



**KIKUSUI**

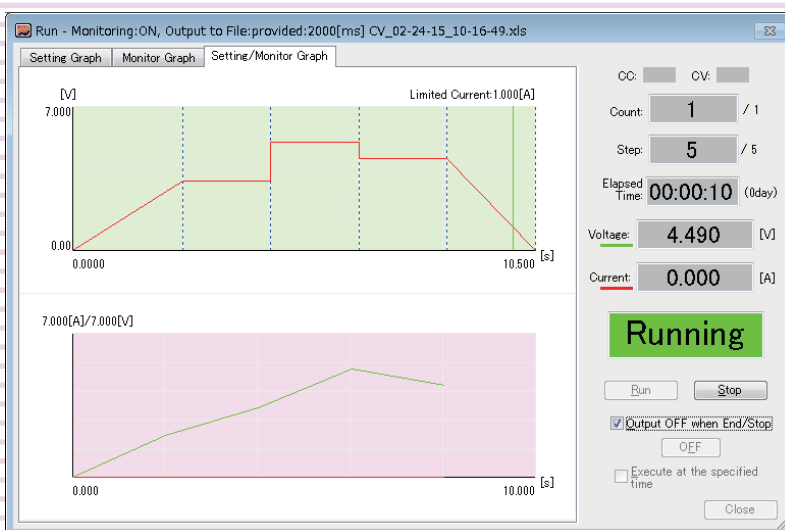
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# Operation Guide

Sequence Creation Software

## SD025-PMX Wavy for PMX

Ver. 6.x



## About This Guide

This guide is a PDF version of the SD025-PMX Wavy for PMX help file.

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# Introduction

Sequence Creation Software SD025-PMX Wavy for PMX is a software application that is used to create and execute sequences on PMX Series regulated DC power supplies. This operation guide explains how to use Sequence Creation Software SD025-PMX Wavy for PMX to control PMX Series regulated DC power supplies.

## ■ Applicable version

This operation guide applies to version 6.x of SD025-PMX Wavy for PMX. To find out the version of the Wavy for PMX, 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 SD025-PMX Wavy for PMX to control DC power supplies and instructors of such users.

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

## ■ Trademarks

Microsoft and Windows are trademarks of Microsoft Corporation in the United States and/or other countries.

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## ■ Notations used in this guide

- In this guide, SD025-PMX Wavy for PMX is referred to as "Wavy for PMX" or "Wavy." PMX Series regulated DC Power Supply is referred to as the "PMX 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.

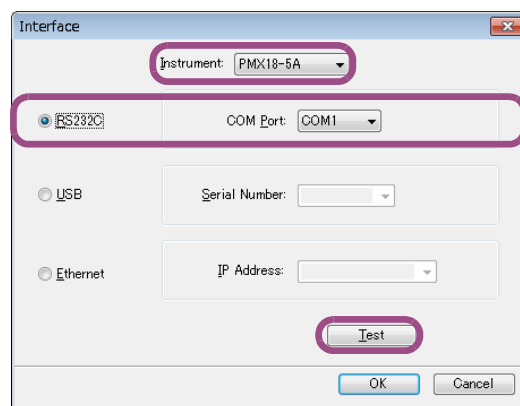
## Using the RS232C interface

### ■ Configuration on the PMX series

- 1** Turn the **POWER** switch on of the PMX Series.
- 2** Make sure that the PMX output is off.
- 3** Press **[CONFIG]** key twice.  
The voltmeter displays "CF20."
- 4** Turn **[CURRENT]** knob to select **[232]**.
- 5** Press **[LOCAL]** key.  
The PMX series exits from CONFIG settings.
- 6** Turn off the PMX series and then back on.
- 7** Connect the PMX series to your PC.

### ■ Configuration of Wavy

- 8** Click on the **[Setting]** menu and select **[Interface]**.  
The **[Interface]** window opens.



- 9** Select the connected PMX Series 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 PMX35-1A, you will not be able to set values exceeding 36.75 V (35 x 1.05).
- 10** Select **[RS232C]**.

- 11** Set the [COM Port (COM1to COM20)].
- 12** Click [Test] to verify that your PC is communicating with the PMX Series.  
The protocol on the PMX series side is fixed. It is set as follows:  
Baudrate: 19200 bps, Data bit: 8 bits, Stop bit: 8 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.
- 13** Click [OK].

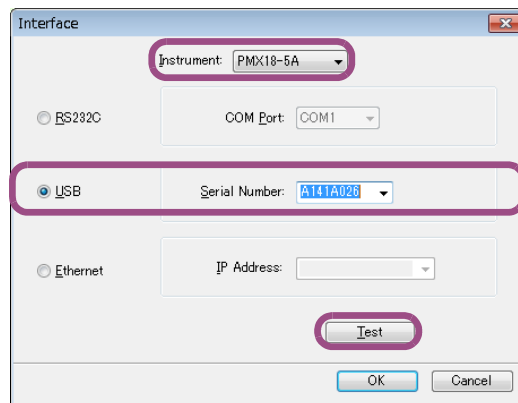
## Using the USB interface

### ■ Configuration on the PMX series

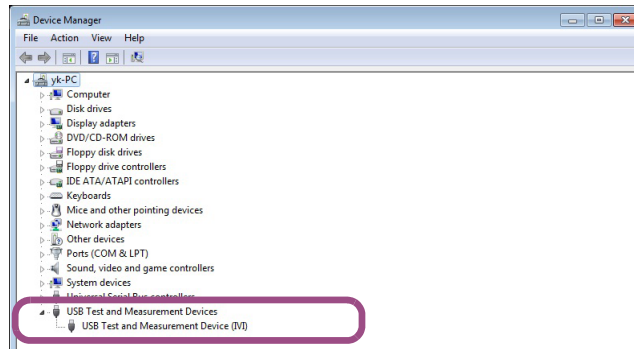
- 1** Turn the **POWER** switch on of the PMX Series.
- 2** Make sure that the **PMX** output is off.
- 3** Press **[CONFIG]** key twice.  
The voltmeter displays "CF20."
- 4** Turn **[CURRENT]** knob to select **[uSb]**.
- 5** Press **[LOCAL]** key.  
The PMX series exits from CONFIG settings.
- 6** Turn off the PMX series and then back on.
- 7** Connect the PMX series to your PC.

### ■ Configuration of Wavy

- 8** Click on the **[Setting]** menu and select **[Interface]**.  
The **[Interface]** window opens.



- 9** Select the connected PMX Series 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 PMX35-1A, you will not be able to set values exceeding 36.75 V (35 x 1.05).
- 10** Select **[USB]**.
- 11** Select the serial number of the PMX Series in **[Serial Number]**.  
You can confirm the serial number on the rear panel of the PMX Series.  
If the serial number is not displayed even when the PMX series is connected properly, verify that the PMX Series is being recognized on your PC. In the Control Panel, click **[System and Security]**. Then, click **[Device Manager]** under **[System]**.



