRT_CPMotion ON |
|---|---|---|
| Go, BGo, TGo | OK | OK |
| Jump | OK | OK |
| JTran | OK | OK |
| PTran | OK | OK |
| Move, BMove, TMove | – | OK |
| FCSMove | – | OK |
| Arc | – | OK |
| Arc3 | – | OK |
| CvMove | – | OK |
| Jump3CP | – | OK |
| Jump3(JumpTlz) | – | OK |

- Initial definition of VRT_CPMotion is OFF.
- If turning VRT_CPMotion ON, automatically SoftCP turns ON.
- Cannot use with conveyor tracking or force control function.
  (VRT function automatically disabled.)

Note

**Effect on VRT_CPMotion when Power OFF**

Definition of selected VRT_CPMotion does not change if turning OFF the power.

### See Also

VRT, VRT_Set

### VRT_CPMotion Example

```
VRT_CPMotion On
```

# VRT_CPMotion Function

Returns enable or disable VRT function during CP motion.

### Syntax

VRT_CPMotion

### Return Values

0 = VRT is disabled during CP motion.
1 = VRT is disabled during CP motion.

### See Also

VRT, VRT_Set

### VRT_CPMotion Example

```
Print VRT_CPMotion
```

# VRT_Def Function

Returns definition status of selected VRT number.

### Syntax

VRT_Def (VRT number|VRT label)

### Parameters

| | |
|---|---|
| VRT number | Integer expression specifying VRT number to return the status. |
| VRT label | Specify the VRT label to return the status. |

### Return Values

Returns “True” when parameter is defined in specified VRT number and returns “False” when parameter is not defined in specified VRT number.

### See Also

VRT_Set, VRT_CPMotion

### VRT_ Def Example

```
Print VRT_ Def(1)
```

# VRT_Description

Define a description for selected VRT number.

### Syntax

VRT_Description VRT number|VRT label, “Comment”

### Parameters

| | |
|---|---|
| VRT number | Integer expression specifying VRT number to description.<br>(VRT number 0 is default. Cannot define a description.) |
| VRT label | Specify VRT label. |
| Comment | Define a random character string (except NULL character) that is less than 255 words. |

### See Also

VRT_Set, VRT_CPMotion

### VRT_Description Example

```
VRT_Description 1, “Comment”
```

# VRT_Description$ Function

Returns description of selected VRT number.

### Syntax

VRT_Description (VRT number|VRT label)

### Parameters

| | |
|---|---|
| VRT number | Integer expression specifying VRT number to return descriptions. |
| VRT label | Specifies VRT label that returns description. |

### Return Values

Returns defined descriptions of VRT number as a string.

### See Also

VRT_Set, VRT_CPMotion

### VRT_Description Example

# VRT_Label

Define a label to selected VRT number.

### Syntax

VRT_Label VRT number, “Label”

### Parameters

| | |
|---|---|
| VRT number | Integer expression specifying VRT number to define a label.<br>(VRT number 0 is default. Cannot define a description.) |
| Label | Define a random character string (except NULL character) that is less than 32 words. |

### See Also

VRT_Set, VRT_CPMotion

### VRT_Label Example

```
VRT_Label 1, “Label”
```

# VRT_Label$ Function

Returns label of selected VRT number.

### Syntax

VRT_Label(VRT number)

### Parameters

VRT number Integer expression specifying VRT number to return a label.

### Return Values

Returns defined VRT label as a string.

### See Also

VRT_Set, VRT_CPMotion

### VRT_Description Example

```
Print VRT_Label$(1)
```

# VRT_Number Function

Returns VRT number that corresponding VRT label.

**Syntax**

VRT_Number(VRT label)

**Parameters**

VRT label Specify VRT label to return VRT number.

**Return Values**

Returns number of specified VRT label.

**See Also**

VRT_Set, VRT_CPMotion

# VRT_Set

Define VRTParam1 and VRTParam2 of VRT function for each VRT number.

