Operation Manual

Sequence Creation Software

Wavy for PBZ Ver.6

(SPEC70525)

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KIKUSUI ELECTRONICS CORP.

Before You Contact Customer Support

Before you contact customer support for repairs, inspection, or adjustments, read over the manual one more time and reinspect the product. If you still have problems or questions, contact your Kikusui distributor or agent.

For Safe Use

Before executing a test using this software application, carefully read the operation manual of the product,thoroughly, and pay careful attention when making connections and performing the operation. Improper connections or handling may cause serious accidents such as injuries or fire.

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This manual applies to versions 6.x of the “Wavy” for PBZ.

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Chapter 1 Introduction

1.1 Overview

This sequence creation software “Wavy” is an application software that supports the internal sequence feature of the PBZ series, intelligent bipolar power supply.
Using this “Wavy” enables you to create and edit sequences easily with a mouse. When you execute a sequence, you can view the current position, monitor the voltage and current, and save this information. The monitored data is graphed in real time.
In addition to the sequence feature, you can also perform “direct control” as if you were using a remote. You can directly set the voltage and current, turn the output on and off, and configure the monitor.
The “Wavy Ver. 6” is only applied with the PBZ series.

1.2 System Requirements

PC Requirements

CPU	Core2 or better
OS	Windows8 (x86/x64), Windows7 (x86/x64)
CD-ROM drive	Necessary to install the “Wavy”
Mouse	Necessary
Display resolution	1024 × 768 dots or higher resolution (DPI: 96)
Memory	2 GB or more
Hard disk	10 GB or more of free space

* When you use the software, turn the OS’s power-saving mode and screen saver off.
  Also, avoid using this software at the same time as other applications.
* If you are using a PC that has advanced power management (APM) or sleep mode, disable these features.
* When you change the DPI setting, the display may not appear properly, because of the resolution.
* You will need to add additional memory to perform testing over extended periods.

Interface Specifications

You can use a USB, GPIB, LAN or RS232C interface.

To use a GPIB interface, you need to ensure that the GPIB driver provided by the appropriate manufacturer is installed and enabled. Depending on the OS, you may have to install the newest driver. Download the newest GPIB drivers from the Webpages of the companies.

National Instruments Corporation	NI-488.2 driver
CONTEC CO.	API-GPIB(98/PC)W95/NT Ver. 3.50 or later
Interface Corporation	GPC-4301 Ver.1.10-06 or later for Windows
Agilent Technologies 82357B USB/GPIB	Agilent IO Libraries Suite Version 15.0 or later

* For information about installing a GPIB driver, see the manufacturer's operation manual.
* Use a **crossover cable** for RS232C.
* The software may not function properly if you use a USB serial converter to connect to an RS232C interface.
* To use a USB or LAN interface, a USB driver is required to be installed. (VISA library).

1.3 Software Specifications

Operation Modes

There are two operation modes: CC (constant-voltage) mode and CV (constant-current mode). Both bipolar and unipolar operations are supported.

For each step in the sequence data, you can set the value (the DC voltage or current), the time interval, and the transition type (step or ramp), and you can turn on and off the trigger, output, AC signal, and pausing.
You can make the AC signal a sine wave, a triangle wave, a square wave, or one of 16 user-defined arbitrary waveforms, and you can set its amplitude of wave form (AC voltage or current), frequency, and starting phase.
The time interval can be set as indicated in the table below.

Milli seconds	0.1	to	9999999.9 [ms]
Seconds	0.0001	to	99999.9999 [s]
Minutes	0.1	to	9999.9 [min]
Hours	0.1	to	999.9 [h]

For the DC voltage or current, you can enter up to three decimal places.
The maximum number of sequence steps is 1024.
You can set the number of sequence repetitions from 1 to 10,000 or infinity .
“Step program division,” which is the repeating of a portion of the sequence data multiple times, can be performed (script function).

* If the step time exceeds 1000 seconds, the DC signal level after 1000 seconds is the same as the DC signal stop setting. If you want to perform a ramp transition that takes longer than 1000 seconds, you have to combine multiple steps. The same AC signal.

Monitoring Feature

You can read back the value of output voltage and current.
The monitoring interval ranges from 500 to 600,000 ms (0.5 to 600 s).
* The precision of the time interval is determined by the PC operating environment.

Creating and Editing feature of the User-Defined Arbitrary Waveform

You can register up to 16 waveforms.
The waveform data ranges from -32768 to 32767 (signed 16-bit), and the number of data points is 1024.
The “Wavy” can load measurement data by the measuring instrument such as an oscilloscope (text file) as user-defined-waveform data (up to 10,000 lines).
* This function can only be used for the USB or GPIB connection.

Direct Control

You can remotely set the voltage and current, output on/off, and read back the value of output voltage and current.
* This feature is independent from the sequence feature.

Chapter 2 Preparation

This chapter explains how to prepare the product for testing, starting with unpacking.

2.1 Unpacking and Inspecting the Product

After you receive the product, make sure that all its accessories are included and that nothing has been damaged during shipping.
If something is missing or damaged, contact a Kikusui distributor or agent.

Accessories	Quantity	Check
Wavy for PBZ Ver.6　CD-ROM	1	
Setup Guide	1	

2.2 Installing the Software

Log in as an administrator before you perform the installation.

(1) Start Windows.

(2) Insert the setup CD-ROM into the CD-ROM drive.

(3) A setup program window appears momentarily.

* If the setup program window does not appear, use Windows Explorer to run the AUTORUN.EXE file on the CD-ROM.

(4) Follow the directions that appear on the screen to install the “Wavy for PBZ Ver.6”.

* For details, see the setup guide.

Chapter 3 Starting Wavy

To start the “Wavy for PBZ”, double-click the “**Wavy for PBZ”** icon on the desktop.

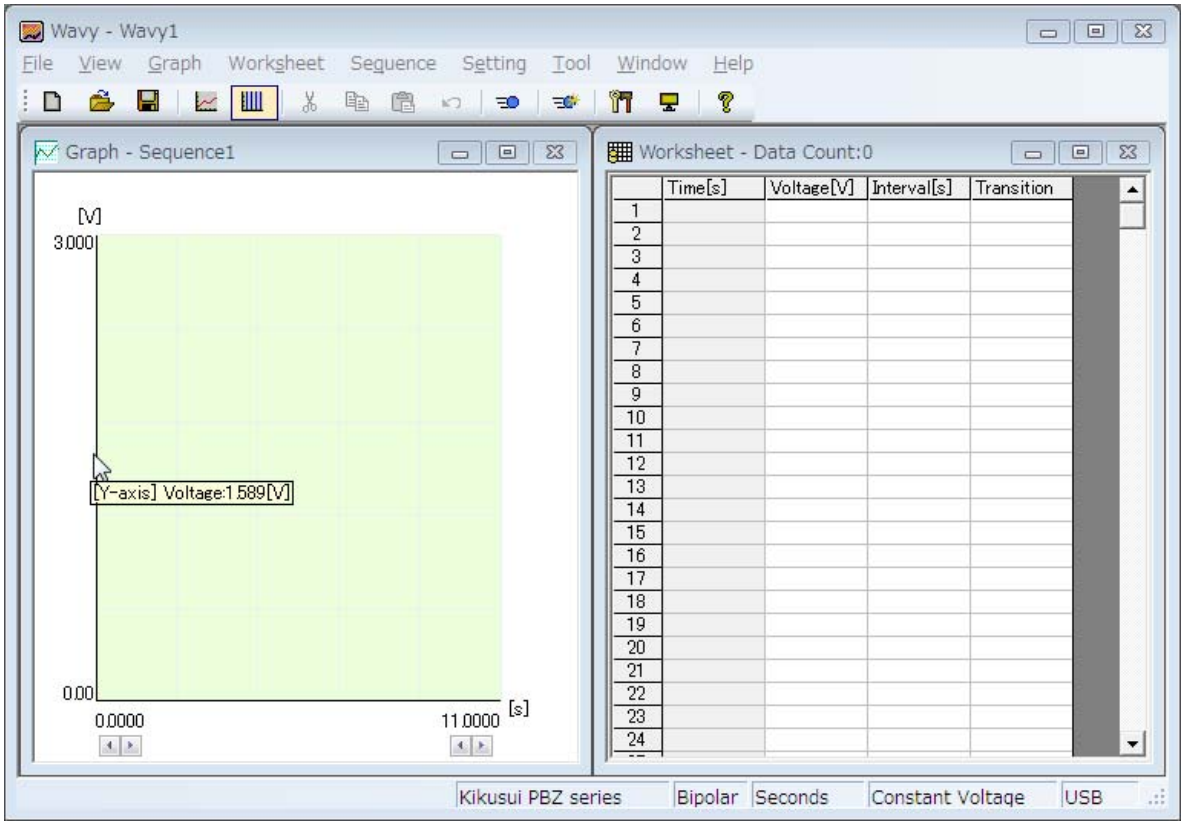


Fig. 3-1 Main window

The general procedure for using the “Wavy” is listed below.

(1) Open the Mode dialog box, and configure the operation mode.
(2) Create sequence data in the main window.
(3) Open the Send window, and write the sequence data that you created to the PBZ.
(4) Open the Execute window, and execute the sequence.

* Before you send or execute the data, be sure to configure the interface.
Make sure that the interface settings match to the configuration set on the PBZ.

On the **View** menu, click “**Waveform View”**. The “**Waveform View”** and “**Image View”** windows open. Use the mouse to arrange the windows on the screen.
These two windows provide information about the AC signal.

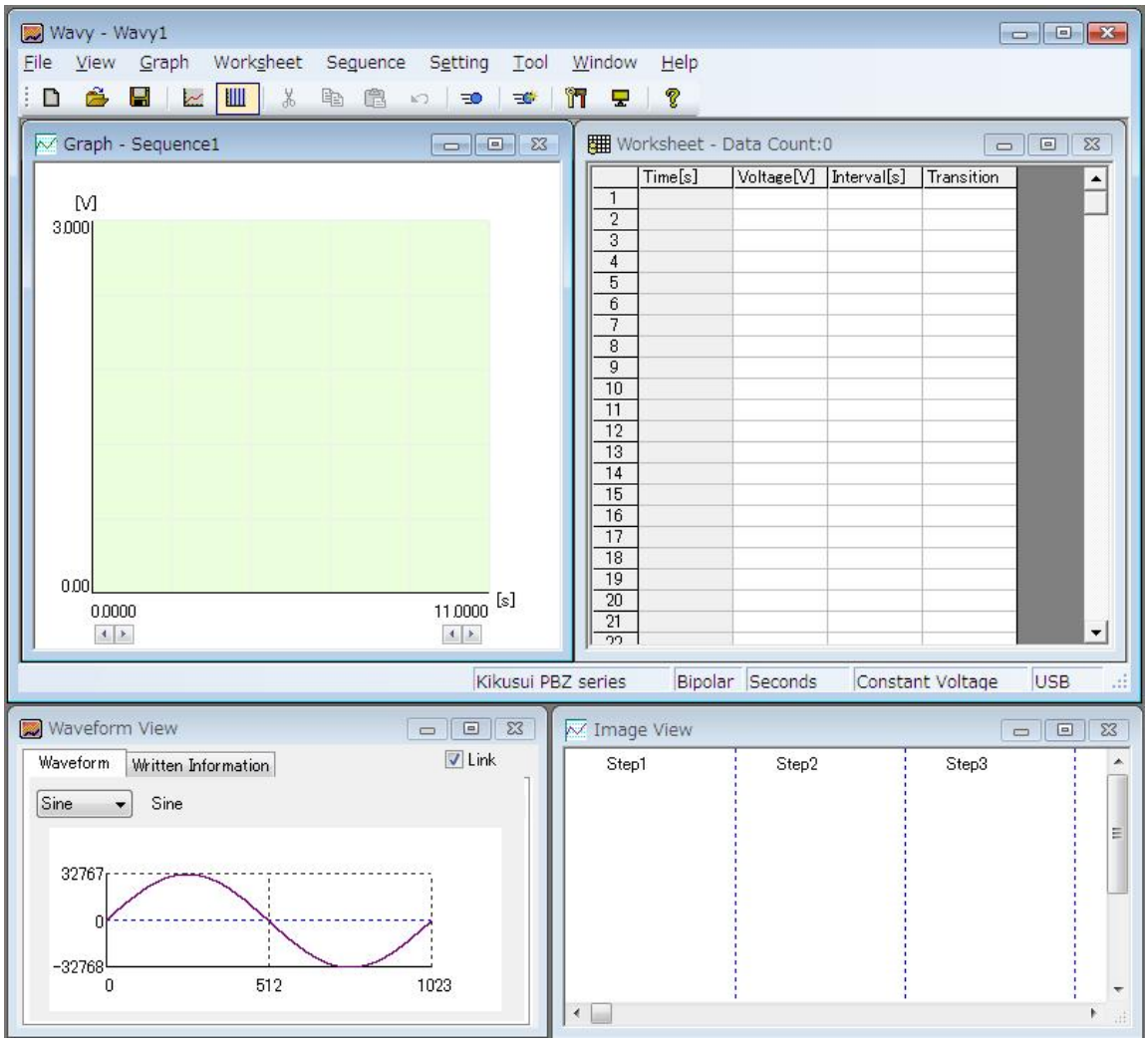


Fig. 3-2 Main window, Waveform View window, and Image View window

Useful Tips

When you exit the “Wavy”, the windows layout will be cleared.
However, you can save the windows layout when you restart the “Wavy”.
From the **View** menu, click “**Save Windows Layout”**. When **Save Windows Layout** is selected, a check mark appears in the check box.

When pressing the F6 key, the “**Waveform View**” and “**Image View”** windows will be displayed and .

Fig. 3-3 shows the display when you load the “PbzTestData.wvy”. The “PbzTestData.wvy” is located in the “WavyPbz” subfolder of the “Public Documents” folder.*

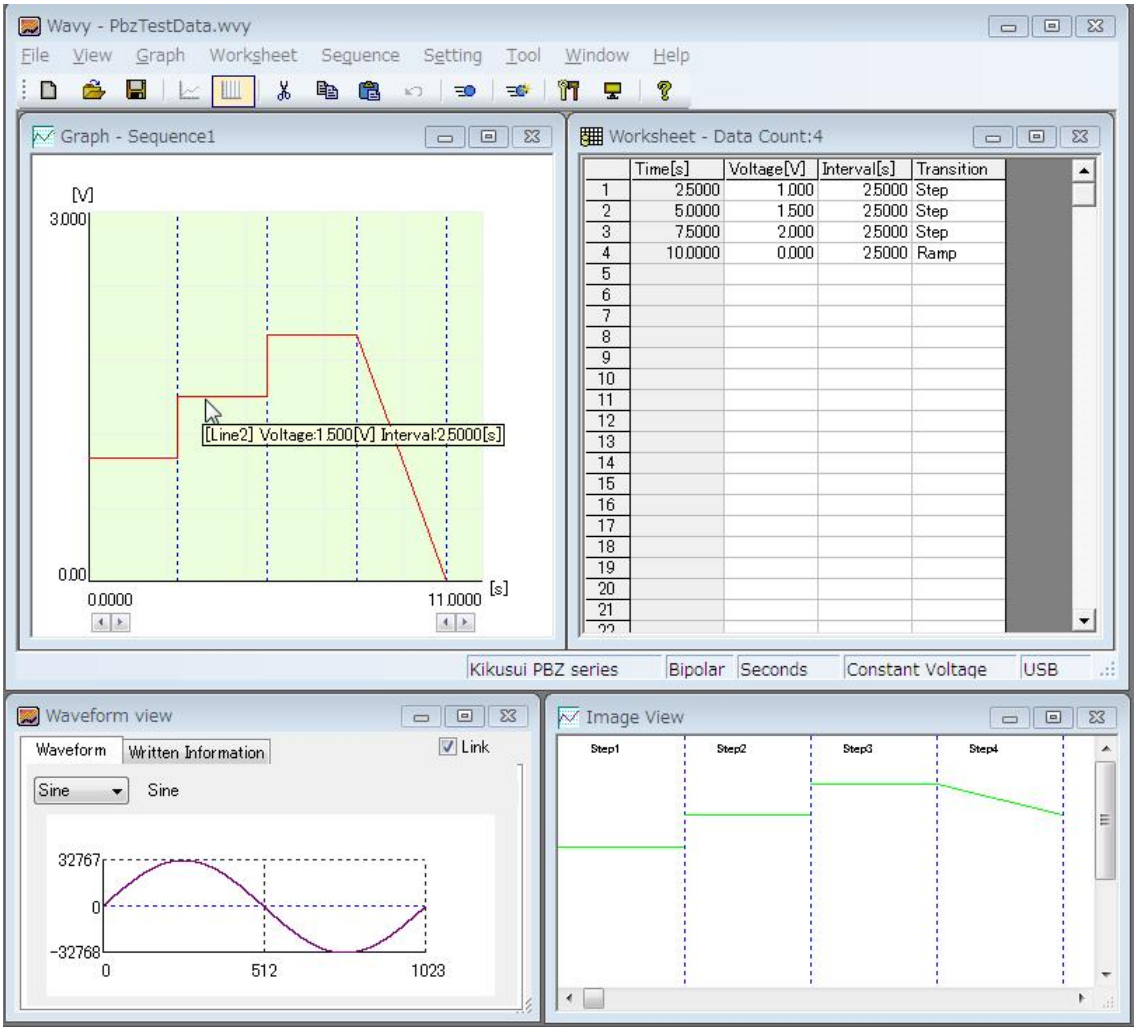


Fig. 3-3 Sample data display

* In Windows 7 and Windows Vista, the “WavyPbz” folder is created in the “Public Documents” folder. In Windows XP, it is created in the folder specified in the setup.

Chapter 4 Communication Interface

On the “**Setting”** menu, click “**Interface”** to open the “**Interface”** dialog box.

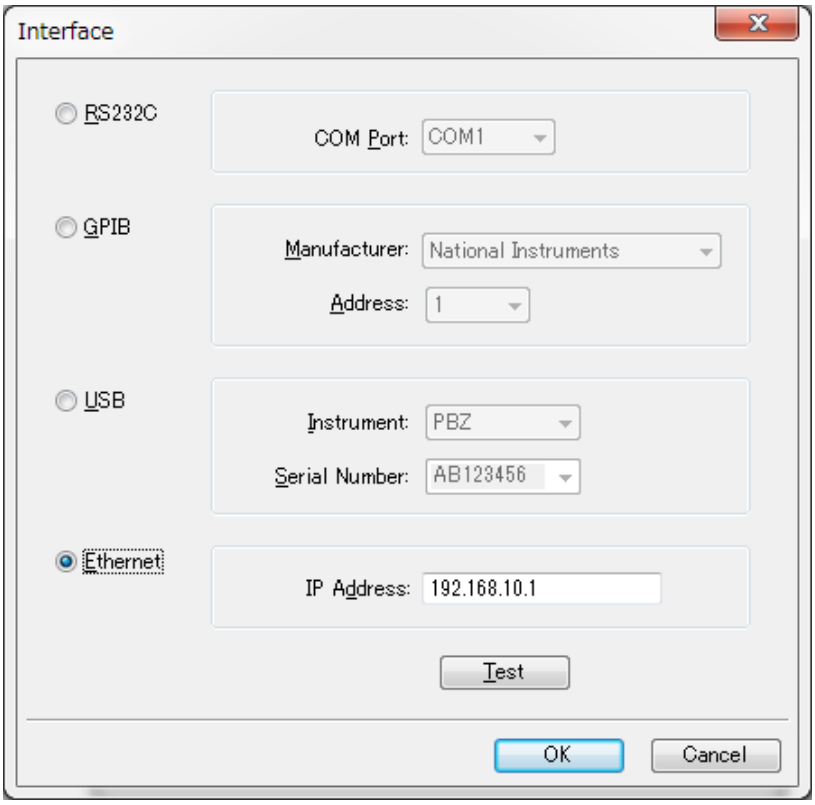


Fig. 4-1 Interface dialog box

Select the communication interface to connect with the PBZ.
After the settings, click “**Test”** to make sure that the “Wavy” communicate with the connected device properly. If the “Wavy” connects to the device properly, a the device’s name and serial number will be displayed in the message box.

* Confirm that the interface settings of connected device matchs to the CONFIG setting of the PBZ. The factory default interface setting is set to the “USB”. To become valid the setting status after you change, turn the PBZ off and then on again.

RS232C

A device’s communication protocol are factory default settings.

Baudrate (Bit rate)	19,200 bps
Databits	8 bits
Stopbits	1 bit
Parity bit	NONE
Flow control	ON

* Use a **crossover cable** for RS232C.

GPIB

Select the appropriate manufacturer and GPIB address.
To use a GPIB interface, ensure that the appropriate manufacturer's GPIB driver is installed and enabled. Use the appropriate manufacturer's utility application to execute the ***IDN?** command and test the connection.

National Instruments Corporation	NI-488.2 driver
CONTEC CO.	API-GPIB(98/PC)W95/NT Ver. 3.50 or later
Interface Corporation	GPC-4301 Ver.1.10-06 or later for Windows
Agilent Technologies 82357B USB/GPIB	Agilent IO Libraries Suite Version 15.0

* For information about how to install a GPIB driver, see the appropriate manufacturer's operation manual.
* Depending on the OS, you may have to install the newest driver. Download the newest GPIB drivers from the Webpages of the companies.

USB/LAN

To control the PBZ through USB or LAN, you need to install a VISA library. The USB driver is included in the VISA library.

VISA (Virtual Instrument Software Architecture) was developed by the VXIplug&play Systems Alliance. It is the standard specification for measurement instrument connection software. You need one of the following VISA libraries.

NI-VISA by National Instruments Corporation (Ver. 3.2 or later)
Agilent VISA by Agilent Technologies, Inc. (Agilent IO Libraries M.01.00 or later)
KI-VISA by Kikusui Electronics Corporation (Ver. 3.0 or later)

You can use any of the VISA libraries listed above.If NI-VISA or Agilent VISA is already installed on your PC, you do not need to install KI-VISA.

Use the appropriate manufacturer's utility application to execute the ***IDN?** command and test the connection.

* For details about a VISA library, see the operation manual produced by the manufacturer.
* Do not install multiple VISA libraries on the same PC.

Chapter 5 Mode Settings

On the “**Sequence”** menu, click “**Mode”** to open the “**Mode”** dialog box.