Verify if “USB Test and Measurement Device” is indicated. If the device does not appear in the [Device Manager], reinstall VISA.

**12** Click [Test] to verify that your PC is communicating with the PMX Series.

**13** Click [OK].

### When the PMX Series suddenly becomes unrecognized

When the PC enters sleep mode, it may stop recognizing the PMX Series. In such a case, disconnect the USB cable once and reconnect it.

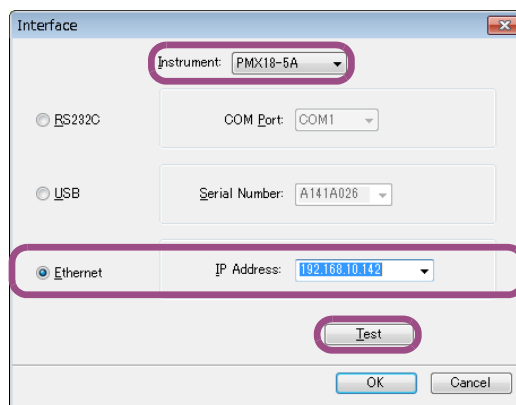
## Using the LAN interface

### ■ Configuration on the PMX series

- 1** Turn the **POWER** switch on of the PMX Series.
- 2** Make sure that the **PMX** output is off.
- 3** Press **[CONFIG]** key twice.  
The voltmeter displays "CF20."
- 4** Turn **[CURRENT]** knob to select **[LAn]**.
- 5** Press **[CONFIG]** key.
- 6** Turn the **VOLTAGE** and **CURRENT** knobs to set the protocol.  
Set DHCP (CF30) and AUTO IP (CF31) to "on."
- 7** Press **[LOCAL]** key.  
The PMX series exits from CONFIG settings.
- 8** Turn off the PMX series and then back on.
- 9** Connect the PMX series to your PC.

### ■ Configuration of Wavy

- 10** Click on the **[Setting]** menu and select **[Interface]**.  
The **[Interface]** window opens.



- 11** Select the connected PMX Series 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 PMX35-1A, you will not be able to set values exceeding 36.75 V (35 x 1.05).
- 12** Select **[Ethernet]**.



See p. 9

### 13 From [IP Address], select the IP address of the connected PMX series.

To find out the IP address, refer to the CONFIG settings (CF35 to CF38) on the PMX Series. For more details, see the PMX Series user's manual.

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

### 14 Click [Test] to verify that your PC is communicating with the PMX Series.

### 15 Click [OK].

## When the PMX Series suddenly become unrecognized

When you are not using a fixed IP address, the IP address of the PMX Series may change. If the PMX Series suddenly become unrecognized, confirm the IP address by checking the CONFIG settings (CF35 to CF38) on the PMX Series. If the IP address has been changed, re-enter the update IP address in the [IP Address].

## 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.

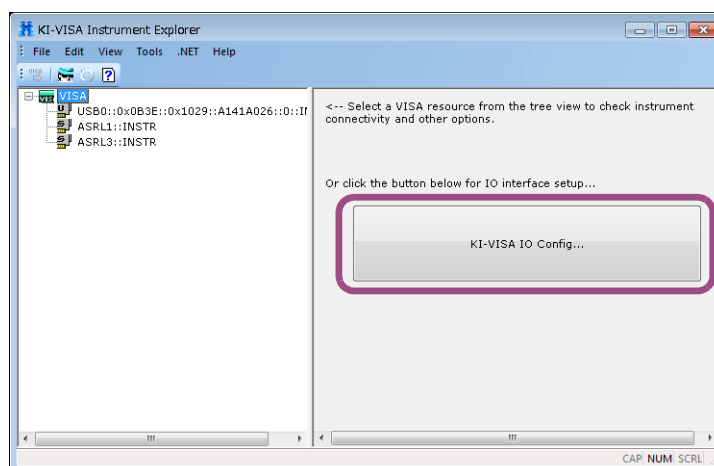
Instrument Explorer will start.

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

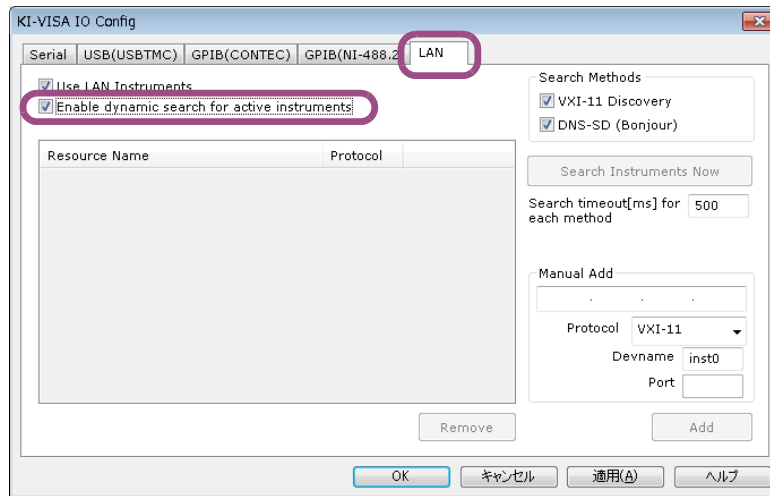
32 bit OS: C:\Program Files (x86)\IVI Foundation\VISA\VisaCom\KiVisa

### 2 Click [KI-VISA IO Config].



### 3 Click the [LAN] tab.

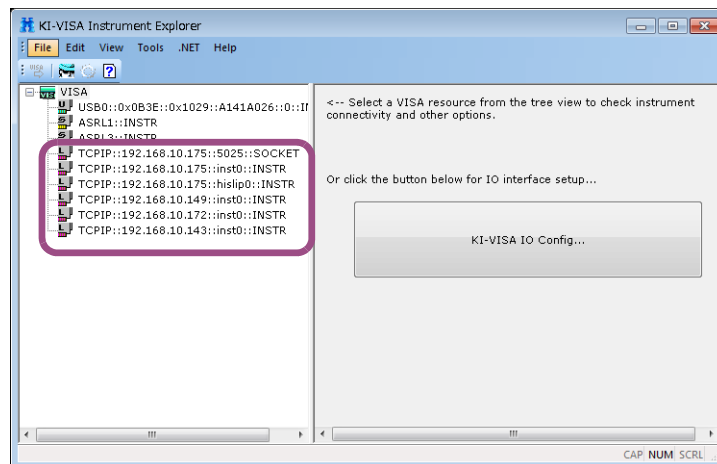
**4** Select the [Enable dynamic search for active instruments] check box.



**5** Click [OK].

The KI-VISA IO Config window opens.

**6** Check that the IP address of the connected PMX series appears in the tree on the left side of the Instrument Explorer window, and close Instrument Explorer.

