CONTROL SOFTWARE FOR DP SERIES TYPE L

INSTRUCTION MANUAL

NF Corporation

DA00057717-004

CONTROL SOFTWARE FOR DP SERIES TYPE L

Instruction Manual

■ About registered trademarks

National Instruments is a trademark of National Instruments Corporation in the United States.
Microsoft is a registered trademark of Microsoft Corporation in the United States.
Windows is a registered trademark of Microsoft Corporation in the United States.
WAVE DESIGNER is a registered trademark of NF Corporation in Japan.
Other company or product names are generally the trademarks or registered trademarks of their respective holders.

——— Preface ———

Thank you for purchasing our Programmable AC Power Source DP series.
For safe and correct use of the electrical product, please first read "Safety Precautions" on the next page.

- This manual consists of the following chapters.
  If it is the first time for you to use this product, start with "1. Outline."

  1. Outline: Provides an overview of the functions of the Control Software.

  2. Installation: Explains the environment required for Control Software to operate and the installation method.

  3. Control Software Operation: Explains the basic operations of Control Software, such as starting/exiting, the window configuration, the system setting, and so on.

  4. Basic Controller: Explains how to operate the "Basic controller" function, one of the primary functions of the Control Software.

  5. Simulation: Explains how to operate the "Simulation" function, one of the primary functions of the Control Software.

  6. Sequence: Explains how to operate the "Sequence" function, one of the primary functions of the Control Software.

  7. Measurements Logging: Explains how to operate the Measurements Logging.

  8. Arbitrary Waveform Editing: Explains how to operate the Arbitrary waveform editing tool (WAVE DESIGNER for DP series Type L).

  9. Maintenance: Explains the management of the CD-ROM, and what to do when it is damaged.

- Coverage of the mentioning contents.
  The version of the control software for DP series Type L is indicated on these instructions about a product after 1.60.

——— Safety Precautions ———

For safe use, ensure to obey the following warnings and cautions.
We are not responsible for damage resulting from failure to obey these warnings and cautions.

- Ensure you obey the instructions in this instruction manual.

  This instruction manual contains instructions for safe operation and use of this product.
  Before using the product, please read this manual first.
  All the warning items contained in this instruction manual are intended for preventing risks that may lead to serious accidents. Ensure to obey them.

- If you notice anything strange

  If the power system controlled by this product produces smoke, unusual odor, or strange sound, immediately stop using it.
  Should you encounter any anomaly like above, make sure the system cannot be used until the repair is completed, and immediately contact us or our agent.

Disclaimer

"Control Software for DP series Type L" (hereinafter abbreviated as "this software") is shipped after being tested and inspected sufficiently by NF Corporation.
Should you encounter any failure caused by a manufacturing defect or accident during transportation, contact us or our agent.
We have no responsibility for any damage caused by using this software. We also are not obligated to provide any modifications or support, if you have problems with this software. Use this software on your own responsibility.

About Copyrights

This software is the copyright of NF Corporation, and is protected under Japanese copyright law and international agreements.
You may make a copy of this software for backup or archival purposes only, or you may retain the original for backup or archival purpose only and install this software onto the hard disk.
You may not reproduce any part of, or all of, this instruction manual without permission.

Contact Us

Should you find any fault or any questions, please contact us or our agent from whom you purchased the product.
When you contact us or our agent, tell us the model name (or product name), version number, and more detailed symptom/condition of use.

Contents

Page**Preface** i
Safety Precautions ii
Disclaimer/About Copyrights/Contact US iii
Table of Contents iv
List of Figures x
List of Tables xi
1. Outline 1
1.1 Overview 2
1.2 Software Configuration 3
1.3 Communication with DP power source at Software Startup 3
1.4 Conventions Used in This Manual 3
2. Installation 4
2.1 System Requirements 5
2.2 Installation Procedure 6
2.2.1 Installation of Driver Software 6
2.2.2 Installation of Control Software for DP series Type L 7
3. Control Software Operation 8
3.1 Start and Exit 9
3.1.1 Start 9
3.1.2 Exit 9
3.2 Communication with DP power source 10
3.3 Composition of Main Window 11
3.4 Function Switching and Function Display Section 11
3.5 Common Display Section 12
3.5.1 Operation Bar 12
3.5.2 Status Monitor 12
3.5.3 Status Bar 12
3.6 System Setting 13
3.6.1 Model Setting 13
3.6.2 Connection Setting 16
3.7 Error Message 17
4. Basic Controller 18
4.1 Name of Each Component in the Window 19
4.2 Operations on Each Section 20
4.2.1 Menu Bar 20
4.2.2 Tool Bar 20
4.2.3 Reload and Set Buttons 21
4.2.4 Basic Setting 21
4.2.5 Output Setting 22

4.2.6 Limiter Setting 23
4.2.7 Operation Bar 24
4.3 DP power source Setting File 25
4.3.1 Save As 25
4.3.2 Save 25
4.3.3 File Reading 25
4.4 Memory 26
4.4.1 Store 26
4.4.2 Recall 26
4.4.3 Reset 26
4.5 Status 27
4.5.1 Status Monitor 27
4.5.2 Clear 27
4.6 Logging 28
4.7 Arbitrary Waveform Editing 28
4.8 Restrictions in the Communication Offline State 28
5. Simulation 29
5.1 Name of Each Component in the Window 30
5.2 Operations on Each Section 31
5.2.1 Menu Bar 31
5.2.2 Tool Bar 31
5.2.3 Basic Setting 32
5.2.4 Parameter Setting 33
5.2.5 Graph 34
5.2.6 Operation Bar 34
5.3 Simulation Setting File 35
5.3.1 Save As 35
5.3.2 Save 35
5.3.3 File Reading 35
5.3.4 Write to USB Memory (Export) 35
5.4 Control 37
5.4.1 Start 37
5.4.2 Stop 37
5.4.3 Output On 37
5.4.4 Output Off 37
5.4.5 Switch Execution Mode 37
6. Sequence 38
6.1 Name of Each Component in the Window 39
6.2 Operations on Each Section 40
6.2.1 Menu Bar 40
6.2.2 Tool Bar 41
6.2.3 Basic Setting 41

6.2.4 Step Arrangement 42
6.2.5 Step-control Parameter Setting 45
6.2.6 Intra-Step Parameter Setting 46
6.2.7 Operation Bar 47
6.3 Sequence Setting File 48
6.3.1 Save As 48
6.3.2 Save 48
6.3.3 File Reading 48
6.3.4 Write to USB Memory (Export) 48
6.4 Control 49
6.4.1 Start 49
6.4.2 Stop 49
6.4.3 Hold 49
6.4.4 Branch 49
6.4.5 Output On 50
6.4.6 Output Off 50
6.4.7 Switch Execution Mode 50
7. Measurements Logging 51
7.1 Open or Close the Measurements Logging Window 52
7.1.1 Open the Measurements Logging Window 52
7.1.2 Close the Measurements Logging Window 52
7.2 Name of Each Component in the Window 52
7.3 Operations on Each Section 53
7.3.1 Menu Bar 53
7.3.2 Tool Bar 53
7.3.3 Start, Stop, and Clear 54
7.3.4 Logging Conditions 54
7.4 Log Display Section 55
7.5 Measurements Log File 55
8. Arbitrary Waveform Editing 57
8.1 Overview 58
8.2 Opening/Closing the Arbitrary Waveform Editing Window 59
8.2.1 Opening the Arbitrary Waveform Editing Window 59
8.2.2 Closing the Arbitrary Waveform Editing Window 59
8.3 Name of Each Component in the Window 60
8.4 Operations on Each Section 61
8.4.1 Menu Bar 61
8.4.2 Tool Bar 62
8.4.3 Control Panel Section 62
8.4.4 Waveform Display Section 62
8.5 Waveform Display Section 63
8.5.1 Waveform Display Area 63

8.5.2 Display Magnification 63
8.5.3 Markers 64
8.5.4 Waveform Manipulation 65
8.5.5 Example of Arbitrary Waveform Editing 67
8.5.6 Grid 67
8.6 File Operation 68
8.6.1 Custom Format File 68
8.6.2 Text Format File 68
8.6.3 File Reading 69
8.6.4 Exporting the File for DP power source 69
8.7 Printing Waveforms 69
8.8 Editing a New Arbitrary Waveform 70
8.8.1 Range/Page 71
8.8.2 Select a Waveform 71
8.8.3 Parameter Setting 72
8.8.4 Waveform Function Setting 73
8.8.5 Created Arbitrary Waveforms Examples 77
8.8.6 Operation of Parameter File for Arbitrary Waveform Editing 79
8.8.7 Print 79
8.9 Interpolate 80
8.9.1 Control Point Setting 81
8.9.2 Execute Interpolation 82
8.9.3 Created Arbitrary Waveforms Examples 83
8.9.4 Control Point File Operation 84
8.10 Operation 85
8.10.1 Types of Operation 86
8.10.2 Set a Operation Target 86
8.10.3 Operation Execution 86
8.10.4 Created Arbitrary Waveforms Examples 87
8.11 Compress/Expand 88
8.11.1 Compression/Expansion along Horizontal Axis 88
8.11.2 Compression/Expansion along Vertical Axis 89
8.11.3 Created Arbitrary Waveforms Examples 90
8.12 System Setting 92
8.12.1 X Axis Unit Settings 92
8.12.2 Y Axis Unit Settings 93
8.13 Memory 93
8.13.1 Memory Transfer 93
8.13.2 Memory Clear 93
9. Maintenance 94
9.1 CD-ROM Management 95
9.2 Replace Damaged CD-ROM 95

9.3 Check Version 95

Figures and Tables

■List of Figures

Page
Figure 3-1 Shortcut Icon on Desktop 9
Figure 3-2 Exit Confirmation Dialog 9
Figure 3-3 Dialog that Opens when the Software was Started in Communication Offline State 10
Figure 3-4 Composition of Main Window 11
Figure 3-5 Operation Bar 12
Figure 3-6 Status monitor 12
Figure 3-7 Status Bar 12
Figure 3-8 System Setting Dialog 13
Figure 3-9 Working Power Units Dialog (DP120LM 3P4W mode) 14
Figure 3-10 Working Power Units Dialog (Power unit error) 14
Figure 4-1 Basic Controller Window 19
Figure 4-2 Menu Composition of Basic Controller 20
Figure 4-3 Basic Controller Tool Bar 20
Figure 4-4 Reload and Set Buttons 21
Figure 4-5 Basic Setting 21
Figure 4-6 Confirmation Dialog for Clearing the Setting 21
Figure 4-7 Output Setting 22
Figure 4-8 Example of Setting Range Error Dialog 22
Figure 4-9 Limiter Setting 23
Figure 4-10 The Indication of OUTPUT Button 24
Figure 4-11 Store and Recall Dialogs 26
Figure 4-12 Status Display Example (Sensing Voltage Anomaly) 27
Figure 5-1 Simulation Window 30
Figure 5-2 Menu Composition of the Simulation 31
Figure 5-3 Simulation Tool Bar 31
Figure 5-4 Basic Setting (Mode, Range, and Repeat) 32
Figure 5-5 Confirmation Dialog for Clearing the Setting 32
Figure 5-6 Basic Setting (Trigger Setting) 32
Figure 5-7 Parameter Setting 33
Figure 5-8 Setting of Start Phase and Stop Phase 33
Figure 5-9 Graph 34
Figure 5-10 Operation Bar of the Simulation 34
Figure 6-1 Sequence Window 39
Figure 6-2 Menu Composition of Sequence 40
Figure 6-3 Sequence Tool Bar 41
Figure 6-4 Basic Setting (Output Mode and Output Range) 41

Figure 6-5 Confirmation Dialog for Clearing the Setting 41
Figure 6-6 Basic Setting (Trigger Setting) 42
Figure 6-7 Step Arrangement Buttons 42
Figure 6-8 Confirmation Dialog for Deleting a Step 42
Figure 6-9 Error Dialog for Copying Data 44
Figure 6-10 Enabling or Disabling Start Phase and Stop Phase 45
Figure 6-11 Set Behavior Type 46
Figure 6-12 Operation Bar of Sequence 47
Figure 7-1 Measurements Logging Window 52
Figure 7-2 Menu Composition of the Measurements Logging 53
Figure 7-3 Measurements Logging Tool Bar 53
Figure 7-4 Logging Setting Dialog 54
Figure 8-1 Created Arbitrary Waveforms Examples 58
Figure 8-2 The Confirmation Dialog When Finishing Editing Arbitrary Waveforms 59
Figure 8-3 The Arbitrary Waveform Editing Window 60
Figure 8-4 Menu Composition of the Arbitrary Waveform Editing Window 61
Figure 8-5 Tool Bar in the Arbitrary Waveform Editing Window 62
Figure 8-6 Transitions for Control Panels 62
Figure 8-7 Operations with the Clip Board 66
Figure 8-8 Editing a New Arbitrary Waveform 70
Figure 8-9 When "Waveform Function" is Selected 73
Figure 8-10 Interpolate 80
Figure 8-11 Operation 85
Figure 8-12 Compression/Expansion 88
Figure 8-13 Memory Transfer/Memory Clear Dialog 93
Figure 9-1 System Setting Dialog Window 95

■List of Tables

Page

Table 2-1 System Requirements 5
Table 3-1 Communication Type 16
Table 4-1 Status Display List 27
Table 8-1 Waveform Selection 71
Table 8-2 Parameters of the Standard Waveform 72
Table 8-3 Embedded Constant 74
Table 8-4 Operators 75
Table 8-5 Embedded Function 75
Table 8-6 Example of User-defined Unit of Horizontal Axis 92

1. Outline

1.1 Overview ……2
1.2 Software Configuration ……3
1.3 Communication with DP power source at Software Startup ……3
1.4 Conventions Used in This Manual ……3

1.1 Overview

Control Software for DP series Type L is a program to support the Remote control, Arbitrary waveform creation, Sequence, and Simulation functions of Programmable AC Power Source DP series Type L(hereinafter abbreviated as "DP power source"). This software works on Windows (7 or 8.1 or 10) running on a personal computer (PC), and can transfer the output control data, arbitrary waveform data, sequence data, and simulation data to the DP power source through USB or LAN, or perform various functions on the DP power source.

The major functions of this software are listed below. For detailed operations of the Sequence and Simulation functions, refer to the instruction manual of DP power source.

■ Basic operation function

- Remote control
- Status monitor
- Measurements Logging

■ Arbitrary waveform function

- Creating, editing, and saving the Arbitrary waveform data
- Transferring the Arbitrary waveform data to the DP power source
- Exporting the file for DP power source

■ Sequence function

- Creating, editing, and saving the Sequence data
- Transferring the Sequence data to the DP power source
- Execution control of Sequence function on the DP power source
- Monitor display during Sequence execution
- Exporting the file for DP power source

■ Simulation function

- Creating, editing, and saving the Simulation data
- Transferring the Simulation data to the DP power source
- Execution control of Simulation function on the DP power source
- Monitor display during Simulation function execution
- Exporting the file for DP power source

1.2 Software Configuration

This software consists of three major functions displayed on the same screen, and two tools.

■ Major functions
- Basic controller
- Sequence function
- Simulation function

■ Tool functions
- Arbitrary waveform creation function
- Logging function

1.3 Communication with DP power source at Software Startup

This software checks the communication connection with the DP power source when it is started.
When the communication connection with the DP power source is established, the software retrieves the parameter settings of Basic controller from the DP power source, and displays them on the PC screen.
If the communication connection with the DP power source cannot be established, the software starts as it is, and the default settings of the software are used for the parameters of Basic controller. This software can create the setting data of each function without connecting to the DP power source.
If the system setting of this software contains different model name and phase configuration from those of the connected DP power source, unexpected behavior may result. Make sure that the model name and phase configuration defined in the system setting of the software match with those of the DP power source that is connected.

1.4 Conventions Used in This Manual

This manual uses the following conventions to describe the functions of this software.
- Menu names displayed on the screen, and user-input text: block letters enclosed by [ ].
  Example: [Wave], [s=2*pi;]
- Button names displayed on the screen, and keys that user should press: block letters enclosed by [ ].
  Example: [Cancel], [OK], [Alt]
- String that represents each function or item of this software: block letters enclosed by " ".
  Example: "Basic controller", "Arbitrary waveform editing tool", "DP power source setting file"
- Press one key while holding down another key: Two keys are connected by "+".
  Example: [Ctrl] + [O]
- Press one key, release it and press another key: Two keys are connected by ", ".
  Example: [Alt], [F]

2. Installation

2.1 System Requirements ·····5
2.2 Installation Procedure·····6

2.1 System Requirements

Make sure that your system satisfies the requirements described in Table 2-1, before installing this software.

Table 2-1 System Requirements

Item	Description
OS	Windows 7 (32-bit/64-bit) / 8.1 (32-bit/64-bit) / 10 (32-bit/64-bit) English
Display	1024 x 768 pixel or higher, 256 colors or more
Free hard disk drive space	64 MB or more
Disk drive	CD-ROM drive
Communication interface	USB / LAN
Software component	Microsoft .NET Framework 4.0 VISA environment See “2.2.1 Installation of Driver Software”

---- Notes ----------

- This software might not operate properly depending on the conditions of your operating system.
- A CD-ROM drive is required only when installing this software.

■ About software component

In most cases, .NET Framework 4.0 component is already installed in Windows 7/8.1/10.

When this software is installed, this software checks whether .NET Framework 4.0 is installed in your computer, and if it is not, it displays a message prompting to install the component. If the computer is connected to Internet, the software automatically downloads .NET Framework 4.0 and installs it.

2.2 Installation Procedure

To install/uninstall this software, log on to Windows with Administrator permissions.
To establish the communication connection between this software and the DP power source, the USB driver software or the VISA environment must be installed.