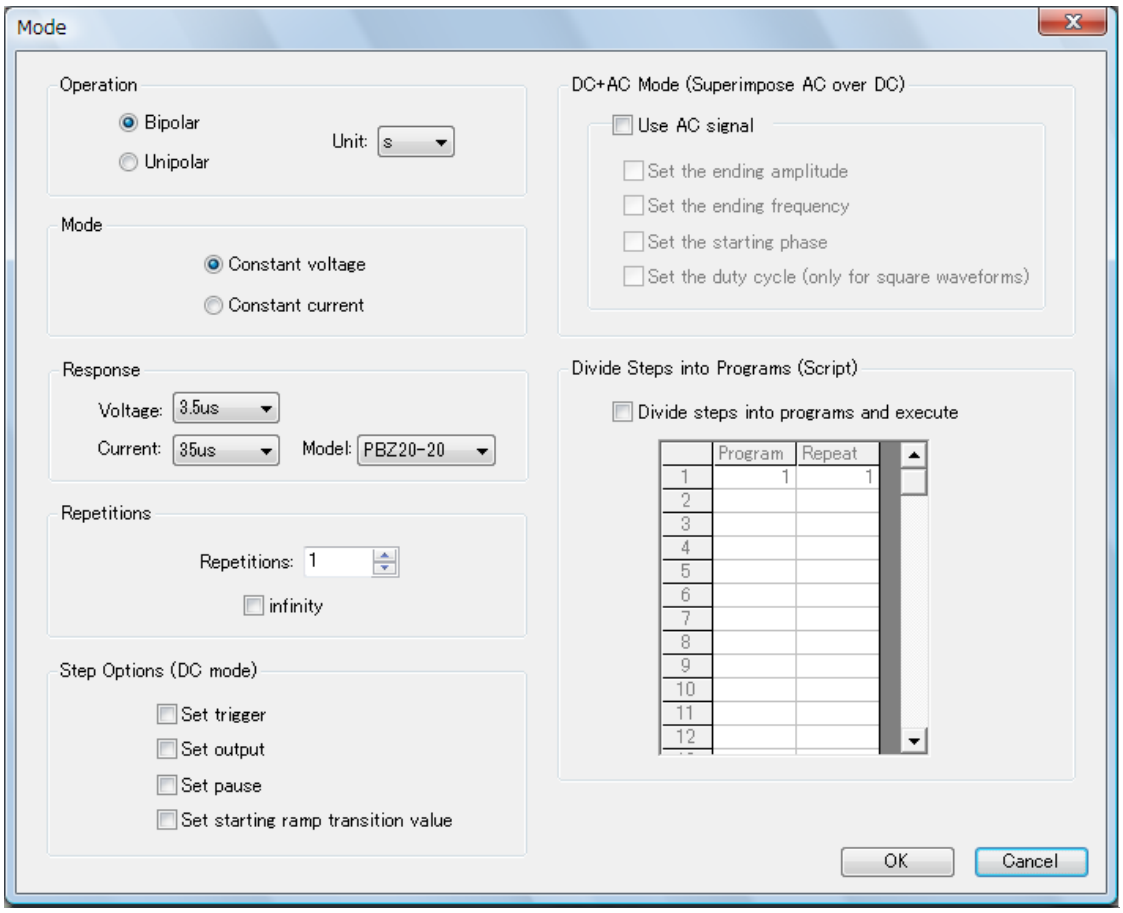


Fig. 5-1 Mode dialog box

Under **Operation**, set **Unit** to the unit of time that you want to use for the sequence data.

ms (milliseconds)	0.1 to 9999999.9 [ms]
s (seconds)	0.0001 to 99999.9999 [s]
min (minutes)	0.1 to 9999.9 [min]
h (hours)	0.1 to 999.9 [h]

Configure the settings under **Mode**, **Response**, and **Repetitions** (you can set the number of repetitions to a value between 1 and 10,000).

Select the appropriate sequence-data step options.

- When the **Set trigger** check box is not selected, the trigger is always written as OFF.
- When the **Set output** check box is not selected, the output is always written as ON.
- When the **Set pause** check box is not selected, the pose is always written as OFF.
- When the **Set starting ramp transition value** check box is not selected, the starting ramp transition value is always written as OFF.

When the **Use AC signal** check box is selected, an AC signal is superimposed on the DC signal.

Select the appropriate step items for the AC signal as well.

- When the **Set the ending amplitude** check box is not selected, the sequence is written with no amplitude sweep.
- When the **Set the ending frequency** check box is not selected, the sequence is written with no frequency sweep.
- When the **Set the starting phase** check box is not selected, the starting phase is written as FREE.

When the **Divide steps into programs and execute** check box is selected, selected portions of the sequence data can be executed multiple times.
You can create up to 16 programs and specify the number of repetitions for each program.
You can set the program order freely (for up to 16 programs).

* This feature is made possible by the scripting feature of the PBZ.
* The details of this feature are described in chapter 14, “Dividing Steps into Programs.”

* For details of the sequence data, see the Operation Manual of PBZ Series.

Chapter 6 Creating and Editing Sequence Data

When you move the mouse pointer over the Y-axis, it becomes a crosshair (Fig. 6-1).

Then, move the mouse pointer on the crosshair while holding the mouse left button (Fig. 6-2).

The position will be fixed when you release the mouse left button at the desired location (Fig. 6-3).

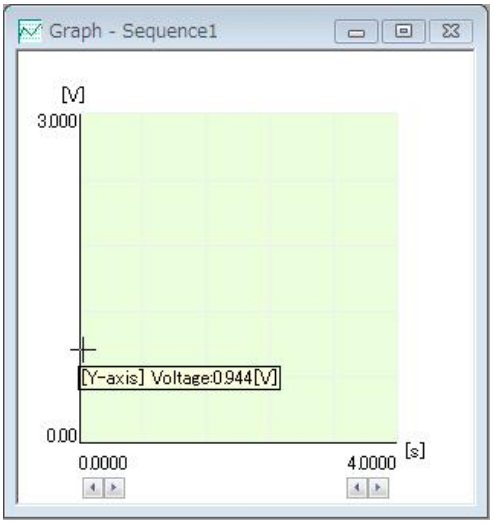


Fig. 6-1 Starting point of the mouse pointer

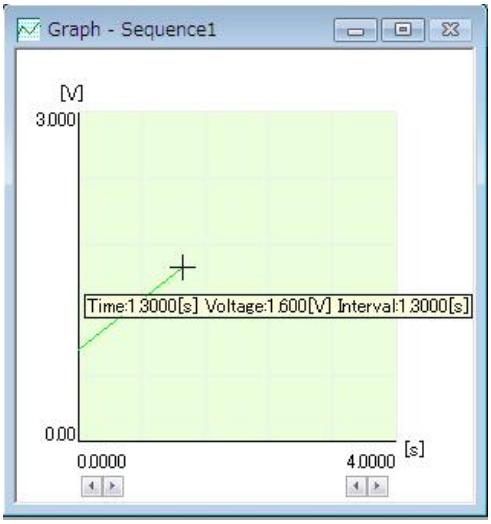


Fig. 6-2 Moving the mouse pointer

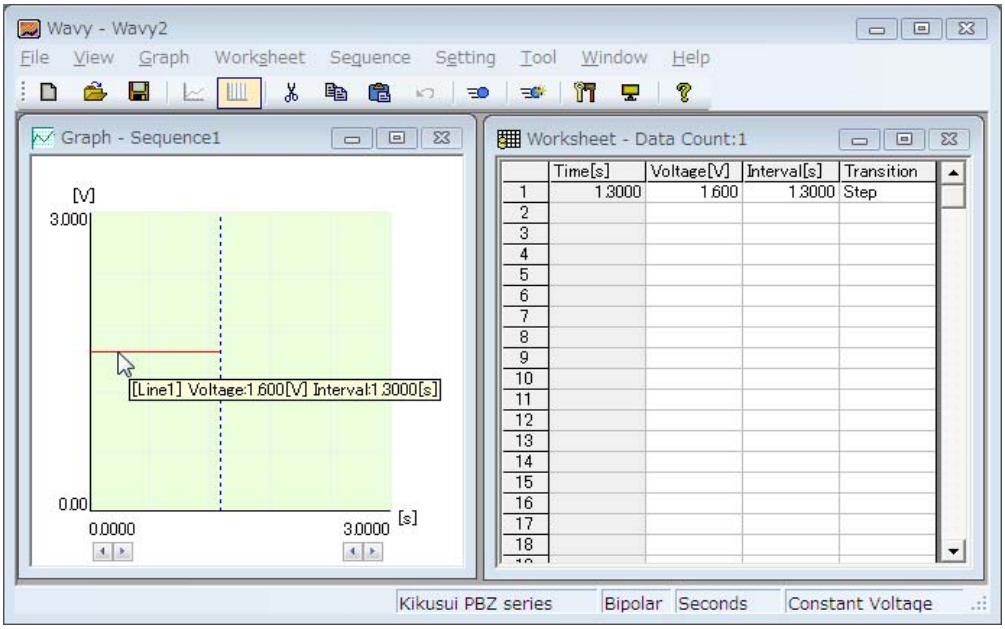


Fig. 6-3 Ending point of the mouse pointer

One step's worth of data is created on the worksheet.

You can also create data directly on the worksheet. You can do so by typing directly into the cell (data) of which data you want to create, by selecting a cell and pressing ENTER, or by double-clicking on a cell. To cancel data entry, press ESC.

*** You cannot enter values in the Time column. They are calculated automatically when you enter values in the Interval column.**

To edit a voltage or current value, double-click on the line that you want to change. The end of the line becomes a black dot (Fig. 6-4).
Move the mouse pointer over the black dot so that the mouse pointer turns into a double-headed arrow (Fig. 6-5), and then drag the mouse pointer up or down (Fig. 6-6). Drop the mouse pointer in the desired location.

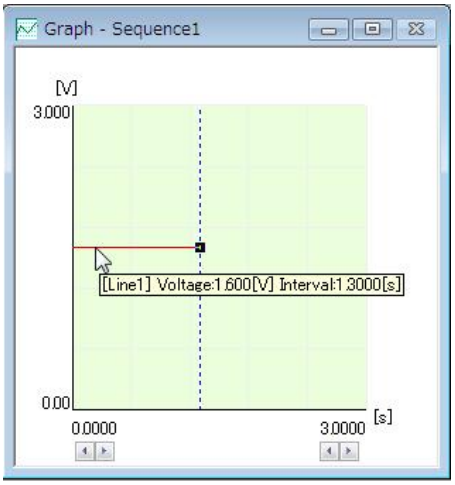


Fig. 6-4 Selecting the value to change

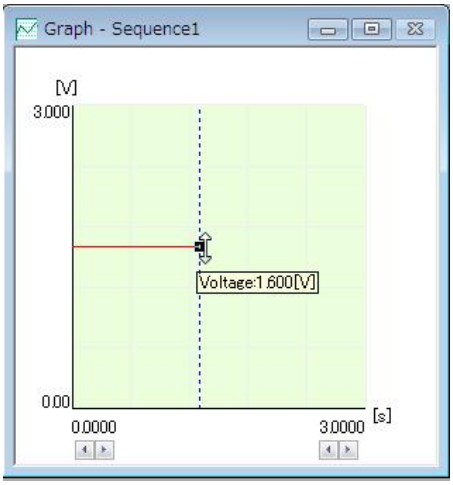


Fig. 6-5 Starting to change

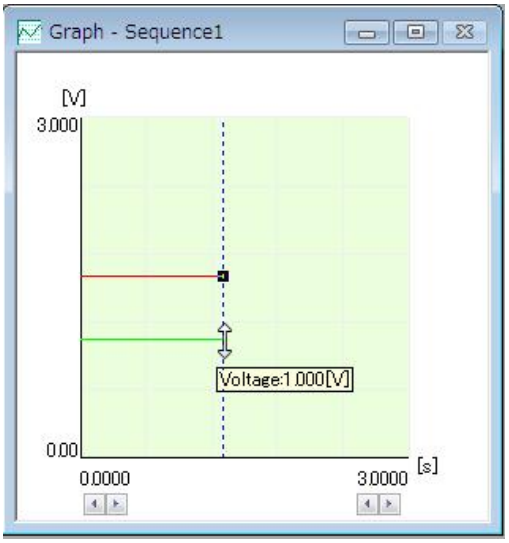


Fig. 6-6 Changing by moving

To change the time interval, double-click the dotted blue (vertical) line.
You can move the line by following the procedure for changing the voltage or current value.

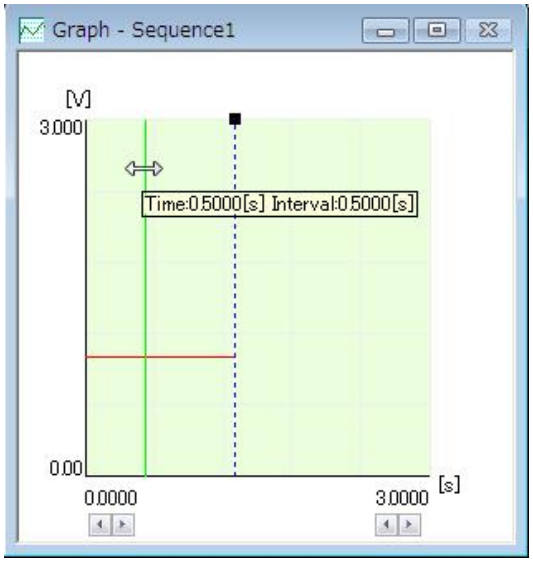


Fig. 6-7 Changing by moving (time)

To edit a transition, double-click the line of which you want to edit.
The end of the line becomes a black dot. Right-click of the mouse on the line, point to **Transition**, and then click **Ramp** or **Step**. Follow the same procedure to delete a transition.

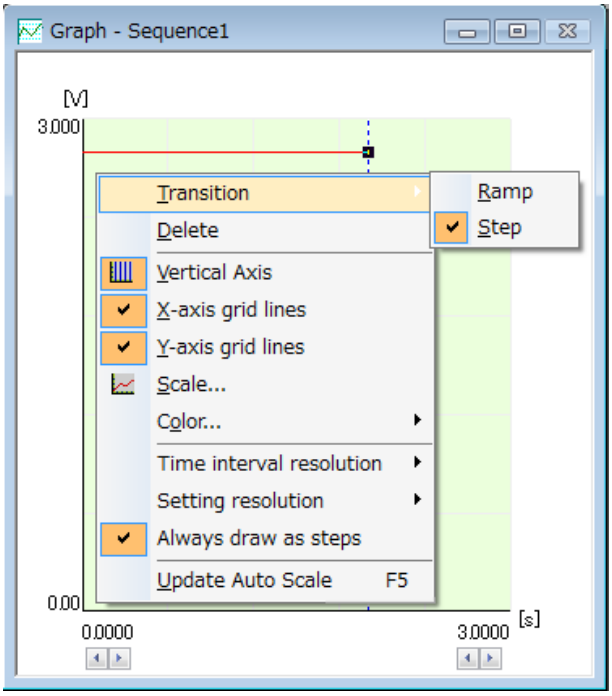


Fig. 6-8 Changing the transition

* In mouse drawing, the decimal place is determined by the setting of the "**Time interval resolution"** and "**Setting resolution"**. If you select "**Always draw as steps"**, transitions are always drawn as step transitions, never as ramp transitions.

If you select **Scale** in Fig. 6-8, a dialog box for setting the graph scale opens.

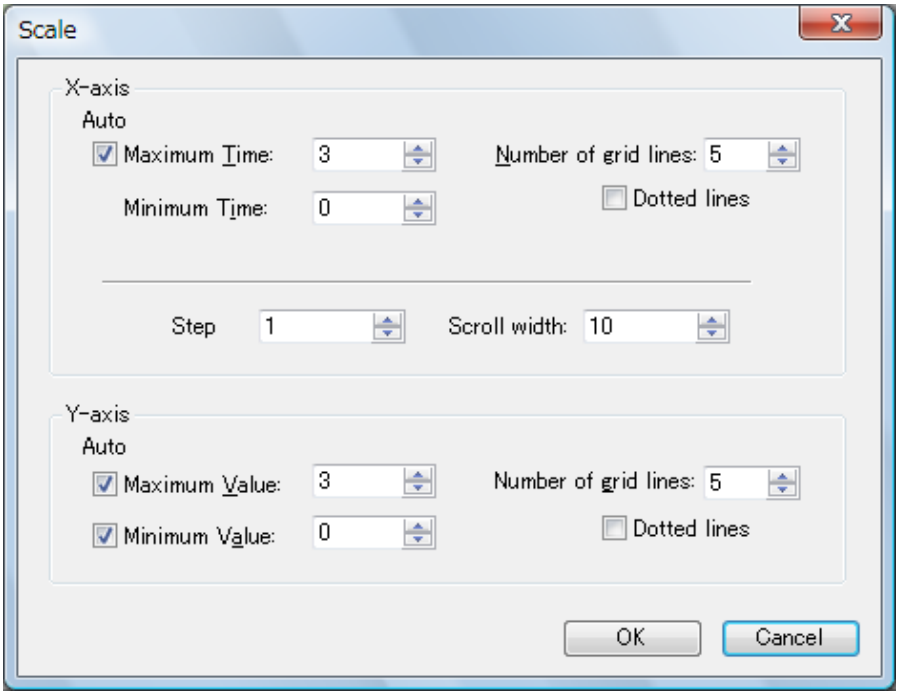


Fig. 6-9 Setting the graph scale

When the "**Auto"** check boxes are selected, the scale changes automatically.
When a file is loaded or sequence data is entered, the maximum and minimum values of the graph's X and Y axes are set automatically.

To prevent from the changing values, clear the "**Auto"** check boxes.
When you do so, be aware that the values that are out of the specified range will not be displayed.

The "Number of grid lines" settings for the X and Y axes determine the number of grid lines that are displayed in the background of the graph.
If you set the value to 1, only a border is displayed.
If you do not want to display grid lines on the graph, on the **Graph** menu, clear the check marks next to **X-axis grid lines** and **Y-axis grid lines**.

When the "**Dotted lines"** check box is selected, the grid lines are dotted instead of solid.

The step value is the amount that values change when you click the spin box in Fig. 6-10.
The scroll width is the minimum distance between the minimum and maximum value. In the example in Fig. 6-10, if the minimum value is set to 25, the maximum value will change to 35.

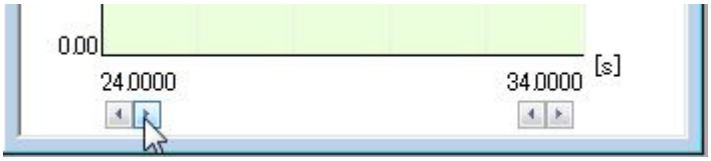


Fig. 6-10 Step value and scroll width

Fig. 6-11 is an example of when sequence data is created and the "**Use AC signal**" check box in the Mode dialog box is selected. You can copy, insert, and delete rows in the step data worksheet. These operations can be performed on multiple lines.

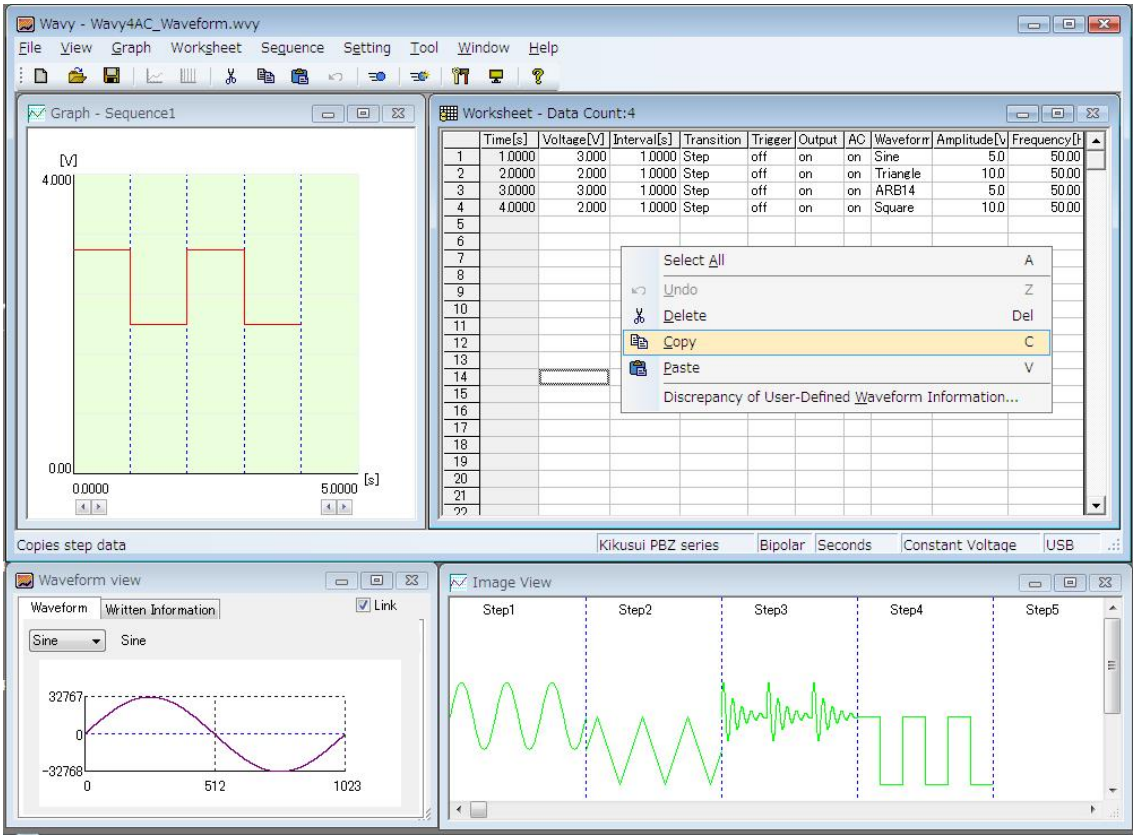


Fig. 6-11 Copying, Inserting, and Deleting Lines

When you enter the data directly onto the worksheet, do so in order, starting with the first line.
You cannot enter data for line 2 (step 2) if no data has been entered for line 1 (step 1).

The shortcut keys in Fig. 6-9 work by themselves and in combination with the CTRL key.

* If you want to insert a new line, copy a line, insert it where you want to insert a new line, and then change the inserted data.

The user-defined arbitrary waveform in the **Waveform View** window changes when you select an item in the Waveform column or the row of a particular step or place the mouse pointer over a line on the graph.
* The user-defined arbitrary waveform will not change if the **Link** check box in the Waveform View window has been cleared.

The Image View window shows three periods of the waveform.

Fig. 6-12 is an example of when all the step options in the Mode dialog box are selected.

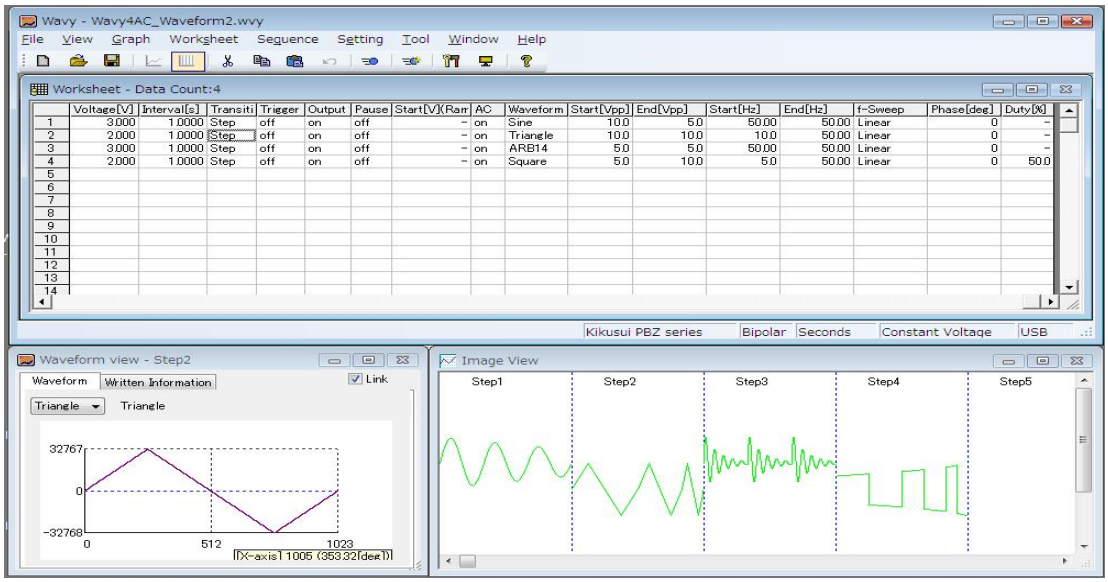


Fig. 6-12 All step options

The Image View window supports the amplitude and the frequency sweep.
The amplitude sweep is shown in the step 1 because the starting amplitude and ending amplitude are different.
The frequency sweep is shown in the step 2 because the starting frequency and ending frequency are different.
In the Step 4, it shows a combination of an amplitude sweep and a frequency sweep.