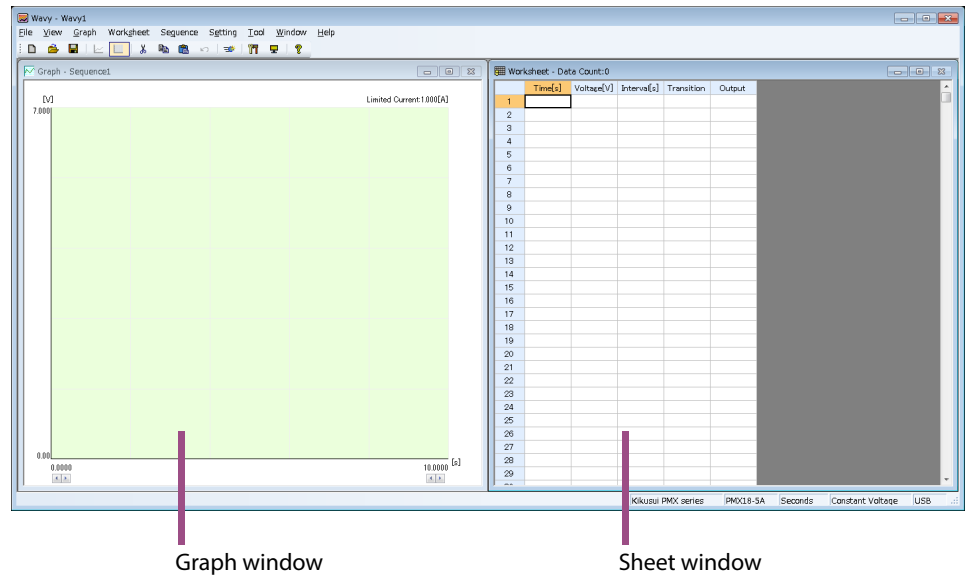


You can now select the IP address in the Wavy's [Interface] window.

# 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.

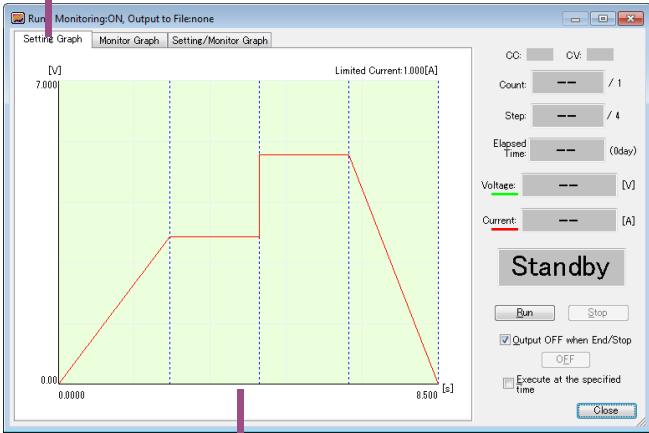
In the [Worksheet] window, you can set the steps by entering the values.

# 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.

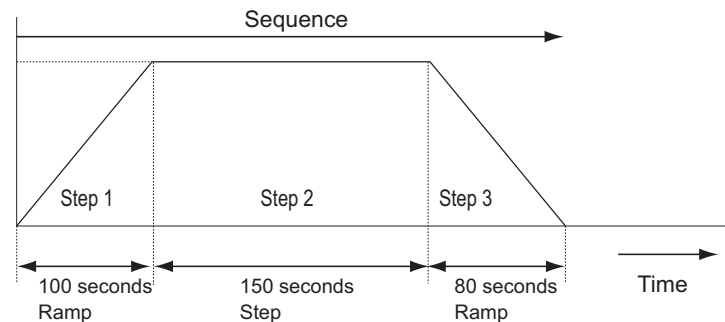
Click the tab to show in the window.



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. A single sequence can comprise up to 1024 steps. The execution of the last step normally concludes the sequence. If you set the repetition count of a sequence, however, the sequence will be repeatedly executed until it reaches to the last count.

## Sequence execution procedure

Set the operating conditions for the sequence.

- [Sequence settings](#)
- [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 PMX series specified by [Instrument] in the interface window. For example, if you specify PMX35-1A, you will not be able to set values exceeding 36.75 V (35 x 1.05).

## Sequence settings

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

- 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. 16

See p. 17

See p. 19

See p. 25

## 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.

Sheet window in CV mode

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

Sheet window in CC mode

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

Time [s] indicates the accumulated time from the beginning, which is unable to be modified.

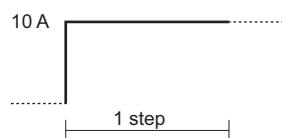
- Voltage (in CV mode)  
Set the voltage when Constant Voltage (CV) mode being enabled.
- Current (in CC mode)  
Set the current when Constant Current (CC) mode being enabled.
- Interval  
Set the execution time for the step.

- Transition (Step or Ramp)

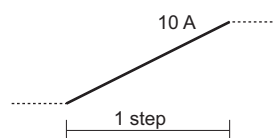
Set the transition type for the step.

The resolution of ramp transition is 50 ms to 100 ms.

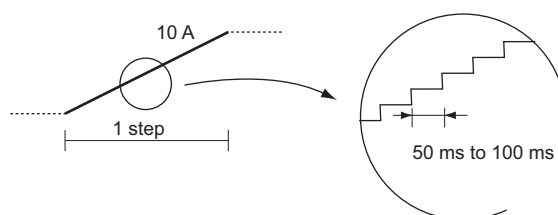
(Example 1) Current: 10 A  
Transition: Step



(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.

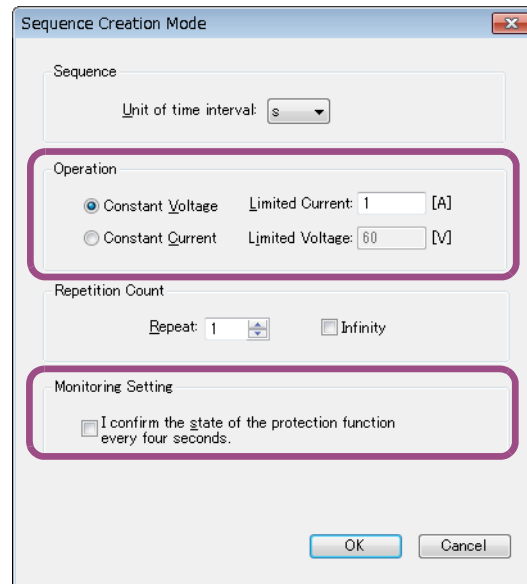
You can edit the steps by either drawing lines in [Graph] window or entering values in [Worksheet] window.

# 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 PMX 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).  
There are three significant decimal places (x.xxx). The actual number of significant decimal places varies depending on the PMX 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 PMX Series regulated DC power supply. You can set overvoltage protection (OVP), and overcurrent protection (OCP).