### Syntax

(1) VRT_Set VRT number||VRT label, VRTParam1, [VRTParam2]
(2) VRT_Set VRT number||VRT label
(3) VRT_Set

### Parameters

| | |
|---|---|
| VRT number | Integer number (1 to 15) representing VRT number to define.<br>(0 is default. Cannot be specified.) |
| VRT label | Specify the VRT label to define. |
| VRTParam1 | Define a value of VRTParam1. Definition range is from 100 to 500. |
| VRTParam2 | Define a value of VRTParam2. Definition range is from 100 to 500. Also, VRTParam2 should be defined a value that differs ±10% or more compared to VRTParam1. |

### Return Values

When parameters are omitted, the current VRT definition value is displayed.

### Description

VRT function reduces vibration due to robot motion by using definition value of VRTParam1 and VRTParam2.

### See Also

VRT_Set, VRT_CPMotion

### VRT_Set Example

```
VRT_Set 1, 100, 2000
```

# VRT_Set Function

Returns definition value of VRTParam1 and VRTParam2 that is define for each VRT number.

### Syntax

VRT_Set (VRT number|VRT label, VRTParam)

### Parameters

| | |
|---|---|
| VRT number | Integer number (1 to 15) representing VRT number to define.<br>(0 is default. Cannot be specified.) |
| VRT label | Specify the VRT label. |
| VRTParam | Specify VRTParam1 to return VRTParam1.<br>Specify VRTParam2 to return VRTParam2. |

| Constant | Value |
|---|---|
| VRTParam1 | 1 |
| VRTParam2 | 2 |

### Return Values

Returns definition value of VRTParam1 or VRTParam2 in integer value.

### See Also

VRT_Set, VRT_CPMotion

### VRT_Set Example

```
Print VRT_Set(1, VRTParam1)
```

# VRT_Trigger

Output measurement trigger to VR software.

### Syntax

VRT_Trigger(VRTTrigger number)

### Parameters

VRTTrigger number  Integer number (1 to 4) representing VRTTrigger number to define.

### Return Values

Output measurement trigger to VR software.

### Description

When executing the robot motion by using VRT_Trigger command, Waiting time (approx. 1.5 seconds) occurs. (If releasing from the waiting for trigger condition of VR software, automatically added Waiting time will not occur.)

In the following cases, compile error occurs:

Use motion command other than Go, Jump, and Move

Path motion is enabled.

Use it with Force Control function

Use Till command

Use Find command

Use Sense command

Use it with !Parallel Processing!.

Use it with conveyor tracking  function.

Use it with ECP function.

### VRT_Trigger Example

```
Go P1 VRT_Trigger 1
```

# 9. SPEL+ Command

## 9.1 Example

Example 1: VRT number: 1 parameter
Main case: Use VRT function to all motion.

```
Function main
   Motor On
   Power High
      Speed 100
   Accel 100, 100

   VRT_Set 1, 150, 300
   VRT 1
   Go XY(200, 200, 0, 0)
   Go XY(-200, 200, 0, 0)
Fend
```

Example 2: VRT number: 2 parameters
Main case: Use two VRT parameters. Enable/disable VRT function.

```
Function main
   Motor On
   Power High

   Speed 100
   Accel 100, 100

   VRT_Set 1, 150, 300
   VRT_Set 2, 100, 200
   VRT 1
   Go XY(200, 200, 0, 0)
   Go XY(-200, 200, 0, 0)
   VRT 0
   Go XY(-150, 200, 0, 0)
   VRT 2
   Go XY(-120, 200, 0, 0)
Fend
```

Example 3: Do not change VRT number and change VRT parameter.

```
Function main
   Motor On
   Power High

   Speed 100
   Accel 100, 100

   VRT_Set 1, 150, 300
   VRT 1
   Go XY(200, 200, 0, 0)
   Go XY(-200, 200, 0, 0)
   VRT_Set 1, 250, 350
   Go XY(-150, 200, 0, 0)
   Go XY(-120, 200, 0, 0)
Fend
```

Example 4: Use VRT function in CP motion

```
Function main
   Motor On
   Power High

   Speed 100
   Accel 100, 100
   SpeedS 2000
   AccelS 25000, 25000


   VRT_Set 1, 150, 300
   VRT 1
   VRT_CPMotion On

   Go XY(200, 200, 0, 0)
   Move XY(-200, 200, 0, 0)

Fend
```

