

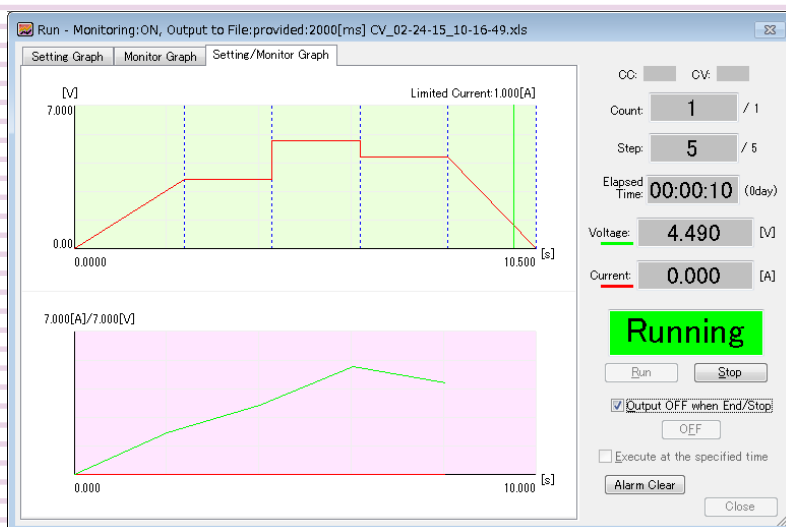


Operation Guide

Sequence Creation Software

SD024-PAV Wavy for PAV

Ver. 6.x



About This Guide

This guide is a PDF version of the SD024-PAV Wavy for PAV help file.

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Introduction

Sequence Creation Software SD024-PAV Wavy for PAV is a software application that is used to create and execute sequences on PAV Series regulated DC power supplies. This operation guide explains how to use Sequence Creation Software SD024-PAV Wavy for PAV to control PAV Series regulated DC power supplies.

■ Applicable version

This operation guide applies to version 6.x of SD024-PAV Wavy for PAV. To find out the version of the Wavy for PAV, click on the Help menu and select About Wavy.

■ Intended readers of this operation guide

This operation guide is intended for users who will use SD024-PAV Wavy for PAV to control DC power supplies and instructors of such users.

It assumes that the reader has knowledge about electrical aspects of DC power supplies.

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■ Notations used in this guide

- In this guide, SD024-PAV Wavy for PAV is referred to as "Wavy for PAV" or "Wavy." PAV Series regulated DC Power Supply is referred to as the "PAV Series."
- The term "PC" means both personal computers and workstations.
- The following markings are used in this guide.

NOTE Indicates information that you should know.

Configuring the Interface

You need to configure the interface before using Wavy.

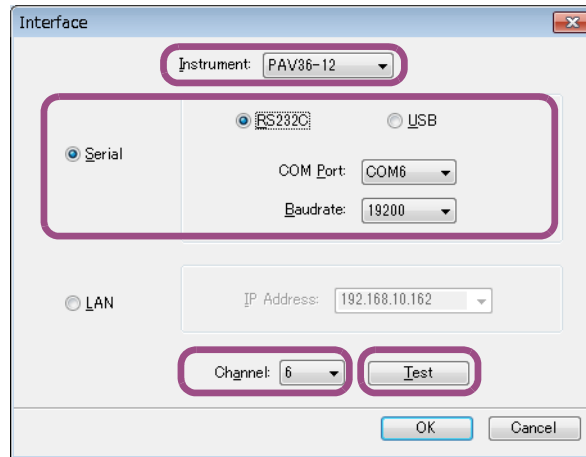
Using the RS232C interface

■ Configuration on the PAV series

- 1 Turn the POWER switch on of the PAV Series.**
- 2 Make sure that the PAV output is off.**
- 3 Press REM.**
The REM LED lights, and the voltmeter shows "INTF" (INTERFACE).
- 4 Press the VOLTAGE knob.**
The ammeter shows the present communication interface name.
- 5 Turn the CURRENT knob to select "232", and then press the CURRENT knob.**
When RS232C is set, the display blinks and returns to the original screen.
- 6 When the ammeter meter shows "Addr" (ADDRESS), press the CURRENT knob.**
The ammeter shows the present address (channel).
- 7 Turn the CURRENT knob to select the address (channel), and then press the CURRENT knob.**
When the address is set, the display blinks and returns to the original screen.
- 8 Turn the VOLTAGE knob until the voltmeter shows "baud" (BAUDRATE), and then press the VOLTAGE knob.**
The ammeter shows the present baudrate.
- 9 Turn the CURRENT knob to select the baudrate, and then press the CURRENT knob.**
When the baudrate is set, the display blinks and returns to the original screen.
- 10 Turn the VOLTAGE knob until the voltmeter shows "LANG" (LANGUAGE), and then press the VOLTAGE knob.**
The ammeter shows the present command language.
- 11 Turn the CURRENT knob to select "SCPI" (SCPI), and then press the CURRENT knob.**
When SCPI is set, the display blinks and returns to the original screen.
- 12 Connect the PAV series to your PC.**

■ Configuration of Wavy

- 13 Start Wavy.**
- 14 Click on the Setting menu and select Interface.**
The Interface window opens.



15 Select the connected PAV from the Instrument.

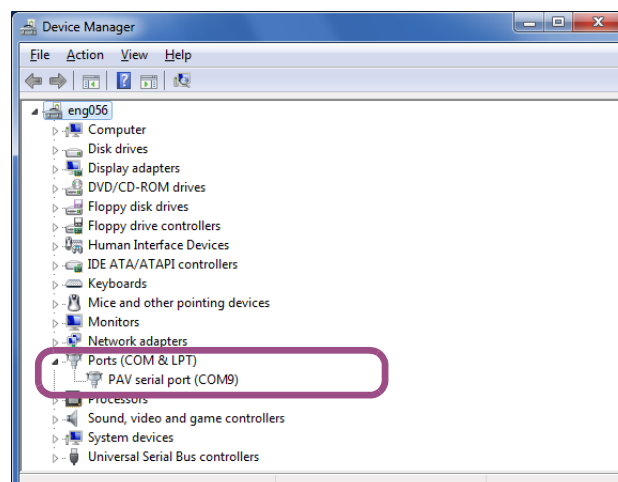
The maximum value that can be specified on Wavy is limited to 105 % of the rated output of the selected model. Select the correct model. For example, if you select PAV36-6, you will not be able to set values exceeding 37.8 V (36 x 1.05).

16 Click on the Serial and select RS232C.

17 From COM Port, select the port number that the PAV is using.

From Windows Control Panel, open Device Manager.

Open Port (COM & LPT) to view the port number in use.



18 Select the Baudrate that you set on the PAV side.

19 Select the Channel (address) that you set on the PAV side.

20 Click Test to verify that your PC is communicating with the PAV.

With the exception of the baudrate, the protocol on the PAV series side is fixed. It is set as follows:

Data bit: 8 bits, Stop bit: 1 bits, Parity bit: none, and X-flow control: off

Wavy exchanges data according to the above protocol settings. There is no need to manually change them on the PC side.

21 Click OK.

Using the USB interface

NOTE

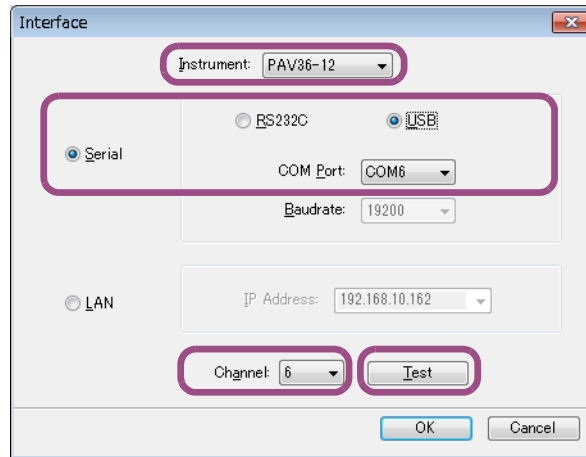
To use a USB, USB driver for PAV series needs to be installed on your PC. The driver is included in the CD-ROM. For details on installing, see the PAV series Communication Interface Manual.

■ **Configuration on the PAV series**

- 1 Turn the POWER switch on of the PAV Series.**
- 2 Make sure that the PAV output is off.**
- 3 Press REM.**
The REM LED lights, and the voltmeter shows "INTF" (INTERFACE).
- 4 Press the VOLTAGE knob.**
The ammeter shows the present communication interface name.
- 5 Turn the CURRENT knob to select "USB" (USB), and then press the CURRENT knob.**
When USB is set, the display blinks and returns to the original screen.
- 6 When the ammeter meter shows "Adr" (ADDRESS), press the CURRENT knob.**
The ammeter shows the present address (channel).
- 7 Turn the CURRENT knob to select the address (channel), and then press the CURRENT knob.**
When the address is set, the display blinks and returns to the original screen.
- 8 Turn the VOLTAGE knob until the voltmeter shows "LANG" (LANGUAGE), and then press the VOLTAGE knob.**
The ammeter shows the present command language.
- 9 Turn the CURRENT knob to select "SCPI" (SCPI), and then press the CURRENT knob.**
When SCPI is set, the display blinks and returns to the original screen.
- 10 Connect the PAV series to your PC.**

■ **Configuration of Wavy**

- 11 Start Wavy.**
- 12 Click on the Setting menu and select Interface.**
The Interface window opens.



13 Select the connected PAV from the Instrument.

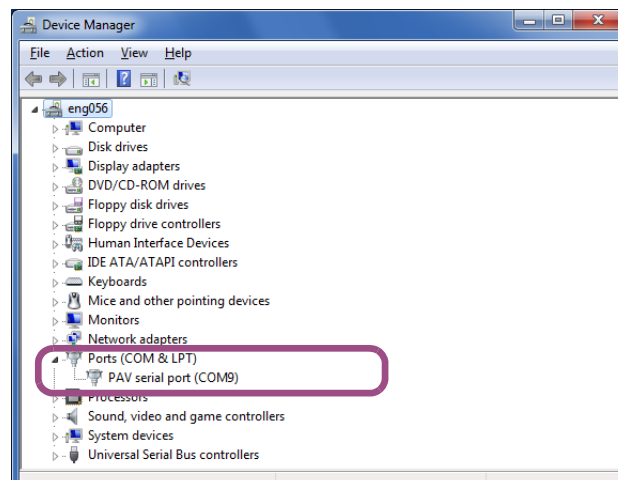
The maximum value that can be specified on Wavy is limited to 105 % of the rated output of the selected model. Select the correct model. For example, if you select PAV36-6, you will not be able to set values exceeding 37.8 V (36 x 1.05).