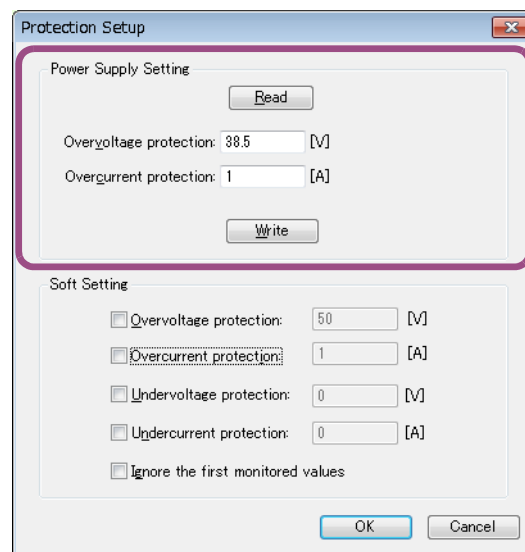
## ■ Software Setting

These are the protection functions which Wavy for PMX 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 PMX 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.
- 3 Click [Write].  
The settings are transmitted to PMX Series and becomes activated.
- 4 Click [OK] to close the window.

## Querying the PMX Series settings

To query and load the present protection settings on the connected PMX Series, click [Read].

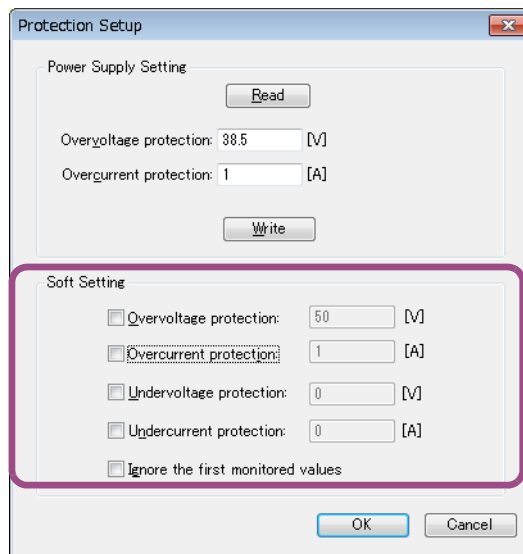
## Using the protection functions of Wavy (Software Setting)

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 PMX series.


### 4 Click [OK] to close the window.

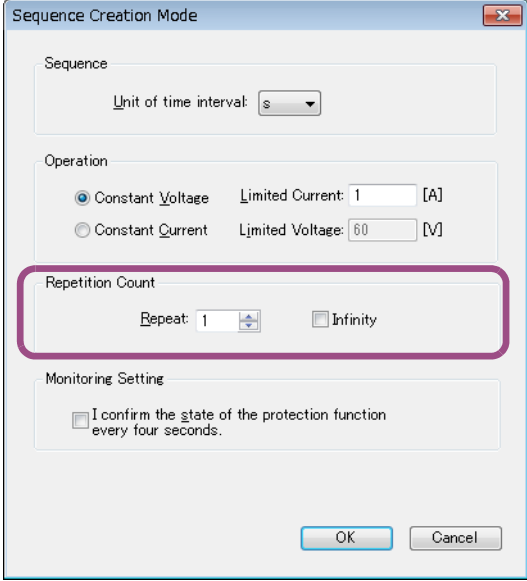
### Ignoring the first monitored values

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).**



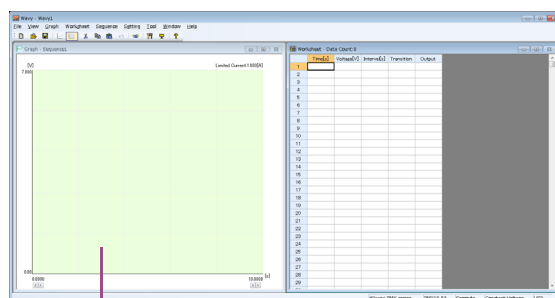
The image shows the 'Sequence Creation Mode' dialog box. It has a title bar with a close button. The dialog is divided into several sections: 'Sequence' with a 'Unit of time interval' dropdown set to 's'; 'Operation' with two radio buttons, 'Constant Voltage' (selected) and 'Constant Current', each with a corresponding 'Limited' value input field (1 [A] and 60 [V] respectively); 'Repetition Count' which is highlighted with a red rectangle, containing a 'Repeat' spinner set to 1 and an 'Infinity' checkbox; and 'Monitoring Setting' with a checkbox 'I confirm the state of the protection function every four seconds.' At the bottom are 'OK' and 'Cancel' buttons.

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

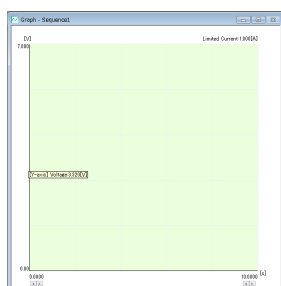
# Creating or Editing Steps by Drawing

## Creating the Steps

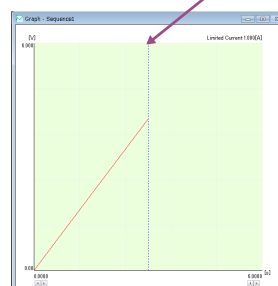
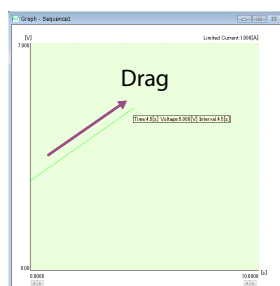
You can create the steps in the [Graph] window.



Graph window



Place the pointer on Y axis and click.



Step-division line

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

### 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.

You can change the scale of the graph and/or step interval unit.

### 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.

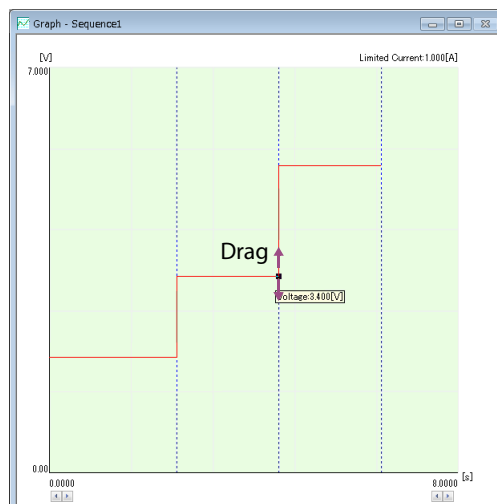
The setting is committed when you release the mouse button, and the corresponding values are entered in the following line of the [Worksheet] window.

Repeat the procedure until you complete creating all the steps.

See p. 25, p. 26

## 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)

- 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.