Note: As shown below, path motion cannot be operated by motions that VRT function automatically “disabled” and “enabled”. (Path motion is “disabled” automatically.)

```
VRT 1
VRT_CPMotion Off

Go P1 CP
Move P2
```

## 9.2 SPEL+ Command Use Condition List

Command window Command can be used in the command window.
Program Command can be used as a statement in the SPEL+ program.
Function Command can be used as a function.

| Command | | Command Window | | Program | Function |
|---|---|---|---|---|---|
| | | RC+ | TP3/TP4 | | |
| V | VRT | ✓ | ✓ | ✓ | ✓ |
| | VRT_Clr | ✓ | ✓ | ✓ | - |
| | VRT_CPMotion | ✓ | ✓ | ✓ | ✓ |
| | VRT_Def | ✓ | ✓ | - | ✓ |
| | VRT_Description | ✓ | ✓ | ✓ | - |
| | VRT_Description$ | ✓ | ✓ | - | ✓ |
| | VRT_Label | ✓ | ✓ | ✓ | - |
| | VRT_Label$ | ✓ | ✓ | - | ✓ |
| | VRT_Number | ✓ | ✓ | - | ✓ |
| | VRT_Set | ✓ | ✓ | ✓ | ✓ |
| | VRT_Trigger | ✓ | ✓ | ✓ | - |

The following commands cannot be executed in NoEmgAbort task and background task.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | Accel | G | Go | S | Sense | V | VLoad |
| | AccelR | H | Home | | SFree | | VLoadModel |
| | AccelS | | HomeClr | | SingularityAngle | | VRun |
| | Arc | | HomeSet | | SingularitySpeed | | VRT |
| | Arc3 | | Hordr | | SLock | | VRT_Set |
| | Arch | I | Inertia | | SoftCP | | VRT_CPMotion |
| | Arm | J | JTran | | Speed | | VSave |
| | ArmSet | | Jump | | SpeedFactor | | VSaveImage |
| | ArmClr | | Jump3 | | SpeedR | | VSaveModel |
| | AutoLJM | | Jump3CP | | SpeedS | | VSet |
| | AvoidSingularity | | JRange | | SyncRobots | | VShowModel |
| B | Base | L | LimitTorque | T | TC | | VStasShow |
| | BGo | | LimZ | | TGo | | VStatsReset |
| | BMove | | LimZMargin | | Till | | VStatsResetAll |
| | Box | | Local | | TLSet | | VStatsSave |
| | BoxClr | | LocalClr | | TLClr | | VTeach |
| | Brake | M | MCal | | TMove | | VTrain |
| C | Cnv_AbortTrack | | MCordr | | Tool | W | WaitPos |
| | Cnv_Accel | | Motor | | Trap | | Weight |
| | Cnv_DownStream | | Move | V | VCal | X | Xqt *3 |
| | Cnv_Fine | O | OLAccel | | VcalPoints | | XYLim |
| | Cnv_Mode | P | Pass | | VCls | | |
| | Cnv_QueAdd | | Pg_LSpeed | | VCreateCalibration | | |
| | Cnv_QueMove | | Pg_Scan | | VCreateObject | | *1: Reset Error is executable |
| | Cnv_QueReject | | Plane | | VCreateSequence | | |
| | Cnv_QueUserData | | PlaneClr | | VDefArm | | |
| | Cnv_Trigger | | Power | | VDefGetMotionRange | | *2: Executable from the Trap Error processing task |
| | Cnv_UpStream | | PTPBoost | | VDefLocal | | |
| | CP | | Pulse | | VDefSetMotionRange | | |
| | Curve | Q | QP | | VDefTool | | |
| | CVMove | | QPDecelR | | VDeleteCalibration | | *3: Executable from the background tasks |
| E | ECP | | QPDecelS | | VDeleteObject | | |
| | ECPClr | R | Range | | VDeleteSeuence | | |
| | ECPSet | | Reset *1 | | VGet | | |
| F | Find | | Restart *2 | | VGoCenter | | |
| | Fine | | | | | | |