14 Click on the Serial and select USB.

15 From COM Port, select the port number that the PAV is using.

From Windows Control Panel, open Device Manager.

Open Port (COM & LPT) to view the port number in use.



A PAV connected to the PC's USB port is handled as though it is connected to the COM (RS232) port by the installed USB driver. As such, when you view the connection on Device Manager, the PAV appears under COM port. Even though it is connected the COM port, there is no need to set the baudrate or other communication protocol settings.

16 Select the Channel (address) that you set on the PAV side.

17 Click Test to verify that your PC is communicating with the PAV.

18 Click OK.

Using the LAN interface

This is applicable only to PAVs with the LAN interface option.

■ Configuration on the PAV series

- 1 Turn the POWER switch on of the PAV Series.**
- 2 Make sure that the PAV output is off.**
- 3 Press REM.**
The REM LED lights, and the voltmeter shows "INTF" (INTERFACE).
- 4 Press the VOLTAGE knob.**
The ammeter shows the present communication interface name.
- 5 Turn the CURRENT knob to select "LAN", press the CURRENT knob.**
When LAN is set, the display blinks and returns to the original screen.
- 6 When the ammeter meter shows "Addr" (ADDRESS), press the CURRENT knob.**
The ammeter shows the present address (channel).
- 7 Turn the CURRENT knob to select the address (channel), press the CURRENT knob.**
When the address is set, the display blinks and returns to the original screen.
- 8 Turn the VOLTAGE knob until the voltmeter shows "LANG" (LANGUAGE), press the VOLTAGE knob.**
The ammeter shows the present command language.
- 9 Turn the CURRENT knob to select "SCPI", press the CURRENT knob.**
When SCPI is set, the display blinks and returns to the original screen.
- 10 Turn the VOLTAGE knob until the voltmeter shows "IP", and then press the VOLTAGE knob.**
- 11 Turn the VOLTAGE knob, and the record the displayed IP address.**
The voltmeter shows "IP !" to "IP4," and the ammeter displays the corresponding IP address.
- 12 Connect the PAV series to your PC.**
- 13 Start an WEB browser to open the PAV home page, and then enter the PAV's IP address.**
Change the settings on the LAN page according to the network that the PAV series is connecting to. For details, see the PAV series LAN Interface Manual.



PAV Series
Regulated DC Power Supply
200W/400W/600W/800W



Home	Configure	Advanced	Users
DC Power	Present LAN Configuration		
LAN	IP Address Source:	DHCP/Auto IP	
Help	IP Address:	192.168.10.151	
LOGOUT	Subnet Mask:	255.255.255.0	
	Default Gateway:	192.168.10.252	
	DNS Server:	192.168.251.22	
	Hostname:	PAV320-1P3-001	
	Description:	PAV Power Supply	
	Controller Access:	One Client Only	
		Modify	

■ Configuration of Wavy

14 Start Wavy.

15 Click on the Setting menu and select Interface.
The Interface window opens.

16 Select the connected PAV from the Instrument.

The maximum value that can be specified on Wavy is limited to 105 % of the rated output of the selected model. Select the correct model. For example, if you select PAV36-6, you will not be able to set values exceeding 37.8 V (36 x 1.05).

17 Select LAN.

18 From IP Address, select the IP address of the connected PAV series.

If the IP address is not displayed even when the PAV series is connected properly, you need to search for the device connected through LAN using the VISA library.

19 Click Test to verify that your PC is communicating with the PAV Series.

20 Click OK.

See p. 10

When the PAV Series suddenly become unrecognized

When you are not using a fixed IP address, the IP address of the PAV Series may change. In such a case, check the IP address from the REM menu, and set the IP address again.

Searching for the device connected through LAN

The following procedure is for when KI-VISA is used for the VISA library. If you are using another VISA library, see the corresponding manual.

1 On the task bar, click Start, All Programs, Kikusui IO Software, KI-VISA, and then Instrument Explorer.

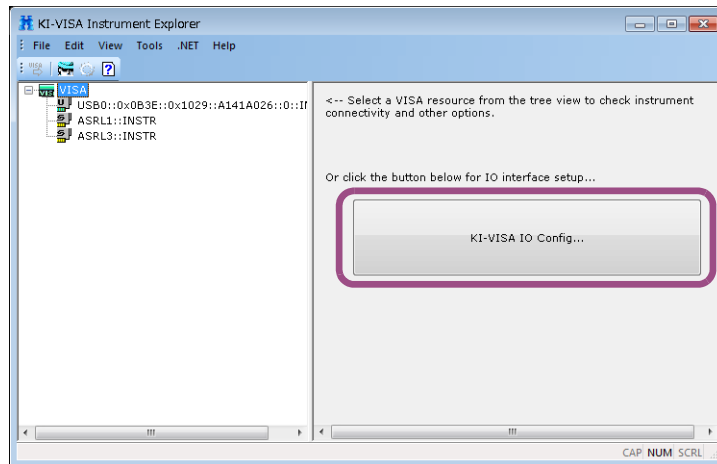
Instrument Explorer will start.

If "Instrument Explorer" is not displayed in the Start menu or the desktop, open KiVisa-Exp.exe in the following folder.

64 bit OS: C:\Program Files\IVI Foundation\VISA\VisaCom64\KiVisa

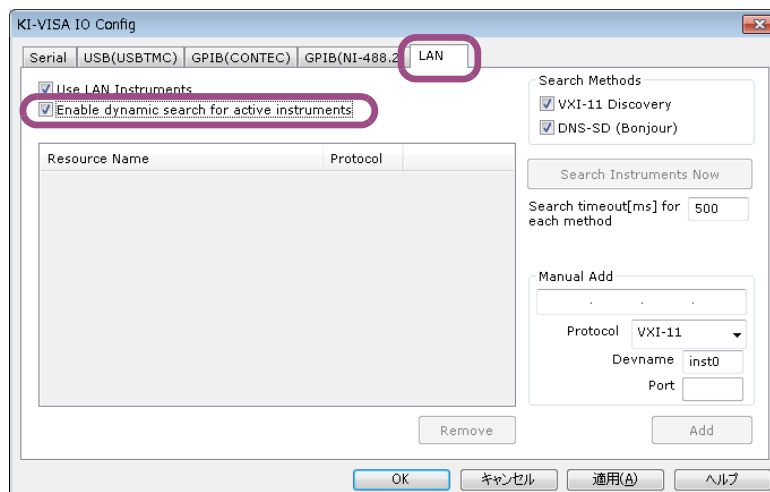
32 bit OS: C:\Program Files (x86)\IVI Foundation\VISA\VisaCom\KiVisa

2 Click KI-VISA IO Config.

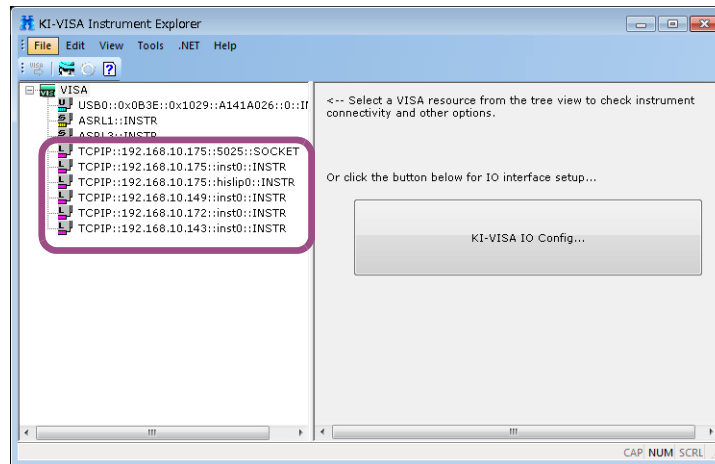


3 Click the LAN tab.

4 Select the Enable dynamic search for active instrument check box.



- 5** Click OK.
The KI-VISA IO Config window opens.
- 6** Check that the IP address of the connected PAV series appears in the tree on the left side of the Instrument Explorer window, and close Instrument Explorer.

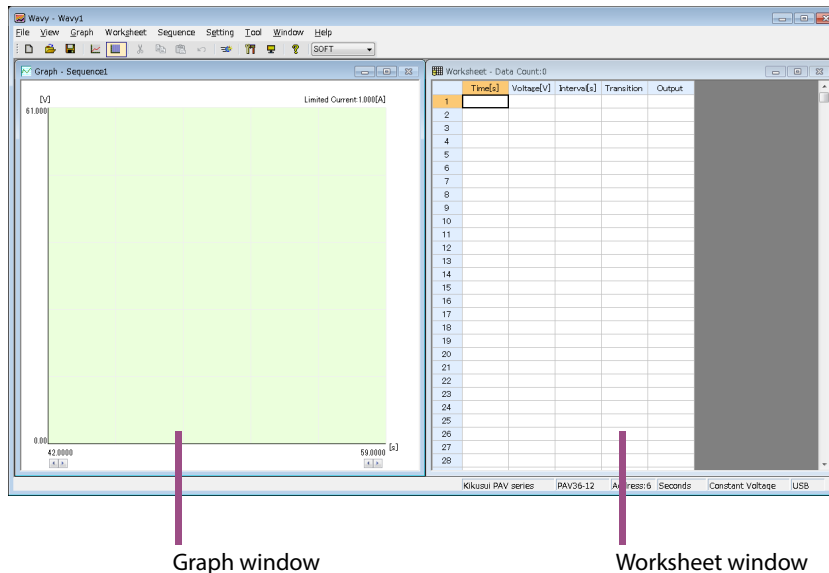


You can now select the IP address in the Wavy's interface window.

Screen Overview

Sequence Setup window

When you start Wavy, a main window comprising Graph and Worksheet windows appears.



In the Graph window, you can set the steps by drawing lines with a mouse.
In the Worksheet window, you can set the steps by entering the values.