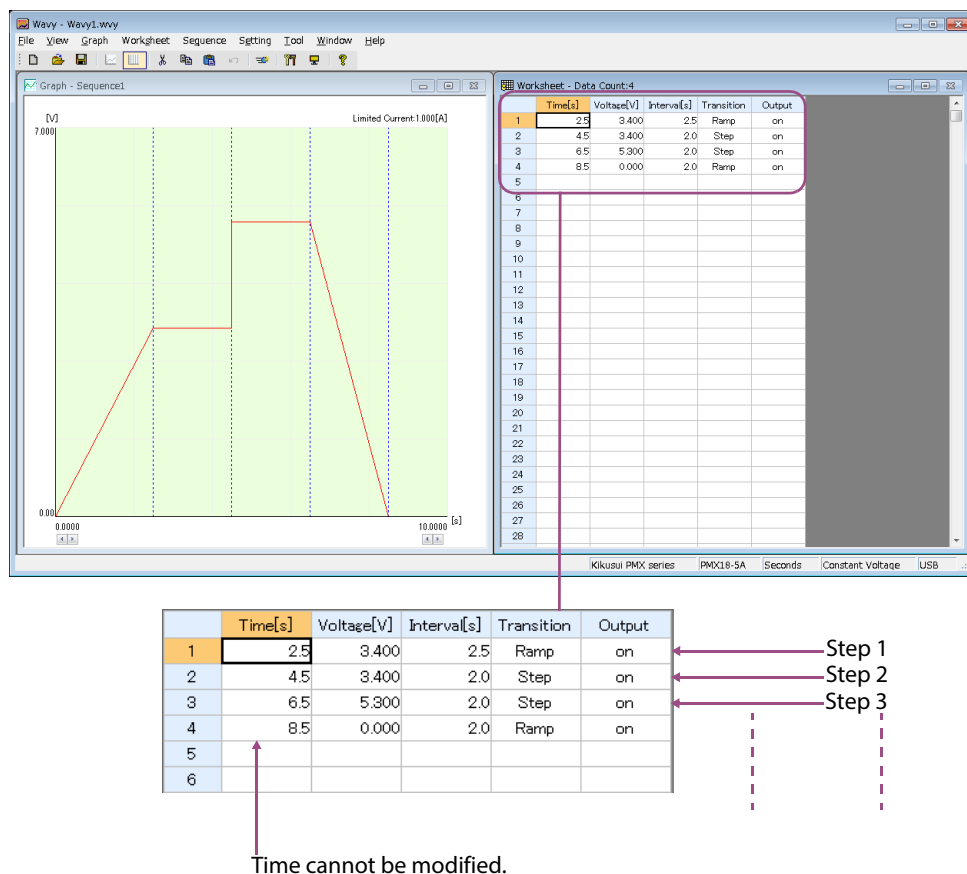
## Deleting the steps

- 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.



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.

To edit the transition and output, double-click the applicable cell, or click the cell and press Enter key. 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 <sup>*1</sup>	"V" or "Ctrl + V"
Delete steps <sup>1</sup>	"Delete"
Undo <sup>1</sup>	"Z" or "Ctrl + Z"
Select all rows	"A" or "Ctrl + A"


<sup>\*1.</sup> A confirmation dialog appears before execution.



# Changing the Step Interval Unit

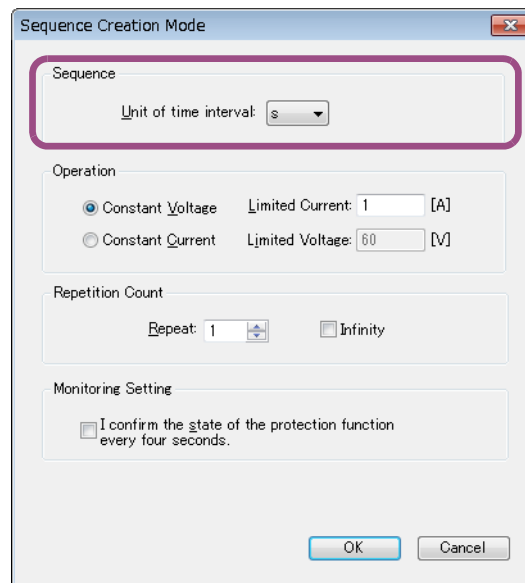
You can set the step interval unit to seconds, minutes, or hours.

Unit	Interval setting range	Setting resolution
s (seconds)	0.5 s to 999.5 s	0.5 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

- 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.

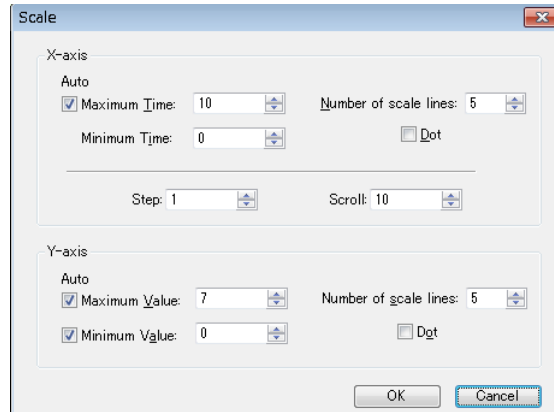


- 3 Click [OK] to close the window.

# 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.

# Saving and Loading Sequence

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

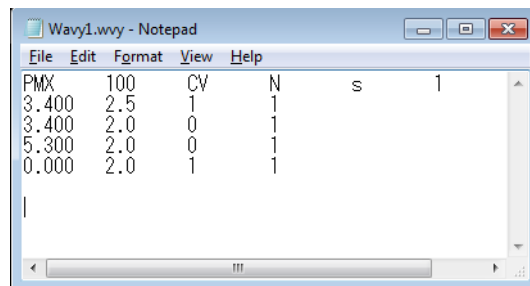
## Saving files

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.



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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.

- First row in the data

1st column	PMX	Series name
2nd column		File version
3rd column	CV	Constant voltage mode
	CC	Constant current mode
4th column	N	Always “N”
	s	seconds
5th column	min	minutes
	h	hours
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

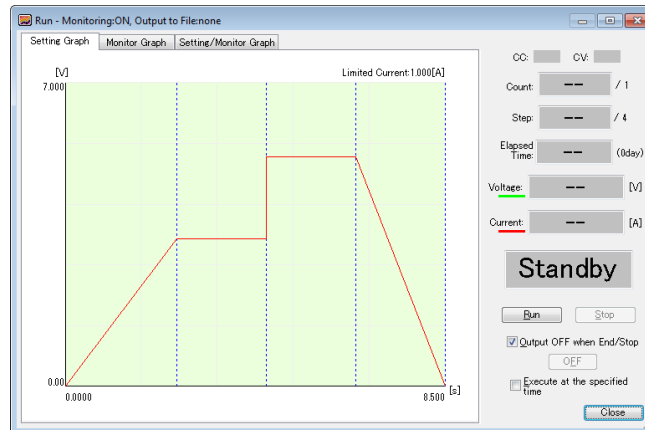
You can load the saved data.

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

# Executing Sequences

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

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



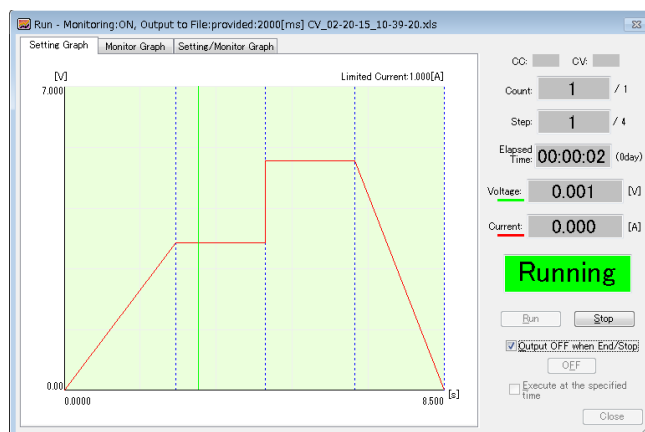
- 2 Click [Run].