**See Also**

Function/Fend, Halt, Resume, Quit, Startmain, Trap

# 10. Troubleshooting

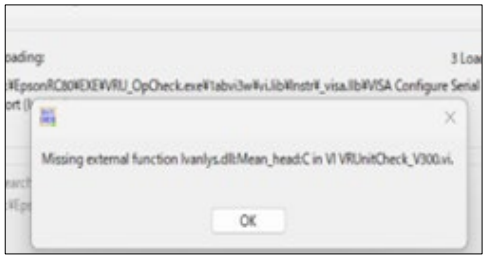
## 10.1 SPEL+ Error Massages

To get remedy for any SPEL+ error, place the cursor on the error message in the run or command window and press the F1 key.

| No. | Message | Remedy | Note 1 | Note 2 |
|---|---|---|---|---|
| 2211 | Cannot clear VRT ' 0 '. | The VRT number 0 cannot be cleared. Review the program. | | |
| 2212 | Cannot clear the specified VRT number while in use. | The VRT cannot be cleared while it is in use. Check whether the VRT is not used. | VRT number | |
| 2214 | VRT number is out of range. | Available VRT numbers are from 1 to 15. Review the program. | | |
| 2215 | Parameter is not defined in specified VRT number. | Parameter is not defined in specified VRT number.<br>Review the VRT number. | | |
| 2375 | Label name length is out of range | The label name length is 32 words. Review the label name. | 1:VRT | |
| 2376 | Description length is out of range. | Description length is 255 words. Review the Description. | 1:VRT | |
| 2547 | The option cannot be used. | Enable the option. | 1:VRT | |
| 2554 | Duplicate data label. Specified label name is already used. Change the label name. | Change the label name. | 1:VRT | |
| 2555 | Specified label was not defined. Specify a defined Label. | Specify a defined Label. | 1:VRT | |
| 4244 | When VRT function was used, Improper acceleration reference was generated. | You attempted to operate the robot with the acceleration reference exceeding the specified value.<br>Decrease the Accel and AccelS value. | | |
| 4245 | When VRT function was used, Improper speed reference was generated in high power mode. | You attempted to operate the robot with the acceleration reference exceeding the specified value.<br>Decrease the Accel and AccelS or Speed and SpeedS value. | | |
| 4246 | When the VRT function was used, the route error occurred. | Change the value of VRTParam1 and VRTParam2 or disable the VRT function. | | |
| 4247 | When the VRT function was used, The internal operation error occurred. | Change the value of VRTParam1 and VRTParam2 or disable the VRT function. | | |

## 10.2 Troubleshooting VR Software Errors

VR Software starting error: If you had the error below when starting VR software, your PC may be equipped with an AMD Ryzen processor. In that case, set the Windows system environment variables as shown in the steps below.



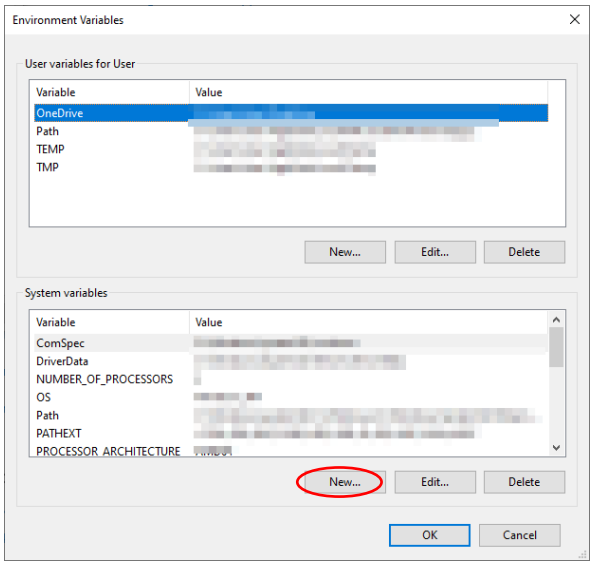

(1) Open the environment variables window. (The steps are different for Windows 10 and 11.)