Fig. 6-13 is an example of when starting the ramp value is specified.

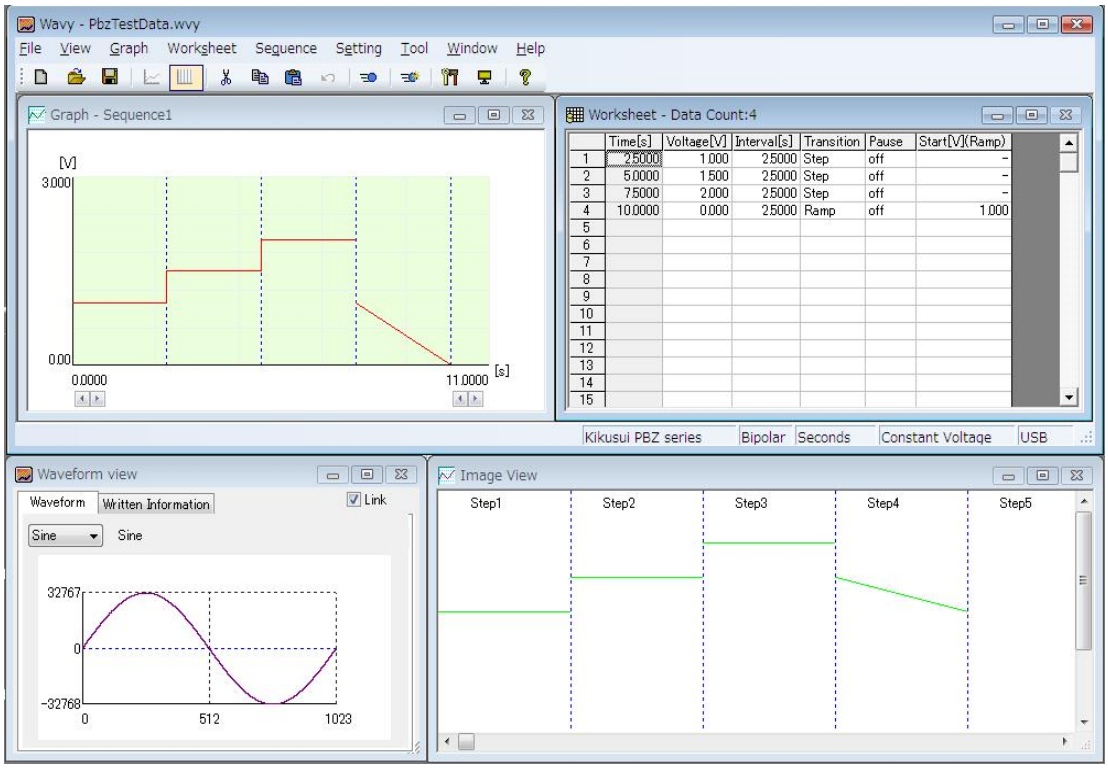


Fig. 6-13 Setting example of the Starting ramp

You can change the display scale range by right-clicking on the Image View window.

Fig. 6-14 Display scale range of the Image View window

Each time you double-click on the window, the display scale shifts between 100 and 50 %.

Caution: When the software writes the data to the device, it does not check the validity of the values that you have entered (whether or not they are within the limits of the device). Therefore, when a sequence is being written, an error may occur on the device. When this happens, the sequence data is incomplete.
Be sure not to specify a voltage or current value that is beyond the specifications of the device.

Chapter 7 Data Transfer

On the “**Sequence”** menu, click “**Transfer”** to open the “**Transfer”** dialog box.

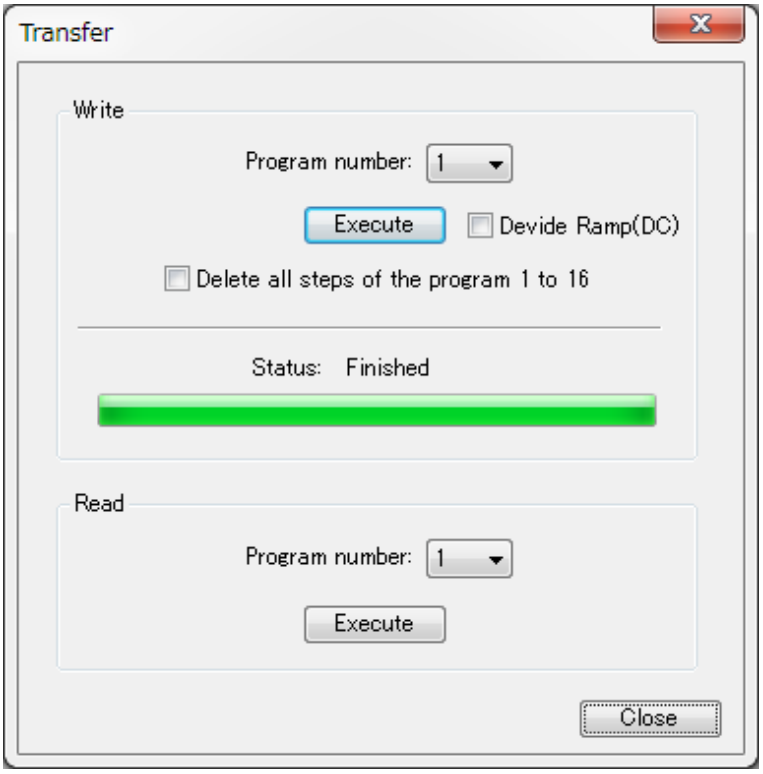


Fig. 7-1 Transfer window

You can write the sequence data for the program 1 to 16.
However, you can only set a maximum of 1024 steps for the program 1 to 16.

When the “**Delete all steps of the program 1 to 16”** check box is selected, the “Wavy” will delete all the sequence data written on the PBZ before writing the current data.
When you click the “**Execute”** button under **Write**, the data is written to the specified program number.

* The data that is written to the PBZ is the mode configuration and the sequence data. You need to write to the PBZ again if you change the mode configuration or the sequence data steps.

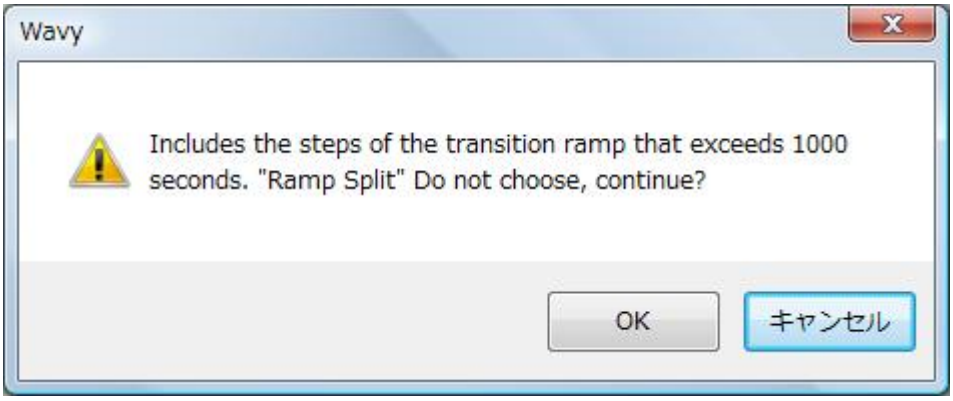
To load sequence data that has been entered from the PBZ panel, click the **“Execute”** button under **Read**.

Devide Ramp(DC)

If the step time exceeds 1000 seconds, the DC signal level after 1000 seconds is the same as the DC signal stop setting. If you want to perform a ramp transition that takes longer than 1000 seconds, you have to combine multiple steps. The same AC signal.

When you select the “**Devide ramp(DC)”** and click the “**Execute”** button under **Write**, a ramp transition that takes longer than 1000 seconds is split several steps.

"Ramp Split", and then write and perform a step beyond the 1000transition ramp is split.



Chapter 8 Executing a Sequence

On the “**Sequence”** menu, click **Execute**. The “**Execute”** window opens.

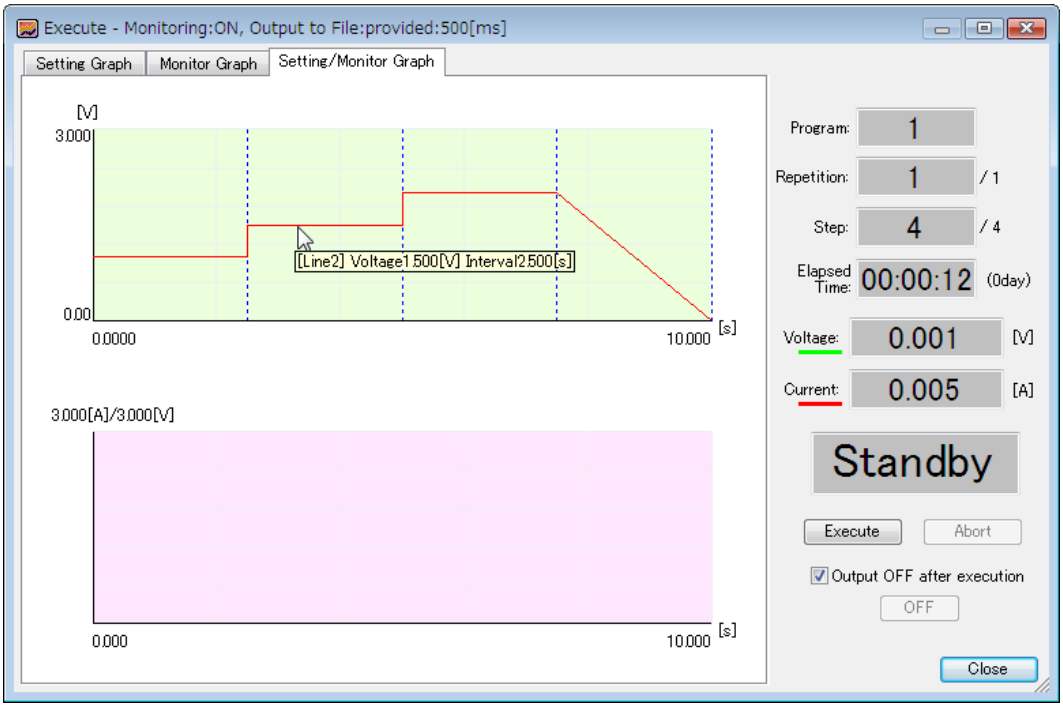


Fig. 8-1 Execute window (ready)

Click “**Execute”** button to execute the sequence that has been written to the PBZ.
To stop the sequence before it finishes, click “**Abort”** button.

The indications that appear in the window are listed in the table below.

Status	Background Color	Description
Ready	Gray	The PBZ is ready to start.
Finished	Gray	The sequence has finished.
Executing	Green	The **Execute** button has been clicked, and the sequence is being executed.
Pause	Blue	The sequence has been paused temporarily.
Abort	Yellow	The **Abort** button has been clicked.
Error	Red	A communication error has occurred.
OVP, OCP, OHP, OPP	Orange	The sequence was stopped because of a protective feature of the device.
OVP, -OVP, OCP, -OCP	Yellow	The sequence was stopped because of a protective feature of the software.

When the **“Output OFF after execution”** check box is selected, output is turned off after the sequence finishes. Output also turns off when “**Abort”** button is clicked.
If the check box is not selected, the “**OFF”** button becomes valid, and you can turn off the output by clicking it.

* If you want to control the time to turn off the output more accurate, add a step to the end of the sequence that turns off the output..

The figure below shows the “**Execute**” window during sequence execution.

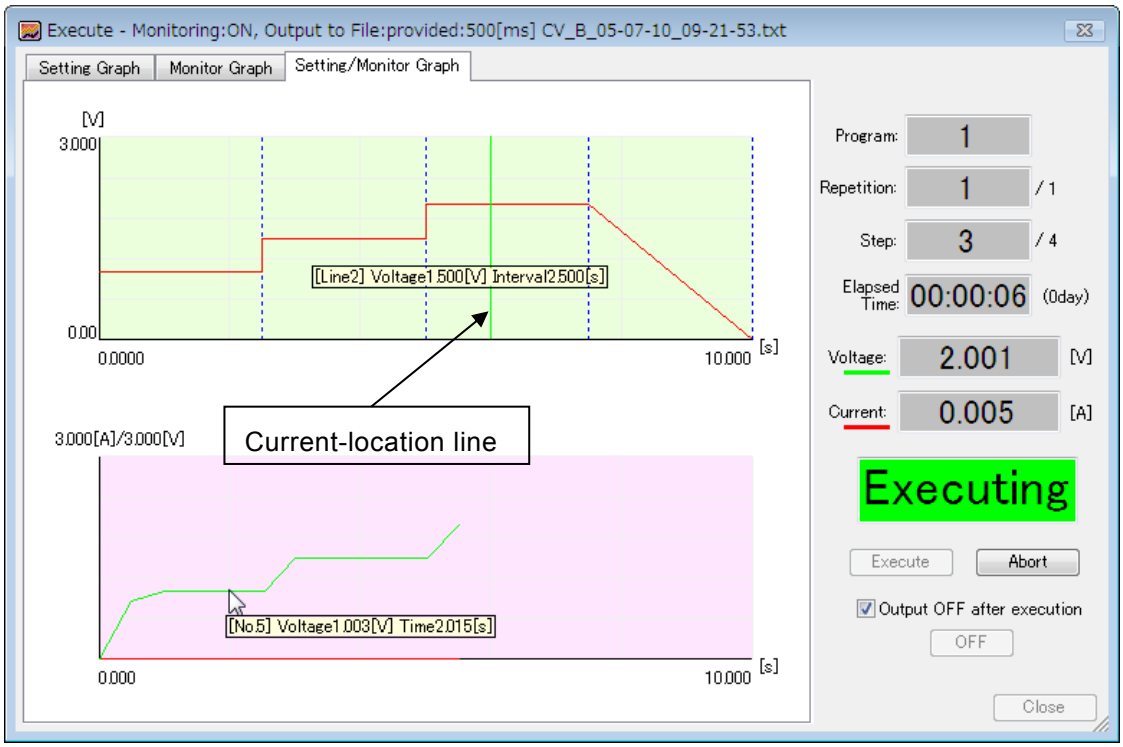


Fig. 8-2　Execute window (executing)

The Execute window indicates the program number, the repetition number, the step number, the elapsed time, the output voltage, and the output current. These indications are updated every 2 seconds.
The current-location line shows the approximate location in the sequence.The line moves every second.

* The monitoring and file information appear in the title of the window.
* During sequence execution, you cannot maximize or resize the window.

To change the sequence graph’s display settings, right-click in it.

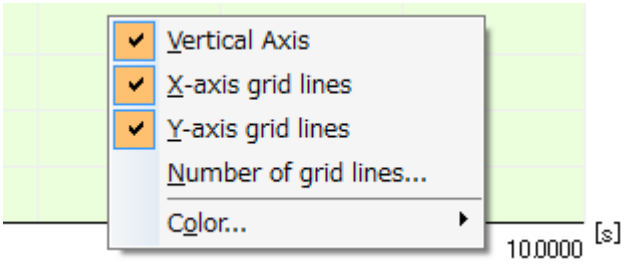


Fig. 8-3　Sequence graph display settings

To change the monitor graph's display settings, right-click in it.

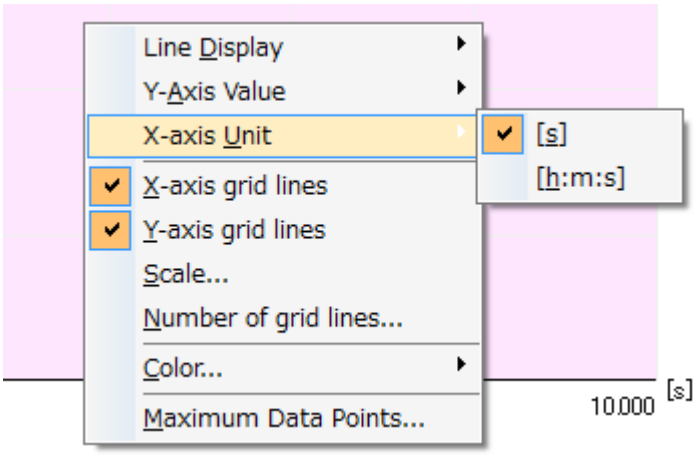


Fig. 8-4 Monitor graph display settings

If you select **Scale** in Fig. 8-4, a dialog box for setting the monitor graph scale opens.

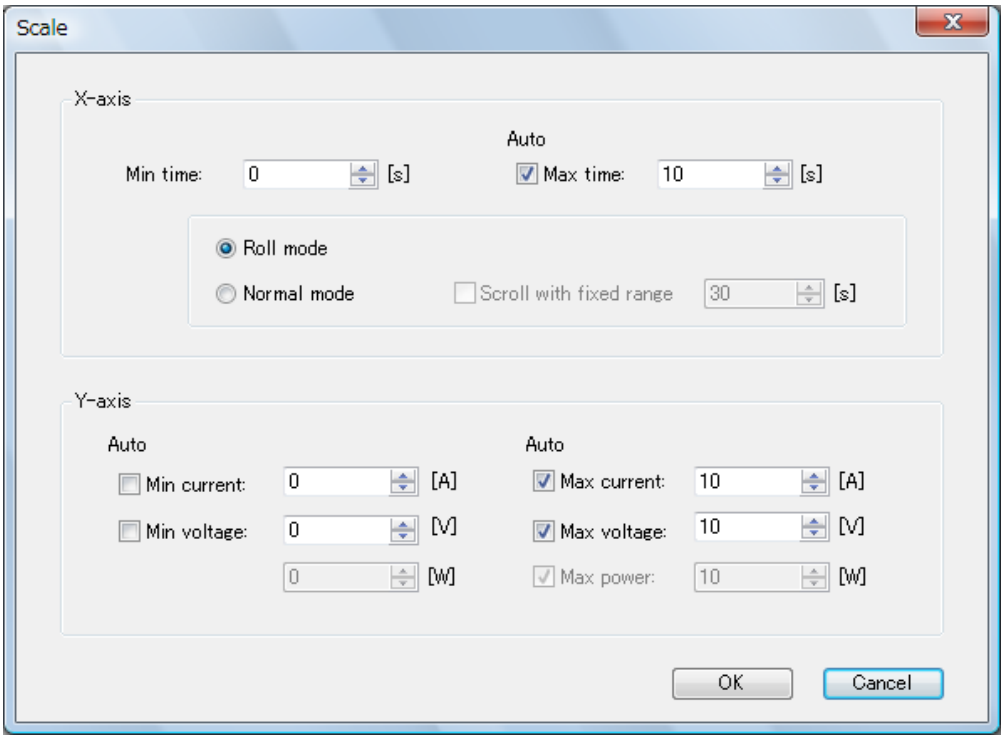


Fig. 8-5 Monitor-graph scale-configuration dialog box

When the Auto check box is selected, if the maximum value exceeds the monitored value, the maximum value is automatically changed to the most appropriate value (auto scaling). The same is true for minimum values.
To prevent from changing the values, clear the Auto check boxes.
When you do so, be aware that the monitored values that are out of the specified range will not be displayed.

There are two modes for auto scaling along the X-axis: roll mode and normal mode.
In roll mode, the minimum and maximum X-axis values are scrolled simultaneously (Fig. 8-6).
The distance between the two values is always the same as the difference between the specified maximum and minimum values.
In normal mode, the minimum X-axis value is fixed, and only the maximum value changes (Fig. 8-7).

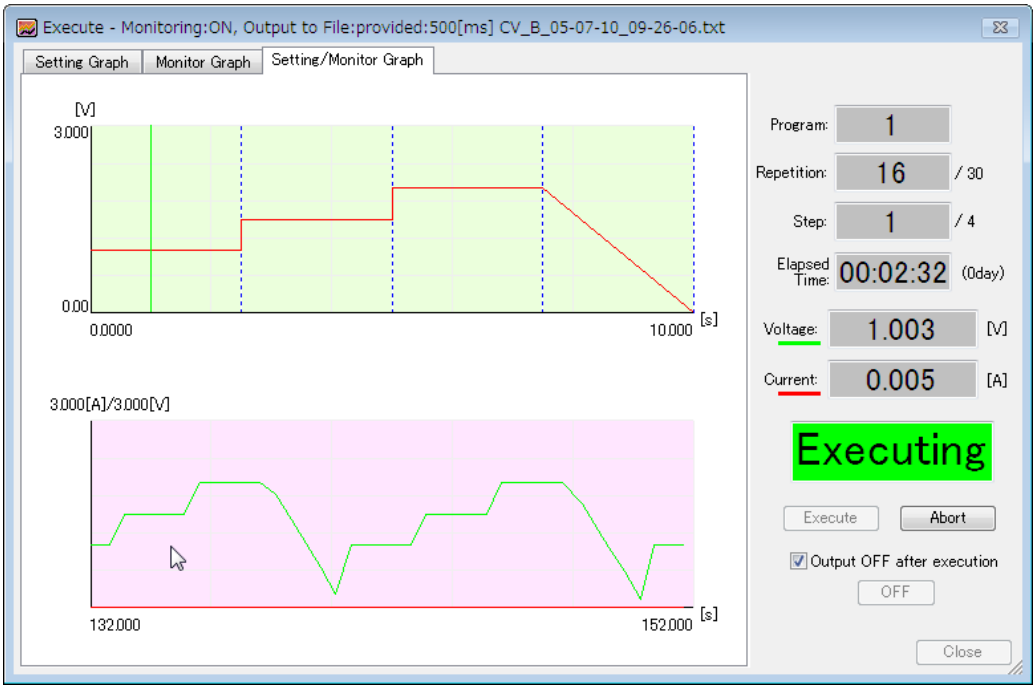


Fig. 8-6 Sequence graph and monitor graph (roll mode)

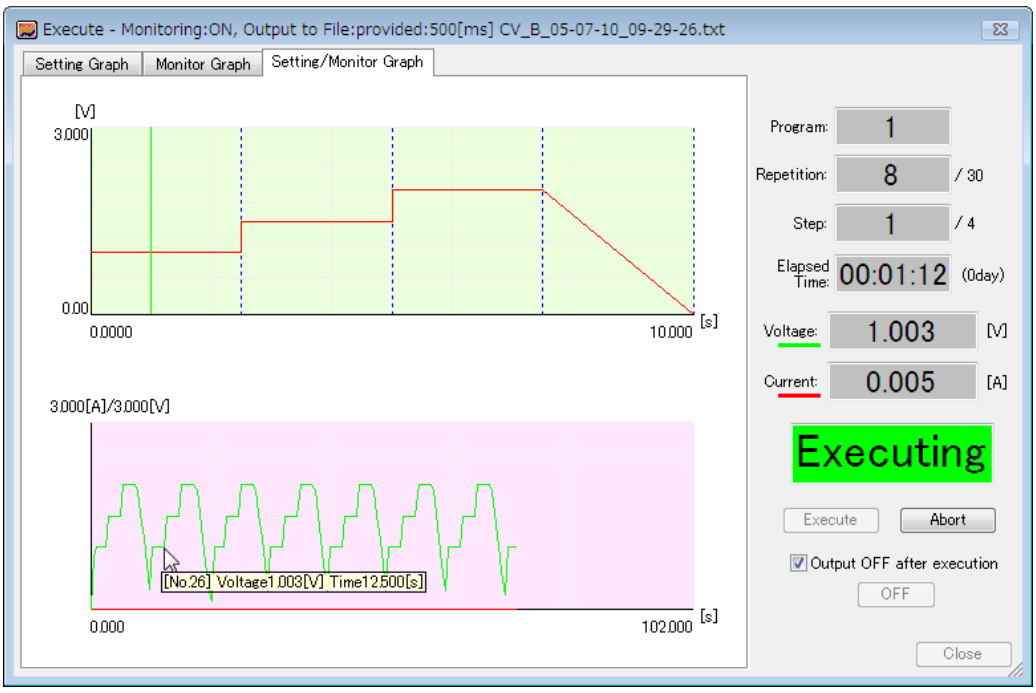


Fig. 8-7 Sequence graph and monitor graph (normal mode)

In normal mode, if you select the **Scroll with fixed range** check box, the data for the specified period of time immediately before auto scaling is performed is displayed when the values are scrolled (as if pre-trigger data were being displayed).