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.



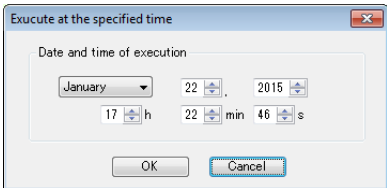
## ■ Turning the output off when a sequence completes

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 to 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 PMX 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 OVP (In case of OVP)	A protection function has been activated.*1 OVP: Overvoltage protection, OCP: Overcurrent protection, UVP: Under-voltage protection, UCP: Undercurrent protection, OHP: Overheat protec- tion, AC: AC input voltage drop, COMM: Internal communication error
Waiting	The PMX 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 PMX series protection function was activated.  
Yellow indicates that a Wavy protection function was activated.

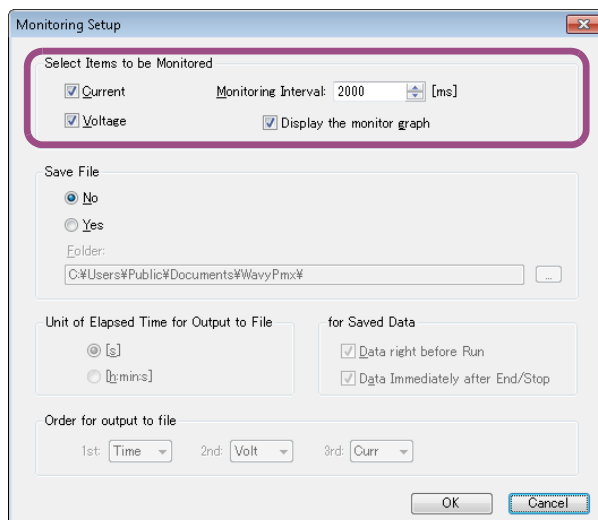
See p. 35

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.

# Displaying Monitors

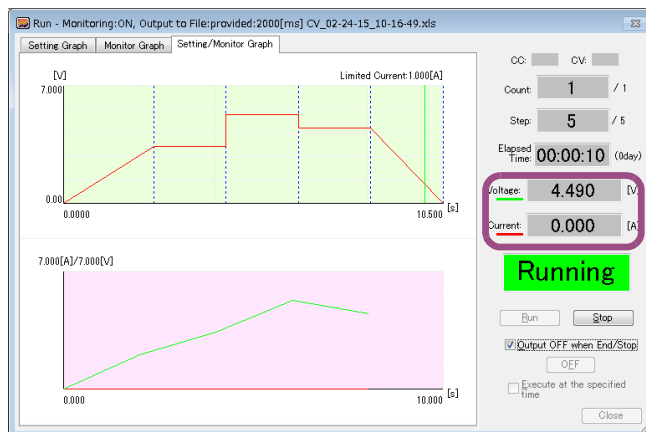
You can have the monitored values and the monitor graph displayed in the [Run] window.

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

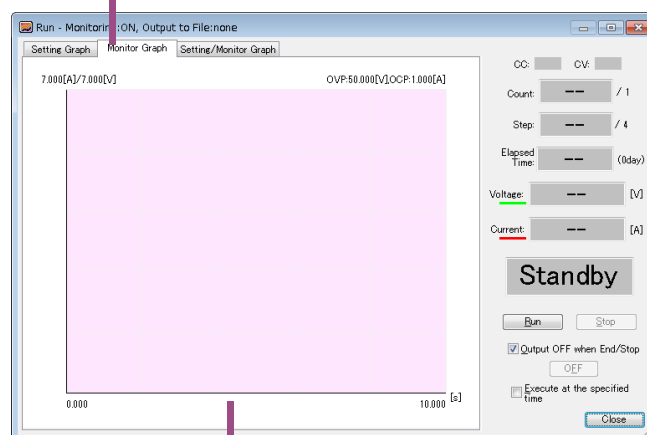
To display the output values in the [Run] window, select [Current] and/or [Voltage] under [Select Items to be Monitored].



## Displaying the monitor graph

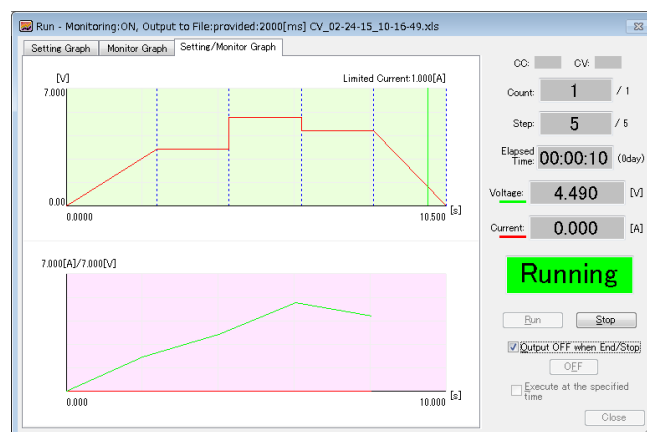
To display the real-time monitor graph, select the [Display the monitor graph] check box under [Select Items to be Monitored]. Further, additional tabs — [Monitor Graph] and [Setting/Monitor Graph] — are displayed in the [Run] window.

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.



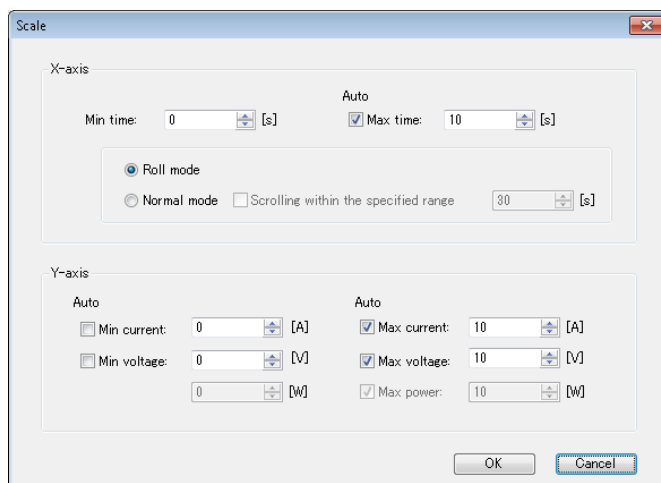
See p. 36

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 time range to be scrolled is defined by subtracting the minimum time setting and the scrolling time from the maximum time setting.