2.2.1 Installation of Driver Software

If the VISA environment is set up in your computer, the USB driver software is already installed. If the VISA environment is not set up, follow the procedure described in 2.2.1 a) to install both the USBTMC driver software we are providing. VISA (Virtual Instrument Software Architecture) is a standard recommended by the IVI Foundation to promote the standardization of instrument software architecture.

---- Notes ----------

- NFUSBTMC Driver can work only on our USBTMC products, including DP series. It is not compatible with the VISA environment. If you want to communicate with other VISA-compatible USBTMC instruments, use the VISA environment.
- NFUSBTMC Driver can be used only in Windows 7. It can not be used with Windows 8.1/10.

---

a) Installation of USBTMC Driver Software

This section describes how to install "NFUSBTMC Driver", the USBTMC driver software we are providing.
If NFUSBTMC Driver is installed, it can co-exist with the VISA environment, but VISA cannot be used to communicate with our NFUSBTMC products, including DP series.
If you want to use a VISA-compatible USBTMC driver software to communicate with our NFUSBTMC products, uninstall NFUSBTMC Driver.

■ Installation procedure

1. Insert the CD-ROM into the CD-ROM drive of your computer.
2. Execute one of the following files in the CD-ROM depending on the version of Windows you are running. The installer starts up.
   32-bit version: English\Application\Driver\x86\setup.exe
   64-bit version: English\Application\Driver\x64\setup.exe
3. Follow the instructions to click the Next button to install the driver. A warning dialog is displayed by Windows security. When it appears, select install to continue the installation.
4. Connect the DP power source to the personal computer with a USB cable, and turn the DP power source on. If the communication interface setting of the DP power source is set to other than USB, set it to USB in advance. Windows will automatically recognize the DP power source, and the USB driver will be set up.

■ Uninstallation procedure

In Windows, select [Control Panel], and then [Programs and Features]. From the list of currently installed programs, select "NFUSBTMC Driver" and delete it.

b) When using the VISA environment

If the VISA environment is set up in your computer, you can use this software in the VISA environment. This software is confirmed to work on NI-VISA Version 16.0 provided by National Instruments Corporation. Please be aware that we do not provide support for problems that occur in the VISA environment provided by other vendor products.

If you want to use this software in the NI-VISA environment, you must obtain the license yourself from National Instruments Corporation. For details of NI-VISA, contact National Instruments Corporation or visit the National Instruments Website.

c) About using LAN interface

To use LAN interface, set up the VISA environment.

About VISA environment, see "b) When using the VISA environment".

2.2.2 Installation of Control Software for DP series Type L

■ Installation procedure

1. Insert the CD-ROM into the CD-ROM drive of your computer.
2. Execute English\Application\Setup\setup.exe in CD-ROM. The installer starts up.
3. Follow the instructions shown in the dialog box to click the Next and install the software.
4. When the installation is finished, remove the CD-ROM from the CD-ROM drive.

After installation, you can perform this software (☞3.1).

■ Uninstallation procedure

In Windows, select [Control Panel], and then [Programs and Features]. From the list of currently installed programs, select "Control Software for DP series Type L" and delete it.

However, the folder where this software is installed is not removed. The folder still contains the operation setting file of this software, and deleting this folder and its files after uninstallation does not cause any problem.

3. Control Software Operation

3.1 Start and Exit ····· 9
3.2 Communication with DP power source ····· 10
3.3 Composition of Main Window ····· 11
3.4 Function Switching and Function Display Section ····· 11
3.5 Common Display Section ····· 12
3.6 System ····· 13
3.7 Error Message ····· 17

3.1 Start and Exit

This section explains how to start and exit the software.

3.1.1 Start

Following two methods are available. The desktop shortcut is automatically created when the software is installed.

- Double-click the shortcut icon on the desktop (Figure 3-1).
- From the Start menu, select [Start] - [All Programs] - [NF] - [Control Software for DP series Type L].

Figure 3-1 Shortcut Icon on Desktop

3.1.2 Exit

Following three methods are available. When you perform the exit operation, the dialog opens as shown in Figure 3-2. To exit, select Yes. To cancel exiting, select No.

- Click the ✕ button in the upper right corner of the window.
- With the window selected, press Alt + F4 on the keyboard.
- From the Menu Bar, select [File] - [Exit].

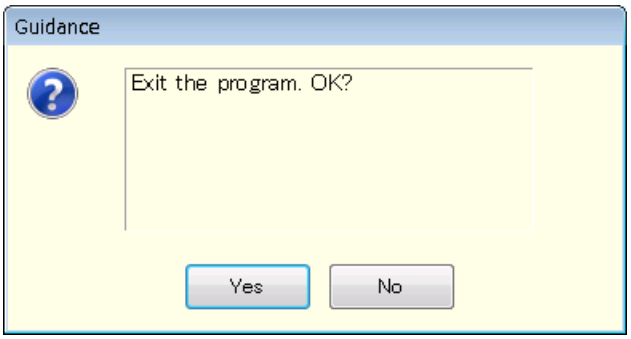

Figure 3-2 Exit Confirmation Dialog

3.2 Communication with DP power source

This software can set and control the DP power source connected via USB or LAN, by communicating with it. To distinguish from the state in which the computer and DP power source are just connected physically using a USB cable or a LAN cable, "communication online state" is used to describe that the communication is established between the software and a DP power source. The state in which the communication is not established between them is called "communication offline state".

■ Start in the communication offline state

When the software is started, it attempts to communicate with the DP power source. If the communication cannot be established, it starts in the communication offline state. In this case, a dialog opens as shown in Figure 3-3.

In the communication offline state, the DP power source cannot be controlled from the computer. The setting data and sequence data can still be created and saved to file. However, even when the software is used in the communication offline state, the system setting should be adjusted in advance for the DP power source to which this is to be connected (☞3.6).

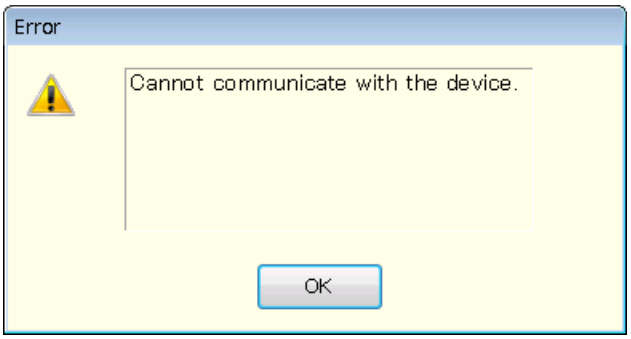

Figure 3-3 Dialog that Opens when the Software was Started in Communication Offline State

3.3 Composition of Main Window

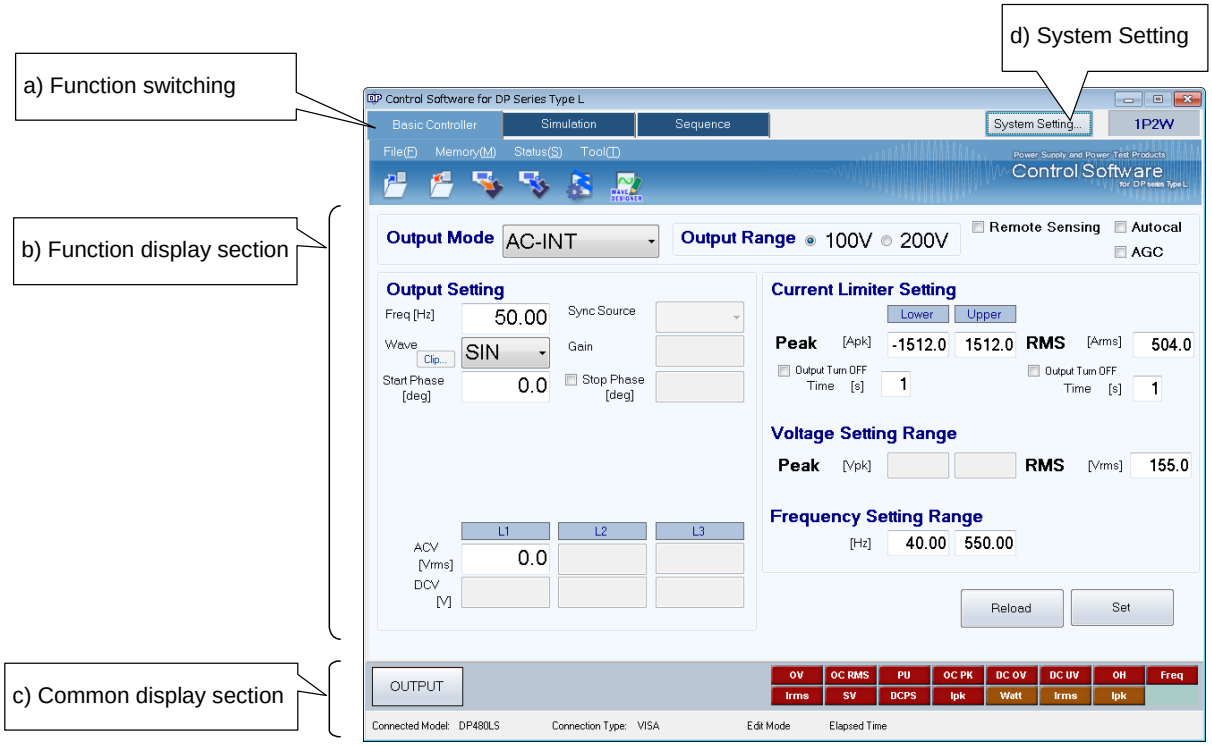

Figure 3-4 Composition of Main Window

a)	Function switching	☞3.4
b)	Function display section	☞3.4
c)	Common display section	☞3.5
d)	System Setting	☞3.6

3.4 Function Switching and Function Display Section

With this software, you can use three types of functions by switching among them.
When you click a function switching tab, items corresponding to that function are displayed in the function display section.

- Basic controller (☞4)
- Simulation (☞5)
- Sequence (☞6)

3.5 Common Display Section

The common display section is shown commonly to all functions.

3.5.1 Operation Bar

The Operation Bar has the output ON/OFF switching button and other buttons for various function operations.

Figure 3-5 Operation Bar

3.5.2 Status Monitor

The status monitor indicates the status of the currently connected DP power source.

Figure 3-6 Status monitor

3.5.3 Status Bar

The status bar indicates the states of the DP power source connection and the software.

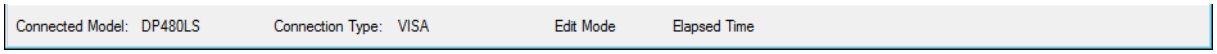

Figure 3-7 Status Bar

- Connected Model

  Shows the model name of the DP power source set in the System Settings.
- Connection Type

  Shows the connection mode with the DP power source set in the System Settings.
- Edit Mode/Control Mode

  Shows the execution mode for the sequence or simulation (☞5.4.5, 6.4.7).
- Elapsed Time

  Shows the time elapsed after the sequence or simulation was started.

3.6 System Setting

When you first use this software, system setting is needed. Click the System Setting button in the upper right corner of the window to open the System Setting dialog as shown in Figure 3-8.
You can change the system setting whenever the software is up and running. However, changing the system setting clears parameters and other settings that are being edited.

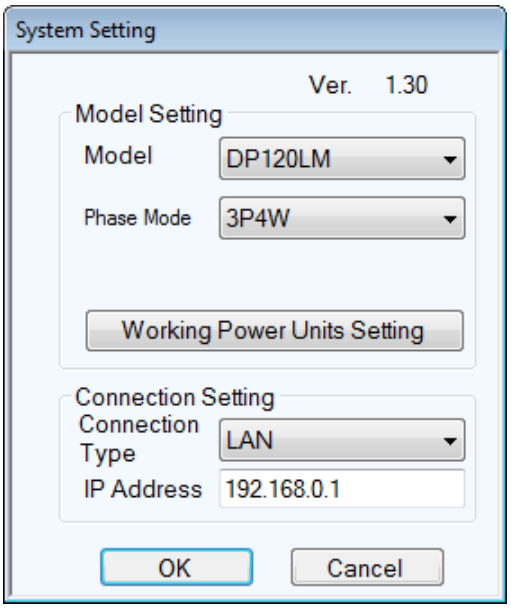

Figure 3-8 System Setting Dialog

3.6.1 Model Setting

Set the model, phase mode, and working power unit configurations of the DP power source to connect. These configurations you have set are shown in the upper frame of the main window. The range of parameters you can set in the function display section is changed based on the phase mode and working power unit configurations specified here.

a) Working Power Units Setting

You can confirm and set the power units' working condition of the DP power source to connect on this dialog. This dialog shows currently working power units with a check.

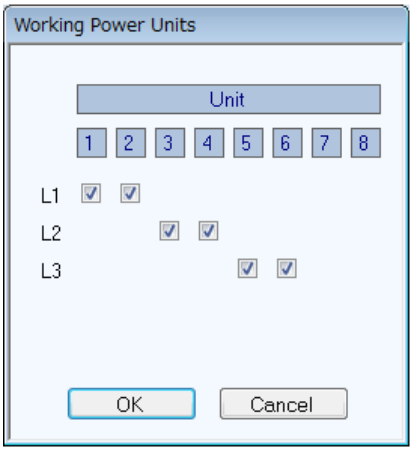

Figure 3-9 Working Power Units Dialog (DP120LM 3P4W mode)

When opening the dialog, control software confirms the error of power units. If some errors have occurred, the check boxes corresponding to the error units are shown in red background.

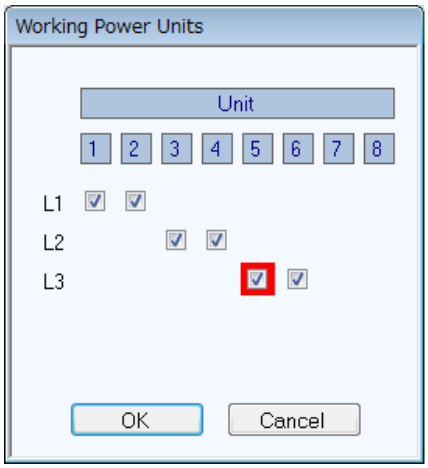

Figure 3-10 Working Power Units Dialog (Power unit error)

In the following cases, uncheck the check box of the power units to be stopped, and click OK button. It takes about 13 seconds to set.

- Operate the DP power source with only normal power units.
- Reduce the number of the working power units for the purpouse of reducing power consumption.

Notes

- If the phase mode is 2P3W or 3P4W, it is necessary to make the same number of operating power units of each phase.
- If you change the number of active power units, the upper and lower value of the current limiter setting will change corresponding to that.(☞ 4.2.6)

Notes

- If you push OK button on power unit errors, this software checks the error status of power units after setting.
- If there is some errors, this dialog does not close and show the status. This dialog will close when you push the button after removing the factor of errors. And the error status of the DP power source will be cleared when the dialog close.

3.6.2 Connection Setting

a) Connection Type

Specify the type of communication with the DP power source to connect. Select the driver software to use (VISA, NFUSBTMC or LAN). The set communication type is shown in the status bar (☞3.5.3).

Table 3-1 Communication Type

Communication Type	Interface	Driver Software (☞2.2.1)
VISA	USB interface	VISA
NFUSBTMC	USB interface	NFUSBTMC
LAN	LAN interface	VISA

b) IP address setting

Set the IP address when the connection type is LAN. The input value is shown at “Remote Setting Window” of the DP power source.(About “Remote Setting Window”, see the instruction manual (remote control) of the DP power source.)

---- Notes ----------

- When the DP power source connects to the network with a DHCP server and LAN connectivity often interrupts, use the fixed IP address. About using the fixed IP address, see the instruction manual (remote control) of the DP power source.

3.7 Error Message

You might see some error message in the dialog while using the software. In that case, handle the error according to the instruction described in the message.

4. Basic Controller

4.1 Name of Each Component in the Window ····· 19
4.2 Operations on Each Section ····· 20
4.3 DP power source Setting File ····· 25
4.4 Memory ····· 26
4.5 Status ····· 27
4.6 Logging ····· 28
4.7 Arbitrary Waveform Editing ····· 28
4.8 Restrictions in the Communication Offline State ····· 28

4.1 Name of Each Component in the Window

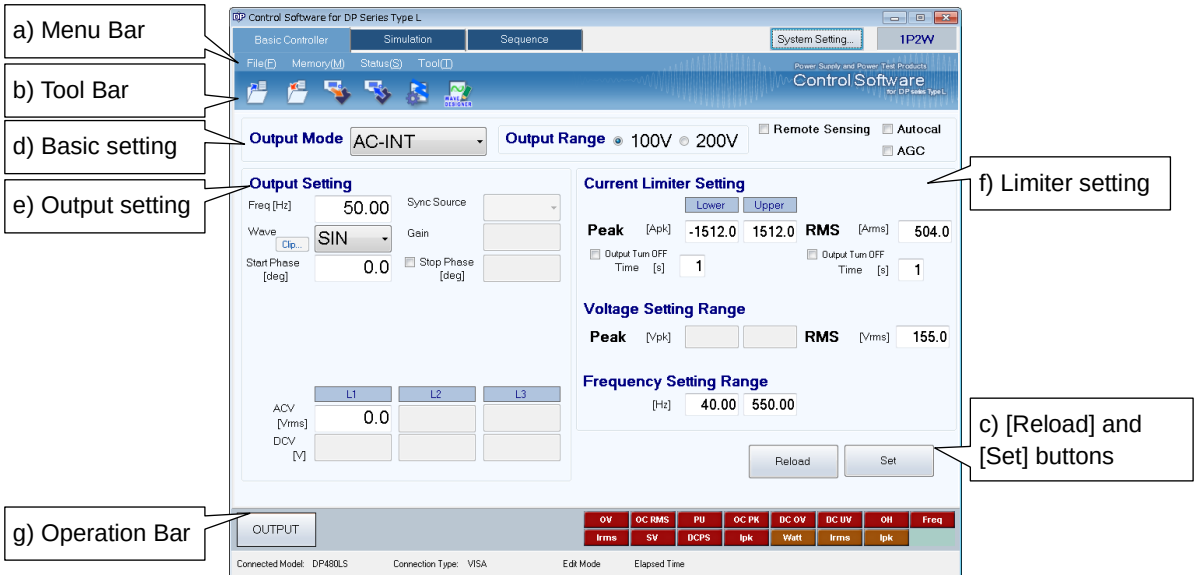

Figure 4-1 Basic Controller Window

a)	Menu Bar	☞4.2.1
b)	Tool Bar	☞4.2.2
c)	[Reload] and [Set] buttons	☞4.2.3
d)	Basic setting	☞4.2.4
e)	Output setting	☞4.2.5
f)	Limiter setting	☞4.2.6
g)	Operation Bar	☞4.2.7

4.2 Operations on Each Section

This section explains how to operate each section assuming that the operation is performed in the communication online state. In the communication offline state, some functions are restricted because the DP power source status cannot be obtained (☞ 4.8).
Based on the DP power source status, you may encounter an error message when setting an item. In that case, handle the error according to the message content.