Selecting the sequence mode

You can select from three sequence modes.
You can select the sequence mode when the sheet window contains no data.

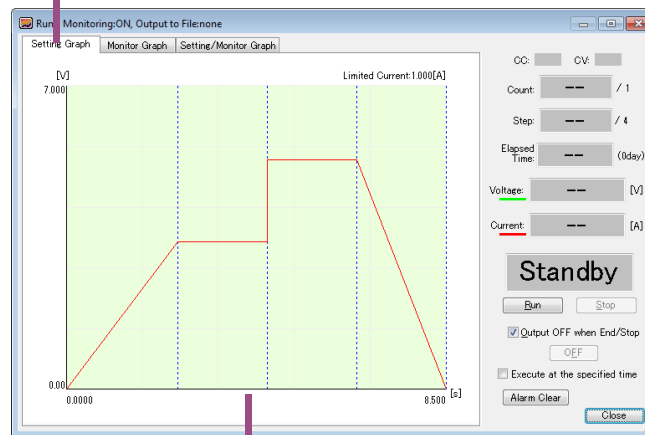
Sequence mode	Description
SOFT	Wavy sends step conditions one step at a time to the PAV series to execute a sequence. All available sequence functions of Wavy can be used.
HARD (LIST) HARD (WAVE)	Wavy uses the hardware sequence function (LIST and WAVE) that the PAV series has. Wavy sends the conditions of all steps to the PAV series first, and then the PAV series sequence begins. Compared to software control, the step transition resolution is smaller, but some limitations apply to the number of steps, sequence time settings, and the like.

Sequence Execution window

This window is used to execute sequences. You can display three types of graphs using the tabs.

Tab	Display
Setting Graph	A graph of the sequence to be executed appears.
Monitor Graph	A real-time monitor graph that graphs monitored voltages and currents while executing a sequence appears.
Setting/Monitor Graph	A graph of the sequence to be executed appears in the top half, and a real-time monitor graph appears in the bottom half.

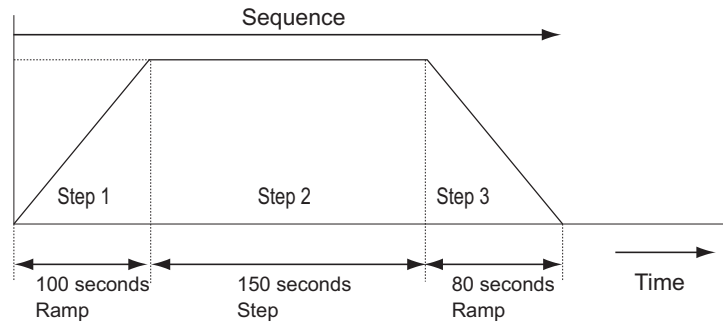
Click the tab to show in the window.



Setting Graph

Overview of Sequence Creation

A sequence is a feature that automatically executes the predefined steps in a given order. You can simulate various waveforms.



A sequence comprises multiple steps, which will be executed in a given order. The execution of the last step normally concludes the sequence. The number of steps that can be created varies depending on the sequence mode. If you set the repetition count of a sequence, however, the sequence will be repeatedly executed until it reaches to the last count.

Sequence mode	Number of steps that can be created
SOFT	1024
HARD (LIST)	12
HARD (WAVE)	12

Sequence execution procedure

Set the operating conditions for the sequence.

Sequence settings

- Selecting the sequence mode
- Setting the Operating Mode
- Setting Protection Functions
- Setting the Sequence Repetition Count

Set the operating conditions for the steps.

Step settings

- Creating or Editing Steps by Drawing
- Creating and Editing Steps by Entering Values
- Saving and Loading Sequence

Execute the sequence.

- Executing Sequences
- Saving Monitored Data

Sequence Settings

NOTE

The maximum value that can be specified on Wavy is limited to 105 % of the rated output of the PAV series specified by Instrument in the interface window. For example, if you specify PAV36-6, you will not be able to set values exceeding 37.8 V (36 x 1.05).

Sequence settings

For a sequence, you need to set the following conditions common for all steps.

- Sequence mode
Select from software control, hardware (LIST), or hardware (WAVE).
- Operating mode (Constant Voltage (CV) or Constant Current (CC))
Set the operating mode. The current/voltage limit can also be specified.
- Protection settings
Configure the protection settings.
- Repetition count
Set how many times to repeat the sequence.
- Step interval
Configure the step interval unit.

See p. 12

See p. 17

See p. 18

See p. 20

See p. 27

Step settings

For each step, you need to configure a set of values as shown in the figure below. One step corresponds to one operation in a waveform to be executed.

NOTE

- The hardware (LIST) and hardware (WAVE) sequence modes do not have Transition or Output setting. In hardware (LIST) mode, the transition is fixed to step while in hardware (WAVE) mode, it is fixed to ramp. The output is fixed to on.
- The first step in hardware (WAVE) sequence mode will be a ramp transition from the output voltage or output current immediately before the execution of the sequence.
- Time [s] indicates the accumulated time from the beginning, which is unable to be modified.

Worksheet window in CV

	Time[s]	Voltage[V]	Interval[s]	Transition	Output
1					
2					
3					

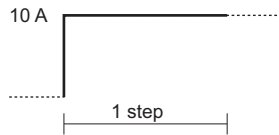
Worksheet window in CC

	Time[s]	Current[A]	Interval[s]	Transition	Output
1					
2					
3					

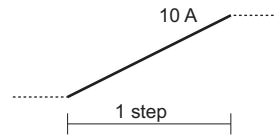
See p. 18

- Voltage (in CV mode)
Set the voltage when Constant Voltage (CV) mode being enabled.
The output voltage setting is limited as follows by the hardware OVP and UVP values of the protection function.
 $UVP \text{ value} \leq \text{output voltage} \leq OVP \text{ value}$
- Current (in CC mode)
Set the current when Constant Current (CC) mode being enabled.
- Interval
Set the execution time for the step.
- Transition (Step or Ramp)
Set the transition type for the step.
The resolution of ramp transition is 50 ms to 100 ms.

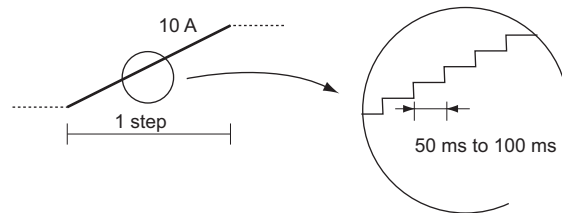
(Example 1) Current: 10 A
Transition: Step



(Example 2) Current: 10 A
Transition: Ramp



As shown in the figure below, the ramp transition is at a given resolution.




When the step interval is limited, the ramp line may not be linear.

- Output (on or off)
Switch on/off of the output.

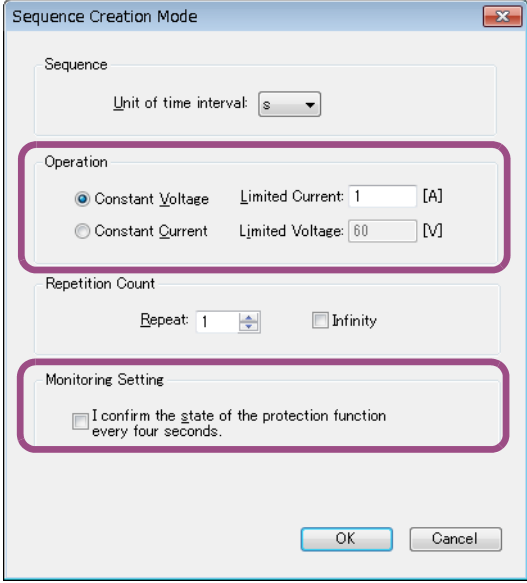
You can edit the steps by either drawing lines in Graph window or entering values in Worksheet window.

Setting the Operating Mode

Select the operating mode among two modes: constant voltage (CV) or constant current (CC) mode.

- 1 **Click on the Sequence menu and select Sequence Creation Mode. Or, click  on the toolbar.**

The Sequence Creation Mode window opens.



- 2 **To use the PAV series in constant-voltage mode, select Constant Voltage. To use it in constant-current mode, select Constant Current.**
- 3 **Enter the limited current (for CV mode) or limited voltage (for CC mode).**
The number of significant decimal digits is three for voltage and four for current. The actual number of significant decimal places varies depending on the PAV Series to which the PC is connected.
- 4 **To monitor the activation of protection functions during sequence execution, select the I confirm the state of the protection every four seconds check box.**
- 5 **Click OK to close the window.**

Setting Protection Functions

You can enable the protection functions by setting one of two protection functions: Power Supply Setting and Soft Setting.

■ Power Supply Setting

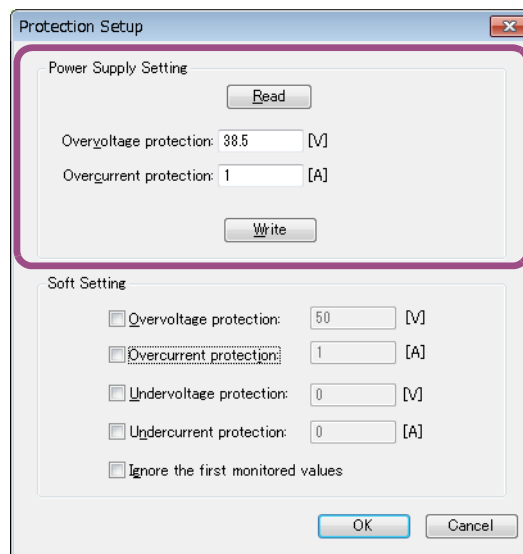
These are the protection functions incorporated in PAV Series regulated DC power supply. You can set overvoltage protection (OVP), and overcurrent protection (OCP).

■ Software Setting

These are the protection functions which Wavy activates on the basis of monitored data. You can set overvoltage protection (OVP), overcurrent protection (OCP), undervoltage protection (UVP), and undercurrent protection (UCP).

Using the protection functions on PAV Series (Power Supply Setting)

- 1 **Click on the Sequence menu and select Protection Setup.**
The Protection Setup window opens.