Windows 10:

1. Open the Control Panel.
2. Select [System and Security]-[System]-[About]-[Advanced system settings]-[Advanced]-[Environment Variables].
3. "Environment Variables" window will open.

Windows 11:

1. Open the Windows Settings.
2. Select [System]-[About]- [Advanced system settings]-[Advanced]-[Environment Variables].
3. "Environment Variables" window will open.

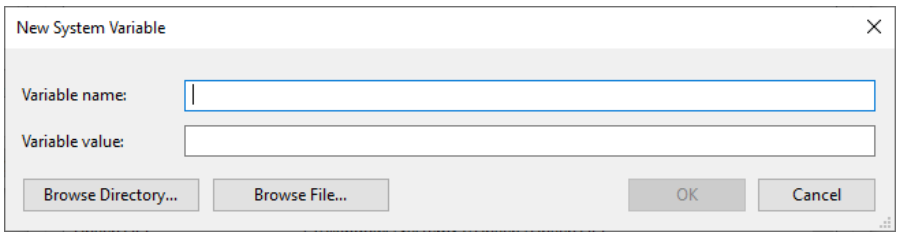


(2) Click [New] of [Environment Variables] (red circle in the above figure). Following "New System Variable" window will open.

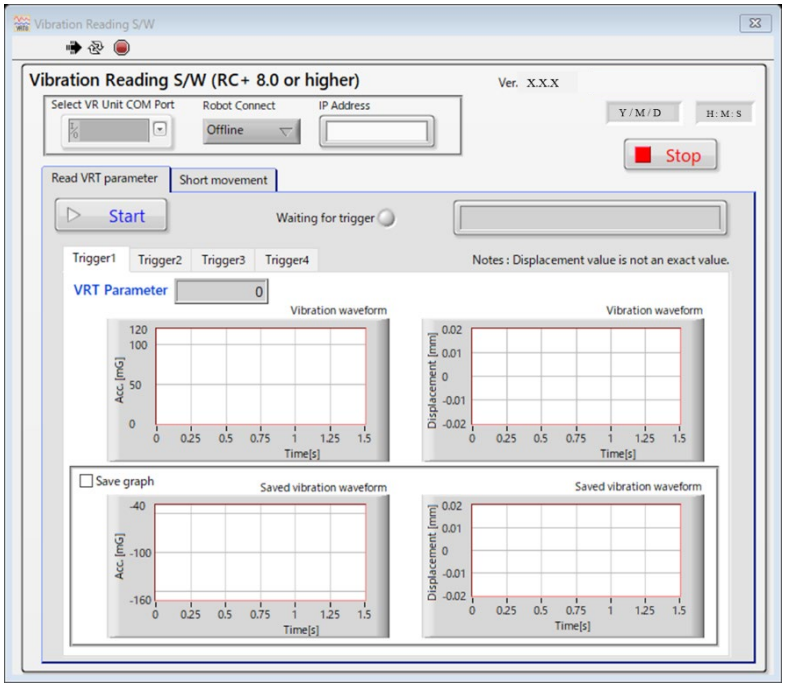
Enter as follows and click the [OK] button.

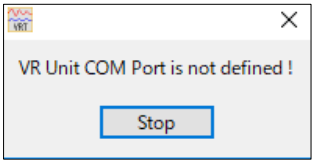
Variable name: MKL_DEBUG_CPU_TYPE

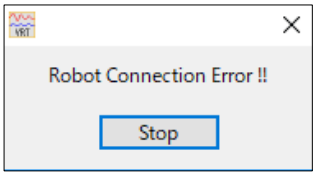
Variable value: 4

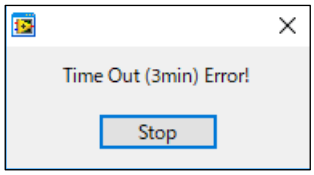



This section describes errors occurred in VR software and countermeasures.