4.2.1 Menu Bar

The menu composition of [Basic Controller] is shown in Figure 4-2.

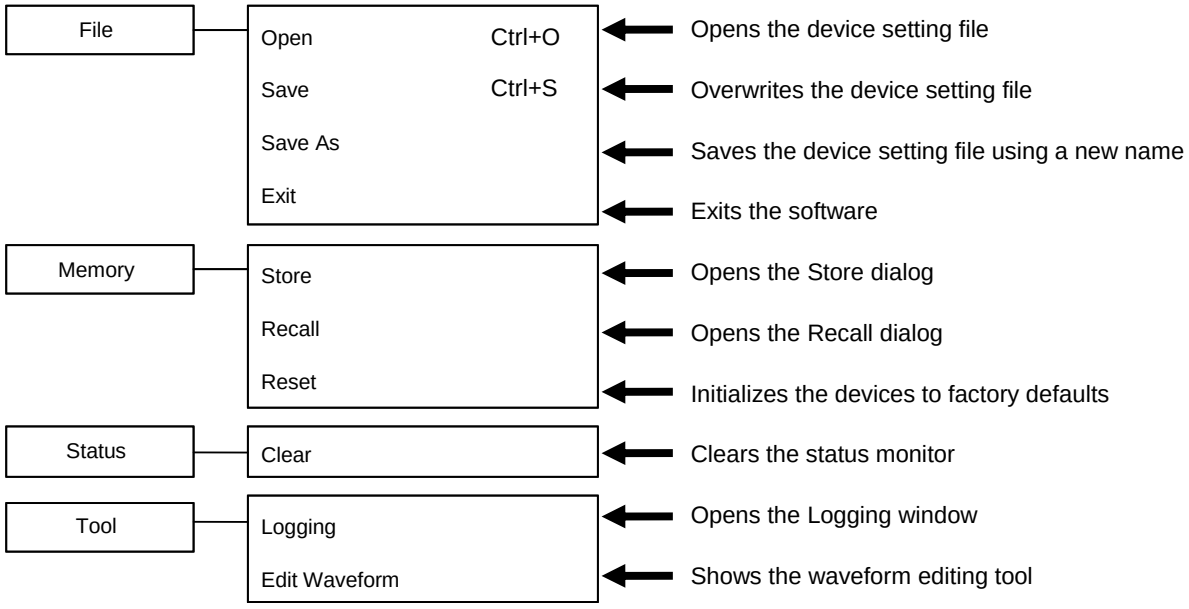

Figure 4-2 Menu Composition of Basic Controller

4.2.2 Tool Bar

On the [Basic Controller] Tool Bar, you just click each icon shown in Figure 4-3 to execute the corresponding function.

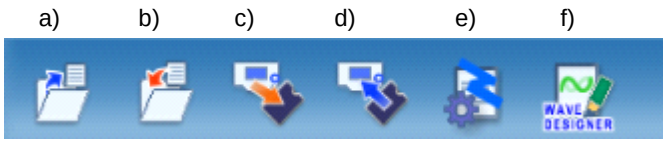

Figure 4-3 Basic Controller Tool Bar

a)	Open	Opens the DP power source setting file.
b)	Save	Overwrites and saves the DP power source setting file.
c)	Store	Opens the Store window.
d)	Recall	Opens the Recall window.
e)	Logging	Opens the Logging window.
f)	Arbitrary Waveform Editing	Shows the Arbitrary waveform editing screen.

4.2.3 Reload and Set Buttons

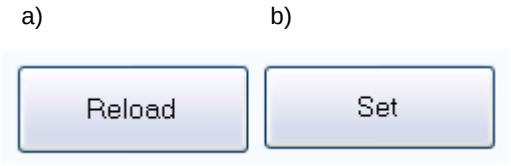

Figure 4-4 Reload and Set Buttons

a) [Reload] button — Obtains the basic, output, and limiter settings from the connected DP power source, and updates the setting values for the windows of the software.

b) [Set] button — Sets the basic, output, and limiter settings entered in the windows of the software to the connected DP power source.

4.2.4 Basic Setting

Figure 4-5 Basic Setting

a) Output mode — Click ▼, and select from the output mode list that opens.

b) Output range — Click the radio button to switch the selection.

c) Remote Sensing/Autocal/AGC — Select the check box to enable each function.

When the output mode or output range setting is changed, the confirmation dialog opens as shown in Figure 4-6. In the communication online state, if Yes is selected, the software asks the DP power source for each setting value after the change process of output mode or output range of the connected DP power source is completed, then updates the setting values displayed in the window. In the communication offline state, each setting value is cleared to the default value held by the software. When you select No, the change to the output mode or output range is canceled.

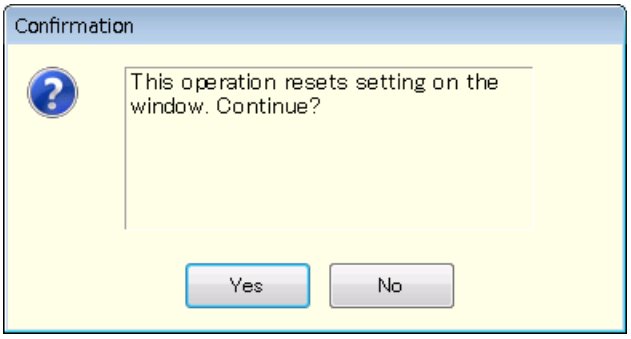

Figure 4-6 Confirmation Dialog for Clearing the Setting

When you change the output mode or output range setting, it may take some time until the setting is switched depending on the settings of the connected DP power source.

4.2.5 Output Setting

Set the output-related items. A grayed item is not available in this output mode.

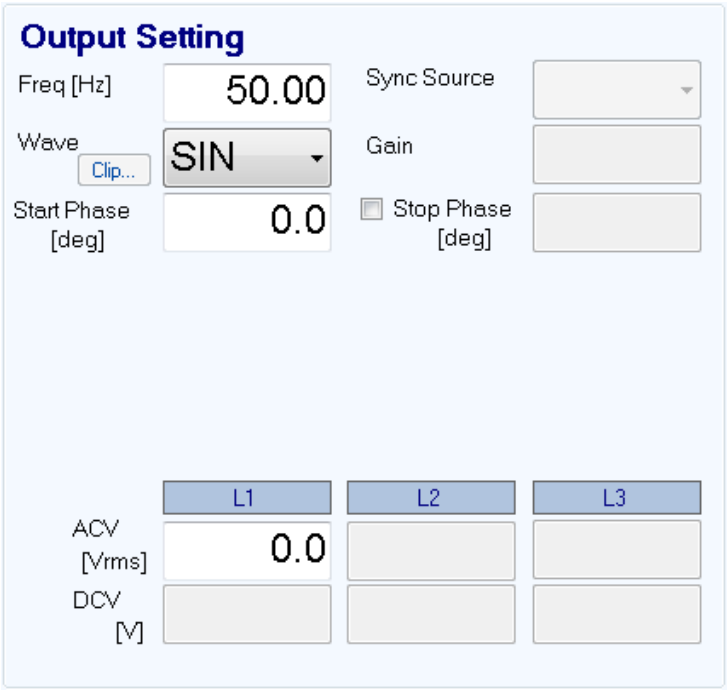

Figure 4-7 Output Setting

In a numerical entry box, if the entered value is out of the setting range, the error dialog opens as shown in Figure 4-8. Enter a value within the setting range shown in the dialog. For details of the setting range, see the instruction manual of the DP power source.

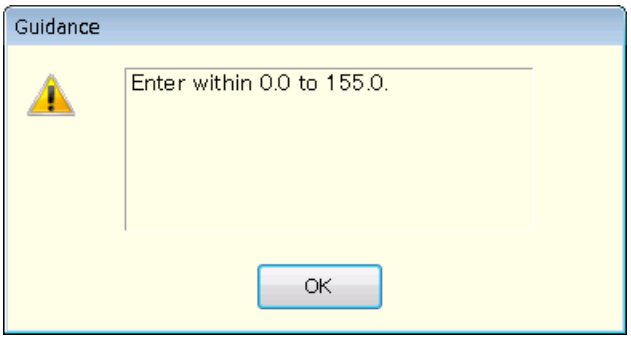

Figure 4-8 Example of Setting Range Error Dialog

4.2.6 Limiter Setting

In the limiter setting, you set the current limiters and the restriction on the setting ranges. The default limiter values held by this software are determined by the model setting in the [System Setting]. If having communicated with the DP power source, the upper and lower value of the current limiter setting changes corresponding with the number of the active power units.(☞ 3.6.1)

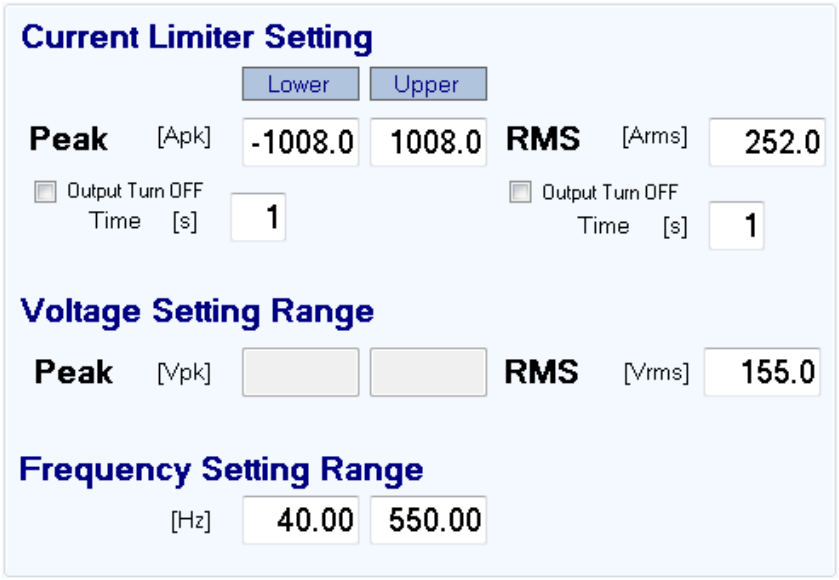

Figure 4-9 Limiter Setting

In a numerical entry box of the limiter setting, if the entered value is out of the setting range, the error dialog opens as shown in Figure 4-8. The range of limiter values held by this software is the value when the maximum number of power units are energized.

4.2.7 Operation Bar

In the Operation Bar, clicking OUTPUT toggles between output on and off of the connected DP power source. The indication of the OUTPUT button changes as shown in Figure 4-10.

OUTPUT Off OUTPUT On

Figure 4-10 The Indication of OUTPUT Button

4.3 DP power source Setting File

This software handles the following one type of file format as the Basic controller setting file.

■ DP power source setting file (extension is RMT)

This file stores the Basic controller settings except the output ON/OFF setting. This file can be read and saved by this software. It cannot be read by the DP power source.

4.3.1 Save As

Saves the DP power source setting file as a new file. The [Save As] dialog can be opened by any of the following two methods. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save As].
- On the keyboard, press Alt, F, A.

4.3.2 Save

Overwrites and saves to the existing DP power source setting file. Following four methods are available. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save].
- On the keyboard, press Alt, F, S.
- On the keyboard, press Ctrl + S.
- On the Tool Bar, click the [Save] icon (☞4.2.2).

4.3.3 File Reading

Opens the DP power source setting file. The Open File dialog can be opened by any of the following three methods.

- From the Menu Bar, select [File] - [Open].
- On the keyboard, press Alt, F, O.
- On the keyboard, press Ctrl + O.

4.4 Memory

This section explains the method to communicate with the DP power source and access or reset the basic setting memory (internal memory).

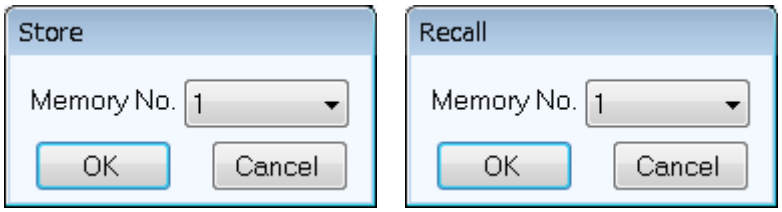

Figure 4-11 Store and Recall Dialogs

4.4.1 Store

The Store dialog can be opened by any of the following two methods. In the Store dialog, specify the internal memory number from the [Memory No.] list, and then click OK to execute the store processing on the DP power source.

- From the Menu Bar, click [Memory] - [Store].
- On the Tool Bar, click the [Store] icon (☞4.2.2).

4.4.2 Recall

The Recall dialog can be opened by any of the following two methods. In the Recall dialog, specify the memory number from the [Memory No.] list, and then click OK to execute the recall processing on the DP power source. After the DP power source finishes the recall processing, the software inquires the DP power source, and updates each setting value in the windows of the software to the recalled value.

- From the Menu Bar, click [Memory] - [Recall].
- On the Tool Bar, click the [Recall] icon (☞4.2.2).

---- **Notes** ----------

- Performing the recall operation with the output on results in an error.

4.4.3 Reset

From the Menu Bar, click [Memory] - [Reset]. The connected DP power source is reset to the factory defaults.

---- **Notes** ----------

- Performing the reset operation with the output on results in an error.

4.5 Status

4.5.1 Status Monitor

The software inquires the connected DP power source for the statuses with the interval of about two seconds, and refreshes the display of the status monitor while the output of the DP power source is on. Table 4-1 shows the list of statuses to be monitored.

After the DP power source status inquiry, the applicable status (i.e., the status is ON) illuminates in red or orange. Figure 4-12 shows the example of status display.

When a red status is ON, the protection function is activated on the DP power source main unit, causing an error. Under this situation, if you try to change the output setting (☞ 4.2.5) or limiter setting (☞ 4.2.6) without clearing the status (☞ 4.5.2), an error occurs.

Table 4-1 Status Display List

Notation	Description	Display color when it is ON
OV	Output overvoltage	Red
OC RMS	Output overcurrent [RMS]	
PU	Power unit internal anomaly	
OC PK	Output overcurrent [peak]	
DC OV	Power unit DC power supply overvoltage	
DC UV	Power unit DC power supply undervoltage	
OH	Overheat	
Freq	Synchronization frequency anomaly	
Irms	Output OFF after RMS current limiter is activated	
SV	Sensing voltage anomaly	
DCPS	Power unit DC power supply anomaly	
Ipk	Output OFF after peak current limiter is activated	
Watt	Wattage limiter is operating	Orange
Irms	RMS current limiter is operating	
Ipk	Peak current limiter is operating	

OUTPUT Off OUTPUT On

Figure 4-12 Status Display Example (Sensing Voltage Anomaly)

4.5.2 Clear

From the Menu Bar, click [Status] - [Clear]. This makes the status monitor display to go off in the windows of the software and clears the DP power source error (equivalent to pressing the ENTER key for an error message window).

4.6 Logging

- Open the [Logging] window (☞ 7). Following two methods are available.
- From the Menu Bar, click [Tool] - [Logging].
- On the Tool Bar, click the [Logging] icon (☞ 4.2.2).

4.7 Arbitrary Waveform Editing

Show the Arbitrary waveform editing tool (☞ 8). Following two methods are available.

- From the Menu Bar, click [Tool] - [Edit Waveform].
- On the Tool Bar, click the [Arbitrary Waveform Editing] icon (☞ 4.2.2).

4.8 Restrictions in the Communication Offline State

In the Basic controller, when you perform an operation that needs communication (e.g., clicking Set, Reload, or OUTPUT), communication with the connected DP power source is attempted. When the communication is established, the software inquires the DP power source about the settings, and updates each setting values in the window.

In the communication offline state, each setting value cannot be obtained from the DP power source. So, when an operation requiring the communication like shown above was performed, each setting value in the window is populated with the default value held by the software.