- 2 **Enter the values of the overvoltage protection and the overcurrent protection.**
The output voltage setting is limited as follows by the OVP and UVP values set here.
$$\text{UVP value} \leq \text{output voltage} \leq \text{OVP value}$$
- 3 **Click Write.**
The settings are transmitted to PAV Series and becomes activated.
- 4 **Click OK to close the window.**

Querying the PAV Series settings

To query and load the present protection settings on the connected PAV Series, click Read.

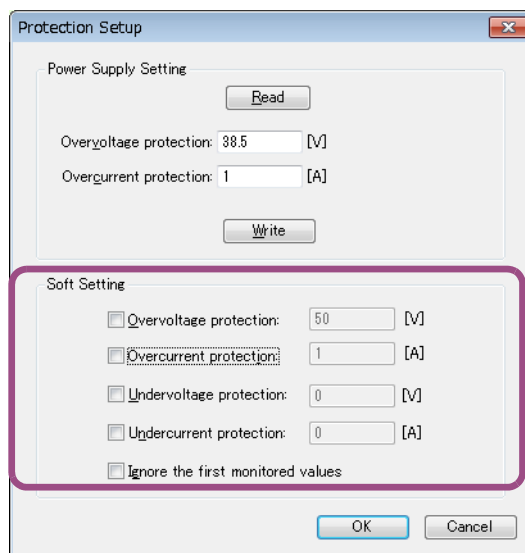
Using the protection functions of Wavy (Software Setting)

When the overvoltage protection or the overcurrent protection being activated, the sequence execution stops if the monitored values equal or exceed the set values.

When the undervoltage protection or undercurrent protection being activated, the sequence execution stops if the monitored values fall below the set values.

1 Click on the Sequence menu and select Protection Setup.

The Protection Setup window opens.



2 Select the protection function to activate.

While the function being selected, you can enter the value in the text box.

3 Enter the values in the text boxes.

Even when you enter protection values, if you clear the check boxes, the protection functions will be disabled.

The maximum values that you can enter do not depend on the rated output of the connected PAV series.

4 Click OK to close the window.

Ignoring the first monitored values

If the unstable values from the initial monitoring is used, the sequence execution may be aborted due to the protection function. If the Ignore the first monitored values check box is selected, sequence execution will continue even if the first monitored values are above or below the protection values.

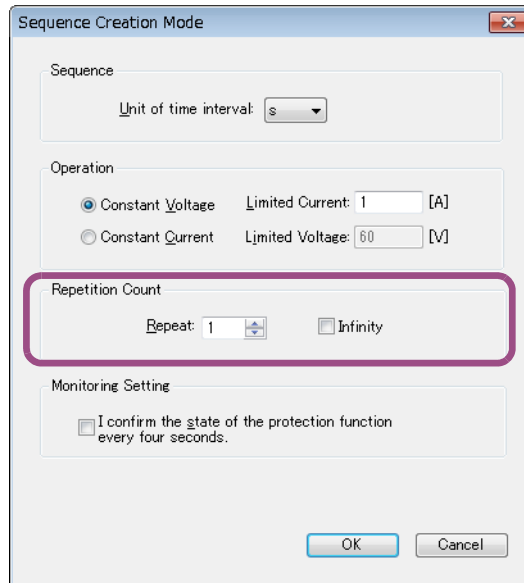
Setting the Sequence Repetition Count

Set the repetition count of the sequence.

- 1 Click on the Sequence menu and select Sequence Creation Mode, or click  on the toolbar.**

The Sequence Creation Mode window opens.

- 2 Set the repetition count (between 1 and 9999, or Infinity).**

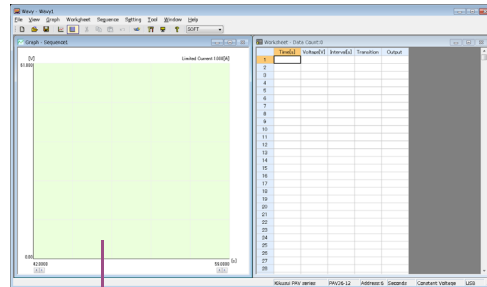


- 3 Click OK to close the window.**

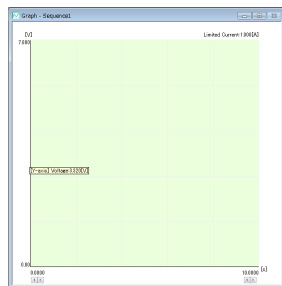
Creating or Editing Steps by Drawing

Creating the Steps

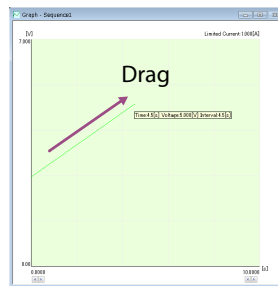
You can create the steps in the Graph window.



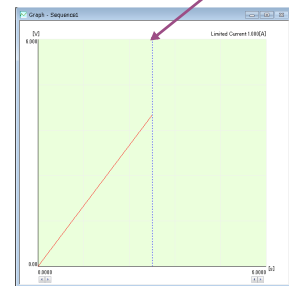
Graph window



Place the pointer on Y axis and click.



Drag



Step-division line

Release the mouse button at the desired point to commit the step.

NOTE

When the sequence mode is hardware (LIST) or hardware (WAVE), a correct waveform may not be output if a value less than 0.1% of the rated output voltage or a value less than 0.2% of the rated output current is specified.

- 1 **Move the pointer over the Y axis.**
The pointer changes to a crosshair, and the voltage (in CV mode) or the current (in CC mode) is indicated.
- 2 **Drag the pointer to the point where the desired time (on X axis) and the desired current/voltage (on Y axis) meets.**
The setting is committed when you release the mouse button, and the corresponding values are automatically entered in the first line of the Worksheet window.
The voltage or current varies depending on the PAV series that the PC is connected to.
You can change the scale of the graph and/or step interval unit.

See p. 27, p. 28

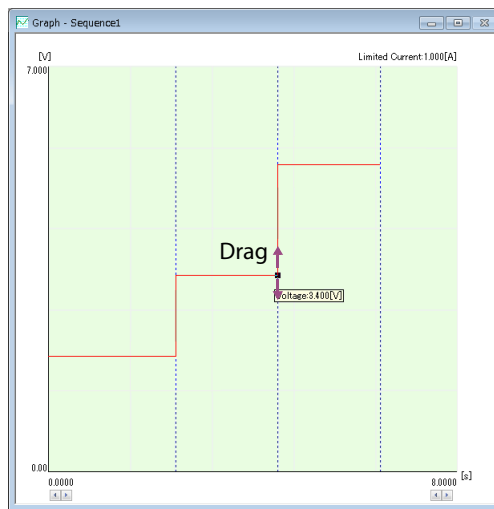
SOFT			HARD(LIST)/HARD(WAVE)		
Unit	Range	Setting resolution	Unit	Range	Setting resolution
s (seconds)	0.5 s to 999.5 s	0.5 s	s (seconds)	0.01 s to 65 s	0.001 s
min (minutes)	0.1 min to 999.9 min	0.1 min			
h (hours)	0.1 h to 999.9 h	0.1 h			

This completes the creation of step 1.

- 3 To add the step, move the pointer over the end point of the previous step. Once the pointer changes to a crosshair, drag the pointer to the desired point.**
The setting is committed when you release the mouse button, and the corresponding values are entered in the following line of the Worksheet window.
Repeat the procedure until you complete creating all the steps.

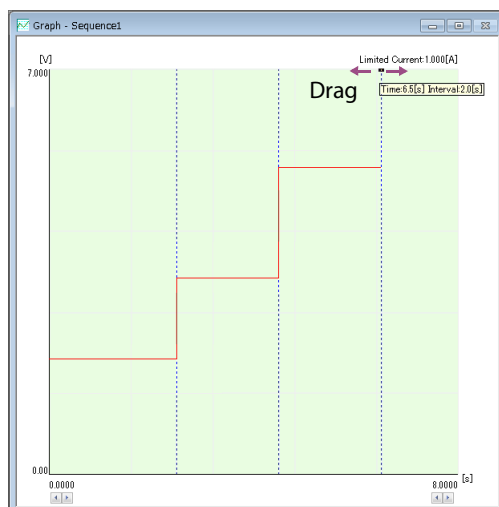
Editing the steps

Changing the voltage or current setting



- 1 Double-click the step line to edit.**
The end point changes to a black square (■), which indicates that you can edit the step.
- 2 Move the pointer over the black square (■).**
The pointer changes to a pair of vertical arrows.
- 3 Drag the pointer vertically until it reaches to the desired point.**
The setting changes.

Changing the interval (step execution time)



- 1 Double-click the vertical line (step-division line) that lies at the end point of the step to edit.**
The top of the step-division line changes to a black square (■), which indicates that you can edit the step.
- 2 Move the pointer over the black square(■).**
The pointer changes to a pair of horizontal arrows.
- 3 Drag the pointer horizontally to the desired point.**
The setting changes.

Changing transition (Step or Ramp) (SOFT sequence mode only)

NOTE

You can change the transition only when the sequence mode is set to software control. In hardware (LIST) mode, the transition is fixed to step while in hardware (WAVE) mode, it is fixed to ramp.

- 1 Double-click the step line to edit.**
The top of vertical line (step-division line) changes to a black square (■), which indicates that you can edit the step.
- 2 Right-click and select Transition from the context menu, then point to Ramp or Step.**
The transition of the step changes.

Deleting the steps

- 1 Double-click the step line to delete.**
The top of vertical line (step-division line) changes to a black square (■), which indicates that you can edit the step.
- 2 Right-click and select Delete.**
The step is deleted.

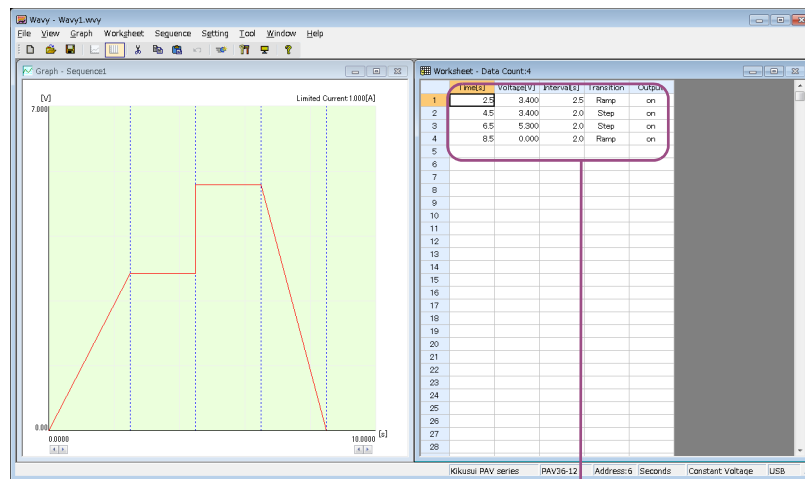
Creating and Editing Steps by Entering Values

Creating the Steps

You can create the steps in the Worksheet window.