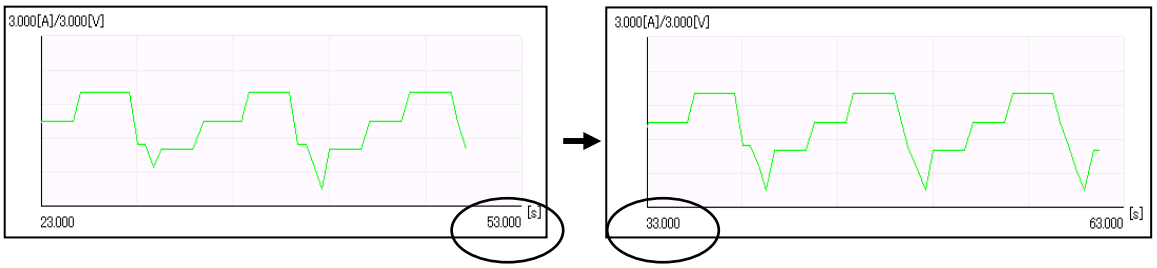


Fig. 8-8 Example of Scrolling with a Fixed Range

In Fig. 8-8, the fixed range is set to 20 s.
If the data exceeds the maximum X-axis value, the minimum X-axis value is 53 - 20 = 33 s.

By moving the cursor to **X-axis Unit** in Fig. 8-4, you can display a submenu for setting the monitor graph X-axis value indications to '[s]' or '[h:m:s]'.

If you click "**Maximum Data Points"** in Fig. 8-4, the dialog box in Fig. 8-9 appears.

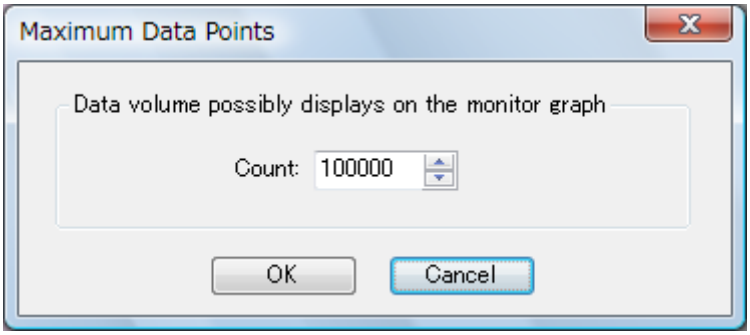


Fig. 8-9 Maximum data points

When you perform testing over a long period of time, the amount of data in the monitor graph may increase to levels that strain your system's memory capacity.
When the amount of memory is insufficient, the PC may become overloaded and unable to function properly.
In this dialog box, you can set the maximum number of data points to display in the monitor graph.
You can set the maximum number of points to a value from 10,000 to 1,000,000. The default value is 100,000.
When the number of data points that you set here is exceeded, older monitored data is deleted.

* As a general rule of thumb, one point of monitored data uses approximately 200 bytes of memory (the actual value varies depending on the PC environment).
  If the “Wavy” acquires one monitored data point every second, it will have acquired 86,400 points after 24 hours.

86,400 points × 200 B = approx. 16.5 MB

  Set an appropriate value based on the amount of physical memory on your PC.

* The maximum number of data points that you set does not affect the data that is saved to monitored data files.
* The amount of system resources used by the process of drawing the monitor graph on the screen increases with the amount of data and the displayed range on the graph.
* When you perform testing over a long period of time, we recommend that you use Task Manager or some other application to check the amount of physical memory being used.

* You cannot change the mode or operations while the PBZ output is turned on.
  If you attempt to do so, the following message appears:
  An error occurred. -221 “Settings conflict”

Chapter 9 Configuring Monitor Settings

On the “**Sequence”** menu, click “**Monitor Settings”** to open the “**Monitor Settings”** dialog box.

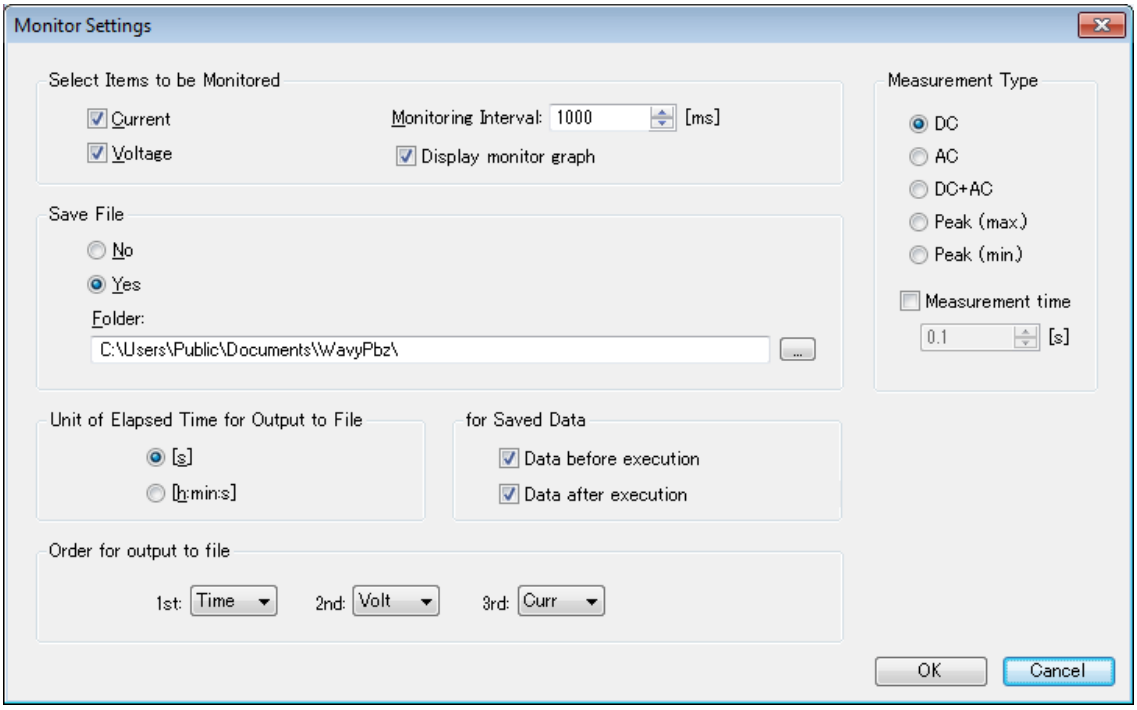


Fig. 9-1 Monitor Settings dialog box

When the “**Current”** check box is selected, the output current value is displayed during sequence execution.
When the “**Voltage”** check box is selected, the output voltage value is displayed during sequence execution.

The monitoring interval ranges from 500 to 600,000 ms (0.5 to 600 s).

Select an item under **Measurement Type** to choose the type of value to measure.
When the “**Measurement time”** check box is cleared, the measurement time is set to 0.1 seconds (the factory default setting).
If you select the “**Measurement time”** check box, you can set the measurement time to a value from 0.0001 to 3600.000.

* For details, see the PBZ Operation Manual.
* When the measurement time is longer than the monitoring interval, monitored values indicate the measured values that came before the them.

If you select “**Yes”** under the “**Save File”**, the monitored data is saved to a file in the specified folder.

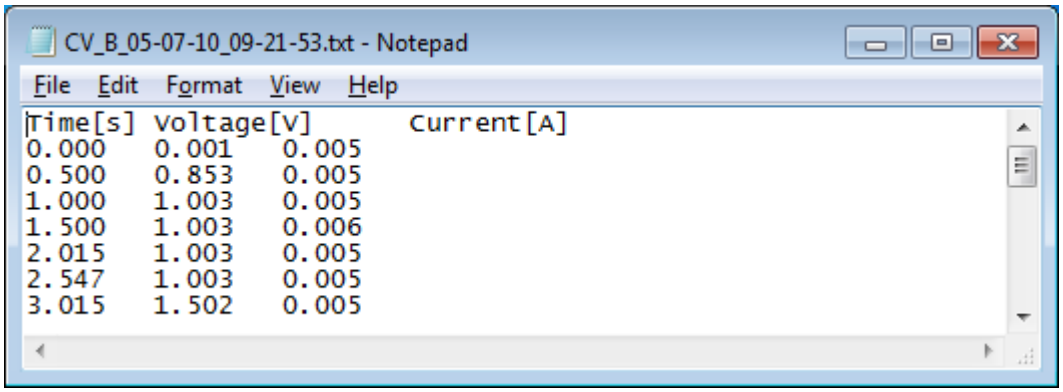


Fig. 9-2 Monitor file

How monitor files are named is explained below.

CV_B_05-07-10_09-21-53.txt

1 2 3

1. CV or CC (constant voltage or constant current)
2. B or U (bipolar or unipolar)
3. Month, day, year, hour, minute, and second when the sequence was executed

You can set the format that the amount of elapsed time is indicated in to [seconds] or to [hours:minutes:seconds].

* The precision of the time (monitoring interval) is determined by the PC operating environment.

* Be aware that **data is separated by tabs**, not spaces.
You can switch from tab separation to comma separation. For details, see chapter 12, “Environment Settings.”

If you select the “**Data before execution”** check box, the monitored value before output started is written to the file as 0 s.
If you select the “**Data after execution”** check box, a monitored value is written to the file immediately after the execution finishes or is stopped (the actual data is acquired within 0 to 2 seconds).

If the “**Display monitor graph”** check box is not selected, the monitor graph is not displayed.

* The monitor graph display is influenced by your PC operating environment. If the influence is extreme, clear this check box.

Chapter 10 Configuring Protection Settings

On the “**Sequence”** menu, click “**Protection Settings”** to open the **Protection Settings** dialog box.

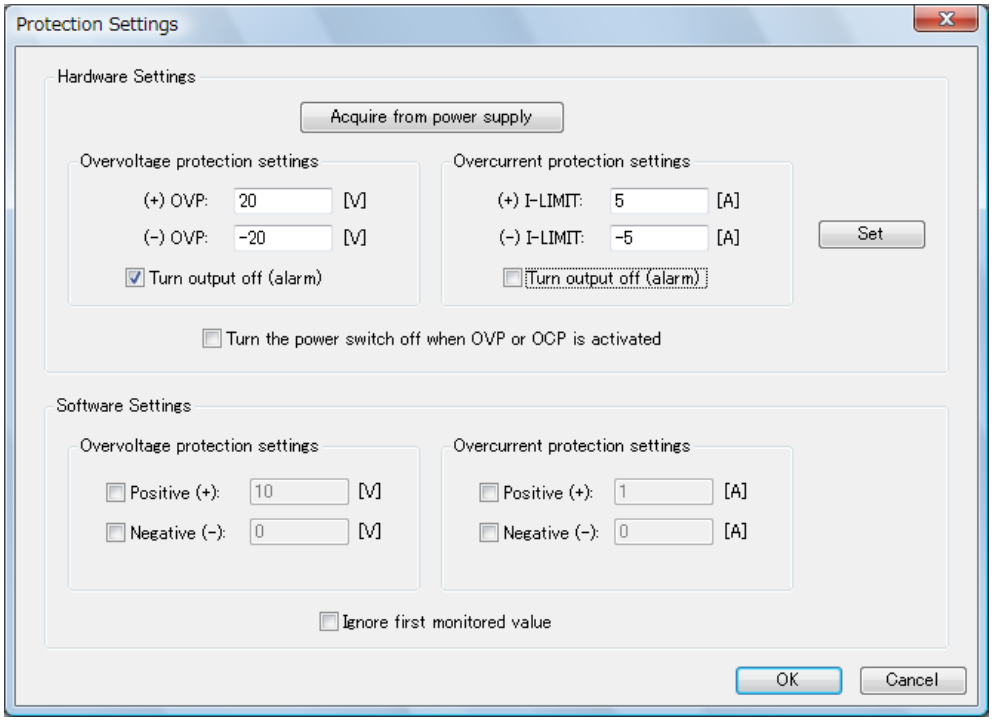


Fig. 10-1 Protection Settings dialog box

The hardware settings deal with the internal protective features of the PBZ.
The software settings deal with how the software uses the monitored data to protect the hardware.

Hardware Settings

If you click “**Acquire from power supply”**, the software loads the overvoltage and overcurrent protection settings from the PBZ. If you click “**Set”** button, the software writes the specified overvoltage and overcurrent settings to the PBZ.
The protective features consist of two types of operations: alarm operations and limit operations. For details, see the PBZ Operation Manual.

Software Settings

When the overvoltage or undervoltage protection or overcurrent or undercurrent protection check box is selected, the software stops sequence execution when the monitored value exceeds or goes below the specified value. This protection feature only functions when monitoring is taking place.

If you select the “**Ignore first monitored value”** check box, the first monitored value after sequence execution is ignored.

Chapter 11 Creating and Editing User-Defined Arbitrary Waveforms

On the “**Sequence”** menu, click “**Create and Edit Waveforms”** to open the “**Waveform Editor”** window.

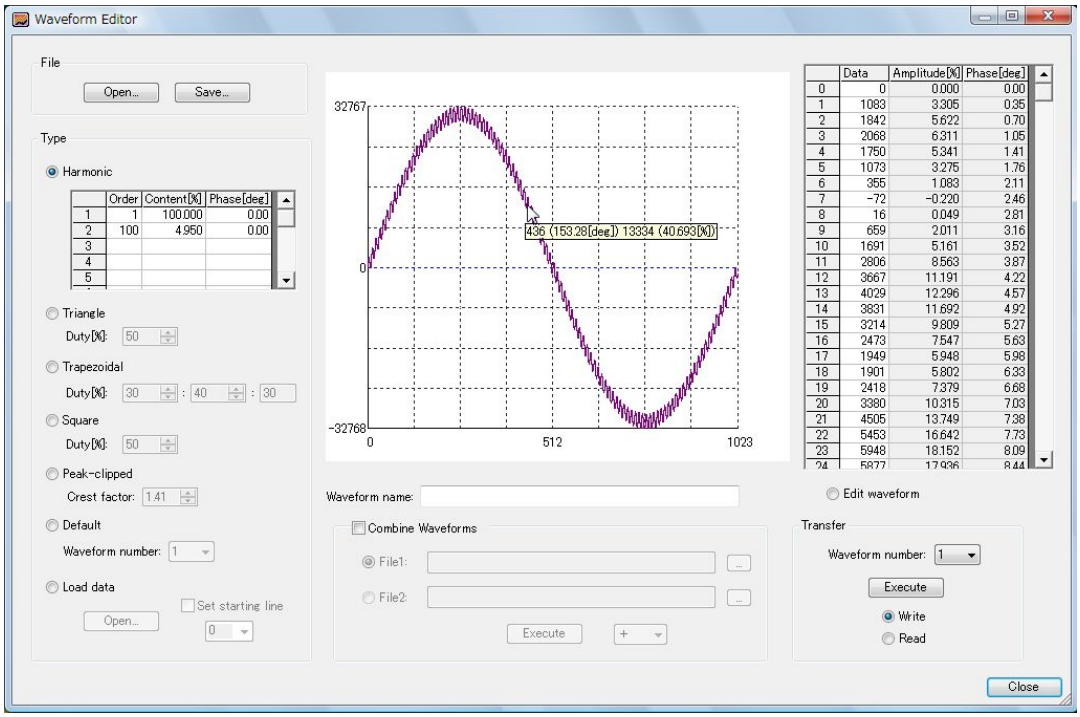


Fig. 11-1 Waveform Editor window

You can select the waveform type from one of the following seven options: Harmonic, Triangle, Trapezoidal, Square, Peak-clipped, Default, and Load data.
Select “**Load data”** to load the measured data (in a text file) from an oscilloscope or other measuring instrument.

If you want to directly edit the data on the worksheet of one of the seven waveform types, select the “**Edit waveform”** radio botton. Doing so enables you to edit the cells on the worksheet.
The waveform data values can range from -32768 to 32767 (signed 16-bit), and the number of data points is 1024.

The procedure for creating and saving a user-defined arbitrary waveform is listed below.

(1) Select a waveform type from Harmonic, Triangle, Trapezoidal, Square, Peak-clipped, Default, and Load data, and create a waveform.
(2) Enter a waveform name, and save the user-defined arbitrary waveform to the user-defined-waveform archive folder.
(3) Select a user-defined-waveform number from 1 to 16, and transfer the user-defined arbitrary waveform to the PBZ.
(4) Information about the user-defined arbitrary waveform is registered in the Written Information tab of the Waveform View window.

* Make sure that the waveform name and the user-defined-waveform file name are the same.
* If you double-click a point on the waveform, the data at that point appears on the worksheet.

Harmonic Waveforms

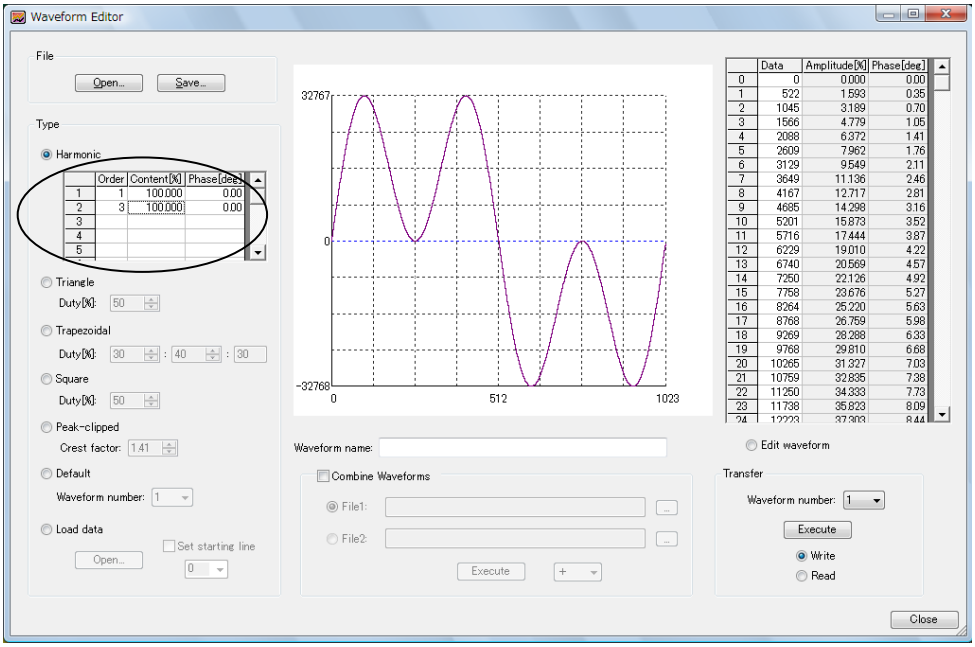


Fig. 11-2 Harmonic waveform type

Enter the Order, Content by percentage, and Phase values on the worksheet (the circled area in Fig. 11-2).
You can set orders within the range from 1 to 999, content by percentage within the range from 0.000 to 100.000, and phase angles within the range from 0.00 to 359.99. The maximum number of steps is 50. To delete a step, press DELETE.

Triangle Waveforms

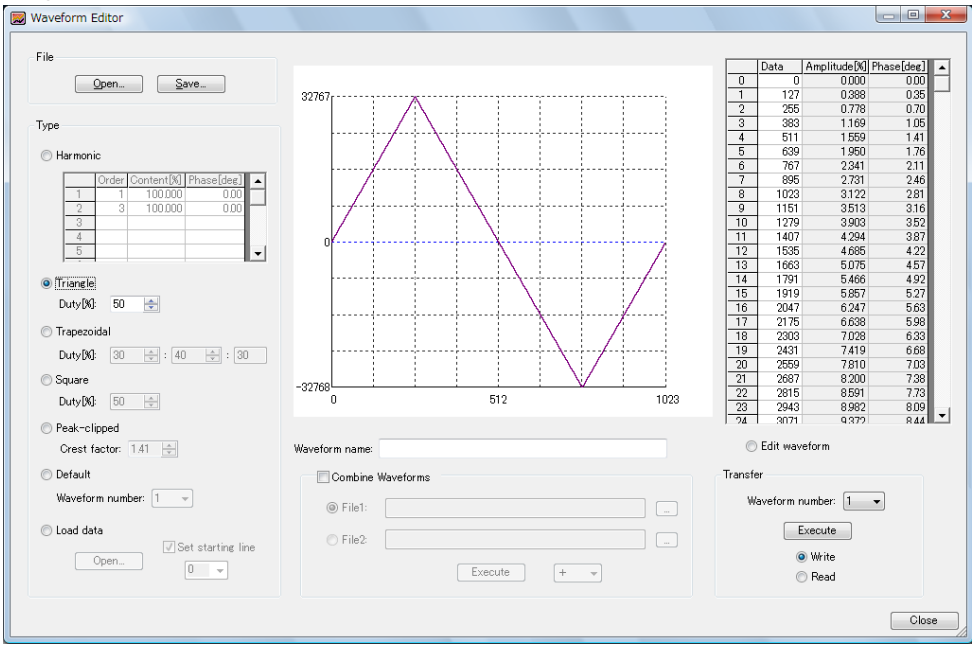


Fig. 11-3 Triangle waveform type

You can set the duty cycle to a value from 0.01 to 99.99.

Trapezoidal Waveform

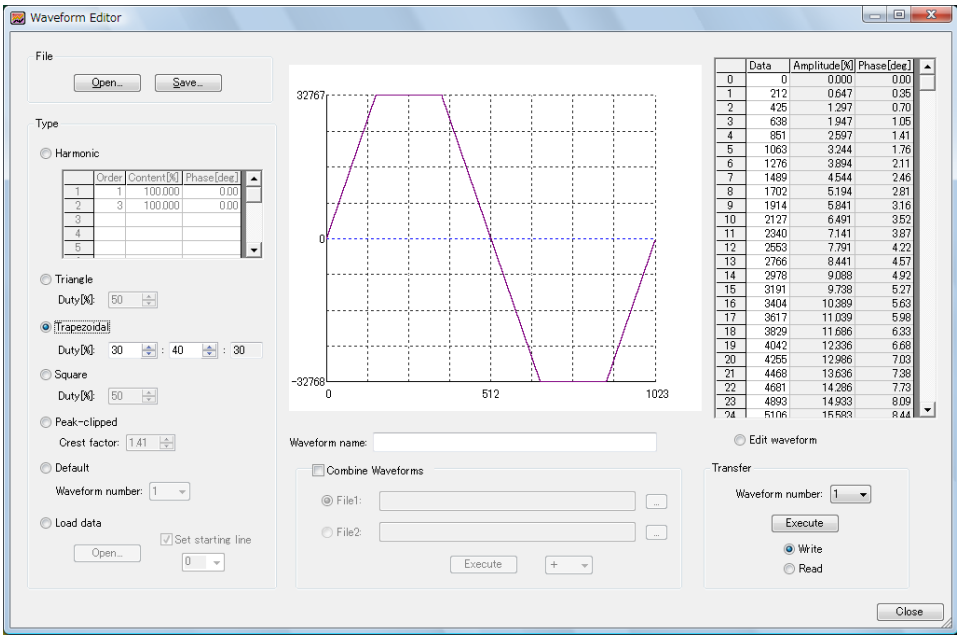


Fig. 11-4 Trapezoidal waveform type

You can set the duty cycle to a value from 0.01 to 99.99.