5. Simulation

5.1 Name of Each Component in the Window····· 30
5.2 Operations on Each Section ····· 31
5.3 Simulation Setting File····· 35
5.4 Control ····· 37

5.1 Name of Each Component in the Window

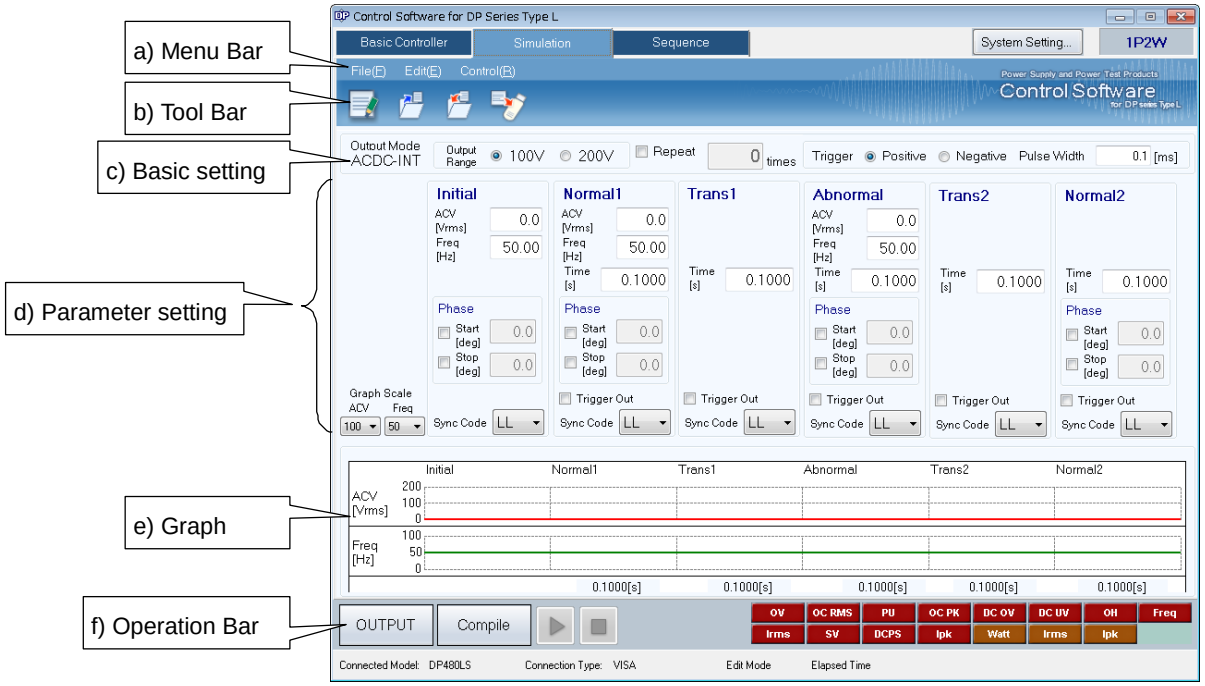

Figure 5-1 Simulation Window

a)	Menu Bar	☞5.2.1
b)	Tool Bar	☞5.2.2
c)	Basic setting	☞5.2.3
d)	Parameter setting	☞5.2.4
e)	Graph	☞5.2.5
f)	Operation Bar	☞5.2.6

5.2 Operations on Each Section

This section explains how to operate each section assuming that the operation is performed in the communication online state. In the communication offline state, some functions are restricted because the DP power source status cannot be obtained (☞ 4.8).
Based on the DP power source status, you may encounter an error message when setting an item. In that case, handle the error according to the message content.

5.2.1 Menu Bar

The menu composition of [Simulation] is shown in Figure 5-2.

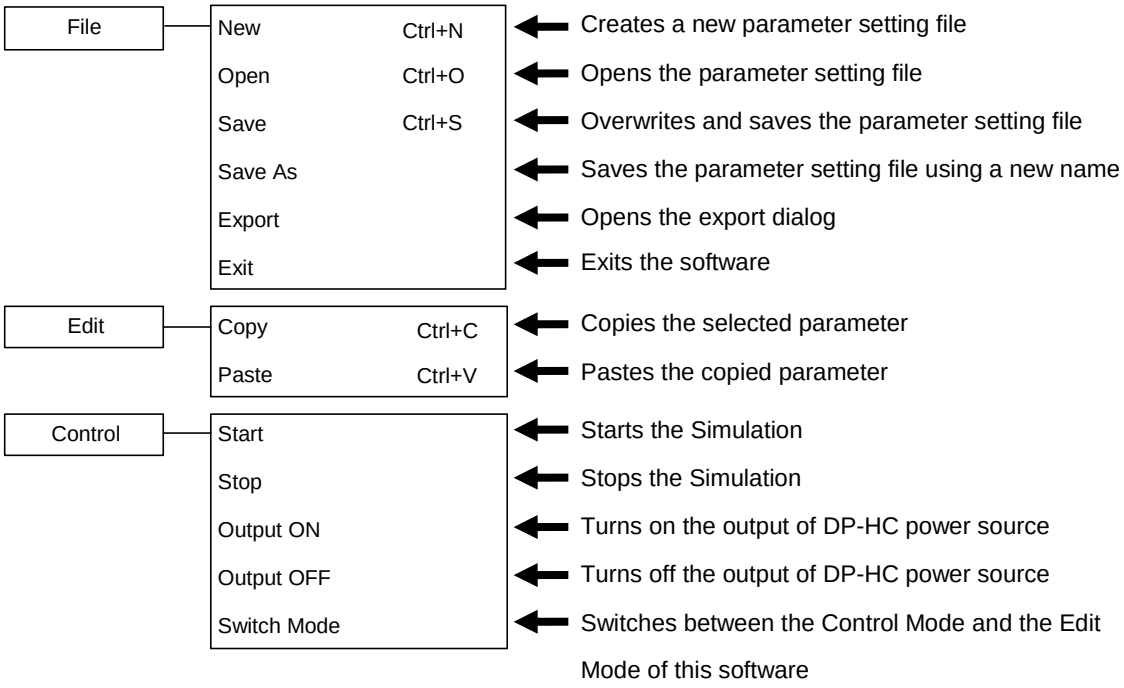

Figure 5-2 Menu Composition of the Simulation

5.2.2 Tool Bar

On the Simulation Tool Bar, you just click each icon shown in Figure 5-3 to execute the corresponding function.

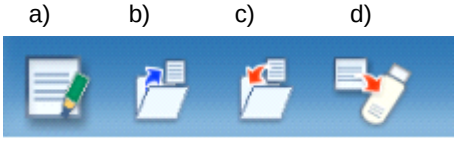

Figure 5-3 Simulation Tool Bar

a) New Creates a new simulation setting.
b) Open Opens the simulation setting file.
c) Save Overwrites and saves the simulation setting file.
d) Export Writes a simulation data file for the USB memory to the USB memory.

5.2.3 Basic Setting

■ Output mode and Output range

Figure 5-4 Basic Setting (Mode, Range, and Repeat)

In a simulation, the output mode is always fixed as "ACDC-INT" and cannot be changed.

The output range setting can be changed using the radio button. Switch the radio button to display the dialog shown in Figure 5-5. Select Yes to clear each of the current setting values (reset to the default values). The cleared setting cannot be undone. If you want to save the current setting before clearing it, select No to cancel the change of the output range and then save the setting to a file (☞5.3).

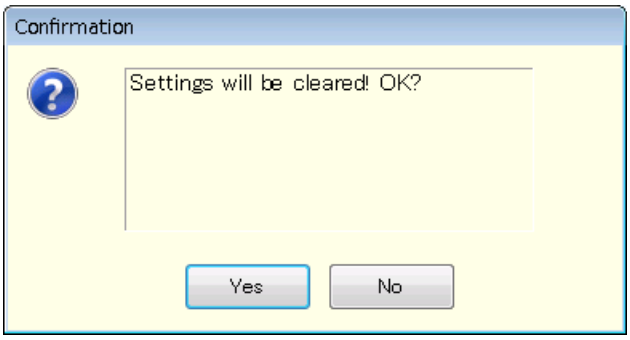

Figure 5-5 Confirmation Dialog for Clearing the Setting

■ Repeat

To enable the repeat of the simulation, select the check box and enter a repeat count. When you enter the repeat count, the software checks if the entered value is within the range. If the entered value is out of the range, the error dialog appears. Enter a value according to the dialog.

■ Trigger setting

Figure 5-6 Basic Setting (Trigger Setting)

Select a polarity from [Positive] or [Negative] and then enter a pulse width. When you enter the pulse width, the software checks if the entered value is within the range. If the entered value is out of the range, the error dialog appears. Enter a value according to the dialog.

5.2.4 Parameter Setting

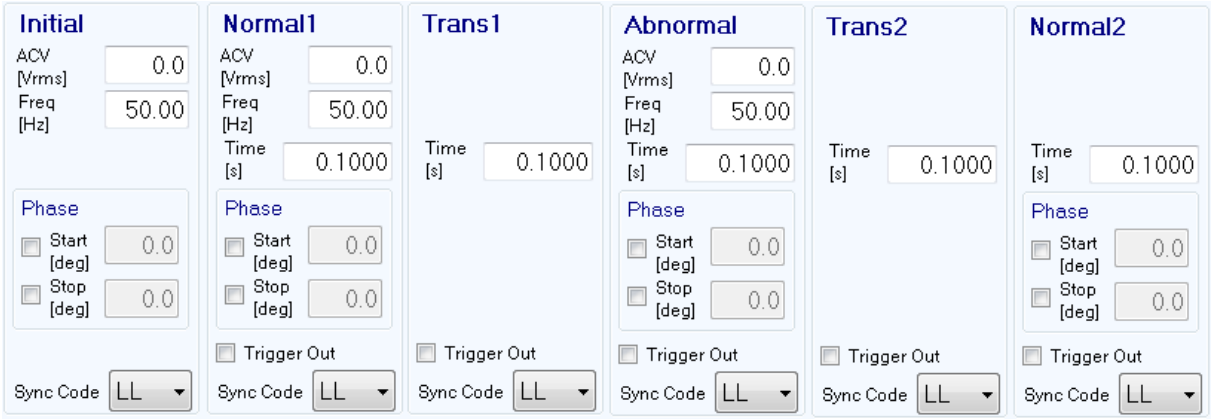

Figure 5-7 Parameter Setting

For a numerical entry box, the error dialog opens if the entered value is out of the setting range. Enter a value according to the dialog.

To enable the Start Phase or Stop Phase, select the [Start] or [Exit] check box in the [Phase] box and then enter a value as shown in Figure 5-8.

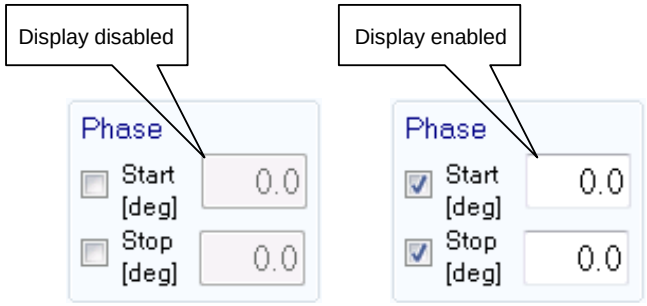

Figure 5-8 Setting of Start Phase and Stop Phase

To enable the trigger output, select the [Trigger Out] check box.

Select a combination of High and Low from the [Sync Code] combo box, which consists of 2 bits.

5.2.5 Graph

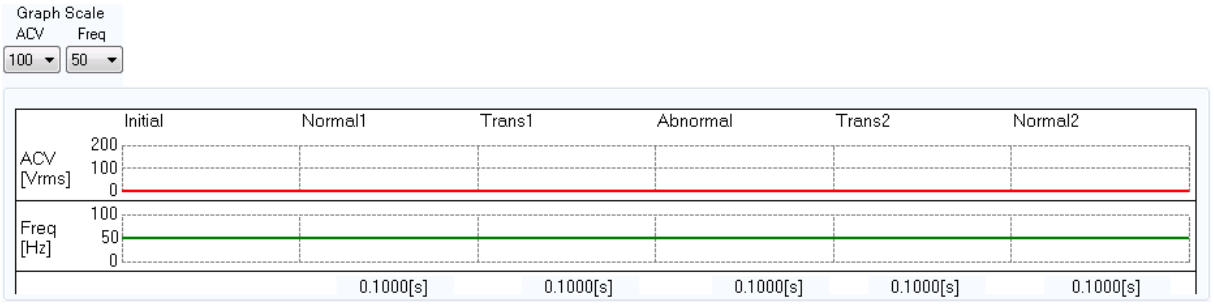

Figure 5-9 Graph

In the graph area, the setting value and variation of the AC voltage (ACV) and the frequency (Freq) are displayed as a graph. Select an appropriate scale from the [Graph Scale] drop-down list, depending on the setting values. A step time is displayed at the bottom of the graph.

5.2.6 Operation Bar

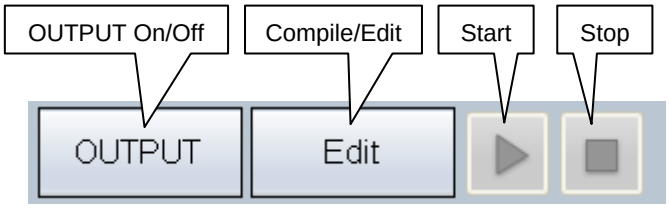

Figure 5-10 Operation Bar of the Simulation

In the Operation Bar of the simulation, you can operate Compile, Start, and Stop of the simulation in addition to switching the output on and off.

5.3 Simulation Setting File

There are the following two types of file format for the simulation data used by this software:

■ Simulation setting file (extension is .sid)

This file can be read and saved by this software. It cannot be read by the DP power source.

■ Simulation data file for the USB memory (extension is .sim)

It can be written (exported) by this software. After writing it to the dedicated folder for the USB memory, it can be read by the panel operation on the DP power source. It cannot be read by this software.

5.3.1 Save As

Saves the simulation setting file as a new file. The [Save As] dialog can be opened by any of the following two methods. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save As].
- On the keyboard, press Alt, F, A.

5.3.2 Save

Overwrites and saves to the existing simulation setting file. Following four methods are available. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save].
- On the keyboard, press Alt, F, S.
- On the keyboard, press Ctrl + S.
- On the Tool Bar, click the [Save] icon (☞ 5.2.2).

5.3.3 File Reading

Opens the simulation setting file. The Open File dialog can be opened by any of the following three methods.

- From the Menu Bar, select [File] - [Open].
- On the keyboard, press Alt, F, O.
- On the keyboard, press Ctrl + O.

5.3.4 Write to USB Memory (Export)

Writes a simulation data file for the USB memory. In this software, a data file is written to the appropriate level under the dedicated folder (NF_TOOL) to allow the DP power source to read it by simply specifying a USB memory drive. If the dedicated folder (NF_TOOL) does not exist in the USB memory, it is automatically created by this software upon writing a data file.

■ Operation procedure

1. From the Menu Bar, select [File] - [Export]. The [Export] dialog appears.

2. In [USB Memory Drive], specify the drive to which the USB memory is connected.
3. In [File Name], specify the file name to be saved.
4. Select OK.

Notes

- A data file in the USB memory cannot be read from the DP power source whose configuration of model and phase is different from that of the system setting of this software that has been selected upon writing to the USB memory.

5.4 Control

This section describes how to control a start, stop, etc. of the simulation.

5.4.1 Start

Enabled only in the execution mode and with the output on. Following three methods are available.

- From the Menu Bar, select [Control] - [Start].
- On the keyboard, press Alt, R, S.
- In the Operation Bar, click [Start] button(☞5.2.6).

5.4.2 Stop

Following three methods are available.

- From the Menu Bar, select [Control] - [Stop].
- On the keyboard, press Alt, R, E.
- In the Operation Bar, click [Stop] button (☞5.2.6).

5.4.3 Output On

It is enabled only in the execution mode. Following three methods are available.

- From the Menu Bar, select [Control] - [Output ON].
- On the keyboard, press Alt, R, N.
- In the Operation Bar, click OUTPUT (☞5.2.6).

5.4.4 Output Off

Following three methods are available.

- From the Menu Bar, select [Control] - [Output OFF].
- On the keyboard, press Alt, R, F.
- In the Operation Bar, click OUTPUT (☞5.2.6).

5.4.5 Switch Execution Mode

Switches between the Edit mode and Execution mode. Switching the Edit mode to the Execution mode corresponds to the compile on the panel operation of the DP power source. Following two methods are available.

- From the Menu Bar, select [Control] - [Switch Mode].
- In the Operation Bar, click Compile/Edit (☞5.2.6).