NOTE

- The hardware (LIST) and hardware (WAVE) sequence modes do not have Transition or Output setting. In hardware (LIST) mode, the transition is fixed to step while in hardware (WAVE) mode, it is fixed to ramp. The output is fixed to on.
- When the sequence mode is hardware (LIST) or hardware (WAVE), a correct waveform may not be output if a value less than 0.1% of the rated output voltage or a value less than 0.2% of the rated output current is specified.



	Time[s]	Voltage[V]	Interval[s]	Transition	Output
1	2.5	3.400	2.5	Ramp	on
2	4.5	3.400	2.0	Step	on
3	6.5	5.300	2.0	Step	on
4	8.5	0.000	2.0	Ramp	on
5					
6					

Step 1
Step 2
Step 3

Time cannot be modified.

The first row in the Worksheet window represents step 1. Time [s] indicates the accumulated time from the beginning and cannot be modified.

To edit the voltage, current, and interval, click the applicable cell and enter the value. The voltage or current varies depending on the PAV series that the PC is connected to.

The step interval that can be specified varies depending on the sequence mode.

SOFT			HARD(LIST)/HARD(WAVE)		
Unit	Range	Setting resolution	Unit	Range	Setting resolution
s (seconds)	0.5 s to 999.5 s	0.5 s	s (seconds)	0.01 s to 65 s	0.001 s
min (minutes)	0.1 min to 999.9 min	0.1 min			
h (hours)	0.1 h to 999.9 h	0.1 h			

To edit the transition and output, double-click the applicable cell, or click the cell and press Enter key (SOFT sequence mode only). By default, the Transition is set to "Step", and the Output is set to "on". Once set, the Transition and Output settings cannot be deleted. To delete these settings, you need to delete the whole step.

You can cancel the edit by pressing Esc key in the middle of entering the values.

Start entering data for step 1 and continue for the following steps in order.

Copying and deleting the steps

You can delete and copy the steps in the Worksheet window.

Also, you can undo the operation once. To undo the last operation, right-click on the Worksheet window and select Undo.

Inserting a copy of a step

- 1 Click a cell in the step to copy.**
You can click any cell in the step that you are going to copy.
You can select consecutive rows by holding down the Shift key.
- 2 Click on the Worksheet menu and select Copy. Or, right-click on the Worksheet window and select Copy from the context menu.**
- 3 Select any cell in the step.**
- 4 Click on the Worksheet menu and select Paste. Or, right-click on the Worksheet window and select Paste from the context menu.**
The copied step is inserted above the selected step.

Deleting a step

- 1 Click a cell in the step to delete.**
You can click any cell in the step that you are going to delete.
You can select consecutive rows by holding down the Shift key.
- 2 Click on the Worksheet menu and select Delete. Or, right-click on the Worksheet window and select Delete from the context menu.**

The deleted step is temporarily copied to the clipboard. Thus, if you select Paste command right after deleting the step, the deleted step will be inserted.

Keyboard shortcuts

You can use keyboard shortcuts on the Worksheet window.


Operation	Shortcut keys
Copy steps	"C" or "Ctrl + C"
Insert a step ^{*1}	"V" or "Ctrl + V"
Delete steps ^{*1}	"Delete"
Undo ^{*1}	"Z" or "Ctrl + Z"
Select all rows	"A" or "Ctrl + A"

*1. A confirmation dialog appears before execution.



Changing the Step Interval Unit

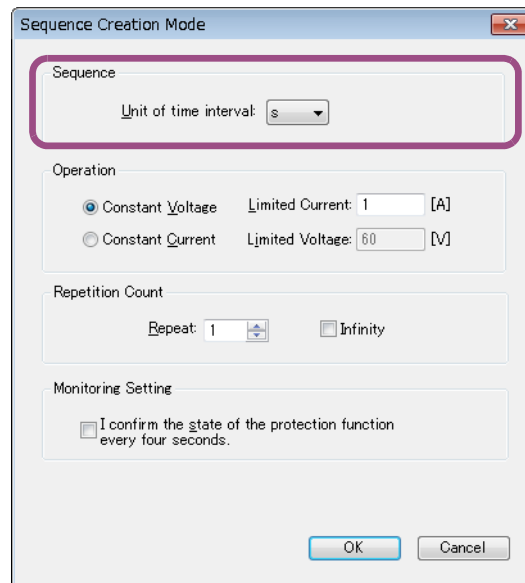
If the sequence mode is software control, you can set the step interval unit to seconds, minutes, or hours.

- 1 **Click on the Sequence menu and select Sequence Creation Mode. Or, click  on the toolbar.**

The Sequence Creation Mode window opens.

- 2 **Select the unit from the Unit drop-down menu.**


If there is step data in the Worksheet window, you cannot change the unit.

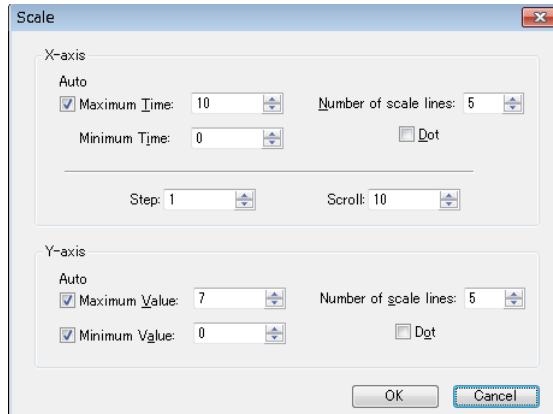


- 3 **Click OK to close the window.**

Changing the Setting Graph Scale

You can change the scale on X-axis and Y-axis in the Graph window.




Select the Graph window, click on the Graph menu, and select Scale. Or, click  on the toolbar. Then, the Scale window opens. You can also right-click on the Graph window and select Scale to open the window.

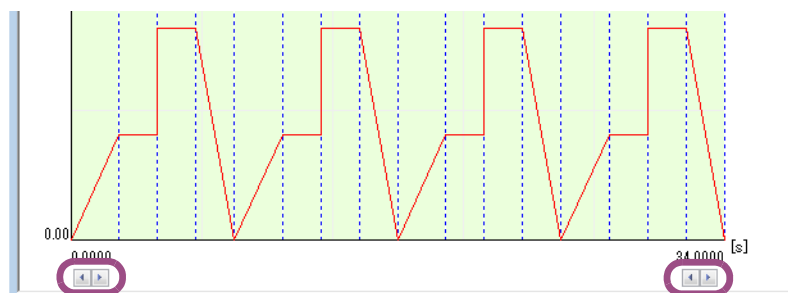


If you select the Maximum Time, Maximum Value, or Minimum Value check box, the auto scaling function is enabled. While the auto scaling function being enabled, the scale is automatically adjusted to create steps or open a saved file.

When the auto scaling function is disabled, the value beyond the range does not appear in the graph.

When you are creating steps by drawing, however, the scale is not automatically adjusted. In this case, click on the Graph menu and select Update Auto Scale to update the scale.

For Step, set the amount of change that takes place when the graph is moved with the   buttons on the graph window. For Scroll, set the unit of scrolling when the graph is moved with the  button on the left side.




Saving and Loading Sequence

After creating the sequence data, you can save the data to a file.

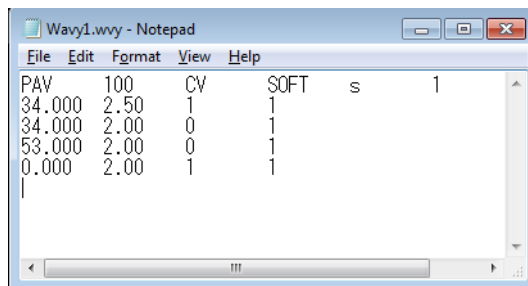
Saving files

To newly save the data to a file, click on the File menu and select Save As.

To overwrite the file, click on the File menu and select Save, or select  on the toolbar. In either case, the file will be saved with extension "wvy".

■ Viewing the saved data

You can open the saved file in Notepad.



See p. 42

By default, the data is saved as tab-separated values. You can select comma-separated values in the Environment Setup window.

- First row in the data

1st column	PAV	Series name
2nd column		File version
3rd column	CV	Constant voltage mode
	CC	Constant current mode
4th column		Sequence mode (SOFT/LIST/WAVE)
5th column	s	seconds
	min	minutes (SOFT sequence mode only)
	h	hours (SOFT sequence mode only)
6th column		Repetition count
7th column		Limited current (in CV mode)
		Limited voltage (in CC mode)

- Second and subsequent rows in the data

1st column	Voltage value or current value	
2nd column	Interval	Unit is indicated in the first row.
3rd column	Transition	0: Step, 1: Ramp
4th column	Output	0: Off, 1: On

Loading the file

You can load the saved data.

Click on the File menu and select Open, or click  on the toolbar.

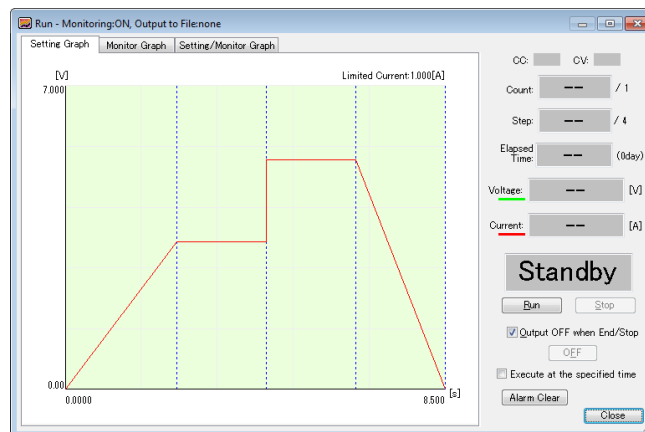
Executing Sequences

See p. 38

Once you complete creating all the steps, you can move on to the sequence execution.