| Connection error of VR unit | | |
|---|---|---|
| Error display |  | VR Unit COM Port is not defined!<br>Unit Sampling Mode Error |
| Countermeasure | Confirm that USB cable is connected properly.<br>When the cable is connected properly, red lamp is lighted up in the back of USB connection part of VR unit.<br>If there is no problem with the connection, execute VR software again.<br>Select COM Port number of VR unit on VR software-[Select COM Port]. | |

| Connection error with Robot | | |
|---|---|---|
| Error display |  | Robot Connection Error!!<br>Proxy initialization error! Check robot Connection. |
| Countermeasure | Make sure that the connection methods of VR software-[Robot Connect] and Epson RC+ - the robot are the same.<br>When changing the settings, execute VR software again. | |

| Other error | |
|---|---|
| Error display |  |
| Countermeasure | If VRT_Trigger command is not executed for 3 minutes by Epson RC+ with waiting for Trigger condition, “Time Out” error occurs.<br>Execute VR software again. |

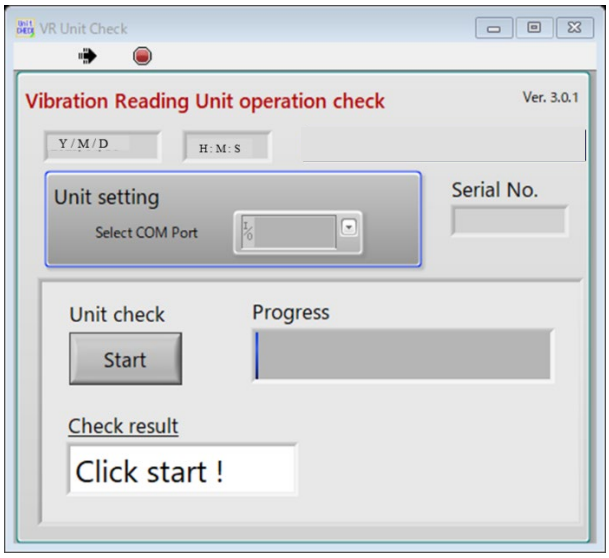
## 10.3 VR Unit Confirmation

There is software to confirm whether sensor of VR unit is broken.

VR unit has function to measure acceleration. Read acceleration of gravity and determine whether the VR unit is normal.

(1) Follow the either way to activate the software for the sensor confirmation.

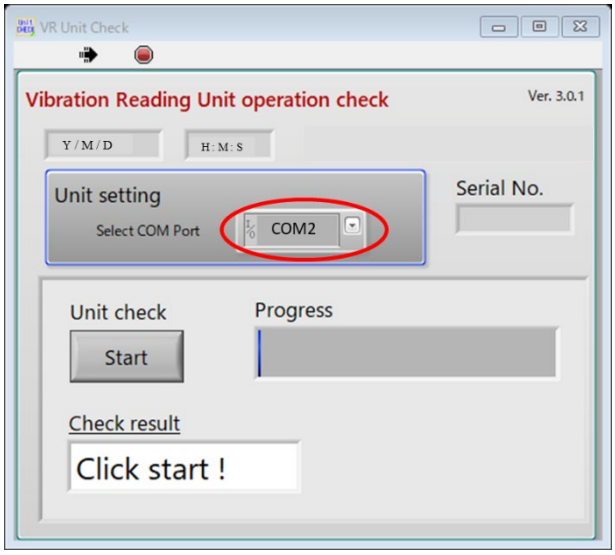
- With Epson RC+ 8.0, click the [Robot Manager]-[VRT]-[Test] button.
- Activate “C: \EpsonRC80\exe\VRU_OpCheck.exe”