6. Sequence

6.1 Name of Each Component in the Window ····· 39
6.2 Operations on Each Section ····· 40
6.3 Sequence Setting File ····· 48
6.4 Control ····· 49

6.1 Name of Each Component in the Window

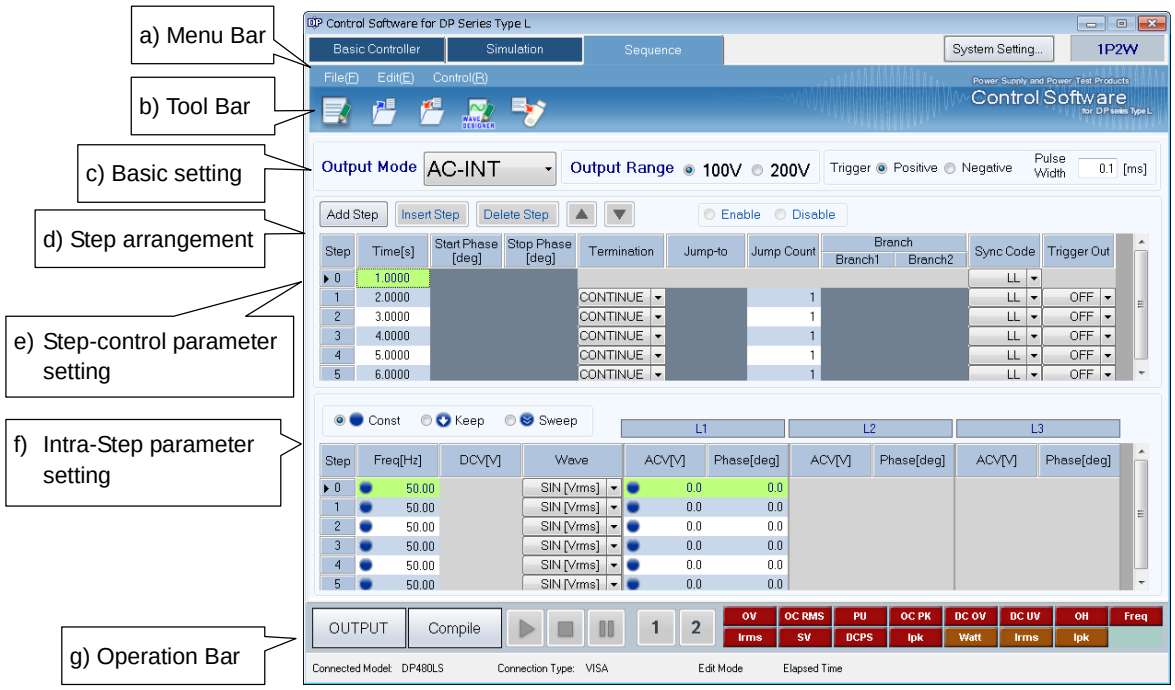

Figure 6-1 Sequence Window

a)	Menu Bar	☞6.2.1
b)	Tool Bar	☞6.2.2
c)	Basic setting	☞6.2.3
d)	Step arrangement	☞6.2.4
e)	Step-control parameter setting	☞6.2.5
f)	Intra-Step parameter setting	☞6.2.6
g)	Operation Bar	☞6.2.7

6.2 Operations on Each Section

6.2.1 Menu Bar

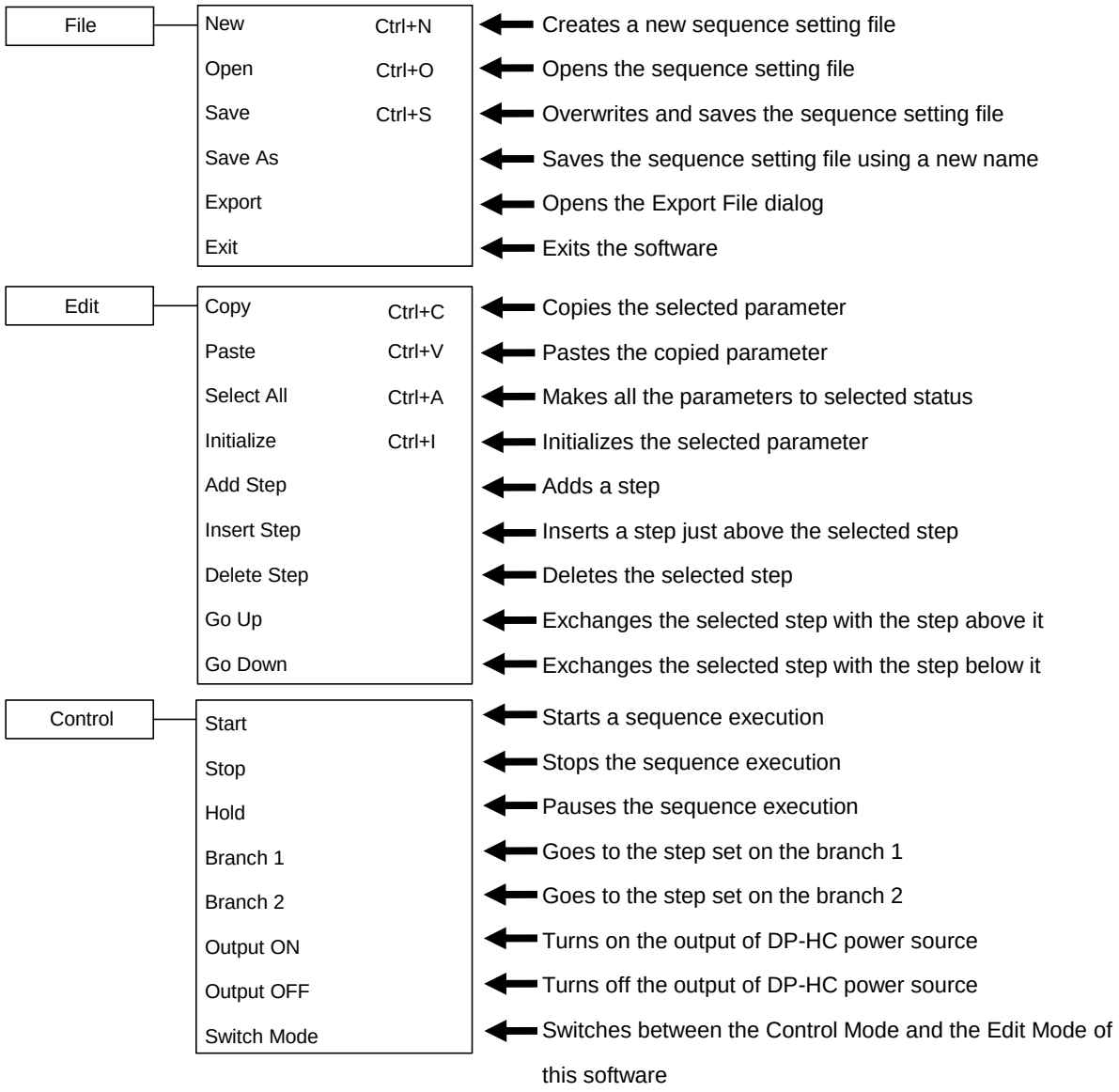

Figure 6-2 Menu Composition of Sequence

6.2.2 Tool Bar

On the Sequence Tool Bar, you just click each icon shown in Figure 6-3 to execute the corresponding function.

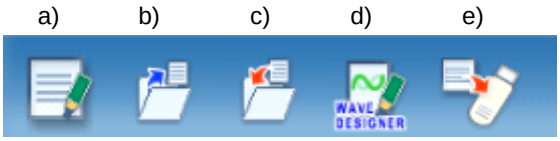

Figure 6-3 Sequence Tool Bar

a)	New	Creates a new sequence setting.
b)	Open	Opens the sequence setting file.
c)	Save	Overwrites and saves the sequence setting file.
d)	Arbitrary Waveform Editing	Shows the Arbitrary waveform editing tool.
e)	Export	Writes a sequence data file for the USB memory to the USB memory.

6.2.3 Basic Setting

■ Output mode and Output range

Figure 6-4 Basic Setting (Output Mode and Output Range)

When the output mode or output range is changed, the dialog opens as shown in Figure 6-5. Select Yes to clear each of the current setting values (reset to the default values). The cleared setting cannot be undone. If you want to save the current setting before clearing it, select No to cancel the change and then save the setting to a file (☞ 6.3).

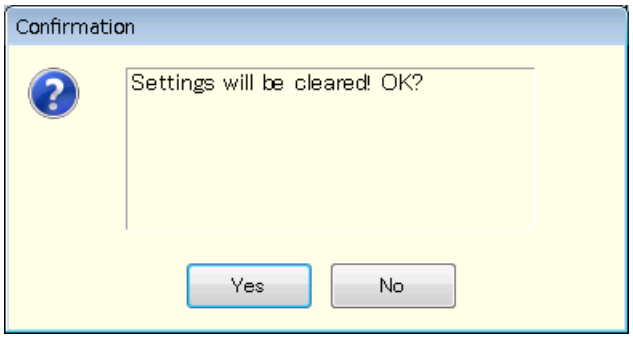

Figure 6-5 Confirmation Dialog for Clearing the Setting

When you change the output mode or output range setting, it may take some time until the setting is switched depending on the settings of the DP power source.

■ Trigger setting

Figure 6-6 Basic Setting (Trigger Setting)

Select a polarity from [Positive] or [Negative] and then enter a pulse width. When you enter the pulse width, the software checks if the entered value is within the range. If the entered value is out of the range, the error dialog appears. Enter a value according to the dialog.

6.2.4 Step Arrangement

This section describes how to add, insert, delete, move, and copy a step (line).

Figure 6-7 Step Arrangement Buttons

---- **Notes** ----------

- When the step number is changed for a step that is set as a jump-to step or branch step, the step number is automatically changed on the calling side of the jump or branching also, preserving the dependency between steps.
- When a step that is set as the destination of any jump-to step or branch step is deleted, the dialog as shown in エラー! 参照元が見つかりません。 appears. When you select Yes, the step is deleted and then the step number of the jump-to or branch step is automatically updated to the step number 0. If you select No, deletion of the step is canceled.

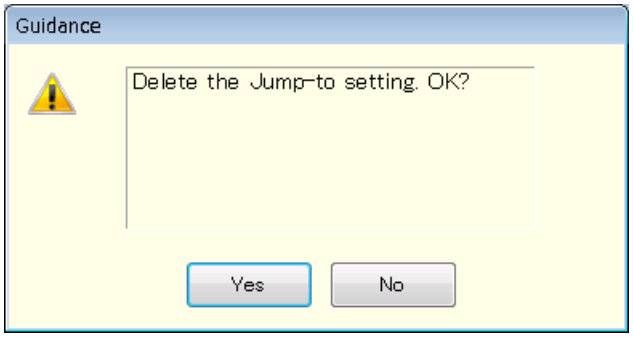

Figure 6-8 Confirmation Dialog for Deleting a Step

■ Add Step

Adds a new step after the last step (line). Following three methods are available.

- From the Menu Bar, select [Edit] - [Add Step].
- On the keyboard, press Alt, E, S.
- Click [Add Step] button of the step arrangement.

■ Insert Step

Adds a new step just above the current cursor step (line). Following three methods are available.

- From the Menu Bar, select [Edit] - [Insert Step].
- On the keyboard, press Alt, E, I.
- Click [Insert Step] button of the step arrangement.

■ Delete Step

Deletes the current cursor step (line). Following three methods are available.

- From the Menu Bar, select [Edit] - [Delete Step].
- On the keyboard, press Alt, E, E.
- Click [Delete Step] button of the step arrangement.

■ Go Up

Exchanges the current cursor step (line) with the step above it. Following three methods are available.

- From the Menu Bar, select [Edit] - [Go Up].
- On the keyboard, press Alt, E, U.
- Click [▲] button of the step arrangement.

■ Go Down

Exchanges the current cursor step (line) with the step below it. Following three methods are available.

- From the Menu Bar, select [Edit] - [Go Down].
- On the keyboard, press Alt, E, D.
- Click [▼] button of the step arrangement.

■ Copy

Copies the setting data in the selected line range or cell range to the Clip Board. Following three methods are available.

- From the Menu Bar, select [Edit] - [Copy].
- On the keyboard, press Alt, E, C.
- On the keyboard, press Ctrl + C.

■ Paste

Pastes the setting data on the clip board to the selected line range or cell range. Following three methods are available.

- From the Menu Bar, select [Edit] - [Paste].
- On the keyboard, press Alt, E, P.
- On the keyboard, press Ctrl + V.

---- **Notes** ----------

- Row numbers and column items should be matched between the destination data range to be pasted and the source data range that was copied to the clip board. If the data ranges do not match, the error dialog shown in エラー! 参照元が見つかりません。 appears.

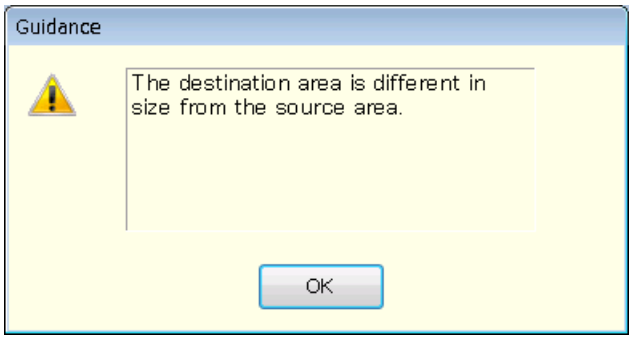

Figure 6-9 Error Dialog for Copying Data

6.2.5 Step-control Parameter Setting

■ Enter a setting value

Select a cell and then enter a value. If the entered value is out of the setting range, the error dialog appears. Enter a value according to the dialog.

Select [Termination], [Sync Code], or [Trigger Out] from the combo box opened by clicking a cell.

■ Entry of start phase and stop phase

When a cell of [Start Phase] or [Stop Phase] is selected, enable and disable radio buttons become enabled. If you select the [Enable] radio button, you can set a phase as shown in Figure 6-10.

■ Clear setting values

Restores a setting value to the default value. Following two methods are available.

- From the Menu Bar, select [Edit] - [Initialize].
- On the keyboard, press Ctrl + I.

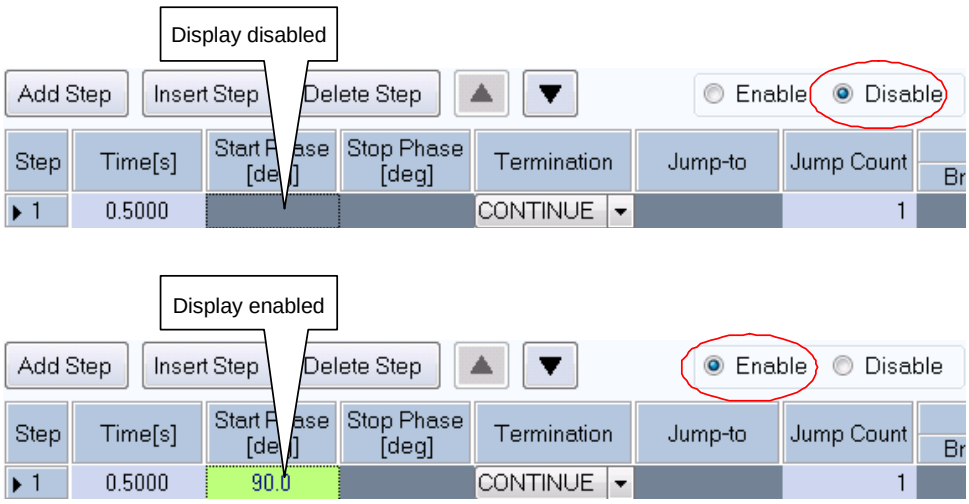

Figure 6-10 Enabling or Disabling Start Phase and Stop Phase

6.2.6 Intra-Step Parameter Setting

■ Enter a setting value

Select a cell and then enter a value. If the entered value is out of the setting range, the error dialog appears. Enter a value according to the dialog.

■ Enter behavior type

When a cell of the setting value in which you can set a behavior type is selected, radio buttons for the behavior type (Const, Keep, and Sweep) are enabled. A behavior type can be set by selecting the radio buttons (Figure 6-11). In the cell, the icon corresponding to the setting behavior type is displayed.

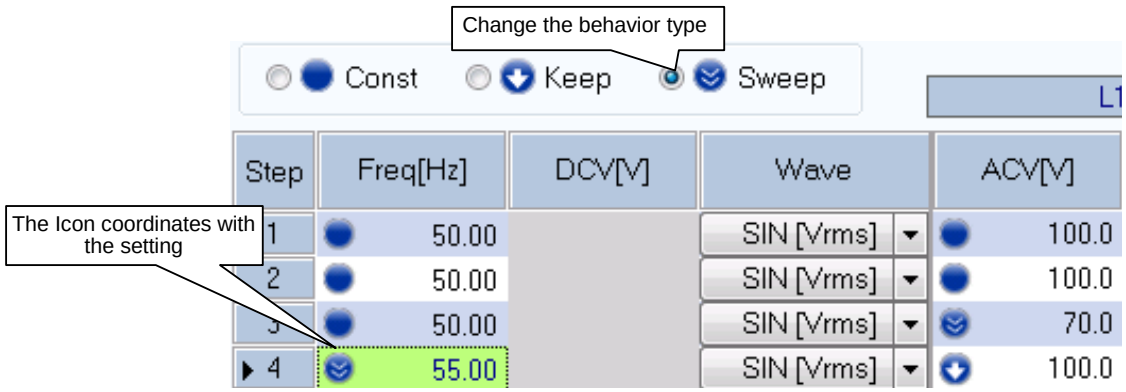

Figure 6-11 Set Behavior Type

6.2.7 Operation Bar

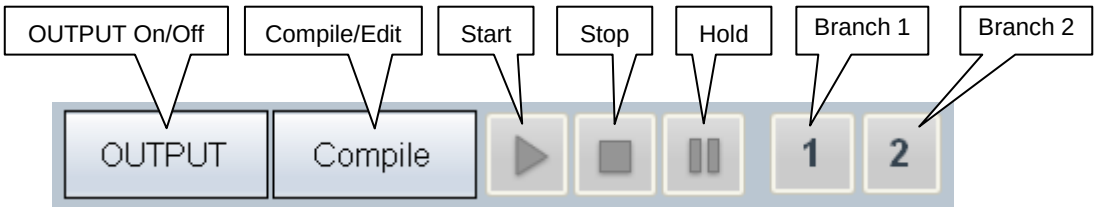

Figure 6-12 Operation Bar of Sequence

In the Operation Bar of the sequence, you can perform Compile, Start, Stop, Hold, Branch 1, and Branch 2 of the sequence in addition to switching the on/off of the output.

6.3 Sequence Setting File

There are the following two types of file format for the sequence data used by this software:

- Sequence setting file (extension is .sqd)
  This file can be read and saved by this software. It cannot be read by the DP power source.

- Sequence data file for the USB memory (extension is .seq)
  It can be written (exported) by this software. After writing it to the dedicated folder for the USB memory, it can be read by the panel operation on the DP power source. It cannot be read by this software.

6.3.1 Save As

Saves the sequence setting file as a new file. The [Save As] dialog can be opened by any of the following two methods. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save As].
- On the keyboard, press Alt, F, A.

6.3.2 Save

Overwrites and saves to the existing sequence setting file. Following four methods are available. For newly created data, the Save operation works as "Save As."

- From the Menu Bar, select [File] - [Save].
- On the keyboard, press Alt, F, S.
- On the keyboard, press Ctrl + S.
- On the Tool Bar, click the [Save] icon (☞ 6.2.2).