Square Waveform

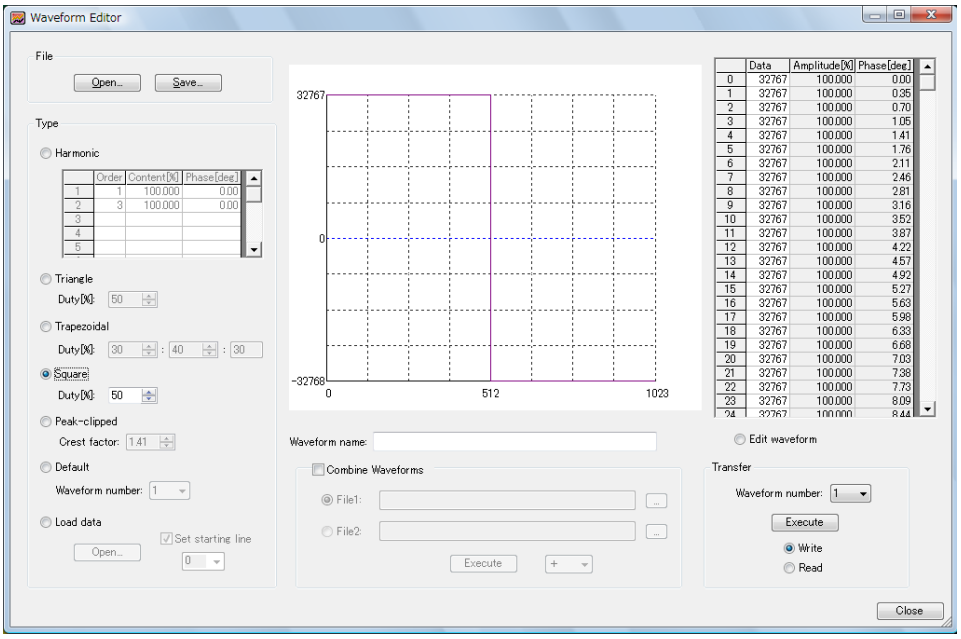


Fig. 11-5 Square waveform type

You can set the duty cycle to a value from 0.01 to 99.99.

Peak-Clipped Waveform

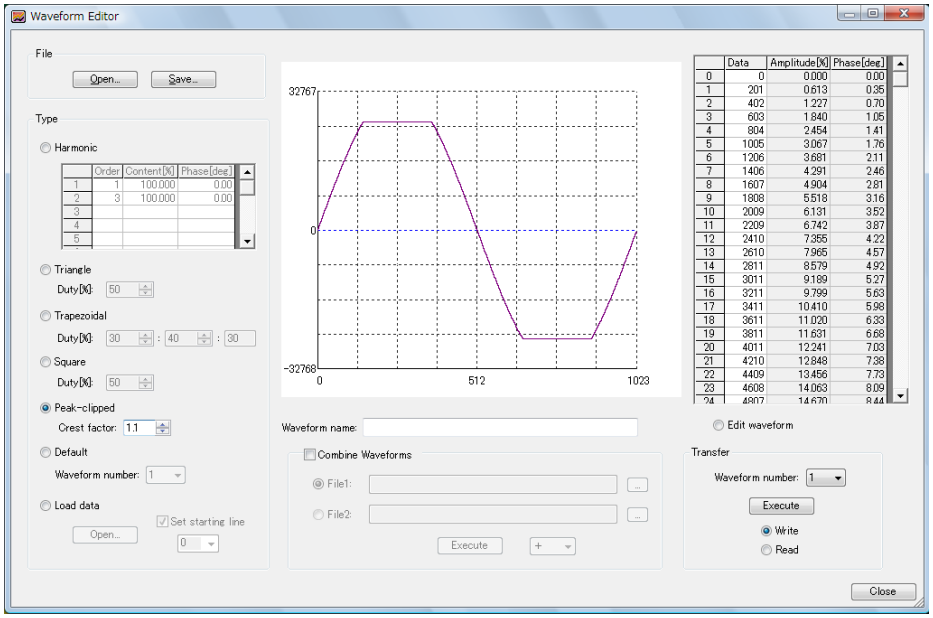


Fig. 11-6 Peak-clipped waveform type

You can set the crest factor to a value from 1.10 to 1.41.

Default Waveform

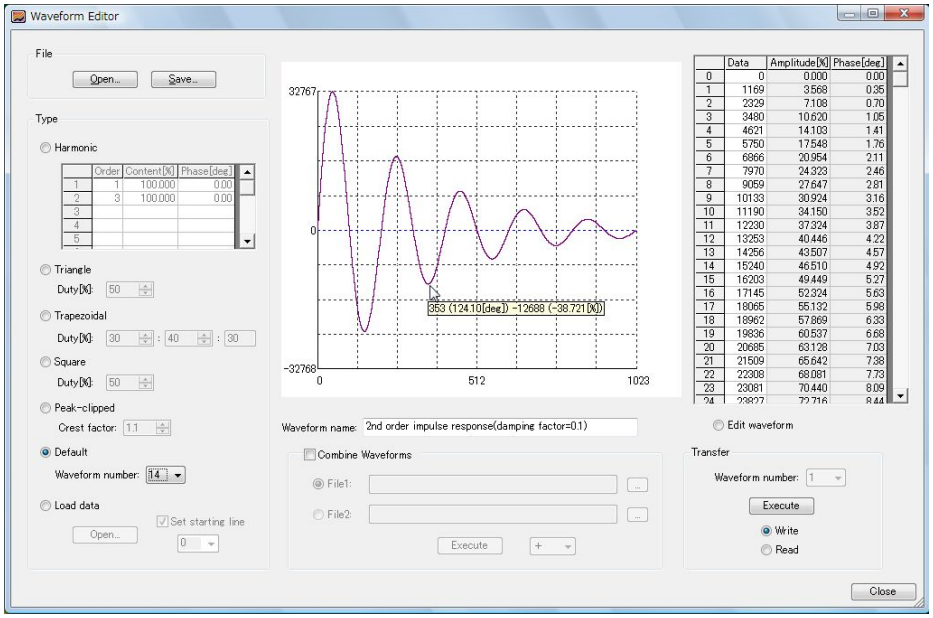


Fig. 11-7 Default Waveform Type

You can select a user-defined-waveform number from 1 to 16. These numbers correspond to waveforms stored in the PBZ internal memory by factory default.

* When you transfer(write) a default waveform, the User-defined-waveform number box is unavailable.

Loaded Waveform

Click “**Open”** button under **Load data**, and select a text file.

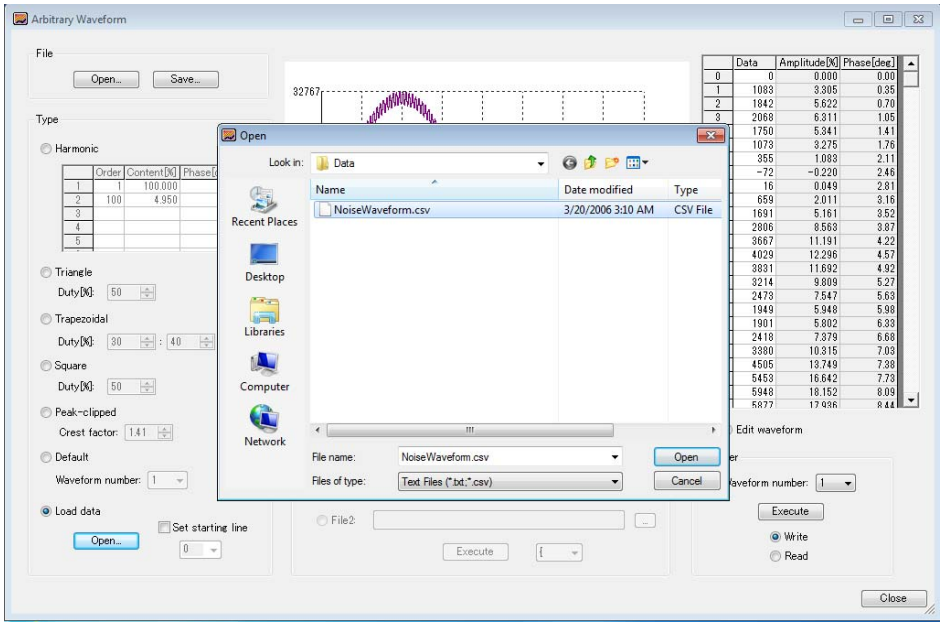


Fig. 11-8 Data Load window

You can load text files that are formatted like the example in Fig. 11-9.

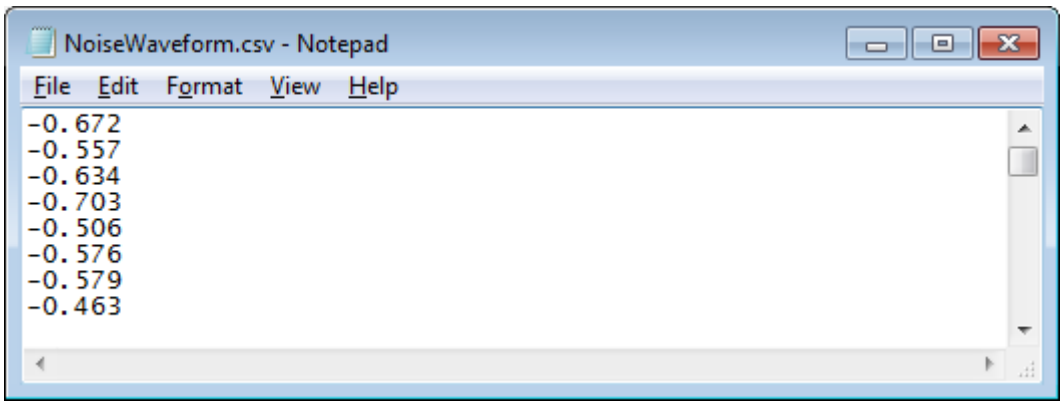


Fig. 11-9 Loadable data file

The file shown above, NoiseWaveform.csv, is contained in the “data” subfolder of the folder that the “Wavy” is installed to.
The maximum number of lines that the “Wavy” can load is 10,000.

In files produced by oscilloscopes and other devices, the header and other information is contained in the first lines.
For these types of files, select the **Set starting line** check box, and set the line to start loading at.

When you load NoiseWaveform.csv, the display shown in Fig. 11-10 appears.

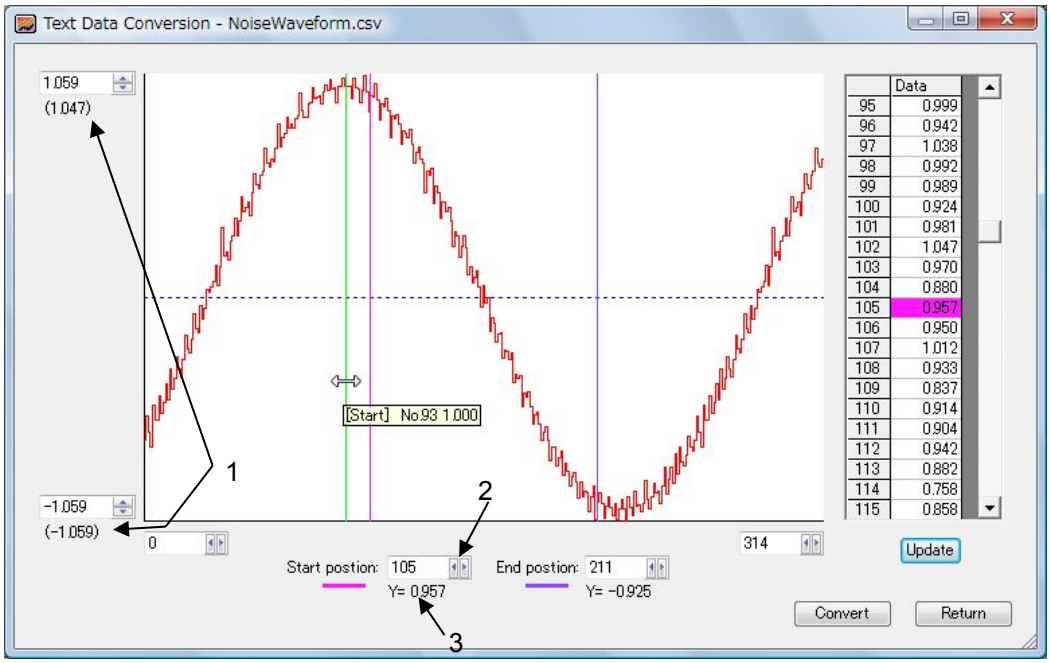


Fig. 11-10 Text Data Conversion window

You can freely change the maximum and minimum X-axis and Y-axis values. After you change the values, press ENTER or click "**Update"** button to change the graph display range.
The values indicated by 1 in the figure (1.047 and -1.059) are the maximum and minimum values.

Adjust the range that you want to convert by changing the starting and ending positions.
You can move the starting and ending position lines by dragging them with the mouse pointer. The data on the worksheet reflects the changes that you make on the graph (the selected data is highlighted).
When you click the spin box indicated by 2 in the figure, the Y-axis value indicated by 3 in the figure changes immediately, and the starting position line also changes. The highlighted values on the worksheet also change.
The same is true for the ending position.

The following operations are also available. Use them as necessary.

If you double-click on the starting or ending position labels or the Y-axis data indicated by 3 in the figure, the corresponding data appears on the worksheet.
If you double-click a point on the waveform, the data at that point appears on the worksheet.
If you double-click a point on the waveform while holding SHIFT, the starting position line moves to the data at that point.
If you double-click a point on the waveform while holding CTRL, the ending position line moves to the data at that point.
If you right-click in the waveform graph, you can change the colors of the starting and ending position lines.

Change the starting and ending positions as shown in Fig. 11-11.

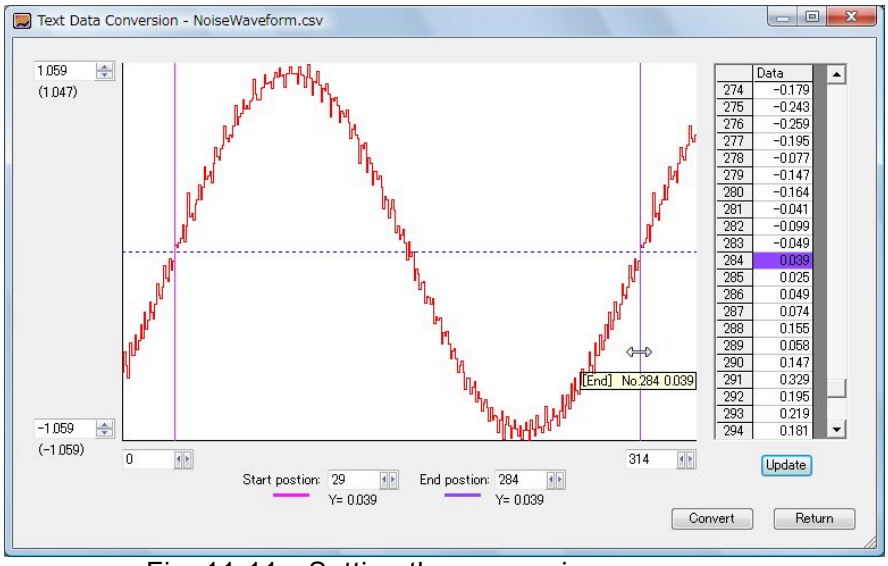


Fig. 11-11 Setting the conversion range

Click "**Convert"** to display a conversion confirmation message.

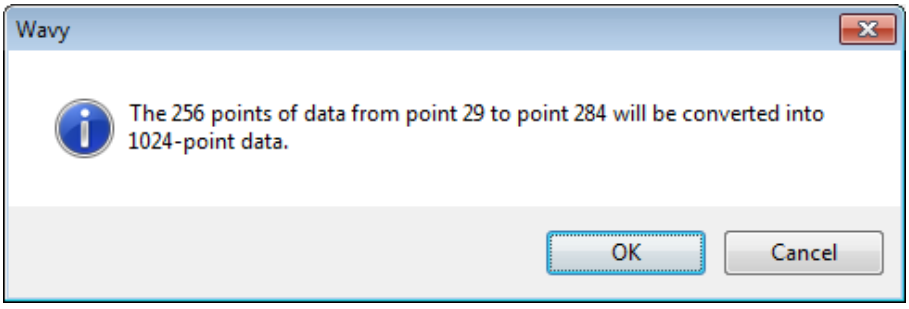


Fig. 11-12 Conversion confirmation message

If you are sure you want to convert the values, click "**OK"** button. After values are converted, the display in Fig. 11-13 appears.

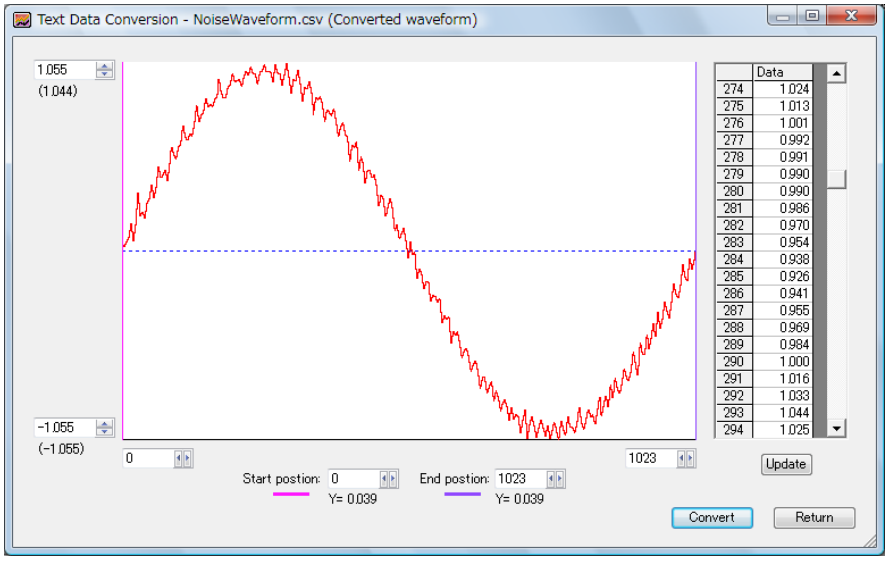


Fig. 11-13 Display after conversion (X axis)

The values on the X axis are converted into 1024 points of data. In the end, the “Wavy” checks the minimum and maximum Y axis values.
If you click **Return**, 1.055 is converted to 32767 and -1.055 is converted to -32768. The data for 0 remains 0.
If you enter maximum and minimum values of which absolute values differ, the graph values are converted so that the maximum value is 32767 and the minimum value is -32768.When this happens, the value of 0 at the center of the graph changes to a different value.

Click “**Return”** button to end the conversion operation (Fig. 11-14).

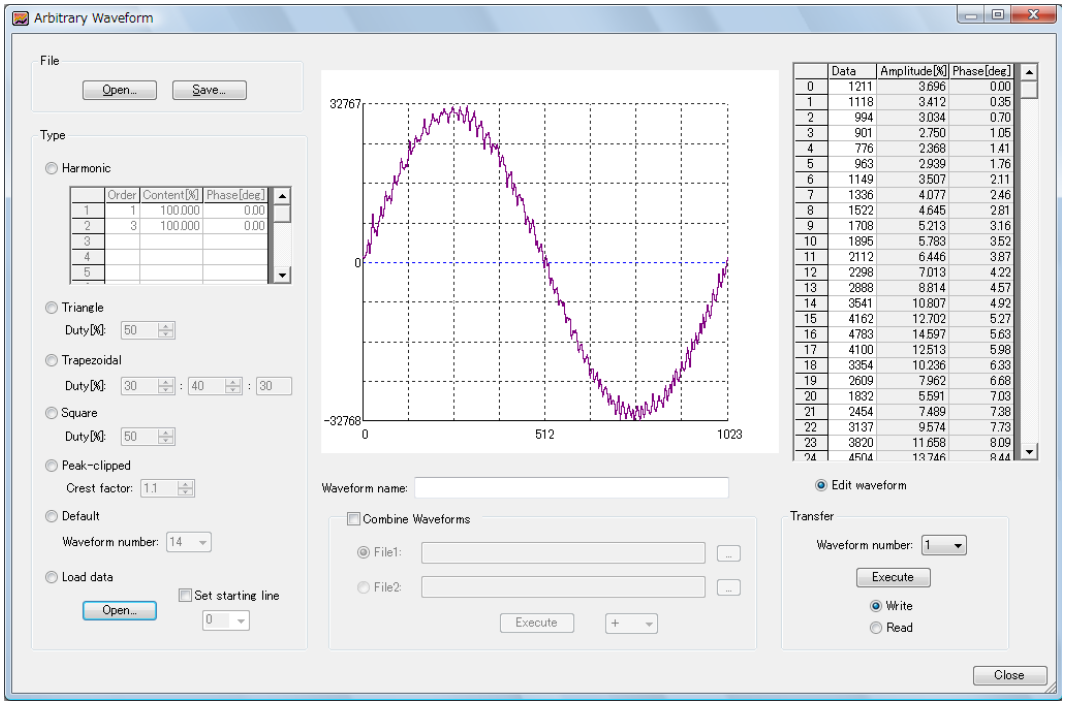


Fig. 11-14 Display after conversion (X and Y axes)

Editing Waveforms

First, select **Peak-clipped**, and set **Crest factor** to 1.41. Then, select the **Edit waveform** check box. Hereinafter, this section will explain how to edit a sine wave.

We will change the values of all data points of which phase is within 80 to 100 degrees to 0. As shown in Fig. 11-15, set the value of data point 228 to 0, click on the data value, and then drag the mouse pointer down.

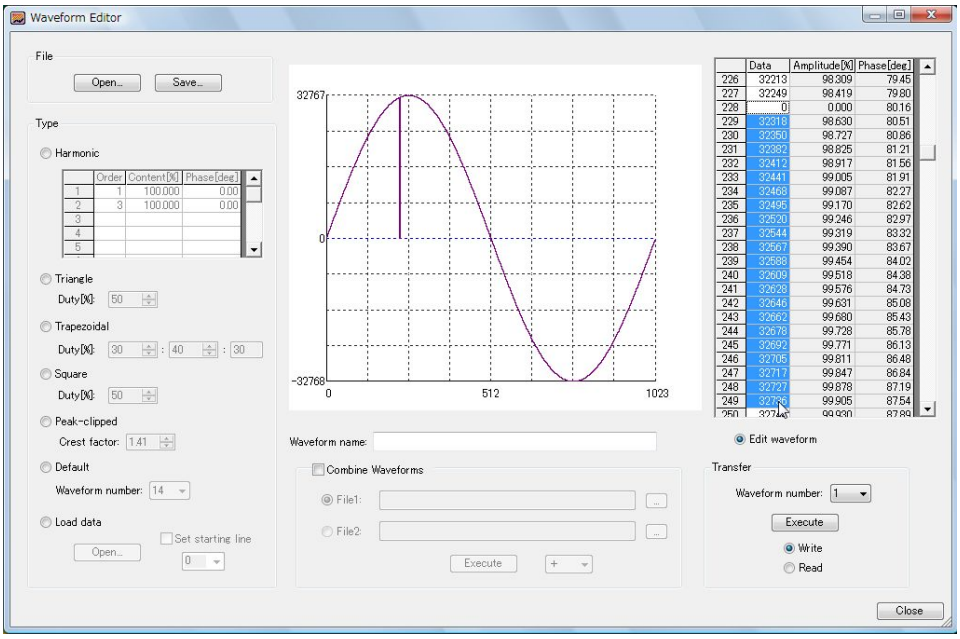


Fig. 11-15　Editing a waveform (part 1)

Drag the mouse pointer all the way down to data point 284. Then click the right mouse button. Select **Consecutive Paste** as shown in Fig. 11-16. As shown in Fig. 11-17, all the selected cells change to the value that you entered for data point 228 (0).