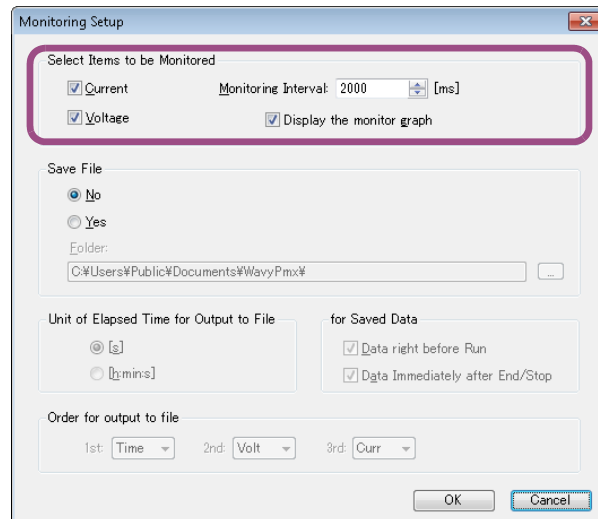
For example, if the minimum time is set to 0 s, the maximum time is set to 23 s, and the scroll time is set to 10 seconds, the time range will be 13 s (calculated from 23-0-10).



# 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.

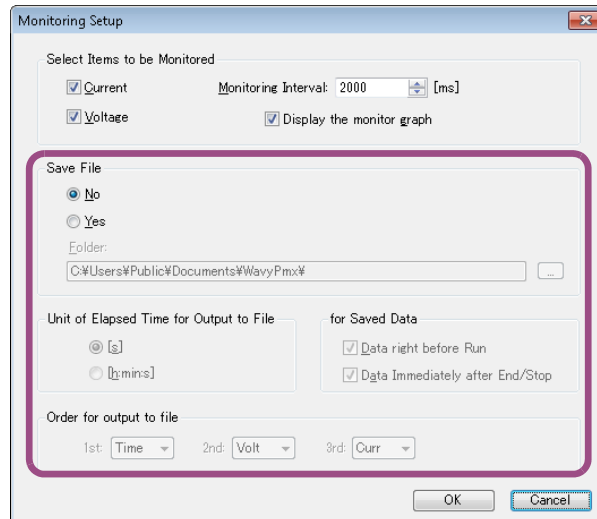


Under [Select Items to be Monitored], set the [Monitoring Interval] to a value between 200 ms and 600000 ms.

# 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.

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

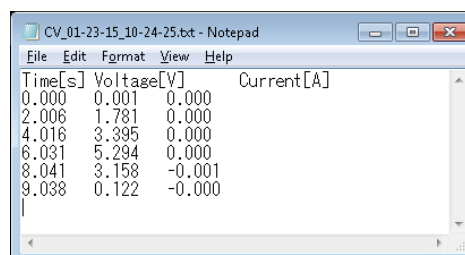
[h:min:s]: Hours, minutes, seconds

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.



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

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See p. 39

## 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

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).

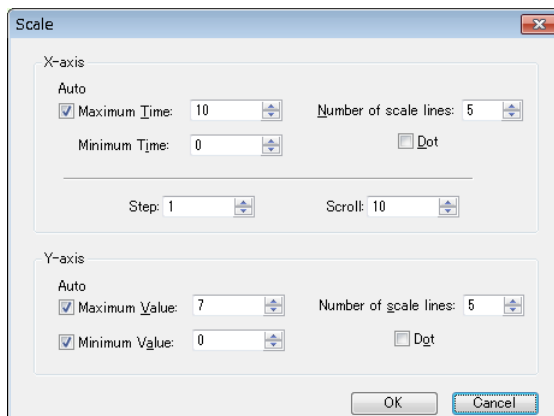
#### ■ Showing and hiding the scales

- [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.

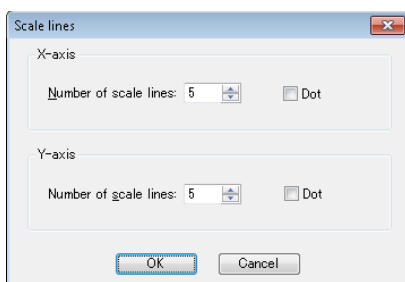


To vary the grid, enter the number in [Number of scale lines].

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].

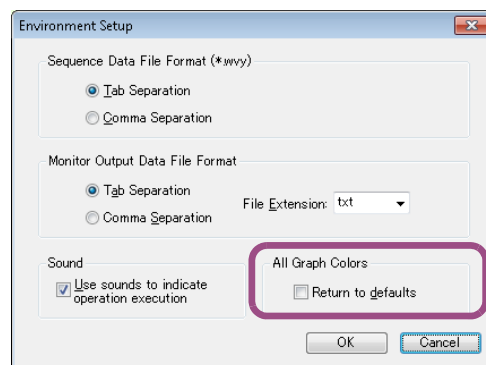
\*3.Right-click on the [Setting Graph] tab in the [Run] window and select [Color].

\*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.

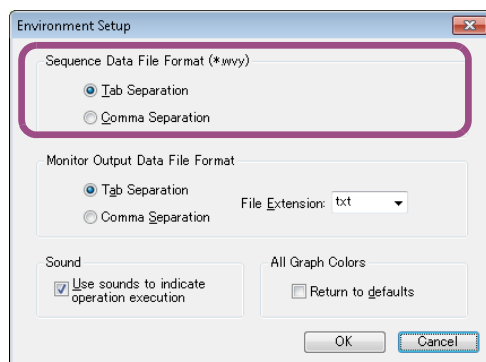
On the [Setting] menu, click [Environment Setup] to display the Environment Setup window.



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

## Changing the sequence data file format

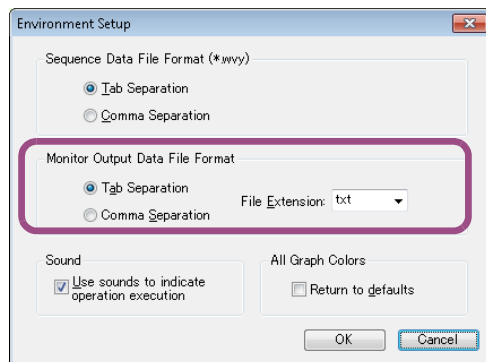
To change the sequence data file format, click on the [Setting] menu and select [Environment Setup]. The [Environment Setup] menu opens.



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.

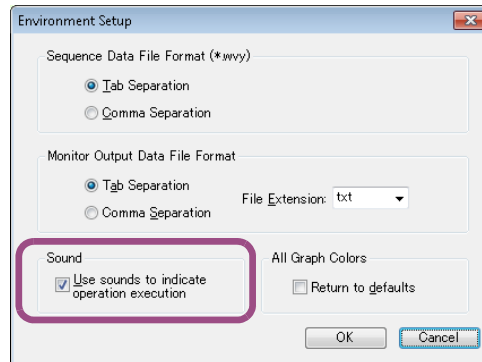


Select either [Tab Separation] or [Comma Separation] under [Monitor Output Data File Format]. By default, [Tab Separation] is selected. Also, you can specify the file extension (txt / csv / log). To specify the file extension, select the desirable extension from the drop-down menu or enter the name.