6.3.3 File Reading

Opens the sequence setting file. The Open File dialog can be opened by any of the following three methods.

- From the Menu Bar, select [File] - [Open].
- On the keyboard, press Alt, F, O.
- On the keyboard, press Ctrl + O.

6.3.4 Write to USB Memory (Export)

Writes a sequence data file for the USB memory. In this software, a data file is written to the appropriate level under the dedicated folder (NF_TOOL) to allow the DP power source to read it by simply specifying a USB memory drive. If the dedicated folder (NF_TOOL) does not exist in the USB memory, it is automatically created by this software upon writing a data file.

■ Operation procedure

1. From the Menu Bar, select [File] - [Export]. The [Export] dialog appears.
2. In [USB Memory Drive], specify the drive to which the USB memory is connected.
3. In [File Name], specify the file name to be saved.
4. Select OK.

---- **Notes** ----------

- A data file in the USB memory cannot be read from the DP power source whose configuration of model and phase is different from that of the system setting of this software that has been selected upon writing to the USB memory.

6.4 Control

This section describes how to control a start, stop, etc. of the sequence.

6.4.1 Start

Enabled only in the execution mode and with the output on. Following three methods are available.

- From the Menu Bar, select [Control] - [Start].
- On the keyboard, press Alt, R, S.
- In the Operation Bar, click [Start] button (☞6.2.7).

6.4.2 Stop

Following three methods are available.

- From the Menu Bar, select [Control] - [Stop].
- On the keyboard, press Alt, R, E.
- In the Operation Bar, click [Stop] button (☞6.2.7).

6.4.3 Hold

Following three methods are available.

- From the Menu Bar, select [Control] - [Hold].
- On the keyboard, press Alt, R, H.
- In the Operation Bar, click [Hold] button (☞6.2.7).

6.4.4 Branch

Describes the branch 1. The branch 2 is similar to the branch 1. Following two methods are available.

- From the Menu Bar, select [Control] - [Branch 1].
- In the Operation Bar, click [Branch 1] button (☞6.2.7).

6.4.5 Output On

It is enabled only in the execution mode. Following three methods are available.

- From the Menu Bar, select [Control] - [Output ON].
- On the keyboard, press Alt, R, N.
- In the Operation Bar, click OUTPUT (☞ 6.2.7).

6.4.6 Output Off

Following three methods are available.

- From the Menu Bar, select [Control] - [Output OFF].
- On the keyboard, press Alt, R, F.
- In the Operation Bar, click OUTPUT (☞ 6.2.7).

6.4.7 Switch Execution Mode

Switches between the Edit mode and Execution mode. Switching the Edit mode to the Execution mode corresponds to the compile on the panel operation of the DP power source. Following two methods are available.

- From the Menu Bar, select [Control] - [Switch Mode].
- In the Operation Bar, click Compile/Edit (☞ 5.2.6).

7.Measurements Logging

7.1 Open or Close the Measurements Logging Window 52
7.2 Name of Each Component in the Window 52
7.3 Operations on Each Section 53
7.4 Log Display Section 55
7.5 Measurements Log File 55

7.1 Open or Close the Measurements Logging Window

7.1.1 Open the Measurements Logging Window

Following two methods are available.

- In the [Basic Controller] Menu Bar, select [Tool] - [Logging].
- Click [Logging] icon (☞4.2.2) on the [Basic Controller] Tool Bar.

7.1.2 Close the Measurements Logging Window

Click the ☒ in the upper right corner of the [Logging] window.

---- Notes ----------

- Close the main window to also close the [Logging] window.

7.2 Name of Each Component in the Window

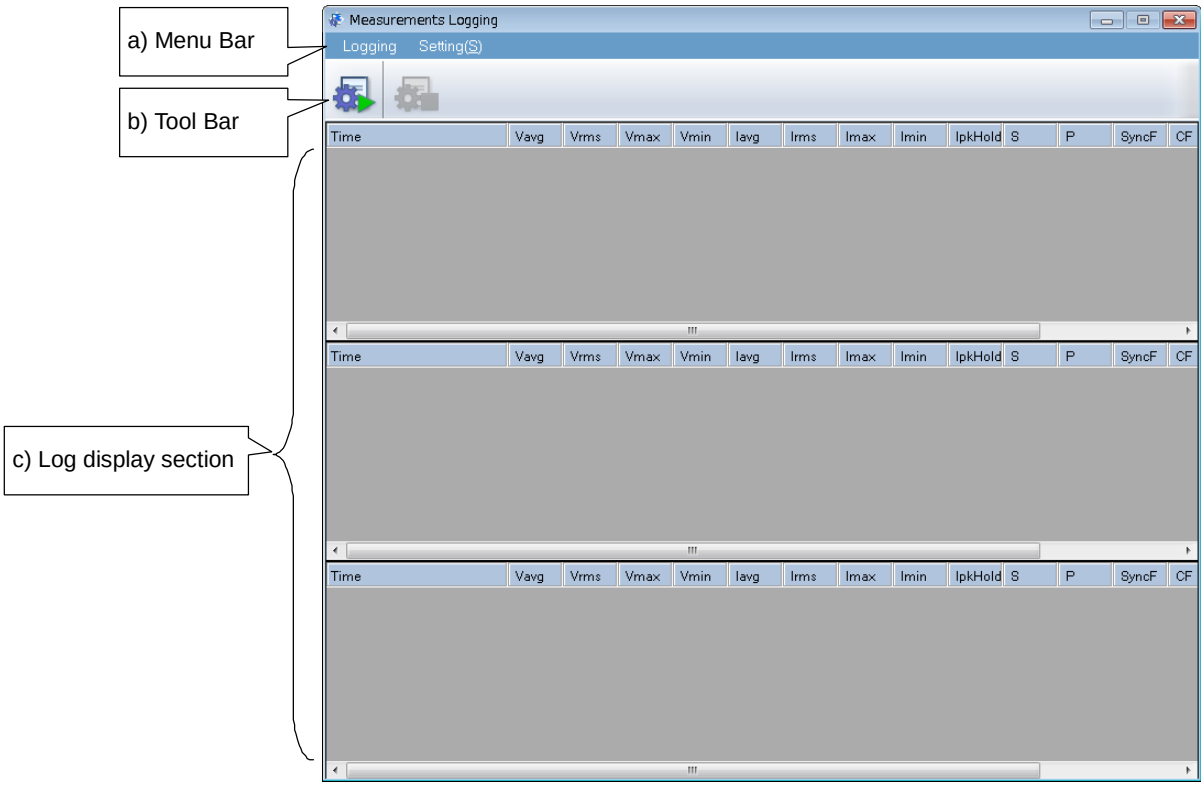

Figure 7-1 Measurements Logging Window

a) Menu Bar ☞7.3.1
b) Tool Bar ☞7.3.2
c) Log display section ☞7.4

7.3 Operations on Each Section

7.3.1 Menu Bar

The menu composition of [Measurements Logging] is shown in Figure 7-2.

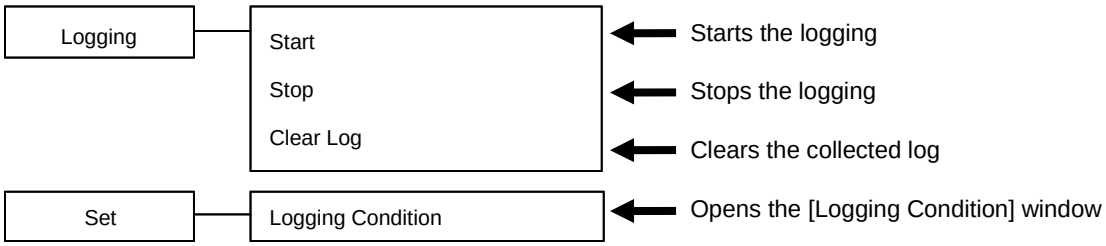

Figure 7-2 Menu Composition of the Measurements Logging

7.3.2 Tool Bar

On the [Measurements Logging] Tool Bar, you just click the icon shown in Figure 7-3 to execute the corresponding function.

Figure 7-3 Measurements Logging Tool Bar

a) Start Logging — Starts the logging.
b) Stop Logging — Stops the logging.

7.3.3 Start, Stop, and Clear

■ Start

Following two methods are available.

- From the Menu Bar, select [Logging] - [Start].
- From the Tool Bar, select [Start Logging] icon.

---- **Notes** ----------

- Collection of the line voltage measurements is not supported.
- Collection of the harmonic current measurements is not supported.

■ Stop

Following two methods are available.

- From the Menu Bar, select [Logging] - [Stop].
- From the Tool Bar, select Stop Logging icon.

■ Clear Log

From the Menu Bar, select [Logging] - [Clear Log] to clear logs in the [Measurements Logging] window. The logged data in the logging file are not cleared.

7.3.4 Logging Conditions

Sets the measurements log file and a logging interval. From the Menu Bar, select [Set] - [Logging Condition] to display the [Logging Setting] dialog.

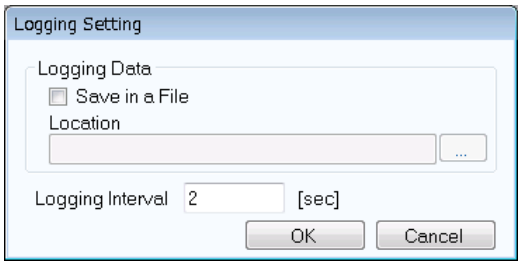

Figure 7-4 Logging Setting Dialog

■ Save in a File

When the [Save in a File] check box is selected, the measurements log file is created and saved to the folder specified in [Location] (☞7.5).

■ Location

Specifies a folder to save the measurements log file.

■ Logging Interval

Specifies the interval of measurements logging in seconds. The range of the value is between 1 to 60.

---- **Notes** ----

- The accuracy of the logging interval is not guaranteed.

7.4 Log Display Section

When the logging is started, a log for each line is created in the log display section with the specified interval. Clear Log operation (☞7.3.3) clears the logs in the log display section.

---- **Notes** ----

- Data in the log display section cannot be copied to the clip board or saved to a file. If you need to keep the log in a file, select the [Save in a File] check box in the [Logging Setting] dialog (☞7.3.4) and use the measurements log file.

7.5 Measurements Log File

When the [Save in a File] check box is selected in the [Logging Setting] dialog (☞7.3.4), starting a logging creates a measurements log file in the folder specified in [Location] and appends a log to the log file. The format of the measurements log file is described below.

■ File name

The file is created with the name of YYYYMMDD_HH_MM_SS.txt based on the time when the logging is started.

■ File format

Text file delimited by comma. The first line includes the item names and the subsequent lines represent measurements logs.

---- **Notes** ----

- Logging data displayed on a window or saved in a file is up to 3600 lines. If logging data exceeds 3600 lines, displayed data will be wrapped around and a new file will be created. Excess data will be saved in the new file.
- Logging may stop if there is not enough empty space in the hard disc.

---

8. Arbitrary Waveform Editing

8.1 Overview ····· 58
8.2 Opening/Closing the Arbitrary Waveform Editing Window ····· 59
8.3 Name of Each Component in the Window ····· 60
8.4 Operations on Each Section ····· 61
8.5 Waveform Display Section ····· 63
8.6 File Operation ····· 68
8.7 Printing Waveforms ····· 69
8.8 Editing a New Arbitrary Waveform ····· 70
8.9 Interpolate ····· 80
8.10 Operation ····· 85
8.11 Compress/Expand ····· 88
8.12 System Setting ····· 92
8.13 Memory ····· 93

8.1 Overview

This chapter uses some examples of creating arbitrary waveforms shown in the Figure 8-1 to help you understand the basic operations and functions of the "Arbitrary waveform editing tool."
We recommend you to operate the tool while reading this chapter to understand how it works more easily.

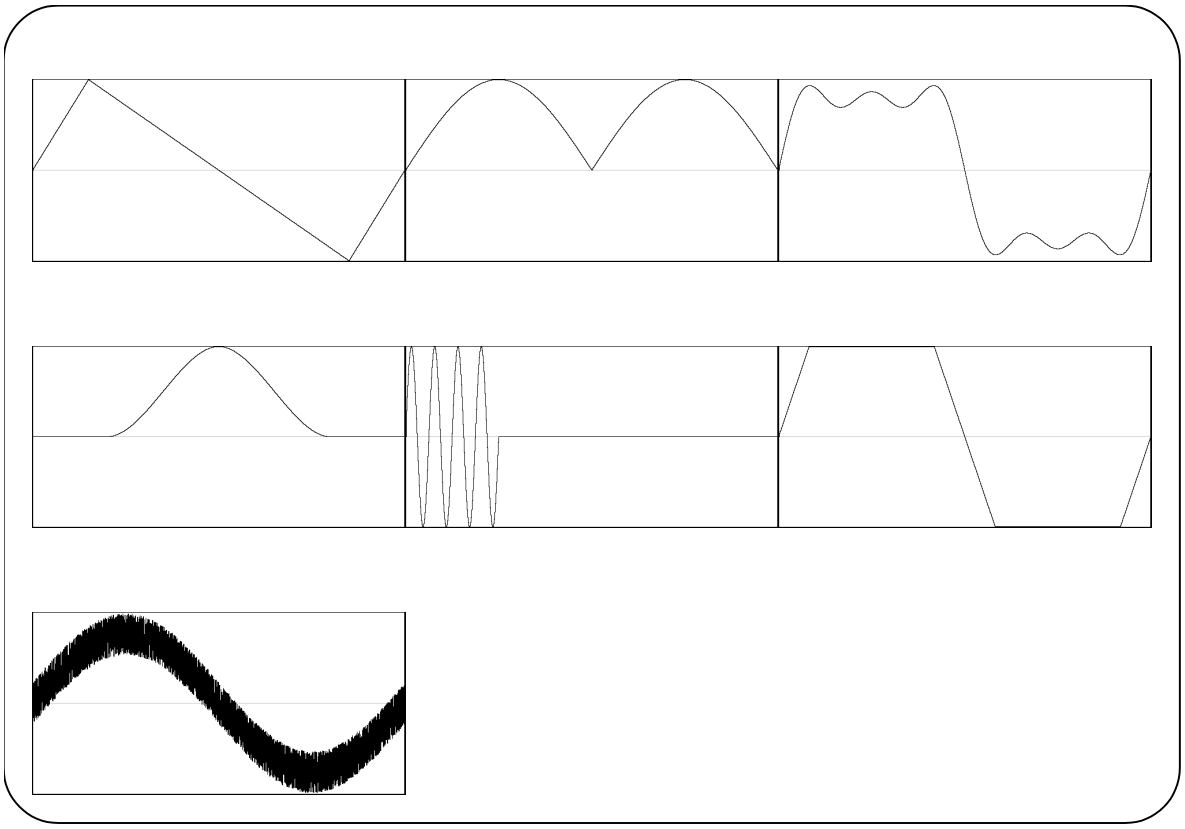

Figure 8-1 Created Arbitrary Waveforms Examples

8.2 Opening/Closing the Arbitrary Waveform Editing Window

8.2.1 Opening the Arbitrary Waveform Editing Window

Following three methods are available.

- In the [Basic Controller] Menu Bar, select [Tool] - [Edit Waveform] (☞ 4.2.1).
- Click the [Arbitrary Waveform Editing] icon (☞ 4.2.2) on the [Basic Controller] Tool Bar.
- Click the [Arbitrary Waveform Editing] icon (☞ 6.2.2) on the [Sequence] Tool Bar.

8.2.2 Closing the Arbitrary Waveform Editing Window

Finish editing arbitrary waveforms. Following two methods are available. When you perform the exit operation, the confirmation dialog opens as shown in Figure 8-2. Select [OK] to close the [Arbitrary Waveform Editing] window.

- From the Menu Bar, select [File] - [Exit].
- Click the ☒ in the upper right corner of the [Arbitrary Waveform Editing] window.

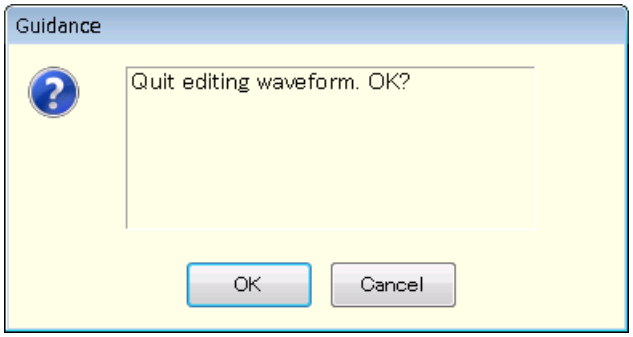

Figure 8-2 The Confirmation Dialog When Finishing Editing Arbitrary Waveforms

---- **Notes** ----------

- Close the main window to also close the [Arbitrary Waveform Editing] window.

8.3 Name of Each Component in the Window

The name of the file used to read/write the waveform data is shown in the title bar. If no file has been read/written, [<Untitled>] is shown in the bar.