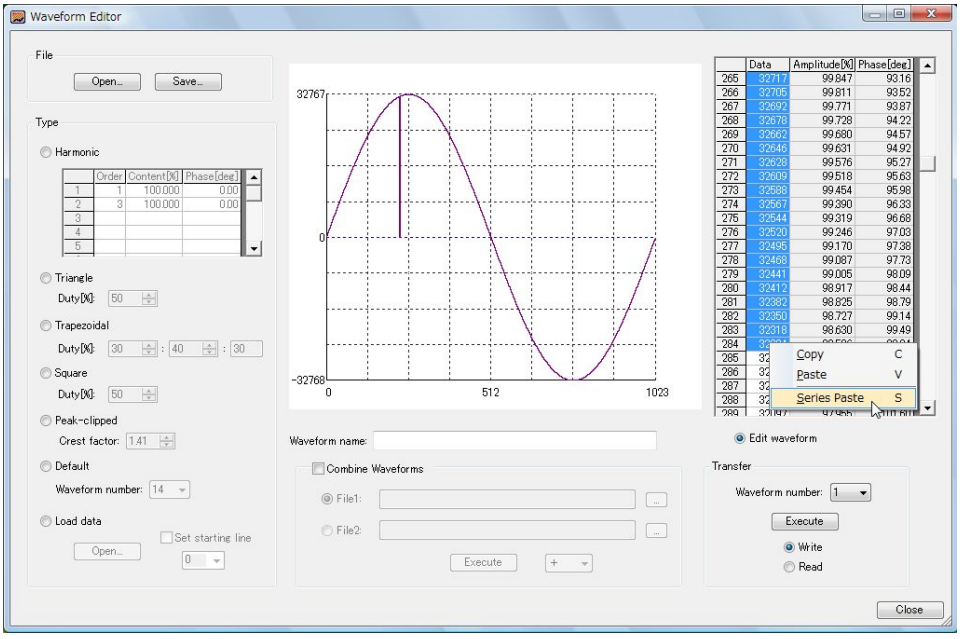


Fig. 11-16　Editing a waveform (part 2)

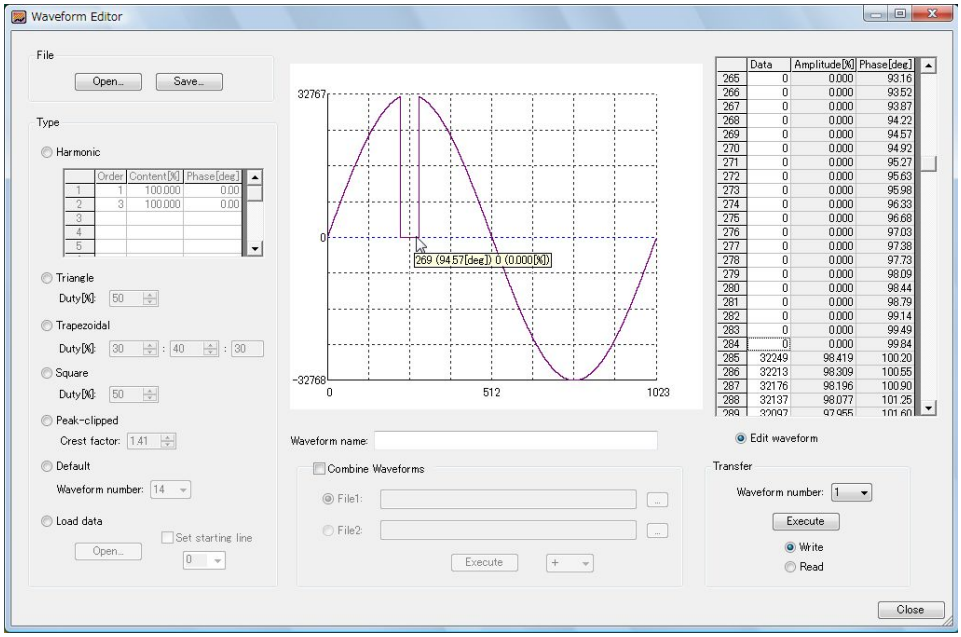


Fig. 11-17 Editing a waveform (part 3)

Finally, enter a waveform name as shown in Fig. 11-18.
Then, click **Save** to save the file to the user-defined-waveform archive folder.
The user-defined-waveform archive folder is the “data” subfolder in the WavyPbz subfolder of the Public Documents folder.* (In Windows XP, the subfolders are created in the folder specified in the setup.)

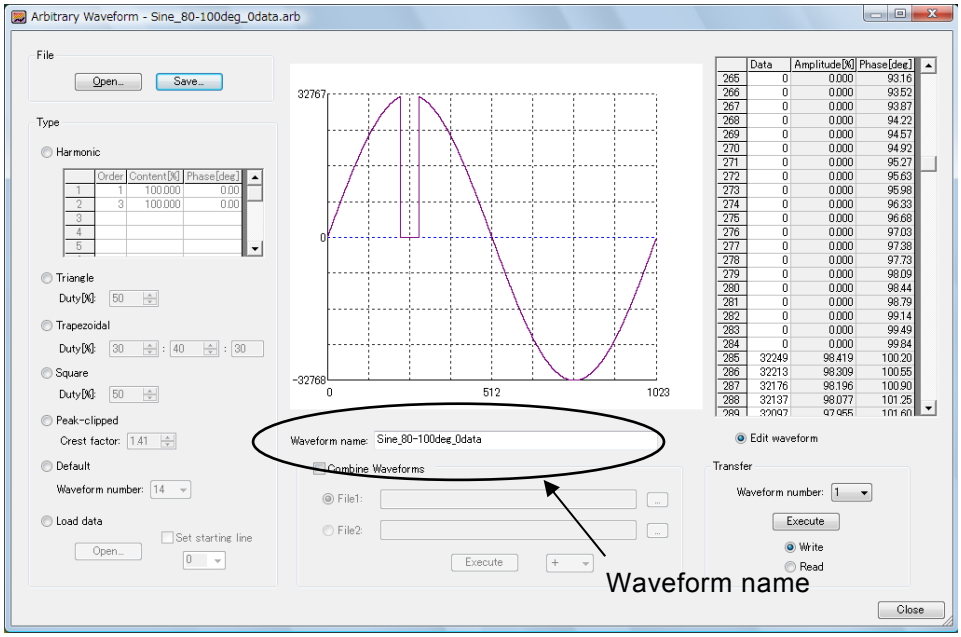


Fig. 11-18 Editing a waveform (last figure)

Now, you can execute the write operation.

* You can change the user-defined-waveform archive folder in the environment settings.
The “Wavy” searches through this folder for user-defined-waveform files. It does not search through other folders.

Arbitrary Waveform Transfer

Set the user-defined-waveform number (1 to 16) by selecting “**Write”** , and click “**Execute”** button.
The confirmation message shown in Fig. 11-19 appears on the display. If you click “**OK”** button, the user-defined-waveform data is written to the PBZ.

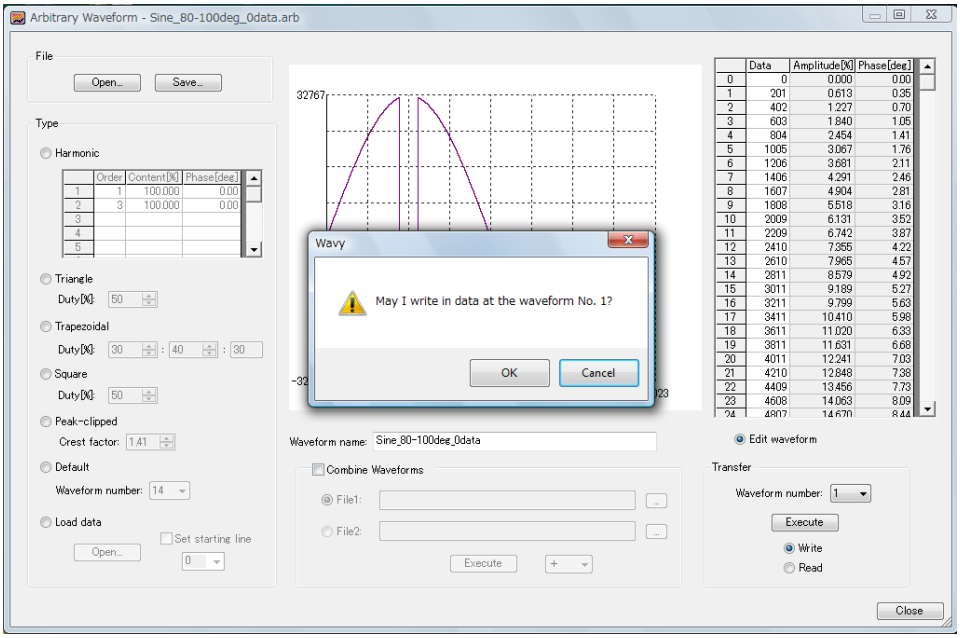
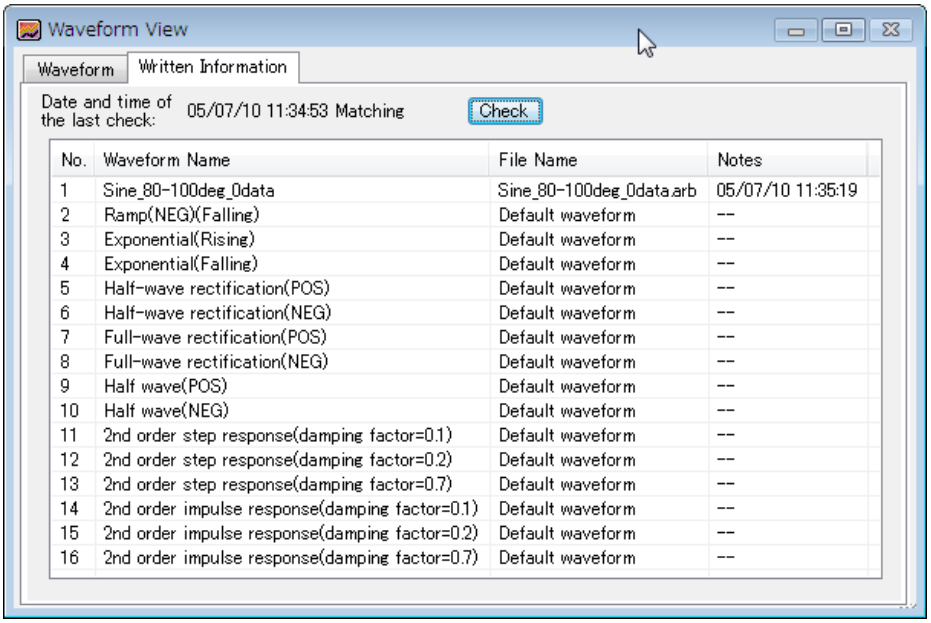


Fig. 11-19 Writing a user-defined arbitrary waveform

When the “Wavy” finishes writing the waveform to the PBZ, the information for the user-defined arbitrary waveform is displayed in the Written Information tab of the Waveform View window.



No.	Waveform Name	File Name	Notes
1	Sine_80-100deg_0data	Sine_80-100deg_0data.arb	05/07/10 11:35:19
2	Ramp(NEG)(Falling)	Default waveform	--
3	Exponential(Rising)	Default waveform	--
4	Exponential(Falling)	Default waveform	--
5	Half-wave rectification(POS)	Default waveform	--
6	Half-wave rectification(NEG)	Default waveform	--
7	Full-wave rectification(POS)	Default waveform	--
8	Full-wave rectification(NEG)	Default waveform	--
9	Half wave(POS)	Default waveform	--
10	Half wave(NEG)	Default waveform	--
11	2nd order step response(damping factor=0.1)	Default waveform	--
12	2nd order step response(damping factor=0.2)	Default waveform	--
13	2nd order step response(damping factor=0.7)	Default waveform	--
14	2nd order impulse response(damping factor=0.1)	Default waveform	--
15	2nd order impulse response(damping factor=0.2)	Default waveform	--
16	2nd order impulse response(damping factor=0.7)	Default waveform	--

Fig. 11-20 Written Information tab of the Waveform View window

The date and time when the waveform was written appear in the Notes column.

Now, click the User-Defined Waveform tab of the Waveform View window, and select Waveform 1.

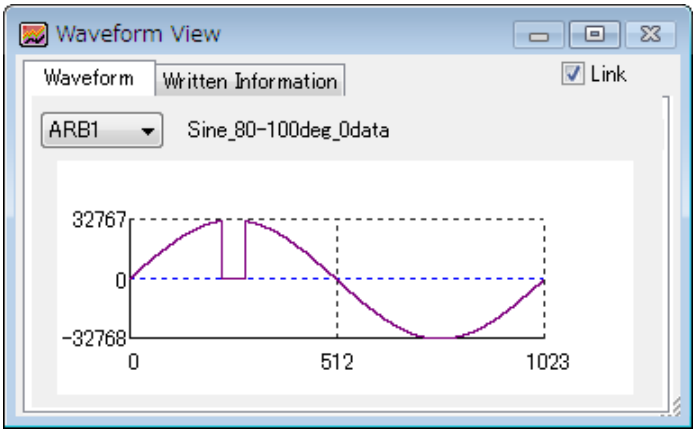


Fig. 11-21 User-defined arbitrary waveform in the Waveform View window

* In addition to writing user-defined arbitrary waveforms, you can also load user-defined arbitrary waveforms.
To do so, select **Load**, select a user-defined-waveform number (1 to 16), and click **Execute**.

*** The "Wavy" cannot send user-defined arbitrary waveforms using RS232C.**

Combining Waveforms

You can use this feature to combine two user-defined arbitrary waveforms.
Select the "**Combined Waveforms"** check box. Select "**File 1"**, and specify the file.
Then, select "**File 2"**, and specify the file.
Select **+** or **-**, and click "**Execute"** button.

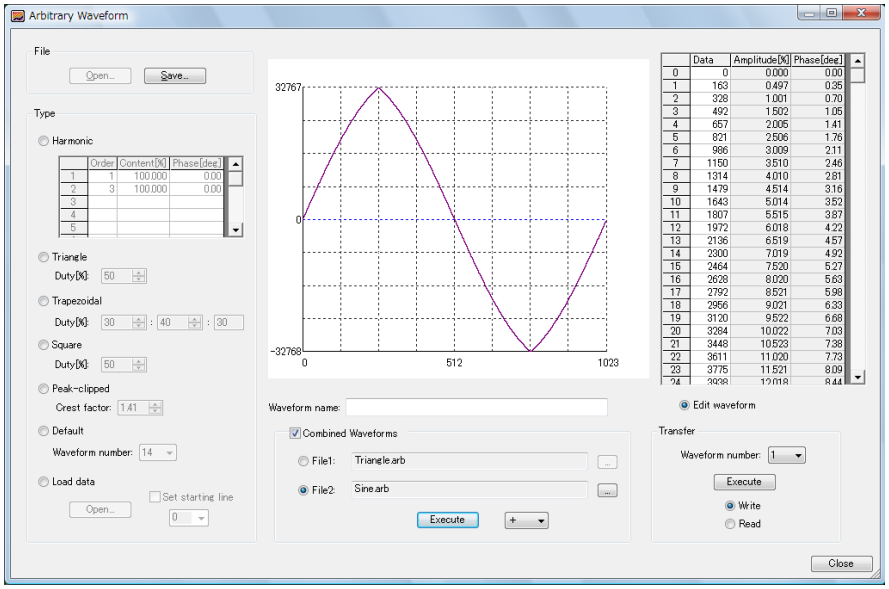


Fig. 11-22 Combining waveforms

Enter a waveform name, and then click the **Save** button to save the file.

Chapter 12 Environment Settings

On the “**Setting”** menu, click “**Environment”** to open the “**Environment Settings”** dialog box.

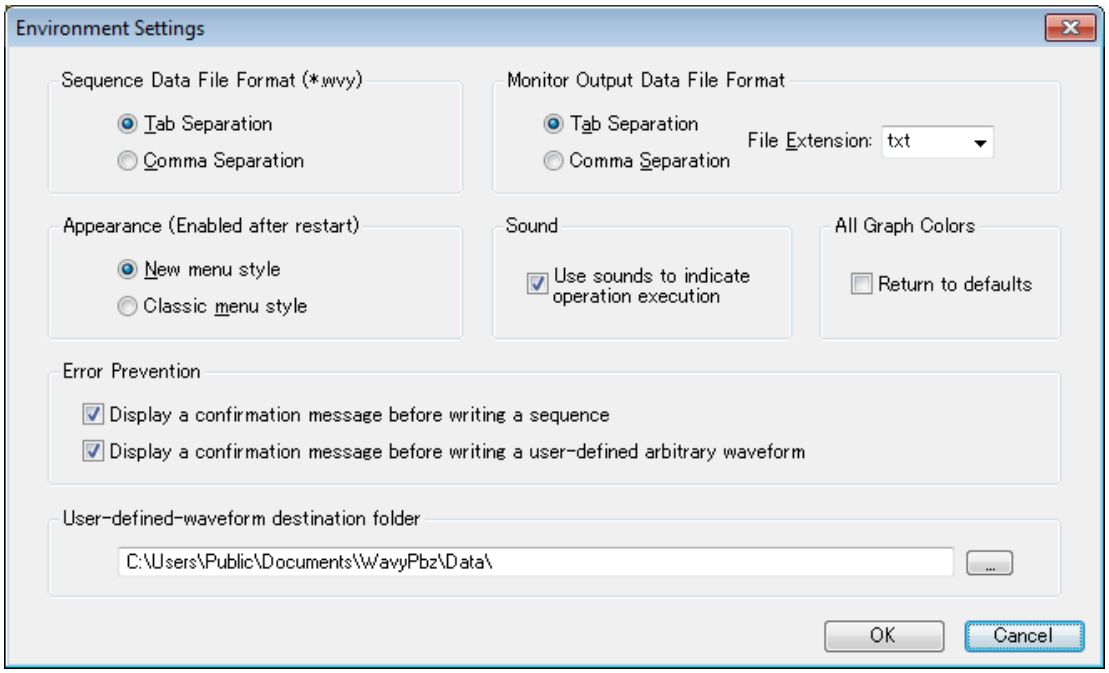


Fig. 12-1 Environment Settings dialog box

The default sequence-data file format is “Tab Separated”, data points are separated by tabs). To separate data points by commas, select “Comma Separated”.
The same is true for the monitored-data file format.
You can set the monitored-data file name extension.

The appearance setting affects the appearance of the menu bar and toolbar.
When you change this setting, the change is applied after you close and restart the “Wavy”.

* If you change the monitored-data file settings so that monitored-data files are comma-separated files with .csv extensions, you can open the files easily using Excel (a conversion wizard does not appear).

The user-defined-waveform archive folder is the folder that the “Wavy” searches when you load sequence data and a user-defined arbitrary waveform is used.
For details, see Chapter 13, “Sequence Data and User-Defined Arbitrary Waveforms.”

Chapter 13 Sequence Data and User-Defined Arbitrary Waveforms

Sequence data and user-defined arbitrary waveform data is linked.
This chapter explains how they are linked.

Typically, when you use a user-defined arbitrary waveform data in the "**Written Information"** tab of the **Waveform View** window, click "**Check"** to confirm the status of the user-defined arbitrary waveforms on the PBZ. The status of the date and time of the last condition can be displayed.

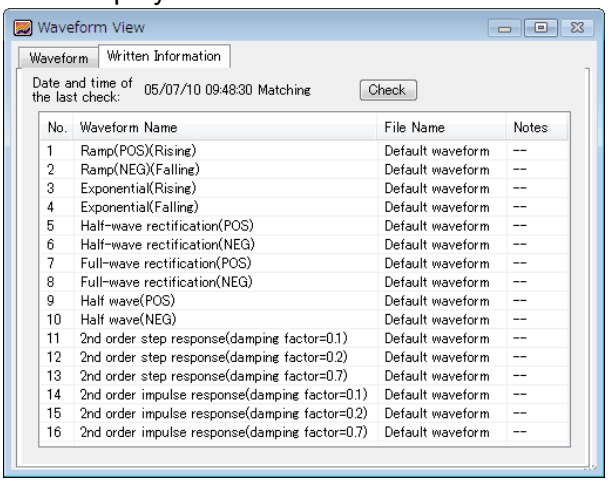


Fig. 13-1 Checking user-defined arbitrary waveforms

In the example in Fig. 13-1, all the user-defined arbitrary waveforms are default waveforms. This is the current state of the PBZ.

The following is the case of that the sequence and user-defined-waveform data shown in Fig. 13-2 was used in the past.

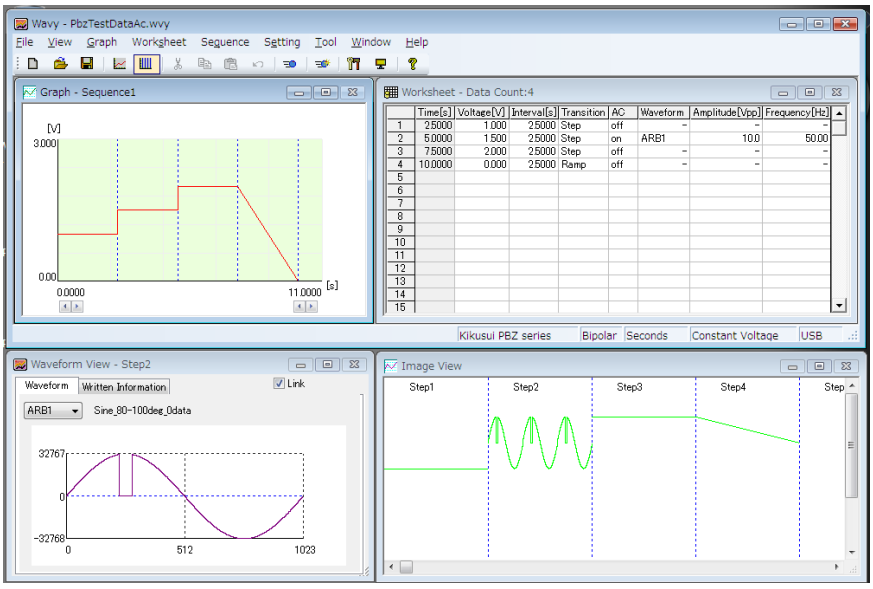


Fig. 13-2 Sequence data and user-defined arbitrary waveform

The user-defined-waveform data shown in Fig. 13-2 is the same data as shown in Fig. 11-18.
This sequence data file was previously saved as "PbzTestDataAc.wvy".

If you open “PbzTestDataAc.wvy” in such condition, the “**Discrepancy of User-Defined-Waveform Information”** dialog box shown in Fig. 13-3 appears on the display.