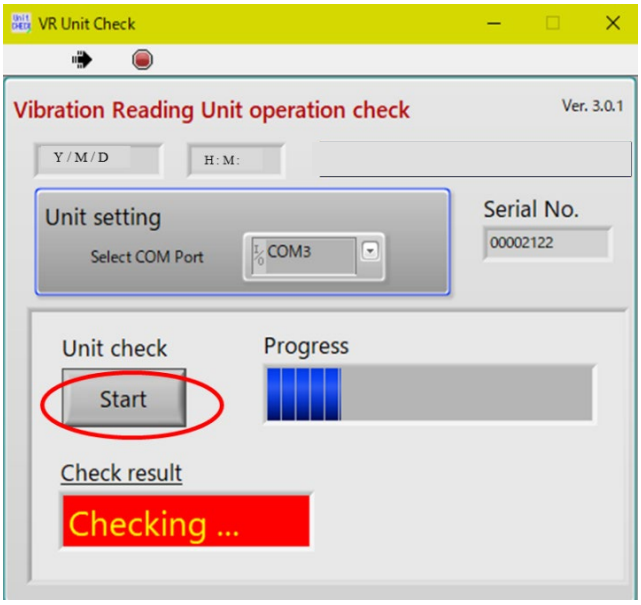

(2) Place the VR unit to position where the unit can stand still.
If the unit does not move, you can place the unit on tilted surface. At this time, you can check the VR unit even if it is not installed on the robot.

(3) Connect the VR unit and PC with USB cable.

(4) Select USB COM number of VR unit on [Unit setting –Select COM Port].

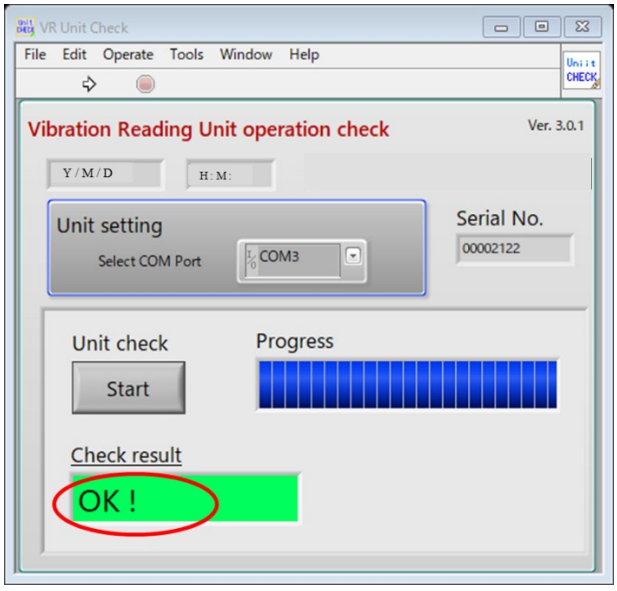


(5) Click the [Start] button to start measurement.
5 seconds after starting the measurement, measurement results are displayed on [Check result].



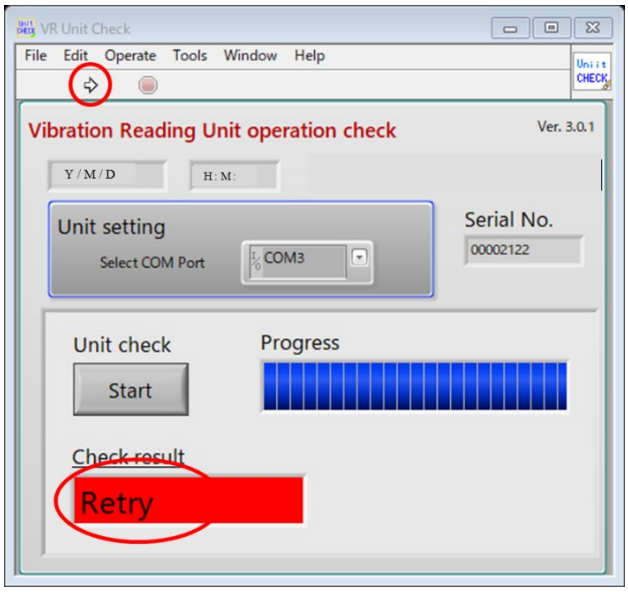

When “OK!” is displayed:

VR unit operates properly.



When “Retry” is displayed:

VR unit may not be stood still.




Click the Execution button  and the [Start] button.