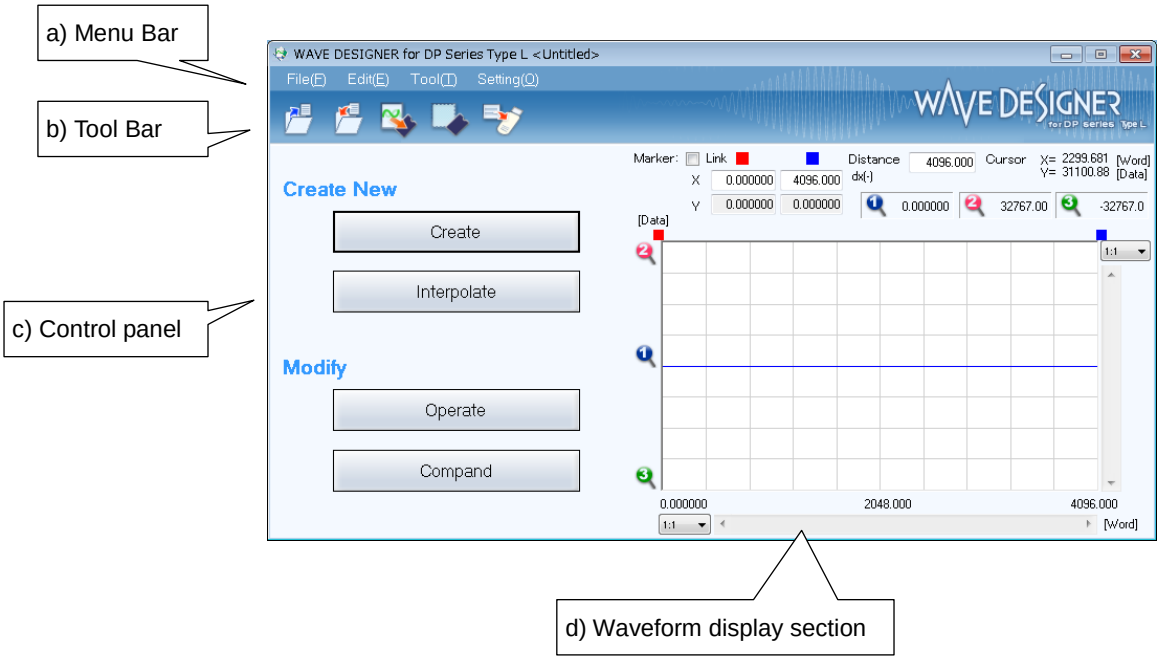

Figure 8-3 The Arbitrary Waveform Editing Window

a)	Menu Bar	☞8.4.1
b)	Tool Bar	☞8.4.2
c)	Control panel	☞8.4.3
d)	Waveform display section	☞8.4.4

8.4 Operations on Each Section

This section provides how to operate each section assuming that the operation is performed in the communication online state.

In the communication offline state, you cannot perform any action requiring communication because the communication with the DP power source is disabled.

Based on the DP power source side status, you may encounter an error message when setting an item. Handle the error according to the message content.

8.4.1 Menu Bar

The menu composition of [Arbitrary Waveform Editing] is shown in Figure 8-4.

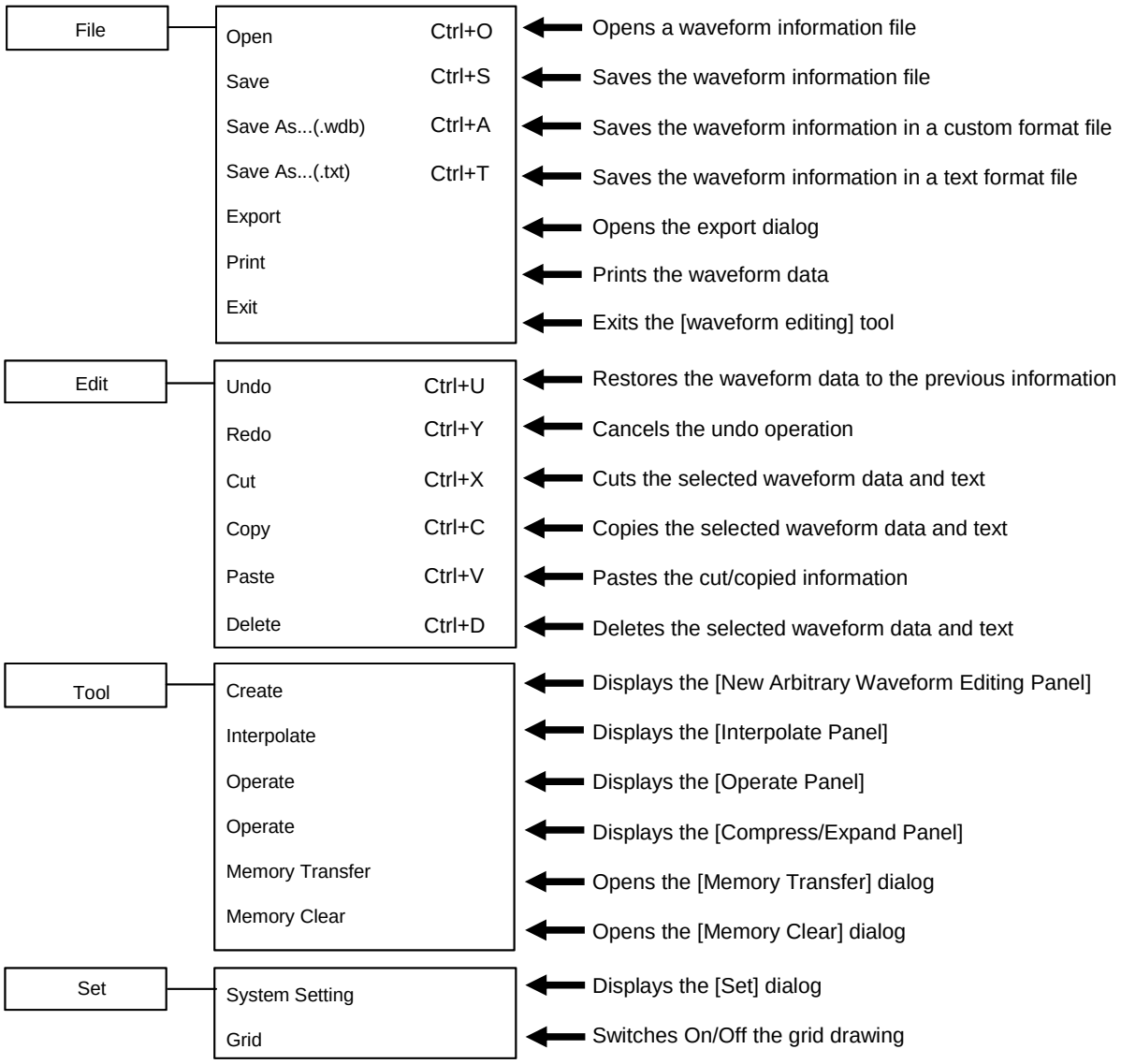

Figure 8-4 Menu Composition of the Arbitrary Waveform Editing Window

8.4.2 Tool Bar

On the [Arbitrary Waveform Editing] Tool Bar, you just click each icon shown in Figure 8-5 to execute the corresponding function.

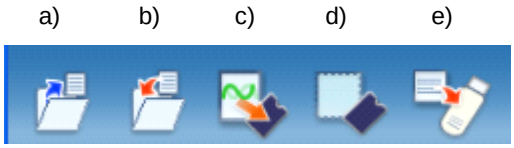

Figure 8-5 Tool Bar in the Arbitrary Waveform Editing Window

a)	Open	Opens a waveform information file.
b)	Save	Saves the waveform information file.
c)	Memory Transfer	Opens the [Memory Transfer] dialog.
d)	Memory Clear	Opens the [Memory Clear] dialog.
e)	Export	Writes a file for the DP power source to the USB memory.

8.4.3 Control Panel Section

In the Control Panel section, the control panel that is currently selected is displayed.
Immediately after the Arbitrary waveform editing tool is started or after each operation, the Select Item Panel is displayed instead.

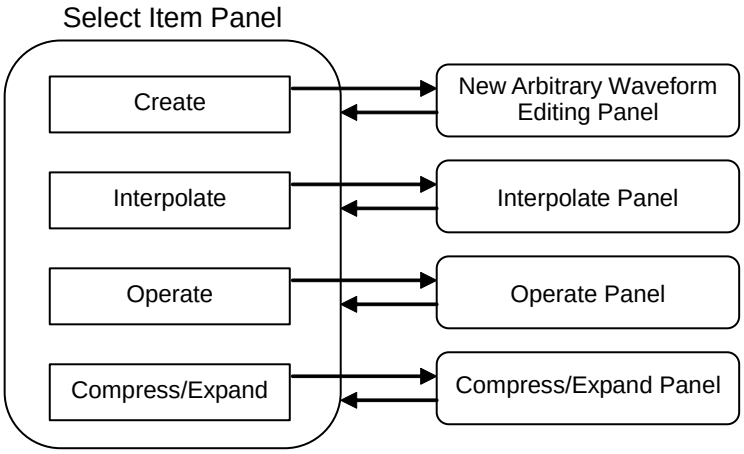

Figure 8-6 Transitions for Control Panels

8.4.4 Waveform Display Section

In the waveform display section, the image of the created waveform or each type of the coordinates data is displayed.

8.5 Waveform Display Section

8.5.1 Waveform Display Area

The waveform data currently being created is always displayed in the waveform display area.
In the waveform display area, coordinate values indicating the display area size, markers used for each operation (☞8.5.3), and the grid for checking the waveform rate (☞8.5.6) are drawn in addition to the waveform data.

8.5.2 Display Magnification

In the waveform display area, you can expand the displayed waveform by changing the display magnification horizontally and vertically.

■ Display magnification of vertical axis

The vertical magnification can be set to [1:1] (displays the complete waveform), [1:2] (expands half of the waveform to be displayed in the entire screen), [1:4], or up to [1:256].
To set the display magnification, click the ▼ button located in the upper part of the vertical scroll bar and select the desired magnification from the displayed list. Pressing the ↓ or → key while the magnification list is displayed increases the magnification, and pressing the ↑ or ← key decreases the magnification. Pressing the Home key shows the waveform in its original size, and pressing the End key displays the waveform in the maximum magnification.

■ Display magnification of horizontal axis

The horizontal magnification can be set to [1:1] (displays the complete waveform), [1:2] (expands half of the waveform to be displayed in the entire screen), [1:4], or up to [1:128].
To set the display magnification, click the ▼ button located on the right of the horizontal scroll bar and select the desired magnification from the displayed list. Pressing the ↓ or → key while the magnification list is displayed increases the magnification, and pressing the ↑ or ← key decreases the magnification. Pressing the Home key shows the waveform in its original size, and pressing the End key displays the waveform in the maximum magnification.

■ Scrolling

When the vertical/horizontal magnification is set to [1:2] or more, you can slide the scroll bar.
The coordinate values of the waveform display area changes as you slide the scroll bar. You can drag the scroll bar to the desired coordinates to observe other parts of the waveform.

8.5.3 Markers

Markers are used to select the waveform range in the horizontal direction when editing or creating any type of the waveform. They are also used to specify the horizontal position in order to read the vertical value of the waveform.
Markers are displayed with red and blue vertical lines in the waveform display area.

■ Markers operation

Two types of markers are used in the Arbitrary waveform editing tool: A marker (red) and B marker (blue).
A marker cannot be located on the right side of B marker. A marker is always located on the left side or same position of B marker. The position of each marker is displayed in the [X] field corresponding to the [Marker:] field of each color. The value of the waveform corresponding to the marker position is displayed in the [Y] field.

■ Moving markers (mouse dragging)

Two methods are provided in order to move markers: dragging a mouse and specifying values.
When the mouse cursor is hovered over a marker, the shape of the cursor is turned into ↔ from ↖.
To move the marker, drag the mouse while the cursor is in this shape. Although the markers on any end of the line can be difficult to identify, they can also be moved by using the maker flag located in the upper part of the waveform display area.
When moving markers by dragging a mouse, the address of the waveform data is moved as a unit of movement. Under the display magnification in which multiple addresses are mapped to one dot, the movement occurs by a step of that number of addresses corresponding to one dot.

■ Moving markers (specifying values)

To specify the marker location with higher resolution, enter values for the marker location directly.
The location display section for A marker is selected by clicking the [X] item corresponding to it or pressing the Alt key and A key. Enter values and press the Tab key to move A marker to the specified location.
To specify the marker location with higher resolution, enter values for the marker location directly.
B marker is also moved to the specified location by clicking the [X] item corresponding to B marker or pressing the Alt key and B key, entering values for B maker in the location display section, and pressing the Tab key.
The marker can be located in any location within the range of the settings/display resolution regardless of addresses of the waveform data by specifying values.

■ Coordinate marker mode

A and B markers can be moved independently or together depending on the Link check box.
When the Link check box is selected, A and B markers are moved together. The gap in the horizontal direction between A and B markers (distance between markers) is displayed on the right of [dX(-)].
When moving one of these markers, the other one is also moved keeping the distance.
When you click the right side of the [dX(-)] or press the Alt key and the - key, enter values, and press the Tab key, B marker is moved so that the gap between markers is set to the specified value.

■ Range of impact by markers

Selecting the range by using markers affects the operations below.

- Range to copy/cut/paste of waveforms (☞8.5.4)
- Range of arbitrary waveforms editing (☞8.8)
- Range to generate waveforms by interpolation (☞8.9)
- Range of performing compression/expansion (☞8.11)
- Range to perform operation among waveforms (☞8.10)

Technically, markers are located "immediately before" the specified/displayed location on the horizontal axes (value displayed on the right of the [X] field).

For example, when the horizontal location is 5 for marker A and 10 for marker B, the selected range is $5 \leq X < 10$. Marker A is located immediately before 5, therefore 5 falls between marker A and B. Marker B is located immediately before 10, therefore 10 does not fall between marker A and B.

8.5.4 Waveform Manipulation

■ Undo and redo

With the Arbitrary waveform editing tool, the waveform data can be restored to the previous status after editing arbitrary waveforms (Undo). To do so, click [Edit] - [Undo] (Alt key, E, U) or press the Ctrl key and U.

To cancel the previous Undo operation (Redo), click [Edit] - [Redo] (Alt key, E, Y) or press the Ctrl key and Y.

■ Cut/copy/paste/delete

With the Arbitrary waveform editing tool, you can cut/copy/paste/delete the waveform data or edit waveforms as needed.

- Cut
  [Edit] - [Cut] (Alt, E, T or Ctrl and X)
- Copy
  [Edit] - [Copy] (Alt, E, C or Ctrl and C)
- Paste
  [Edit] - [Paste] (Alt, E, P or Ctrl and V)
- Delete
  [Edit] - [Delete] (Alt, E, D or Ctrl and D)

When performing the cut or copy operation, the waveform data of the selected part is sent to the clip board.

In this case, the waveform data of the selected part which is 16 bit data (0 to 65535), is sent to the clip board as a number string with one data per one row. If a data value is originally negative, 65536 is added to it to convert into a positive value.

These contents can be pasted to any text editor or spreadsheet software, or can be pasted to itself or any other "Arbitrary waveform editing tools" which are currently active.

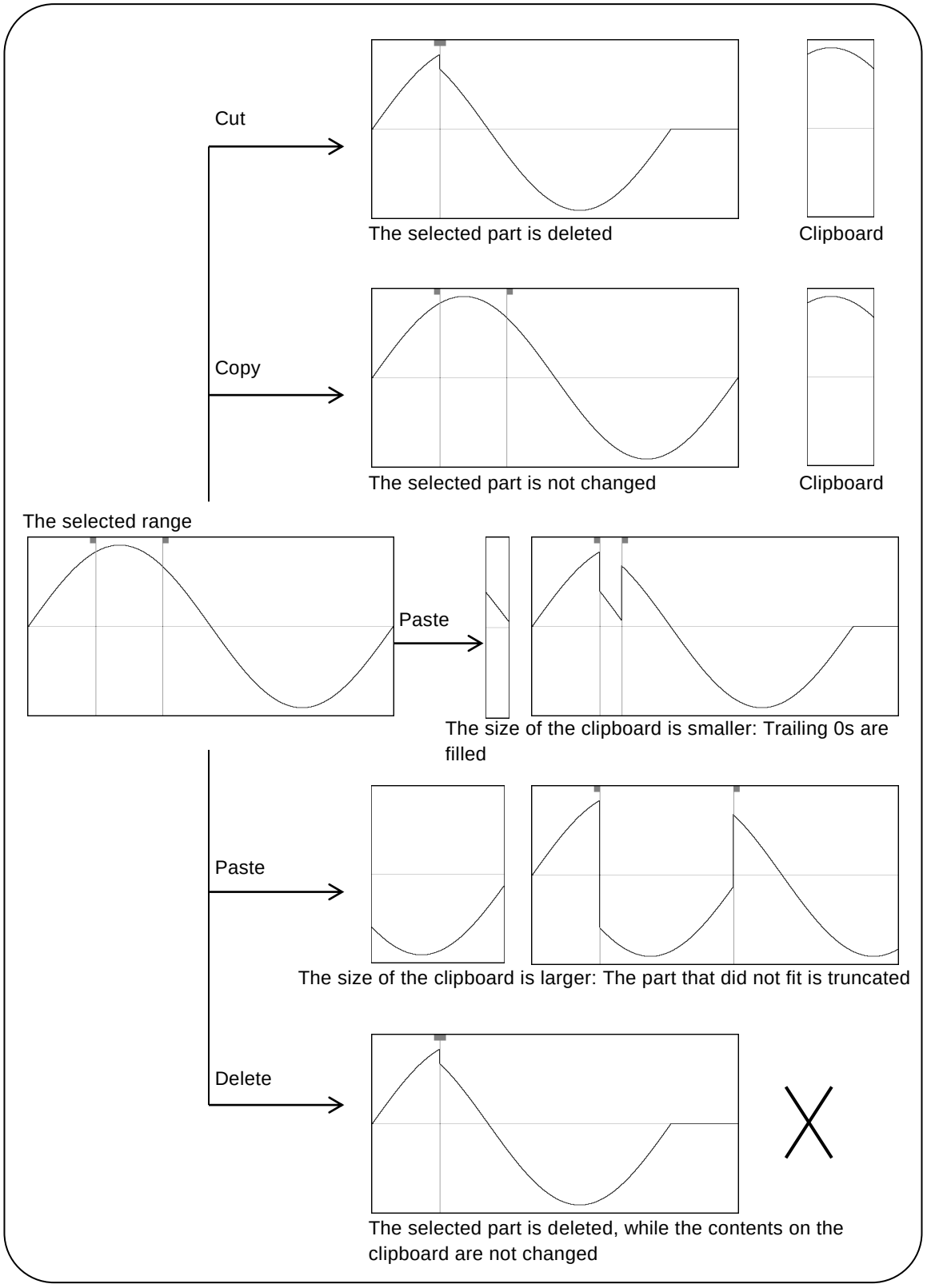

Figure 8-7 Operations with the Clip Board

8.5.5 Example of Arbitrary Waveform Editing

We will create a full-wave rectification waveform to demonstrate copy and paste functions of a waveform.