## 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 PMX series directly

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

To remotely control the PMX 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 PMX 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 PMX 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].

## ■ Output

Click [ON] to turn on the output. Click [OFF] to turn off the output. The present status of the PMX 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 PMX 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 PMX 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

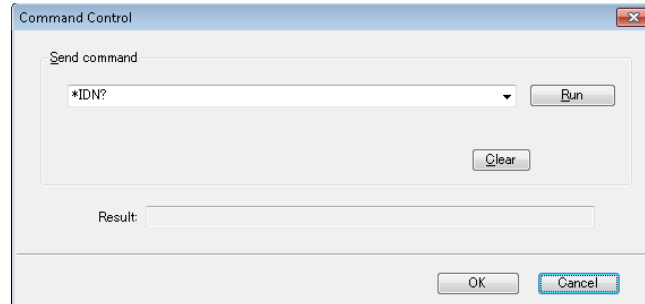
[h:min:s]: Hours, minutes, seconds

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 PMX Series

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

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 PMX Series Communication Interface Manual.

# About Operating Modes

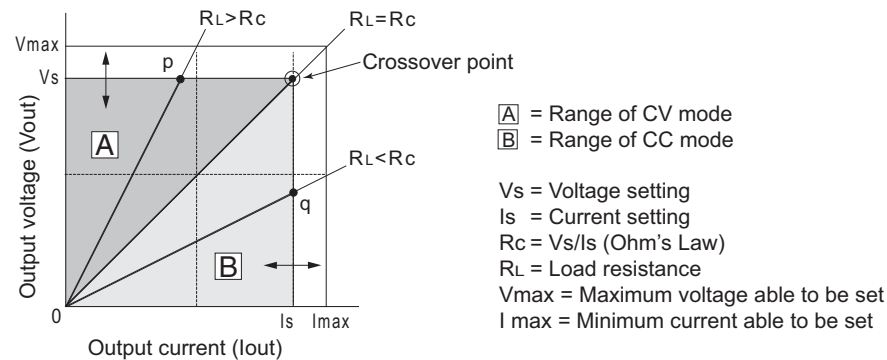
The PMX Series functions as a constant-voltage source or a constant-current source. In constant-voltage (CV) mode, the PMX Series holds the output voltage to a certain value regardless of the load change. Whereas in constant-current (CC) mode, the PMX Series holds the output current to a certain value regardless of the load change. These operating modes are determined by the following three factors.

Output voltage setting ( $V_s$ )

Output current setting ( $I_s$ )

Load resistance ( $R_L$ )

The figure below explains the operating modes.



The load resistance is denoted as " $R_L$ ". The resistance, which is calculated from the voltage and current settings ( $R_c = V_s/I_s$ ), is denoted as " $R_c$ ". The PMX Series is designed to function in CV mode within A range, and function in CC mode within B range. A and B are divided by the " $R_L = R_c$ " boundary line. On this boundary line, the output voltage equals the voltage setting, and the output current equals the current setting. When the load resistance  $R_L$  is greater than the resistance  $R_c$ , the PMX Series operates in CV mode as the operating point (p point) lies within A range. In this case, the current setting ( $I_s$ ) equals the current limit.

While the PMX Series is operating in CV mode, the output voltage is hold to a certain level. Output current " $I$ ", on the other hand, is determined by the equation  $I = V_s/R_L$  and is lower than the current limit " $I_s$ ". The flowing current may not equal the current setting.

For the loads in which transient peak current flows, the current limit " $I_s$ " needs to be set higher than the peak value.

In contrast, when the load resistance  $R_L$  is lower than the resistance  $R_c$ , the PMX Series operates in CC mode as the operating point (q point) lies within B range. In this case, the voltage setting ( $V_s$ ) equals the voltage limit.

While the PMX Series is operating in CC mode, the output current is hold to a certain level. Output voltage " $V$ ", on the other hand, is determined by the equation  $V = I_s/R_L$  and is lower than the current limit " $V_s$ ". The flowing voltage may not equal the voltage setting.

For the loads which causes the transient voltage surge, the voltage limit " $V_s$ " needs to be set higher than the voltage surge.

## Crossover point

The operating modes (CV or CC) automatically switches due to the changes in the load. A crossover point is referred to as the point where the operating mode switches.

For example, if the load changes and the output current reaches to its limit while in CV mode, the PMX Series switches to operate in CC mode for protecting the load. Likewise, if the output voltage reaches its limit while in CC mode, the PMX Series switches to operate in CV mode.

### CV/CC modes operation example

The following cases take the PMX Series with rated output voltage 100 V and rated output current 10 A as examples.

First, assume that 8  $\Omega$  load resistance ( $R_L$ ) is connected to the output terminals of the PMX Series, and the output voltage and output current are set to 30 V and 5 A respectively. In this case, the PMX Series operates in CV mode because  $R_L$  (8  $\Omega$ ) is greater than  $R_c$  ( $R_c = 30 \text{ V} / 5 \text{ A} = 6 \Omega$ ). You can still raise the voltage up to 40 V (calculated from  $V_s = I_s \times R_L$ , that is,  $V_s = 5 \text{ A} \times 8 \Omega = 40 \text{ V}$ ) in CV mode. If you attempt to raise the voltage any further, however, the voltage reaches to the crossover point and the PMX Series automatically switches to operate in CC mode. To allow the PMX Series to continue operating in CV mode, raise the current limit.

Next, assume that 5  $\Omega$  load resistance ( $R_L$ ) is connected to the output terminals of the PMX Series, and the output voltage and output current are set to 30 V and 5 A respectively. In this case, the PMX Series operates in CC mode because  $R_L$  (5  $\Omega$ ) is lower than  $R_c$  ( $R_c = 30 \text{ V} / 5 \text{ A} = 6 \Omega$ ). You can still raise the current up to 6 A (calculated from  $I_s = V_s / R_L$ , that is,  $I_s = 30 \text{ V} / 5 \Omega = 6 \text{ A}$ ) in CC mode. If you attempt to raise the current any further, however, the current reaches to the crossover point and the PMX Series automatically switches to operate in CV mode. To allow the PMX Series to continue operating in CC mode, raise the voltage limit.

# Menu Reference

Menu		Description
File (F)		
New <sup>*1</sup>		Creates a new file.
Open <sup>*1</sup>		Opens an existing file.
Save <sup>*1</sup>		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 PMX.
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 <sup>*1</sup>		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 <sup>*1</sup>		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 <sup>*1</sup>	Cancels the previous operation.
Delete <sup>*1</sup>	Deletes the step data.
Copy <sup>*1</sup>	Copies the step data.
Paste <sup>*1</sup>	Inserts the copied step data.
Sequence	
Run <sup>*1</sup>	Executes the sequence.
Mode <sup>*1</sup>	Sets the sequence mode and the operating mode.
Monitoring Setup <sup>*1</sup>	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 <sup>*1</sup>	Displays the application software information including the version and the copyright.

<sup>\*1</sup> A button with the same function is available on the toolbar.







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