Performing a long sequence increases the data to be displayed in the real-time monitor graph. By setting the maximum data amount, you can reduce the load to PC. Even if you set the maximum data size, all monitored data will be saved.

- 1 Click on the Sequence menu and select Run, or click  on the toolbar. The Run window opens.

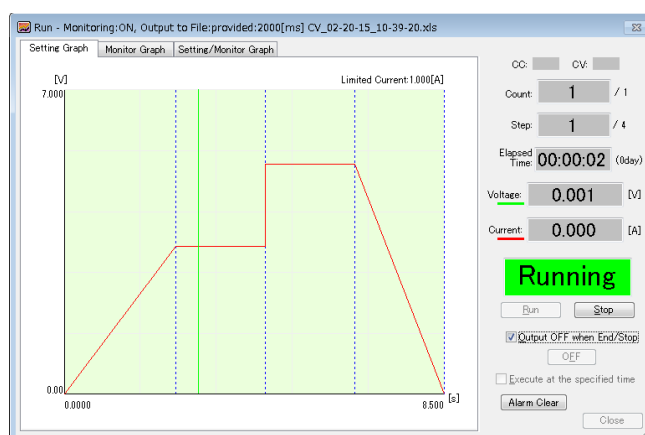


- 2 Click Run. The sequence is executed.

To abort the sequence in progress, click Stop.

The green line roughly indicates the position being executed. When the sequence is repeated for many times or the sequence is rather longer, however, the green line indication may not be stable.

During the sequence execution, you cannot use the menus and the toolbar or change the window size.



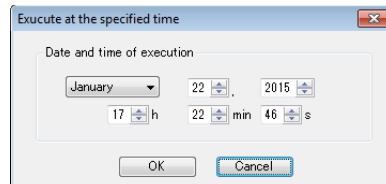
■ Turning the output off when a sequence completes

If you select the Output OFF when End/Stop check box, the output will be automatically turned off when the sequence execution is complete or aborted, or when the protection function is activated.

If this check box is not selected, you need to turn off the output manually. To turn off the output, click the OFF under the OUTPUT OFF when End/Stop check box. While the sequence being in progress, OFF is disabled.

■ Specifying the time to execute the sequence

To specify the time to execute the sequence, select the Execute at the specified time check box. In the opened dialog, enter the target time (year, month, day, hour, minute, second) to execute the sequence.



Information indicated during the sequence execution

CC / CV	In constant current (CC) mode, the box next to CC turns to red. In constant voltage (CV) mode, the box next CV turns to green.
Count	Displays the latest count of the sequence repetition.
Step	Displays the step being executed at the moment.
Elapsed Time	Displays the elapsed time since the sequence execution started.
Voltage/Current	Displays the item (current, voltage) that you selected by clicking Sequence and then Monitoring Setup.

■ Status indicator

During the sequence execution, one of the following status is indicated in the Run window.

Standby	The PAV Series is ready to start.
Running	The sequence is being executed.
End	The sequence is complete.
Stop	The Stop button has been clicked.
Error	A communication error has occurred. Verify the interface settings.
OVP	A protection function has been activated.*1 OVP: Overvoltage protection, OCP: Overcurrent protection, PF: AC input voltage drop, OHP: Overheat protection, COMM: IOC communication error, AC: AC fail, OTP: Overtemperature protection, FOD: Foldback protection, SO: Shut off, INT: Interlock, UVP: Undervoltage protection, INPO: Internal input overflow, INTO: Internal overflow, INMO: Internal time out, ICOM: Internal communication error, UCP: Undercurrent protection
OVP (In case of OVP)	
Waiting	The PAV Series is standing by until the specified time to execute the sequence is reached.

*1. You can determine which protection function (hardware or software) was activated with the background color.
Orange indicates that a PAV series protection function was activated.
Yellow indicates that a Wavy protection function was activated.

■ Clearing alarms

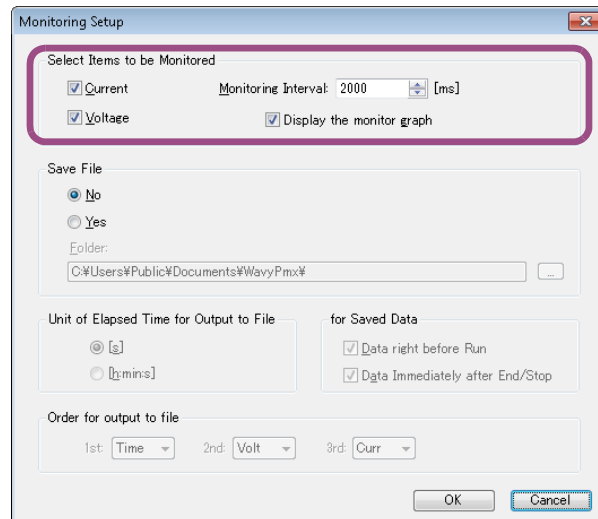
If a protection function of the PAV series is activated and the background changes to an orange alarm status, eliminate the root cause of the alarm, and then click Alarm Clear.

If the background changes to a yellow alarm status, this indicates that a Wavy's protection function has been activated. Change the setting of the protection function that caused the alarm.

Displaying Monitors

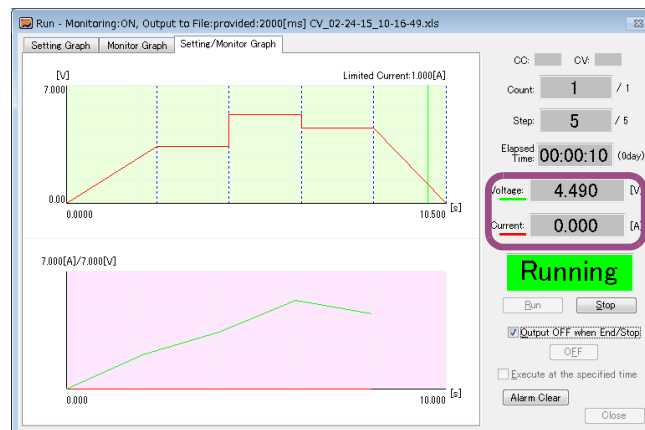
You can have the monitored values and the monitor graph displayed in the Run window.

Click on the Sequence menu and select the Monitoring Setup, or click  on the toolbar. The Monitoring Setup window opens.



Displaying the monitored output values in the Run window

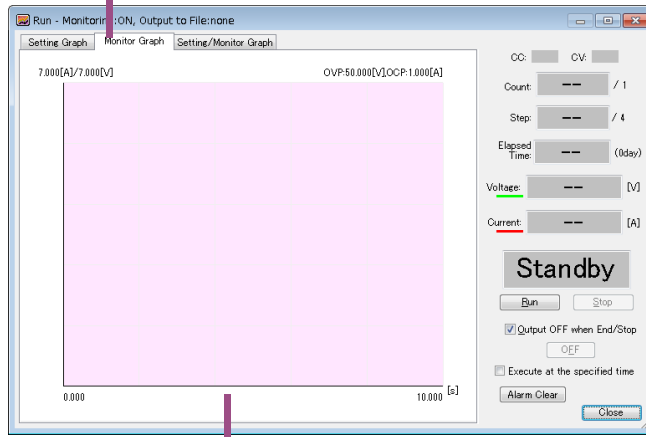
To display the output values in the Run window, select Current and/or Voltage under Select Items to be Monitored.



Displaying the monitor graph

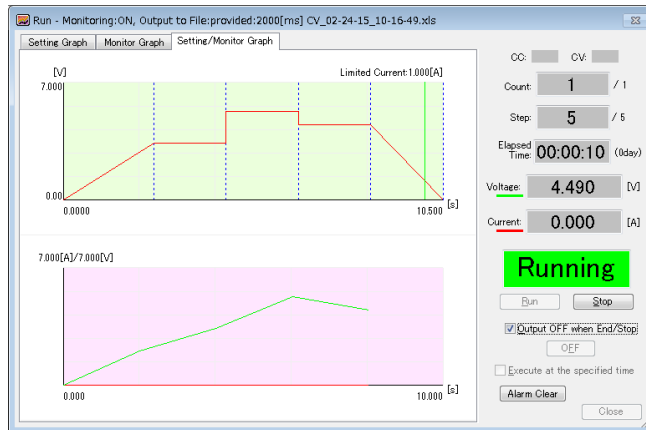
To display the real-time monitor graph, select the Display the monitor graph check box under Select Items to be Monitored. Further, additional tabs — Monitor Graph and Setting/Monitor Graph — are displayed in the Run window.

Click the tab to show in the window.



Real-time Monitor Graph

On the Setting/Monitor Graph tab, both setting graph and real-time monitor graph are displayed.



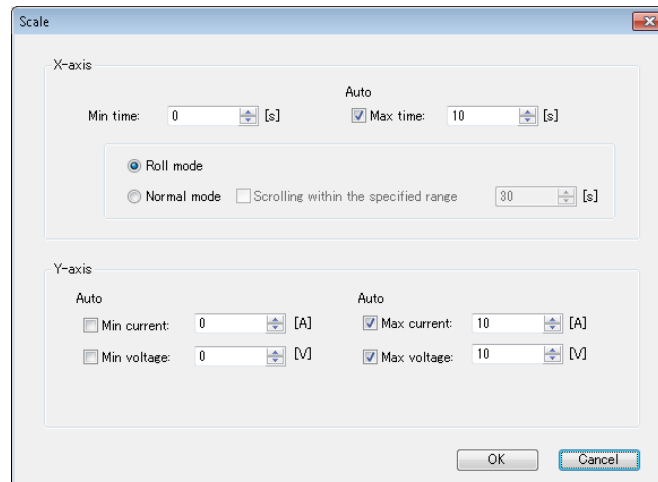
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You can set which graphs (current, voltage, and power) are displayed on the real-time monitor graph by clicking Sequence and then Monitor Setup, and using Select Items to be Monitored. If you move the pointer over the graph, the monitored value will be displayed.