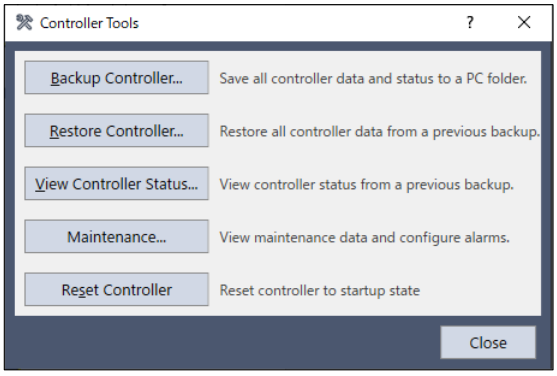
If “OK” is not displayed on [Check result] after clicking the Execution button and the [Start] button repeatedly, please contact us.

(6) Ends the sensor confirmation software.

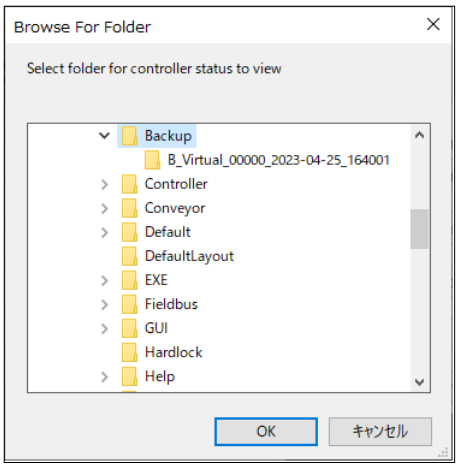
## 10.4 Confirmation of Saved Controller Condition

You can confirm the conditions of saved controller.

(1) Select Epson RC+ 8.0 menu-[Tools]-[Controller] menu to open the [Controller Tools] dialog.




(2) Click on the [View Controller Status] button to open the [Browse For Folder] dialog.




(3) Select the folder where the information is stored.

NOTE

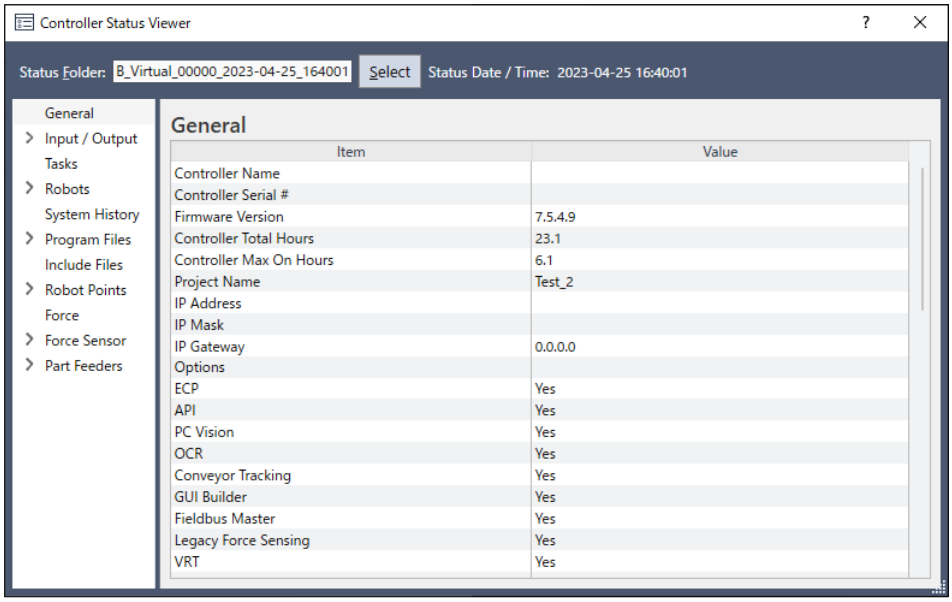
B_controller type_controller serial number_date/time

You can choose the folder that stored Controller status information.

BU_controller type_controller serial number_date/time

(4) Click [OK] to view the selected controller status.

(5) The [Controller Status Viewer] dialog will be displayed.




(6) Select items to view from the tree on the left side of the dialog.

(7) To view another controller status, click the […]button next to the [Status Folder] and select a new status folder.