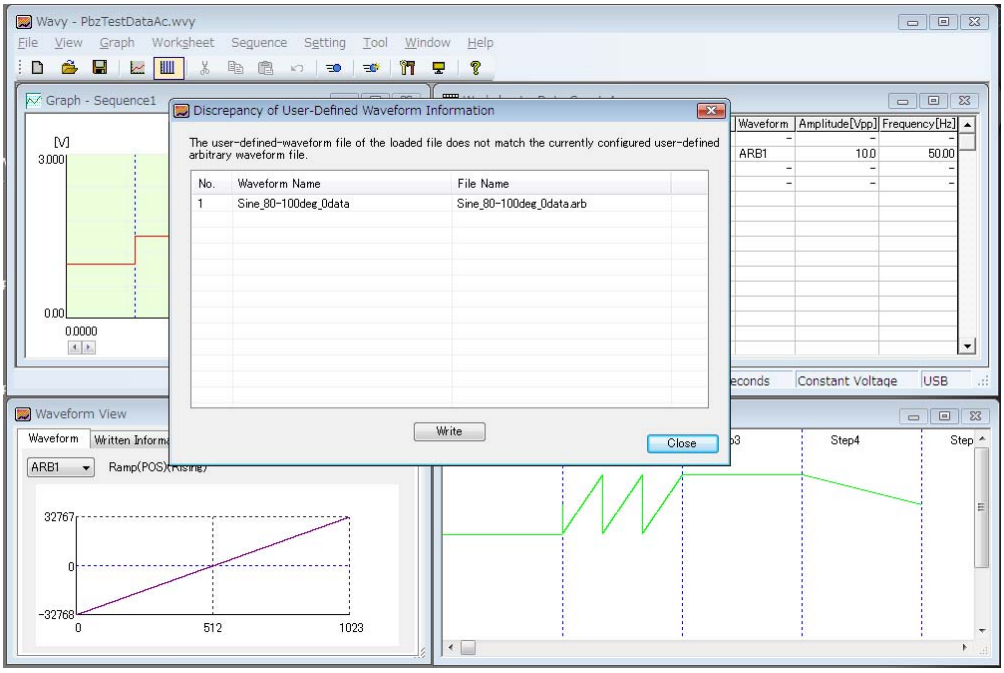


Fig. 13-3　Discrepancy of user-defined-waveform information

This dicrepancy of user-defined waveform information is based on the Written Information tab of the Waveform View window and the loaded sequence-data file.

* The “Dicrepancy of user-defined waveform information” applies only for the file name. Make sure that the waveform name and the file name are the same.

Click “**Write**” button to write the appropriate user-defined-waveform data to the PBZ.

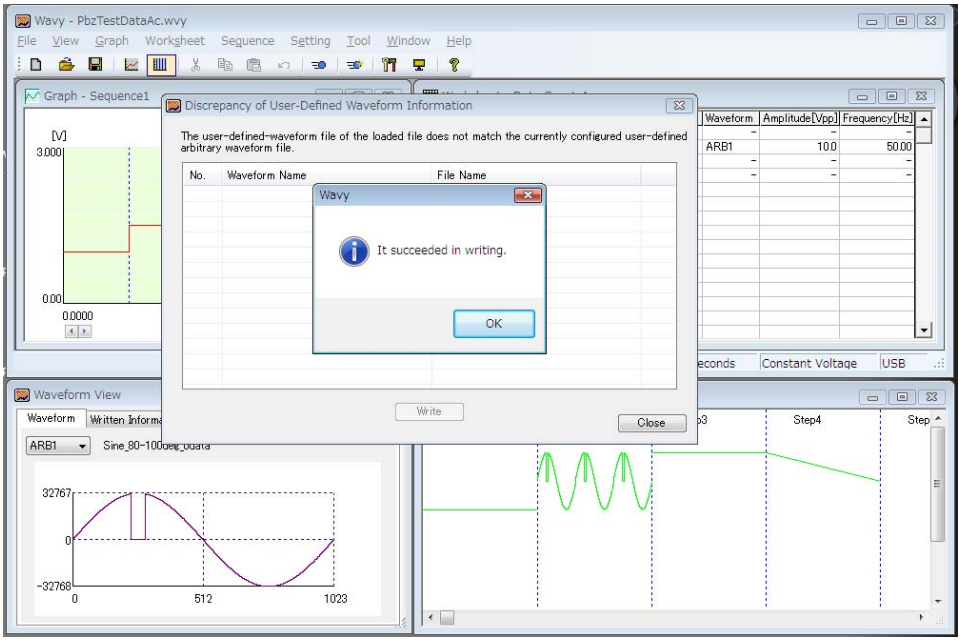


Fig. 13-4　Sending a user-defined arbitrary waveform

When the “**Write”** button is selected, the “Wavy“searches for the appropriate user-defined arbitrary waveform through the user-defined waveform archive folder.. The user-defined-waveform archive folder is the “data” folder in the WavyPbz subfolder of the Public Documents. In Windows XP, it is in the folder specified in the setup.

* You can change the user-defined-waveform archive folder in the environmental settings.

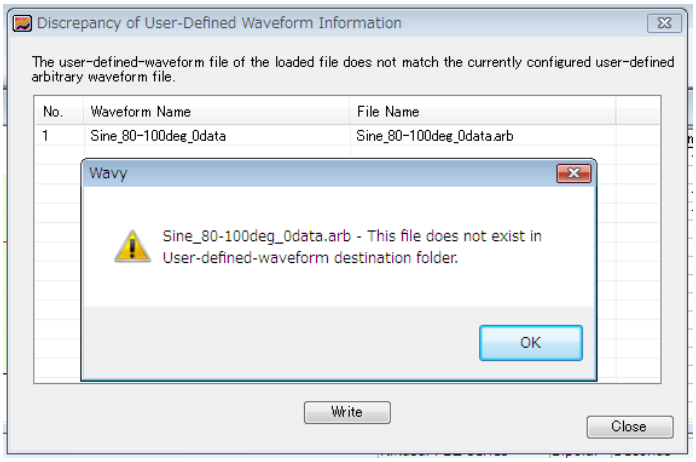


Fig. 13-5 When the user-defined-waveform file cannot be found

* Even if you do not send the waveform here, you can send it in the **Waveform Editor** window and clear the dicrepancy of use-defined waveform information by opening the appropriate user-defined-waveform file and executing the write operation.

* Even if you close the “**Discrepancy of User-Defined Waveform Information”** dialog box, you can display it again by selecting “**Discrepancy of user-defined-waveform information”** on the **Worksheet** menu.

When the Written Information Tab of the Waveform View Window Does Not Match the PBZ

In the **User-Defined Waveform** window, perform the write operation on user-defined arbitrary waveforms that do not match. If you return the PBZ to its factory default settings and then click **Check** in the **Written Information** tab of the **Waveform View** window, the information will not match (Fig. 13-6).

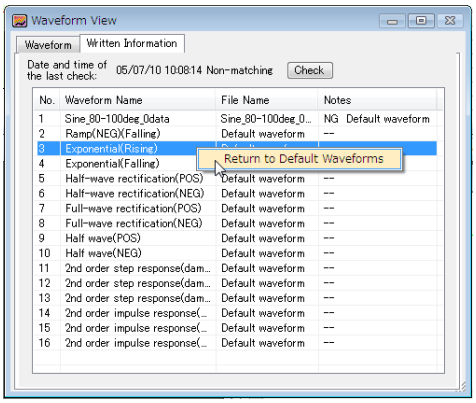


Fig. 13-6 Discrepancy information

Click the right mouse button, and then click “**Return to Default Waveforms”**.

Chapter 14 Dividing Steps into Programs

This chapter explains how to divide steps into programs.

In the "**Mode"** dialog box, select the "**Divided steps into programs and execute"** check box.
On the worksheet, you can enter values into the Program and Number of repetitions (the circled area in Fig. 14-1).
The program can be set from the number 1 to 16, and the number of repetitions can be set from 1 to 10,000.
The maximum number of steps is 16. To delete the step, press "Delete" key.

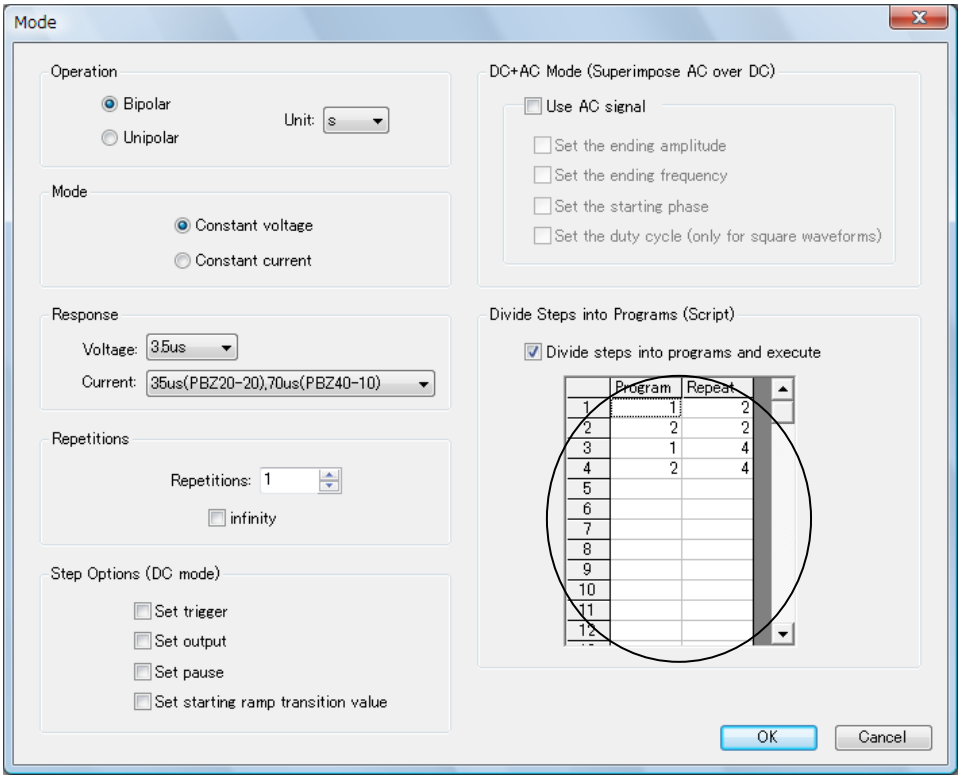


Fig. 14-1 Mode dialog box (dividing steps into programs)

If you configure the "Wavy" as shown in Fig. 14-1, it operates as following.

1. Executes program 1 for twice, execute repeated cycle
↓
2. Executes program 2 for twice, execute repeated cycle
↓
3. Executes program 1 for 4 times, execute repeated cycle
↓
4. Executes program 2 for 4 times, execute repeated cycle

If you specify a value for **Repetitions** in the **Mode** dialog box, the pattern in the circled area of the figure above is repeated.

When the "**Divided steps into programs and execute"** check box is selected, a Program column appears in the main window. In Fig. 14-2, the steps are divided into two programs.

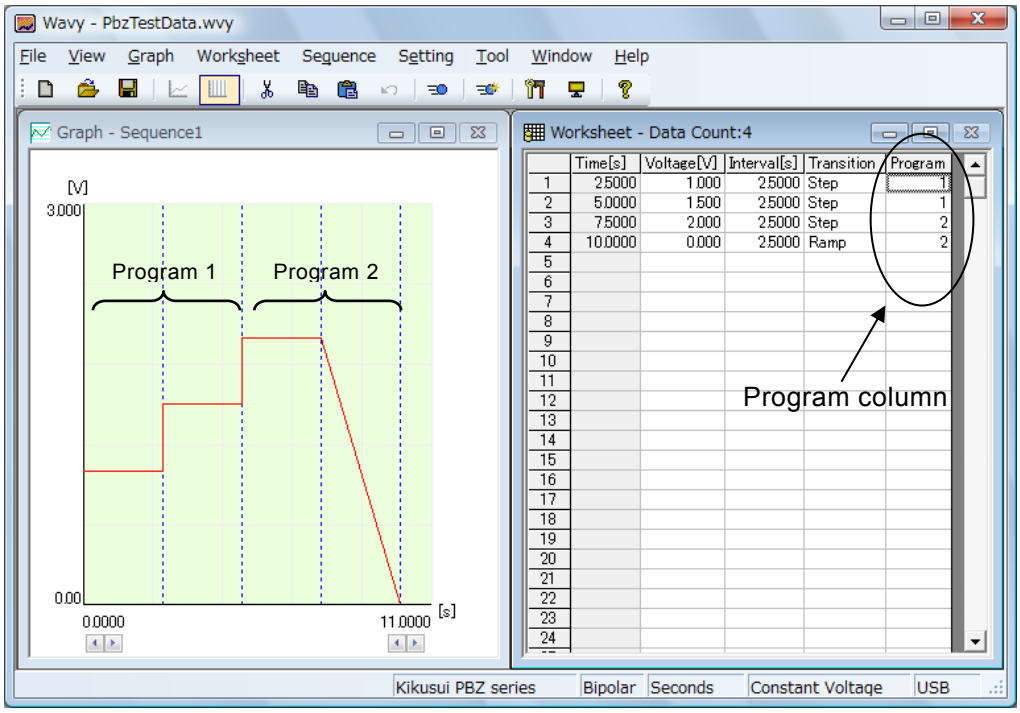


Fig. 14-2 Main window (dividing steps into programs)

Write the setting condition as shown in Fig. 14-1 and Fig. 14-2 to the PBZ, then execute the sequence.
Fig. 14-3 shows an example of the executing sequence.

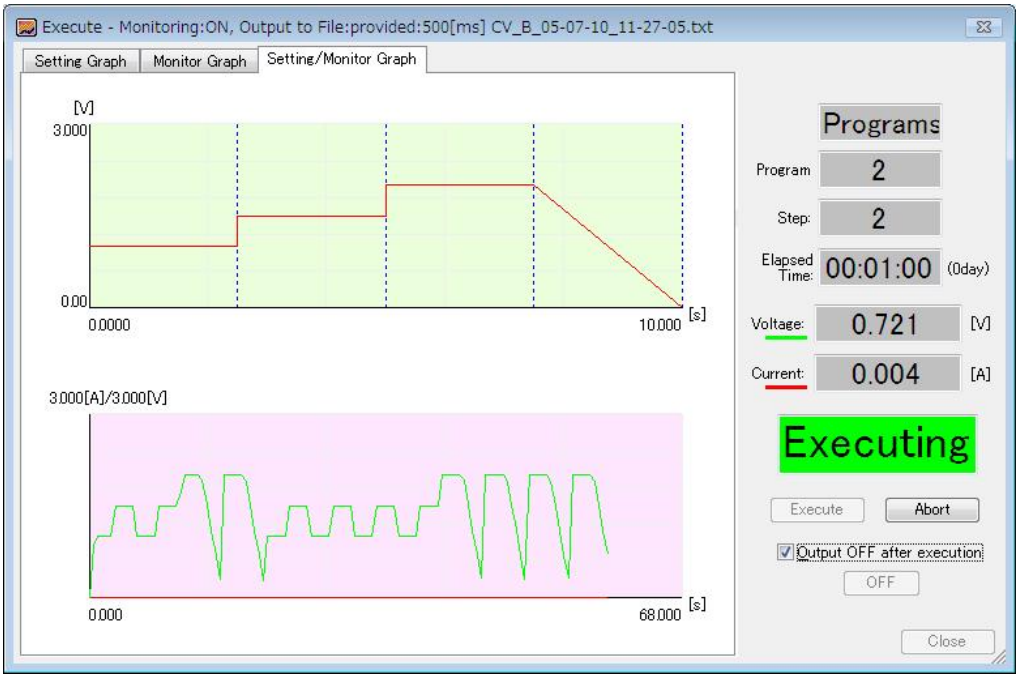


Fig. 14-3 Execute window (divided steps into programs)

* When steps are divided into programs, the current-location line and the number of repetitions are not displayed.

Chapter 15 Changing the Background color and the Line Color

You can change the background color of the graph, line, and other colors as you required.

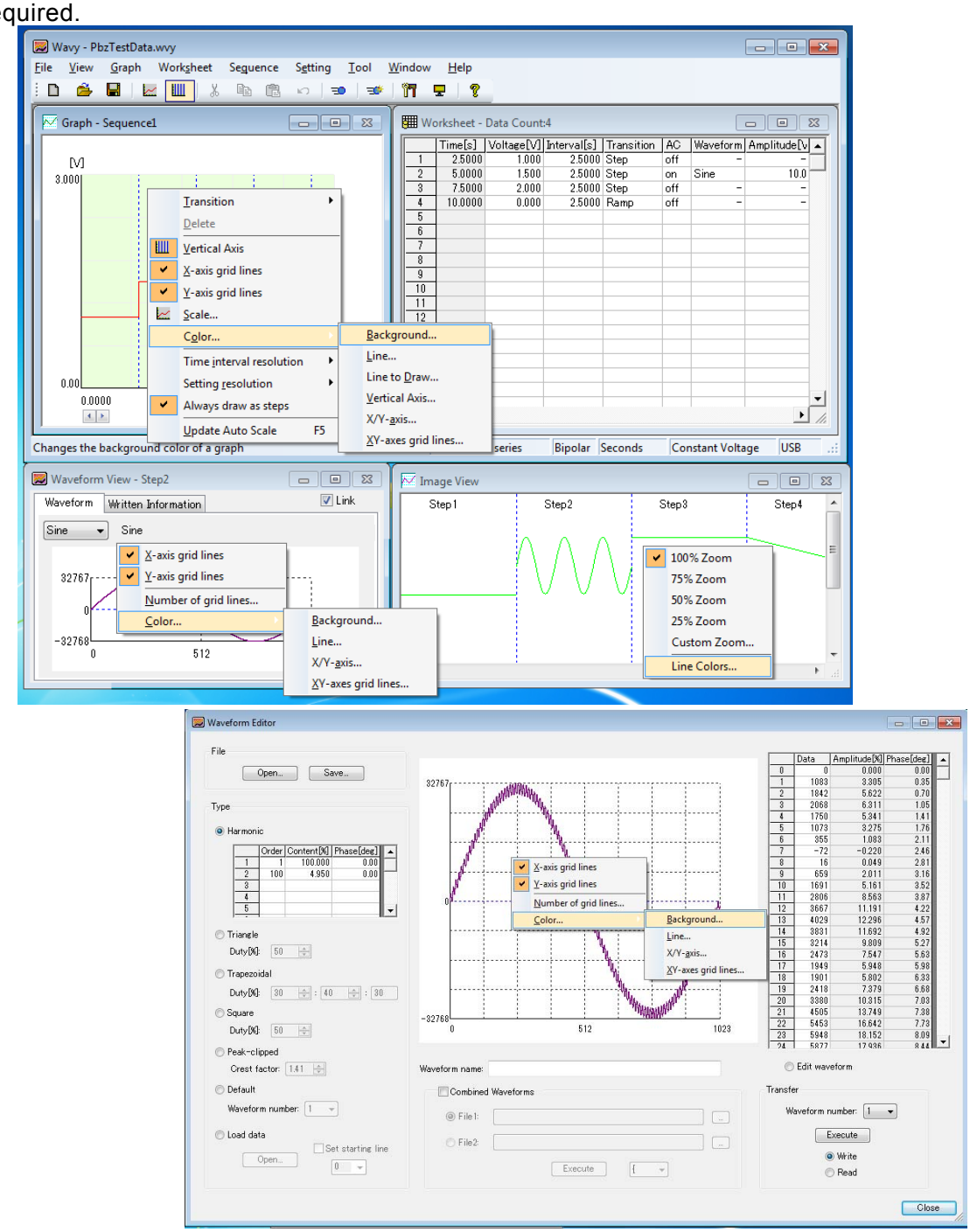


Fig. 15-1 Changing the Background color and the Line Color

* In the environment settings, if you select the "**Return to defaults"** check box under **All Graph Colors**, all the colors that you have changed are returned to the default colors that were displayed immediately after you installed the "Wavy".

Chapter 16 Remote Control Panel

You can configure voltage and current and turn output on and off as if you were using a remote, and you can monitor output voltage and current values. This feature is independent from the sequence feature.
On the "**Tool**" menu, click "Remote **Control** Panel" to open the "**Remote Control Panel**" window.

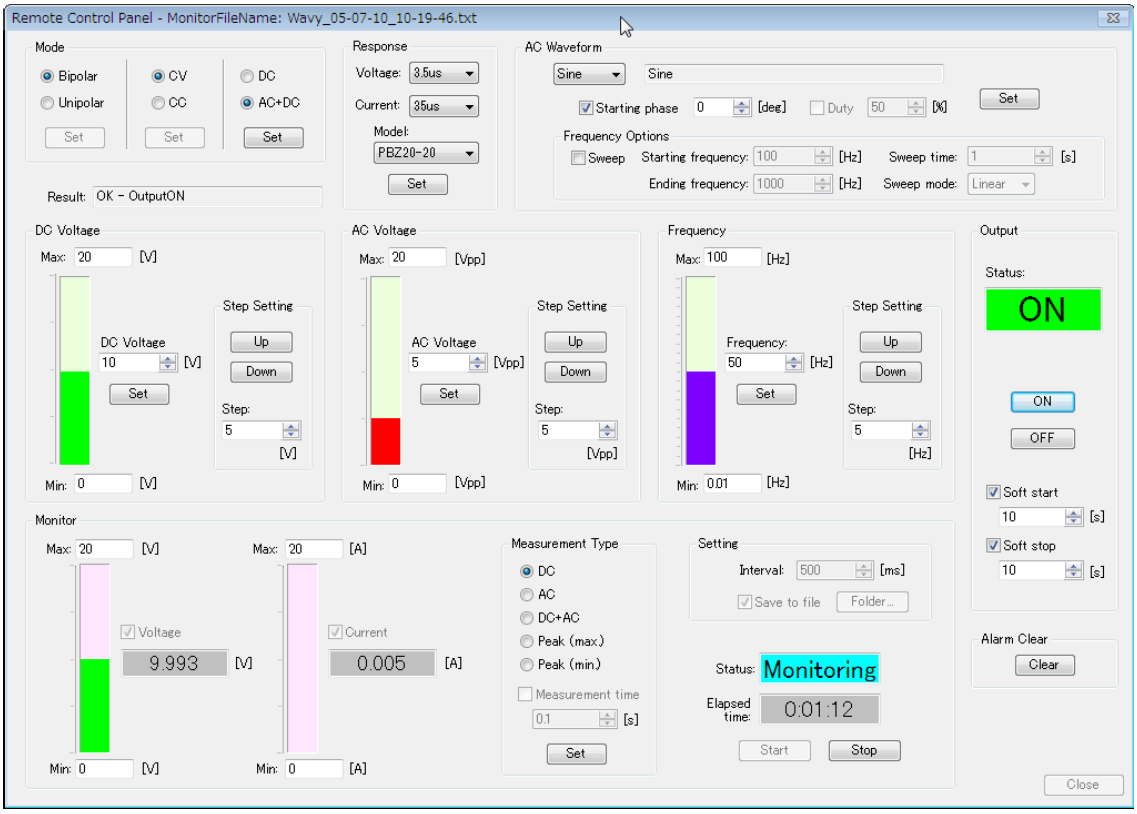


Fig. 16-1 Direct Control window

You can set the operation mode, response, DC voltage or current, and AC voltage or current. When an AC signal is selected, you can select an AC waveform and frequency. You can also turn output on and off and monitor values.
First, set all the maximum and minimum values to match the ranges that you intend to operate in.

You can set the voltage, current, and frequency values by pressing ENTER after you type them.
When you move up or down a step using the spin box, the step value is added or subtracted from the set value.
In Fig. 16-1, if in the **Step Settings** under **DC Voltage**, you click the up the spin box, the value becomes 10 + 5 = 15 (V). The bar scale is determined by the step value.

If in the **Monitor** settings, the **Save to file** check box is selected, the monitored values are saved to a file.
When the check box is selected, you can click **Folder** to specify the folder that the file is saved to.
The file name is Wavy_04-22-08_20-36-01.txt.