Changing the Real-Time Monitor Graph Scale

You can change the scale on X-axis and Y-axis in the real-time monitor graph.

To change the scale, right-click on the real-time monitor graph and select Scale from the context menu. The Scale window opens.



If you select the Maximum time, Maximum current, Maximum voltage, or Minimum Value check box, the auto scaling function is enabled. While the auto scaling function being enabled, the scale is automatically adjusted according to the monitored values.

When the auto scaling function is disabled, the monitored value beyond the range does not appear in the graph.

When the maximum time is set to be automatically scaled

When the Auto check box of Max time is selected, you can specify either Roll mode or Normal mode.

■ Roll mode

The X-axis and Y-axis are simultaneously scaled. The display range is defined by subtracting the minimum time setting from the maximum time setting.

■ Normal mode


In normal mode, the minimum time is fixed to a given value whereas the maximum time is scaled.

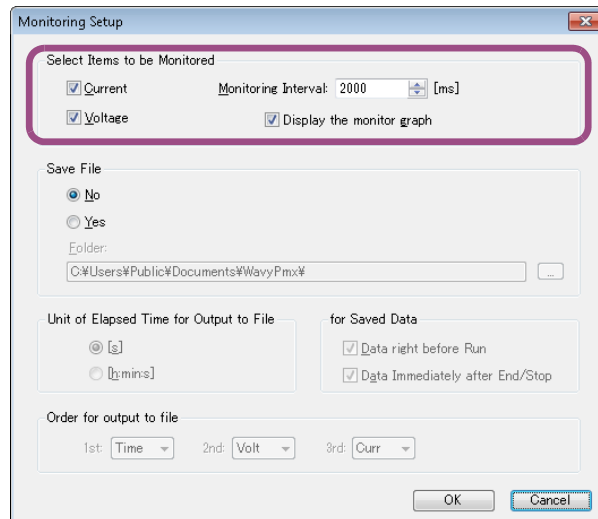
When the Scrolling within the specified range check box is selected, the graph is scaled when the monitored value exceeds the maximum time on the X-axis. In this case, the starting point to be scrolled is defined by subtracting the minimum time setting and the scrolling time from the maximum time setting.

For example, if the minimum time is set to 0 s, the maximum time is set to 23 s, and the scroll time is set to 10 seconds, monitoring starts after 10 s elapses from the 13 s (23-0-10) position.

Changing the Monitoring Interval

You can set the interval for monitoring.


To change the monitoring interval, click on the Sequence menu and select Monitoring Setup, or click  on the toolbar. The Monitoring Setup window opens.

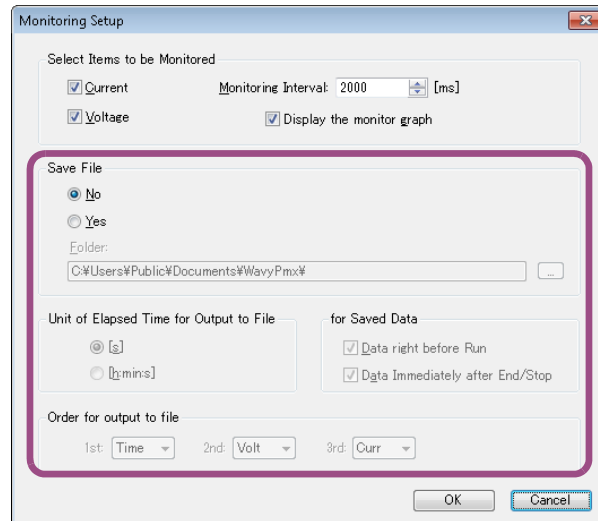


Under Select Items to be Monitored, set the Monitoring Interval to a value between 200 ms and 600000 ms.

Saving Monitored Data

You can save the monitored data in a text format.

To save the monitored data, click on the Sequence menu and select the Monitoring Setup, or click  on the toolbar. The Monitoring Setup window opens.



Select Yes under the Save File, and specify the destination to save the file.

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The given file name concatenates the operating mode, the starting date and time of the execution, and the file extension. You can change the file extension (.txt by default).

You can set the unit of elapsed time to be written to the file. The accuracy of the elapsed time depends on your PC environment.

[s]: Seconds

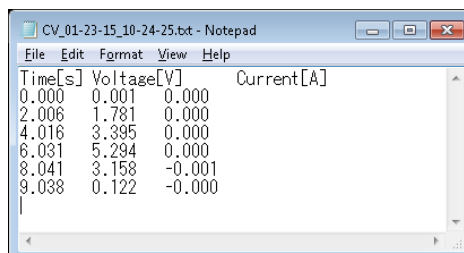
[h:min:s]: Hours, minutes, seconds

If you select the Data right before Run check box under for Saved Data, "0 s" will be written to the beginning of the saved data file ("0 s" would be regarded as the value monitored prior to the sequence execution). If the Data Immediately after End/Stop check box is selected, the monitored values after the sequence is completed or aborted will be appended to the saved data.

Under Order for output to file, you can set the order in which the monitored data (time, voltage, and current) is written to the file.

■ Viewing the saved data

You can open the saved file in Notepad.



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By default, the data is saved as tab-separated values. You can select comma-separated values in the Environment Setup window.

Other Settings

Setting the resolution of the steps to be created by drawing

You can set the resolution of the steps to be created by drawing in the Graph window.

Right-click on the Graph window and select Resolution of setting value from the context menu, then point to the desired resolution (Default), 1st digit of integer, 1st digit of decimal place, 2nd digit of decimal place, or 3rd digit of decimal place). Default is 3rd digit of decimal place.

Always using the step transition mode when creating the steps by drawing (SOFT sequence mode only)

You can restrict the transition mode to “step” when creating the steps by drawing in the Graph window.

Right-click on the Graph window, and then select Draw sequence by step.

Changing the unit of time in the real-time monitor graph

You can change the unit of time ([s] or [h:min:s]) in the real-time monitor graph.

Right-click on the real-time monitor graph and select X-axis Unit from the context menu, then point to the desired unit. Select [s] for seconds, or [h:min:s] for hours:minutes:seconds.

Setting the maximum data size

Executing a long sequence increases the data displayed on the real-time monitor graph, which increases the load to PC and causes the PC to malfunction. By setting the maximum data size, you can reduce the load to PC.

Even if you set the maximum data size, all monitored data will be saved.

Right-click on the real-time monitor graph and select the Max Data Count. The Maximum number of data window opens.

Enter the value between 10 000 to 1000 000. (The default value is 100 000).

When the size of the monitored data exceeds the set value, the oldest data will be deleted and the data size will be restricted to be within the maximum data size.

A single monitored data uses approximately 200 bytes.

It is recommended to watch the physical memory amount in the Task Manager while executing a long sequence.

Changing the graph display


You can change various settings for the setting graph and the real-time monitor graph.

Setting the items (current or/and voltage) to be displayed on the monitor graph

You can set the item (current or/and voltage) to be displayed on the real-time monitor graph.

Right-click on the monitor graph and select the Line Display, then point to the item to be displayed.

Showing and hiding the step-division lines

- Graph window
To show/hide the step-division lines in the Graph window, click on the Graph menu and select Vertical Axis or click  on the toolbar.
Also, you can right-click on the Graph window and select Vertical Axis to toggle the display of the lines.
- Setting graph in the Run window
To show/hide the step-division lines in the Run window, right-click on the setting graph and select Vertical Axis.

Changing the scale of X-axis and Y-axis


You can change the settings for X-axis and Y-axis scales. You can show/hide the scales, specify the line type (solid or dotted) and the number of lines (grid).

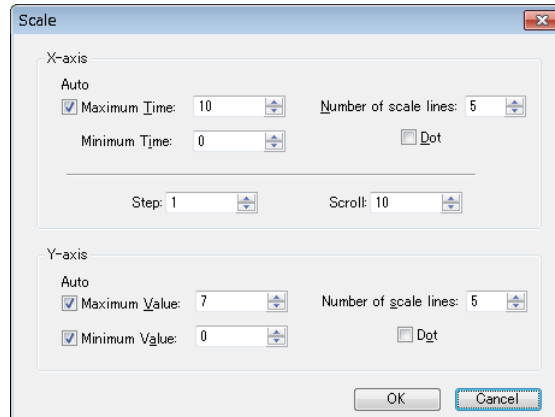
■ Showing and hiding the scales

- Graph window
To show/hide the scale, click on the Graph menu and select either X-axis Scale Lines or Y-axis Scale Lines, or right-click on the Graph window and select X-axis Scale Lines or Y-axis Scale Lines from the context menu.
- Run window
To show/hide the scale, right-click on the graph in the Run window and select the X-axis Scale Lines or Y-axis Scale Lines from the context menu.

■ **Setting the line type (dotted or solid) and the grid**

- Graph window

Click  on the toolbar. The Scale window opens.

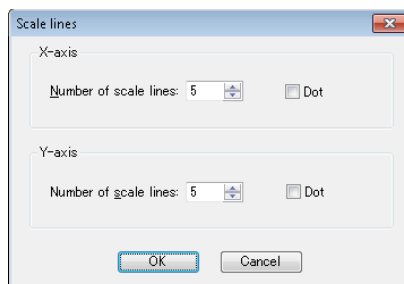


To vary the grid, enter the number in Number of scale lines.

To set the line type to be dotted, select Dot check box. When the Dot is not selected, the line will be solid.

- Run window

Right-click on the graph in the Run window and select Number of scale lines. The Scale lines window opens.



To vary the grid, enter the number in Number of scale lines.

To set the line to be dotted, select Dot check box. When the Dot is not selected the line will be solid.

Changing Y-axis value displayed when the pointer is over

When you move the pointer over X-axis or Y-axis on the real-time monitor graph, the monitored values for X-axis or Y-axis are indicated.

To change the Y-axis value to be indicated, right-click on the monitor graph and select Y-Axis Value, then point to either Current or Voltage.

Changing the graph color

You can change the color of the setting graph and the real-time monitor graph.

To change the graph color, click the Graph menu and select Color, or right-click on the graphs in either Graph or Run window and select Color from the context menu. Depending on the item, the ways to change the color slightly vary.

		Graph menu *1	Graph window *2	Run window: Setting graph *3	Run window: Monitor graph *4
Background	Background color	Yes	Yes	Yes	Yes
Line	Setting line	Yes	Yes	Yes	—
Line to Draw	Line being created	Yes	Yes	—	—
Vertical Axis	Line being created	Yes	Yes	—	—
X/Y-axis	X-axis and Y-axis	Yes	Yes	—	Yes
XY-axis scale lines	Grid lines	Yes	Yes	—	Yes
Line to Run	Line indicating the sequence point in progress	—	—	Yes	—
Current line	Output current line	—	—	—	Yes
Voltage line	Output voltage line	—	—	—	Yes

*1. Click on the Graph menu and select Color.

*2. Right-click on the Graph window and select Color.

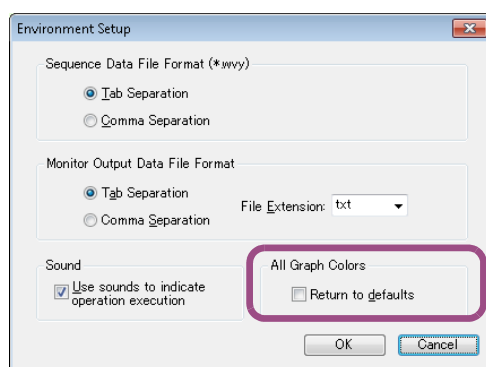
*3. Right-click on the Setting Graph tab in the Run window and select Color.

*4. Right-click on the Monitor Graph tab in the Run window and select Color.

Resetting the graph colors

You can reset the graphs colors you changed back to the default conditions.

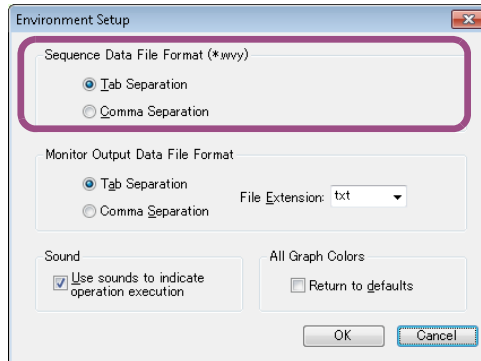
On the Setting menu, click Environment Setup to display the Environment Setup window.



To reset the colors, select the Return to defaults check box, and click OK.

Changing the sequence data file format

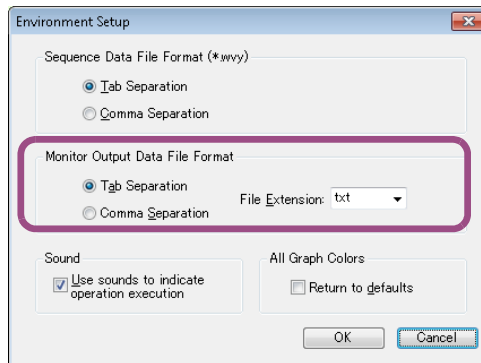
To change the sequence data file format, click on the Setting menu and select Environment Setup. The Environment Setup menu opens.



Select either Tab Separation or Comma Separation under Sequence Data File Format (*.wvy). By default, Tab Separation is selected.

Changing the monitor output data file format

To change the monitor output data file format, click on the Setting menu and select Environment Setup. The Environment Setup menu opens.

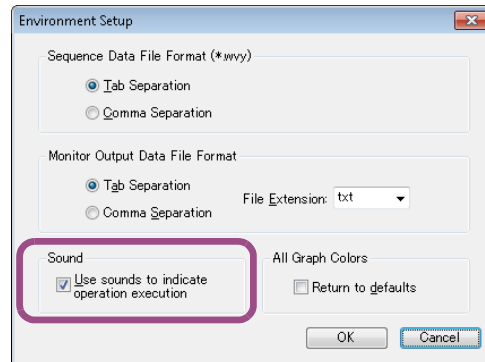


Select either Tab Separation or Comma Separation under Monitor Output Data File Format. By default, Tab Separation is selected. Also, you can specify the file extension (txt / csv / log). To specify the file extension, select the desirable extension from the drop-down menu or enter the name.

Turning the sound on and off

You can turn on or off the sound that is generated when an event (e.g., test execution, completion) occurs.

On the Setting menu, click Environment Setup to display the Environment Setup window.



To turn on the sound, select the Use sounds to indicate operation execution check box.

Arranging the Graph window and the Worksheet window

To arrange the Graph window and the Worksheet window, click on the Window menu and select Cascade, Tile Horizontally, or Tile Vertically.

Controlling the PAV series directly

You can use the direct control window to remotely control the PAV series' voltage and current settings, the output on/off state, and the monitor.

To remotely control the PAV Series, click on the Tool menu and select Remote Control Panel. The Remote Control Panel window opens.



The maximum values that you can enter are limited to the rated output of the connected PAV series x 105 %.

■ Voltage Setting and Current Setting

Enter a value in Voltage and click Set. Likewise, enter a value in Current and click Set. These settings are transmitted to the PAV Series. The up and down arrow keys to the right of the numeric boxes change the values in 1 V or 1 A steps.

If you enter a value in Step under Step Setting, you can adjust the voltage and current by clicking Up or Down.

■ Interface Setting

Use Channel to set the address (channel) of the PAV series that you want to control.

If the I set other PAV connected by a lump check box is selected, PAV series that have been connected through multi-drop connection also become control targets.

■ Output

Click ON to turn on the output. Click OFF to turn off the output. The present status of the PAV Series will be displayed in the indicator above those buttons.

■ Alarm Clear

Click Clear to clear the alarm that occurred.

■ Result

The response from the target PAV series is displayed.

■ Monitor

Click Run to start monitoring. Click Stop to stop monitoring. The elapsed time is indicated during monitoring.

When monitoring is in progress, Wavy also monitors the activation of the PAV series' protection functions. When a protection function is activated, the status appears next to Status. The activation of protection functions is not monitored when monitoring is not in progress.

While the monitoring being stopped, you can set the monitor interval.

To save the monitored output data to a file, select Save File check box under Setting. To specify the file destination and the unit of the elapsed time written to the file, click Folder under Setting. The accuracy of the elapsed time varies depending on your PC environment.

[s]: Seconds

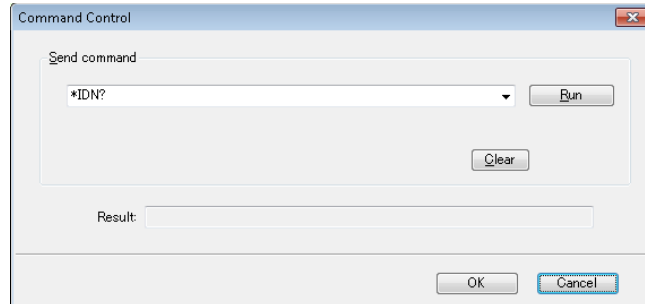
[h:min:s]: Hours, minutes, seconds

The file name concatenates the operating mode, the start date and time of the execution, and the file name extension. You can change the file extension (.txt by default).

Using Commands to Control the PAV Series

You can transmit the commands to the PAV Series directly from Wavy for PAV.

Click on the Tool menu and select Command Control. The Command Control window opens.



Enter a command and click Run.

Then, the result will be displayed.

The transmitted commands (successfully transmitted and received commands only) appear as list items in the drop-down menu. To clear the list items, click Clear.

For details about the commands, see the PAV Series Communication Interface Manual.

Menu Reference

Menu	Description	
File		
New* ¹	Creates a new file.	
Open* ¹	Opens an existing file.	
Save* ¹	Overwrites the file that you are working on.	
Save As	Saves the file with a new name.	
Close	Closes the file.	
Recent File	Shows up to four paths to the recently opened sequence data files (.wvy extension).	
Exit	Exits Wavy for PAV.	
View		
Toolbar	Shows/hides the toolbar.	
Status Bar	Shows/hides the status bar.	
Save Position	Saves the present position and size of the window.	
Previous File	Loads the last file that was used when the software starts.	
Graph		
Transition	Ramp	Changes the transition of the selected line to "ramp".
	Step	Changes the transition of the selected line to "step".
Delete	Deletes the selected line.	
Vertical Axis* ¹	Shows/hides the vertical axis.	
X-axis Scale Lines	Shows/hides the X-axis grid	
Y-axis Scale Lines	Shows/hides the Y-axis grid	
Scale* ¹	Changes the scale of X-axis and Y-axis.	
Color...	Background...	Changes the background color of the graph.
	Line...	Changes the step line color.
	Line to Draw	Changes the line color being drawn.
	Vertical Axis	Changes the vertical axis color.
	X/Y-axis	Changes the color of X-axis and Y-axis.
	XY-axis scale lines	Changes the color of X-axis and Y-axis grid lines.
Display the graph	Shows or hides graphs.	
Resolution of setting value	Default	Changes the setting resolution by dragging.
	1st digit of integer	The default value is three decimal places.
	1st digit of decimal place	
	2nd digit of decimal place	
	3rd digit of decimal place	
Draw sequence by step	Draws graphs using steps regardless of the Transition setting.	
Copy	Copies the graph to the clipboard.	
Update Auto Scale	Applies the auto scaling to the graph.	

Worksheet	
Select All	Selects all cells.
Undo ^{*1}	Cancels the previous operation.
Delete ^{*1}	Deletes the step data.
Copy ^{*1}	Copies the step data.
Paste ^{*1}	Inserts the copied step data.
Sequence	
Run ^{*1}	Executes the sequence.
Sequence Creation Mode ^{*1}	Sets Unit of time interval, Operation mode, Repetition Count, and Monitoring Setting.
Monitoring Setup ^{*1}	Configures the monitor settings to be used while the sequence being executed.
Protection Setup	Sets OVP, OCP, UVP, and UCP.
Setting	
Interface	Configures the interface to connect to the device.
Environment Setup	Sets the file format.
Tool	
Remote Control	Controls the connected device directly.
Command Control	Controls the connected device by using commands.
Window	
Cascade	Cascades the windows.
Tile Vertically	Tiles the windows in the vertical direction.
Tile Horizontally	Tiles the windows in the horizontal direction.
Arrange Icons	Arranges icons along the window frame.
Help	
Help Topics	Opens the help file.
About Wavy ^{*1}	Displays the application software information including the version and the copyright.

*1. A button with the same function is available on the toolbar.



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