* The file format and extension depend on the settings you make in Chapter 12, "Environment Settings."

Chapter 17 Command Control

On the “**Tool”** menu, click “**Command Control”** to open the “**Command Control”** window.

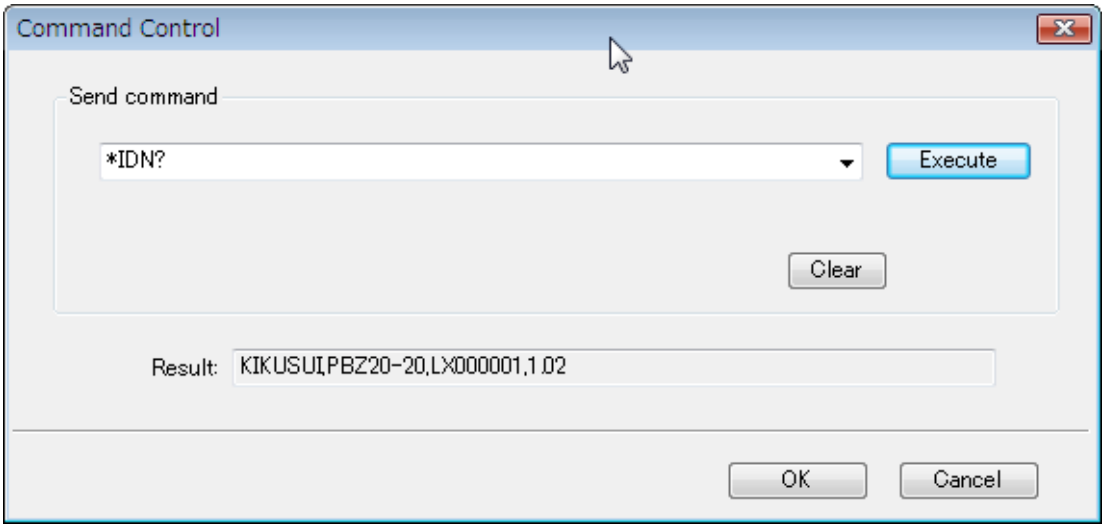


Fig. 17-1 Command Control window

You can use this feature to execute commands independently from the sequence feature.

When the Command is sent and received correctly (up to 10), it appears in the drop-down list.
To clear the drop-down list, click **Clear**.

* Multiple commands are not supported.
* For details about commands, see the PBZ Operation Manual.

Chapter 18 Sequence-Data Files

Sequence-data files are text-format files.

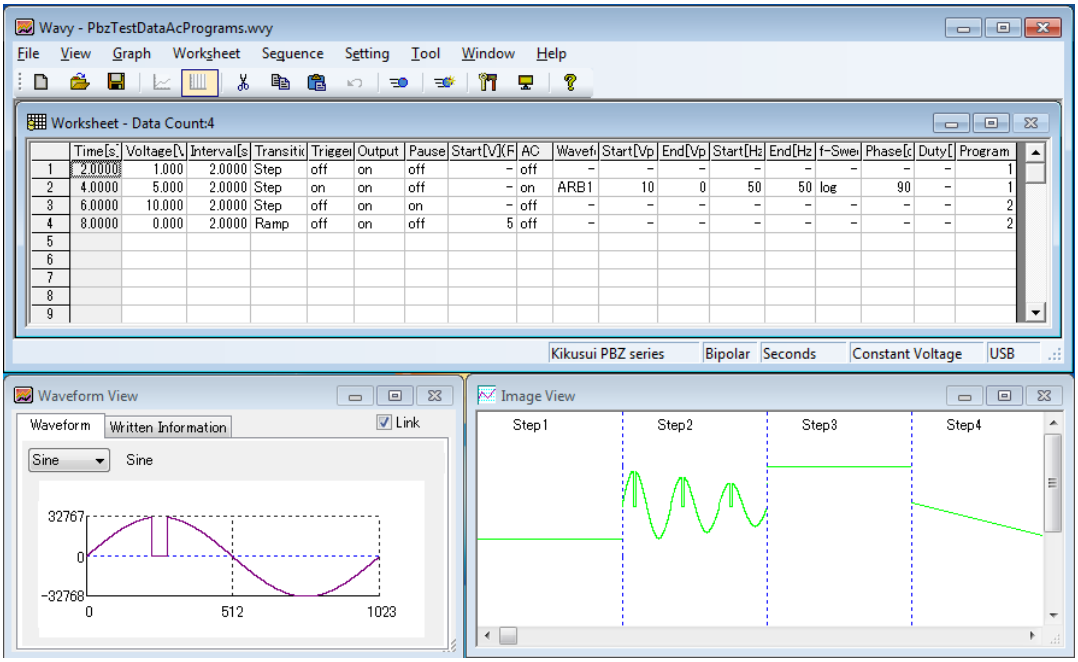


Fig. 18-1 The main window when the “PbzTestDataAc_Programs.wvy” has been loaded.

When the “PbzTestDataAc_Programs.wvy” (shown in Fig. 18-1) is opened using Notepad, it looks like Fig. 18-2.

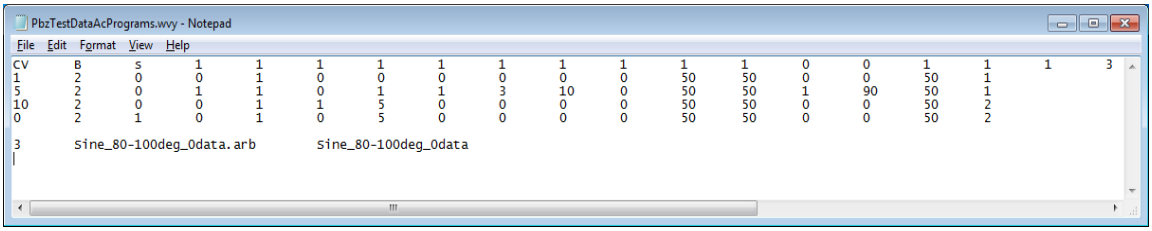


Fig. 18-2 Opening the “PbzTestDataAc_Programs.wvy” in Notepad

Be aware of the form between the **data is “TAB Separated Values (TSV)”**, not spaces.
You can switch the form from the TSV (Tab Separated Values) to the CSV (Comma Separated Values). For details, see chapter 12, “Environmental Settings.”

The first line contains the mode setting, the second to fifth lines contain the sequence data, and after the 7th lines contains the user-defined-waveform data.

The contents of the first line are listed below.

Column	Indication	Description
1st	CV or CC	Constant voltage or constant current
2nd	B or U	Bipolar or unipolar
3rd	ms or s, or min or h	Milliseconds or seconds, or minutes or hours
4th	0 to 10,000	Number of repetitions. 0 indicates infinity.
5th	0 or 1	Trigger column. 0: no column. 1: column.
6th	0 or 1	Output column. 0: no column. 1: column.
7th	0 or 1	Pause column. 0: no column. 1: column.
8th	0 or 1	Starting ramp column. 0: no column. 1: column.
9th	0 or 1	AC column. 0: no column. 1: column.
10th	0 or 1	Ending amplitude column. 0: no column. 1: column.
11th	0 or 1	Ending frequency column. 0: no column. 1: column.
12th	0 or 1	Starting phase column. 0: no column. 1: column.
13th	0 or 1	Duty column. 0: no column. 1: column.
14th	0 to 3	Voltage response. 0 for minimum to 3 for maximum.
15th	0 to 3	Current response. 0 for minimum to 3 for maximum.
16th	0 or 1	Division of steps into programs. 0: no. 1: yes.
17th	1 to 16	Number of step divisions to execute
18th*	1 to 16	Program number
19th*	1 to 10,000	Number of times that the program is repeated

* The number of columns increases by the number of step divisions specified in column 17. If there are two step divisions, a column 20 and column 21 are added.

The contents of the second line are listed below.

Column	Description
1st	The voltage or current value
2nd	Time interval
3rd	Transition type. 0: step. 1: ramp.
4th	Trigger. 0: off. 1: on.
5th	Output. 0: off. 1: on.
6th	Pause. 0: off. 1: on.
7th	The voltage or current value for the starting ramp.
8th	AC. 0: off. 1: on.
9th	Waveform number. 0: sine wave. 1: triangle wave. 2: square wave. 3 to 18: user-defined arbitrary waveforms 1 to 16.
10th	Starting amplitude
11th	Ending amplitude
12th	Starting frequency
13th	Ending frequency
14th	Frequency sweep. 0: linear. 1: log.
15th	Starting phase
16th	Duty cycle (only used for square waveforms)
17th	Program number (used when steps are divided into programs)

The contents of the seventh line are listed below.

Column	Description
1st	User-defined-waveform number
2nd	File name of the user-defined arbitrary waveform
3rd	Waveform name of the user-defined arbitrary waveform

You can also open the “PbzTestDataAc_Programs.wvy” in Excel.
When you want to change voltage, current, time interval, or other values all at once, use Excel.

Chapter 19 Menu Items

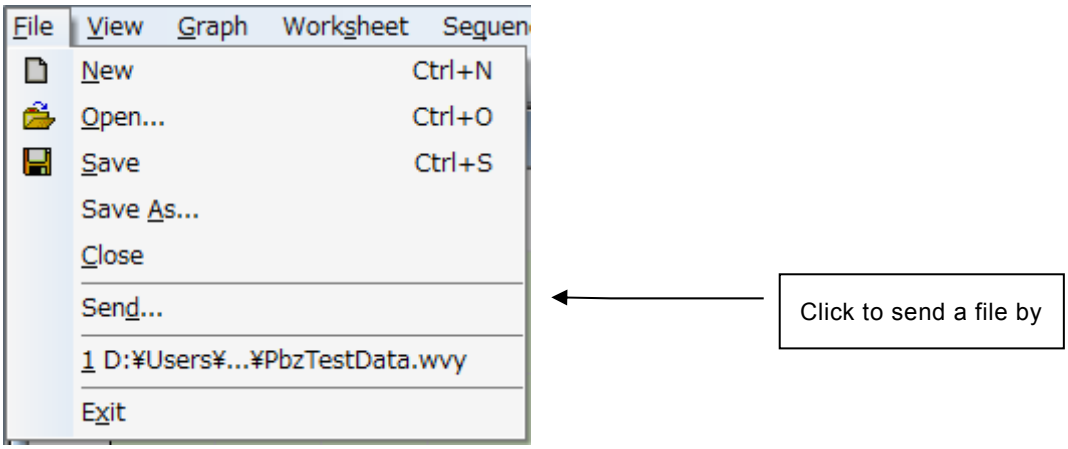


Fig. 19-1 File menu

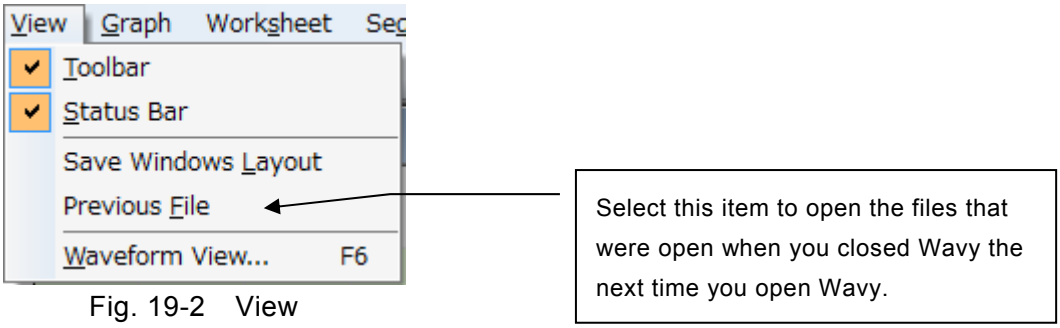


Fig. 19-2 View

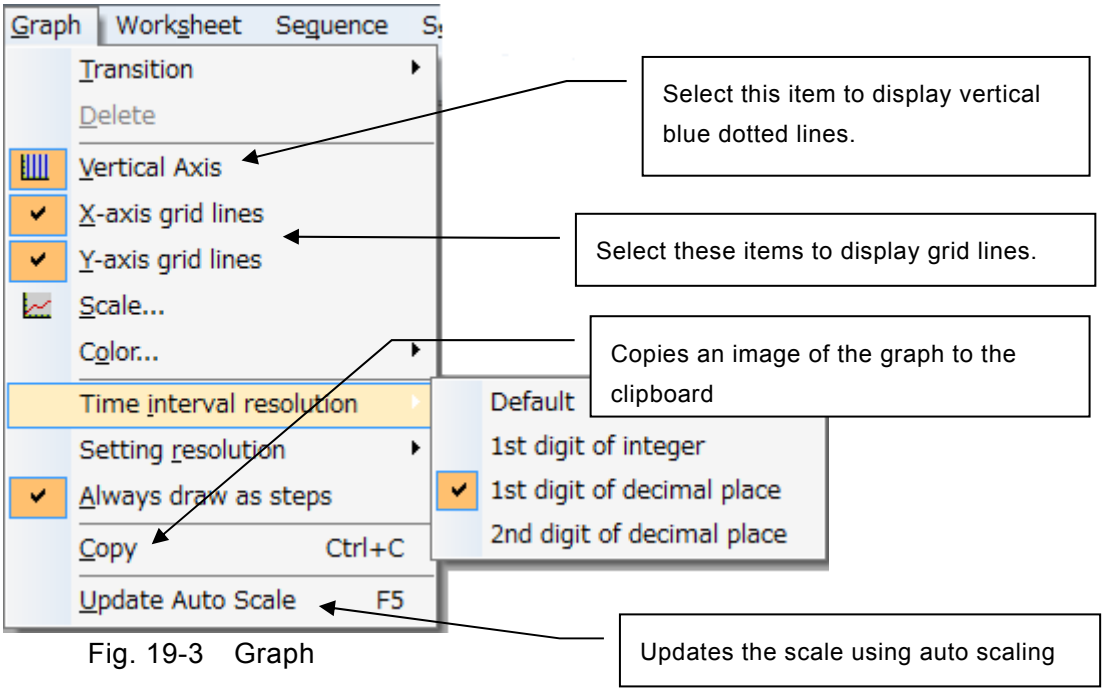
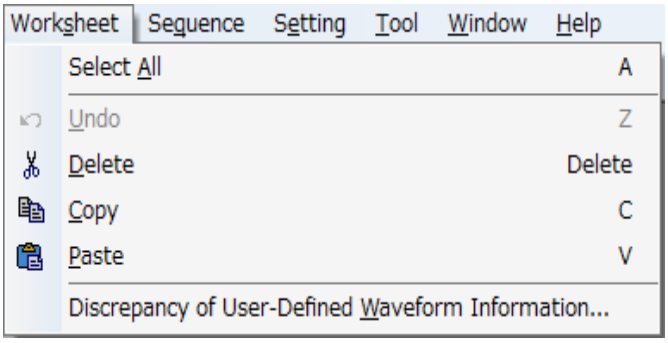


Fig. 19-3 Graph



Use these items to copy, insert, and delete multiple lines of sequence data (step data) that have been entered on the sheet.

Fig. 19-4 Worksheet

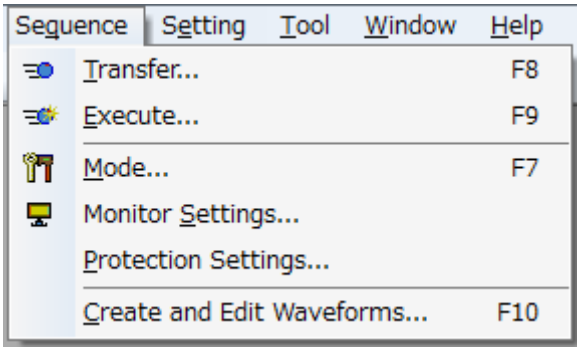


Fig. 19-5 Sequence

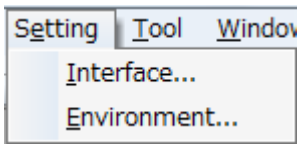


Fig. 19-6 Setting

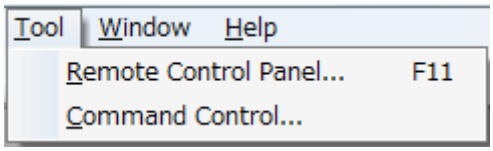


Fig. 19-7 Tool

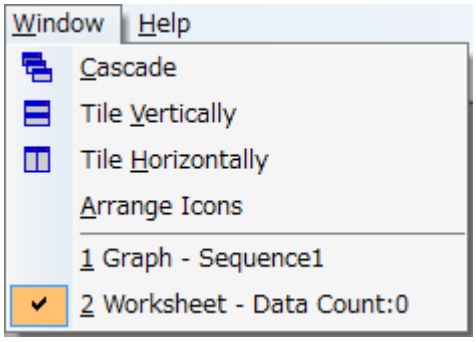


Fig. 19-8 Window

Chapter 20 Toolbar and Status Bar

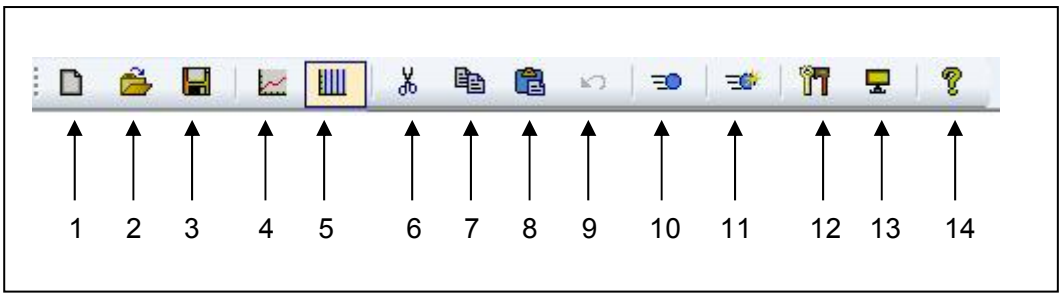


Fig. 20-1 Toolbar

1 New File (CTRL+N)
2 Open (CTRL+O)
3 Save (CTRL+S)
4 Scale
5 Turn Vertical Line Display On/Off
6 Delete (DELETE)
7 Copy (C)
8 Insert (V)
9 Undo (Z)
10 Transfer
11 Execute
12 Mode
13 Monitor Settings
14 “Wavy” Version Information

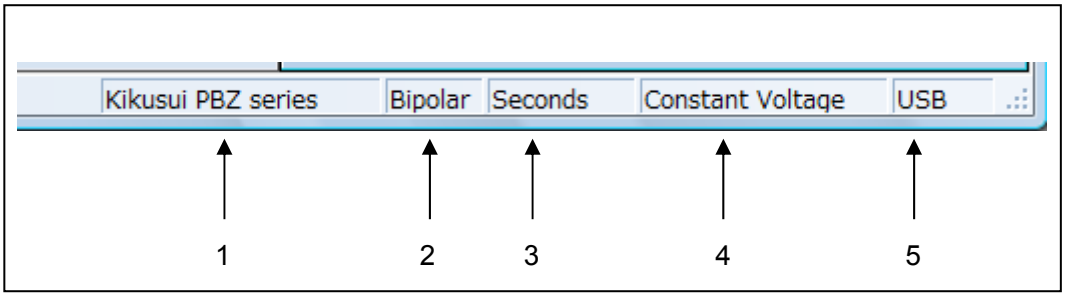


Fig. 20-2 Status bar

1	Device name	
2	Operation mode	Bipolar or unipolar
3	Unit of time	Milliseconds or seconds, or minutes or hours
4	Operation mode	Constant voltage or constant current
5	Interface	USB, GPIB, or RS232C

Appendix Example of the Sequence division

In a transfer screen (figure 7-2), check a "Devide Ramp (DC)" check box and Click a "Execute" button of the "Write".
A certain 4 steps sequence data (figure A-1) are written in as sequence data (figure A-2) of 10 steps.

before the division

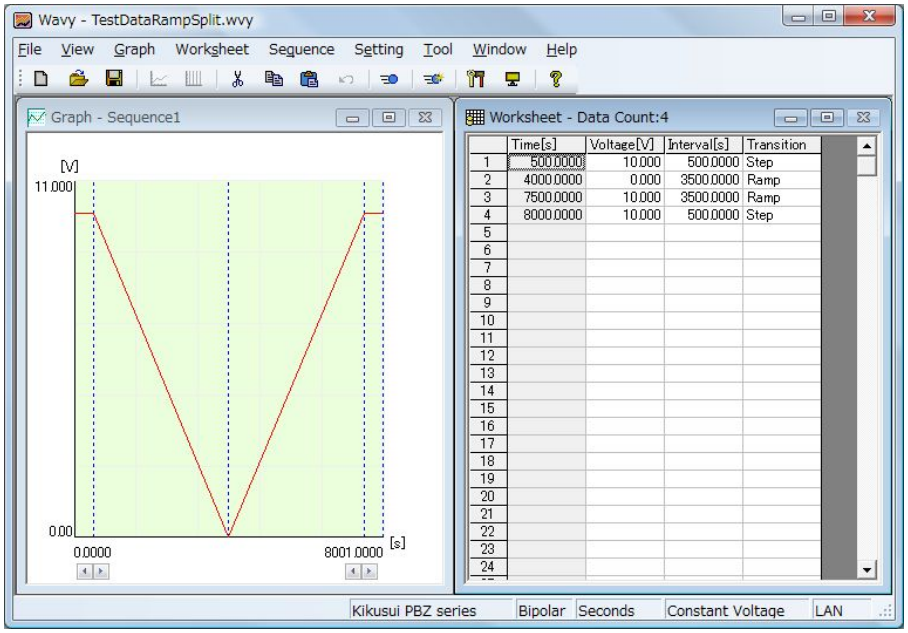


Fig. A-1 Sequence of 4 steps

After the division

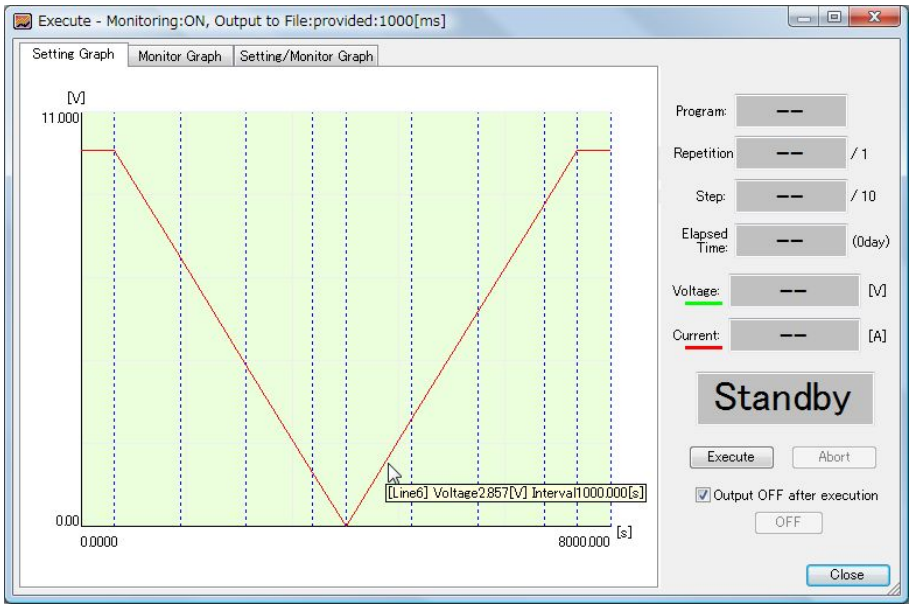


Fig. A-2 Sequence of 10 steps