Step 1:	Click the button on the upper left corner of the screen. You can also click [Tool] - [Create] to obtain the same result.
Step 2:	A sine wave is selected in the initial state. Click the All-Page OK button to return to the waveform display screen.
Step 3:	Move B marker to the center of the waveform. [4096.000] is displayed at the lower right corner of the screen. Enter [2048] (half of 4096) in the numeric area of [X] corresponding to marker B and press the Tab key.
Step 4:	Hold down the Ctrl key and press the C key. You can also click [Edit] - [Copy] to obtain the same result. This operation copies the data between marker A and B, which is the first half of the waveform, to the clip board.
Step 5:	Select the check box to the left of the Link to enter the coordinate marker mode. Enter [2048] in the numeric area of [X] corresponding to the marker A and press the Tab key.
Step 6:	Hold down the Ctrl key and press the V key. You can also click [Edit] - [Paste] to obtain the same result. This operation pastes the waveform data from the clip board to the last half of the waveform.

Description 1: The operation such as clicking the C key with the Ctrl key held down is described by "Ctrl + C" in the following sections. When Ctrl + C (Copy) is performed, the waveform from the copied area remains without changes. When Ctrl + X (Cut) is performed, the data from the selected area is copied to the clip board too, but the waveform from this area is deleted. When Ctrl + D (Delete) is performed, the waveform from the selected area is deleted, but the contents in the clip board are not changed.

Description 2: Markers A and B are used to select the range. For example, if the range specified with the markers is 0 - 4096, the actual selected range is $0 \leq X < 4096$.

8.5.6 Grid

When you select or deselect [Set] - [Grid] (Alt, S, G), a check mark appears or disappears to the left of [Grid]. When the check mark is shown, the grid drawing function is enabled in the waveform display area. When the check mark is hidden, the function is disabled in this area.

The grid is not printed when printing waveforms. (☞ 8.7)

8.6 File Operation

You can read/write the following types of files by using the Arbitrary waveform editing tool. Texts in parentheses indicate file extensions to be added to that type of file.

- Custom format file including the waveform data and the display unit setting (.wdb) (☞8.6.1)
- Text format file including only the waveform data (.txt) (☞8.6.2)
- Text format file including parameters used for editing arbitrary waveforms (.wfn) (☞8.8.6)
- Text format file including the control point information (.prn/.tsv/.csv) (☞8.9.4)

8.6.1 Custom Format File

You can save the waveform data created with the Arbitrary waveform editing tool and the display unit setting in one file.

When you click [File] - [Save As...(.wdb)] (Alt, F, A, or Ctrl + A), the window titled [Save As] will be displayed.

Select the location where the file will be saved, enter the file name, and click the [Save] button. The file extension is ".wdb," which can be omitted when entering a file name.

After you read/write a file, when you click [File] - [Save] (Alt, F, S or Ctrl + S) or the corresponding button on the Tool Bar, the file is overwritten to the current file whose title is shown in the title bar. If you have not performed any file operation, clicking [Save] performs the same action as [Save As] for the custom file.

8.6.2 Text Format File

The waveform data created with the Arbitrary waveform editing tool can be saved as a text file so that the data can be used in other applications easily.

When you click [File] - [Save As...(.txt)] (Alt, F, T or Ctrl + T), the window titled [Save As] will be displayed.

Select the location where the file will be saved, enter the file name, and click the Save button. The file extension is ".txt," which can be omitted when entering a file name.

In a text file, 16 bit data (0 to +65535) is saved as the number string with one data per one row. If a data value is originally negative, 65536 is added to it to convert into a positive value. The number of rows is fixed to 4096.

This file can be read with any text editor or spreadsheet software.

Also, a text file created with any text editor or spreadsheet software can be read with the "Arbitrary waveform editing tool." When creating a text file, include one data per one row. The data must be 16-bit signed integers (–32768 to +32767). Note that the numeric data format is different from that of the created text file.

As a standard, include 4096 data in a data file. If a file includes more than 4096 data, the excess data is skipped during the read process. On the other hand, if a file includes less than 4096 data, they are read into the first part of the waveform and the rest of the waveform will not be changed.

8.6.3 File Reading

Display the Open File dialog by clicking [File] - [Open] (Alt, F, O or Ctrl + O) or the corresponding button on the Tool Bar. Enter the file name and click OK button. The waveform information will be read from the specified waveform data file.

8.6.4 Exporting the File for DP power source

Display the [Export] dialog by clicking [File] - [Export]. Specify the drive where the file will be saved (select the drive to which the USB memory is connected) and a file name, then click the OK button to write the file for DP power source with the specified file name (the file extension is .arb). If the USB memory to be connected to the DP power source does not have a required folder structure beginning with the NF_TOOL folder, a new folder structure will be automatically created before the file is written.
When you connect the USB memory to a DP power source, you can load the arbitrary waveform data written by the control software into the DP power source.

8.7 Printing Waveforms

You can print the waveform data created with the "Arbitrary waveform editing tool" as a waveform image. However, the grid is not printed regardless of the display mode.
When you click [File] - [Print] (Alt, F, P or Ctrl + P), the Print dialog is displayed. For details of the print setup, see the instruction manual of your printer.

8.8 Editing a New Arbitrary Waveform

[New Arbitrary Waveform Editing Panel] is used to create a standard waveform or a formula waveform.

By clicking [Create] button on [Select Item Panel] or performing [Tool] - [Create] (Alt, T, W), [New Arbitrary Waveform Editing Panel] is displayed. Operations on waveform display sections disabled during [New Arbitrary Waveform Editing Panel] is displayed.

Just after editing an arbitrary waveform on [New Arbitrary Waveform Editing Panel] and returning to waveform display screen, the generated waveform can be restored to the state before the edited contents were reflected by selecting [Edit] - [Undo] (Alt, E, U), or Ctrl + U.

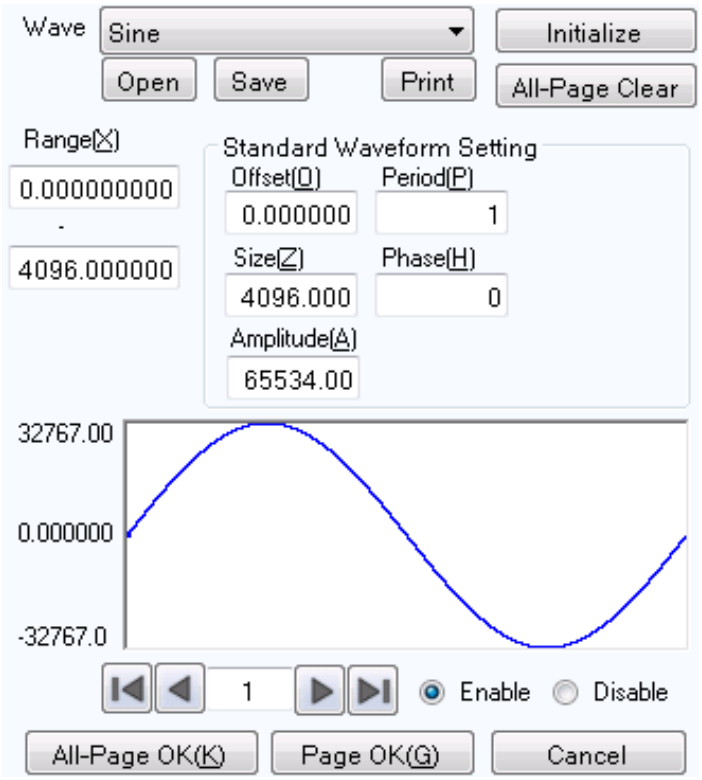

Figure 8-8 Editing a New Arbitrary Waveform

8.8.1 Range/Page

In Edit new arbitrary waveform, a waveform is generated by applying a "range" and a "definition of waveform" that are independent for each page. When [New Arbitrary Waveform Editing Panel] is displayed for the first time, the present range for marker specification is applied as the range for New arbitrary waveform editing.

The range for each page is set on the two numeric input areas under [Range].

If the ranges of two or more pages overlap together, the waveform definition of the page with larger number (the later page) is effective. By utilizing this feature, some parts of waveforms defined on the previous pages can be changed all at once.

Each page can be enabled/disabled independently. Click either [Enable] or [Disable] radio button to make it selected status.

Move between pages by using ◀ button and ▶ button on the left bottom of the Arbitrary waveform editing screen. ◀ button moves to the previous page, and ▶ button moves to the next page.

Clicking ⏮ button moves you to the first active page. Clicking ⏭ button moves you to the last active page.

By entering numbers directly into the value input area between buttons and pressing Enter key, you can jump to the specified page. Available page number is from 1 to 200.

By clicking Initialize button on the top of [New Arbitrary Waveform Editing Panel], you can initialize the setting values for the displayed page to the default values.

To initialize setting values for all pages to the default values at once, click All-Page Clear button. Then [Range] of each page is set to zero.

To generate the waveform on the displayed page, click Page OK button on the bottom of the page.

To arbitrary waveform editings on all pages at once, click All-Page OK button on the bottom of the page.

To return to the waveform display screen without generating a waveform, click Cancel button on the bottom of the page.

8.8.2 Select a Waveform

Click ▼ button on the right of [Wave] on [New Arbitrary Waveform Editing Panel] to display the list of available waveforms. Select a waveform by clicking it.

Table 8-1 shows the types of waveform that can be generated.

Table 8-1 Waveform Selection

Waveform	Description
Sine	Generate a sine wave by setting appropriate parameters.
Triangle	Generate a triangle wave by setting appropriate parameters.
Square	Generate a square wave by setting appropriate parameters.
Noise	Generate a noise waveform that is different every time. It is generated based on the random number calculation. The generated noise waveform is white noise with the uniform distribution in amplitude.
DC	Generate a waveform assuming the data within the specified range as same.
Function	Define a waveform by combining various formulas.

See 8.8.3 for the setting of each parameter.

See 8.8.4 for the setting of waveform function formula.

8.8.3 Parameter Setting

If the setting of [Wave] is sine wave, triangle wave, square wave, noise, or DC, you must set appropriate parameters to generate the wave. The following shows the available parameters to set.

Table 8-2 Parameters of the Standard Waveform

	Sine	Triangle	Square	Noise	DC
Offset	○	○	○	○	○
Size	○	○	○	○	○
Amplitude	○	○	○	○	—
Period	○	○	○	—	—
Phase	○	○	○	—	—
Symmetry	—	○	—	—	—
Duty	—	—	○	—	—
Transition	—	—	○	—	—

■ Type of parameter

The size is the width of [Range] of the page. When the size is changed, the upper limit of range specification is changed.

Amplitude is peak to peak value.

Period specifies how many cycles (waves) of the waveform should be generated within the range.

The unit of phase is deg.

For a triangle waveform, slope (symmetry) can be set. The unit of slope is %.

For a square wave, duty ratio and transition can be set. The unit of duty ratio is [%]. Transition sets the time needed for the wave height to reach from 0% to 100% using the ratio (%) against the cycle.

If [Offset] or [Amplitude] that exceeds +/– full scale value is set, the waveform is clipped at +/– full scale.

8.8.4 Waveform Function Setting

When [Function] is selected in Select a Waveform (☞8.8.2), constant input section [Constant] and formula input section [Y=] are displayed.

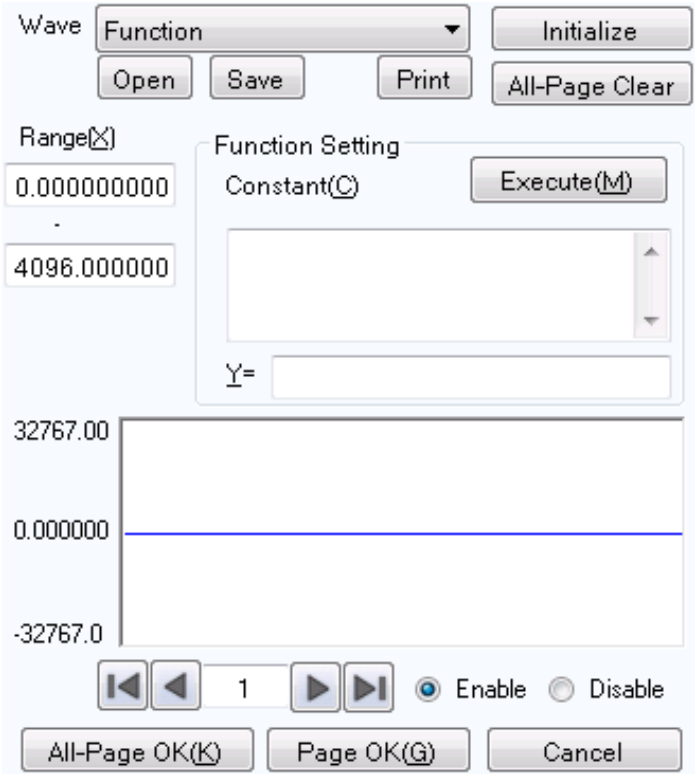

Figure 8-9 When "Waveform Function" is Selected

By entering constant and formula and clicking Execute button, you can check the calculated waveform in waveform display area of [New Arbitrary Waveform Editing Panel].

■ Constant

Constant is described as [constant = value or formula] format, for example, [fs=32767;], [s=2*pi/4096;]. Always add semicolon [;] at the end of a constant definition or formula.

A constant or formula is described in single-byte. Alphabetical characters are case-independent.

Any constant should start with an alphabetical character and consist of alphanumeric characters.

Name of a constant should not be same as any of the embedded functions (☞Table 8-5). It is also recommended to avoid using the same string as one of the embedded constants (☞Table 8-3).

With the All-Page OK button, constant is effective for all pages on and after the defined page.

For example, constants defined on page 1 are effective for all the pages. Constants defined on page 3 are not effective for page 1 and 2, but effective for page 3 and after.

When creating only the waveforms that are displayed by the Page OK button, constants are effective only for pages being displayed. For example, constants defined on page 2 are not effective for page 1 or pages on and after 3.

In this case, to make the constant given on other page effective, click Execute button on the page where the constant is defined to perform a calculation beforehand.

■ Embedded constant

Constants shown in Table 8-3 are embedded into "Arbitrary waveform editing tool."

If you use the above stated method to define a constant with the same name as one of the embedded constants, the definition of that embedded constant is disabled and your definition of values and formulas become effective.

Table 8-3 Embedded Constant

Expression	Meaning	Value
pi	Circular constant	3.1415926535898
c	Speed of light	2.99792458e8
h	Planck's constant	6.6260755e-34
k	Boltzmann's constant	1.380658e-23
r	Euler's constant	0.57721566490153

■ Function

In formula input section [Y=], provide a formula in Y=f(X) format.

[X] is a value to be changed within the range of the page. For example, if the range in a page is 1000 to 2000, [X] in the formula changes between 1000 to 2000.

The value of [X] in the formula is affected by the unit of horizontal axis (☞8.12.1) which is set on the unit setting screen.

For example, consider the following cases that a sine wave is provided by a formula like [Y=] [sin(X)]. Radian expression is used for the arguments of the sin() function.

Assume that the unit of horizontal axis is [Address] and the range is from 0 to 4096. Since 4096=2*π*651.8986…, the result of this formula is a sine wave with about 652 waves.

In the case that the unit of horizontal axis is [Time] and the frequency is 500 Hz, the cycle is 2 ms and 2e-3=2*π*0.0003183…. Then the result of this formula is a value that changes just little around 0° of the sine wave.

In the case that the unit of the vertical axis is [User] and the range is from 0 to 1, 1=2*π*0.1591…. Then, the result of this formula is a waveform of about 1/6 first half of a sine wave.

To obtain 1 wave of sine wave from the simplest formula, set the unit of the horizontal axis to [User] and [Min-Max] to 0 to 6.283185.

The value of [Y=] in the formula is affected by the unit of vertical axis (☞8.12.2) which is set on the system setting screen.

Consider the following cases that a sine wave is provided by a formula like [Y=] [sin(X)]. The value of sin() function is ±1.

In the case that the unit of a vertical axis is [Data], its range is –32768 to +32767. Therefore, the result of this formula is a waveform around 0 with very small amplitude.

In the case that the unit of a vertical axis is [ACV] and the amplitude is 20 Vp-p, its range is ±10. Therefore, the result of this formula is a sine wave of 1/10 of full scale.

In the case that the unit of a vertical axis is [User] and its range is –1 to +1, the result of this formula is a full scale sine wave.

If the result of calculation exceeds +/– full scale, the waveform clips at +/– full scale.

■ Operator

In constant input section [Constant] and formula input section [Y=], combination of Table 8-4 operators can be used.

The operators in the following table are shown in the descending order of the priority.

Logical operator returns 1 when the given condition is true, and returns 0 when false.

Table 8-4 Operators

Operator	Coupling rule	Remarks
( ), Function, Constant, User-defined variable, Number string	→	
+, –, !	←	Unary operator. ! is a logical operator.
^	→	Binary operator, Power
*, /	→	Binary operator, Multiplying/Dividing calculation
+, –	→	Binary operator, Adding/Subtracting calculation
<, <=, >, >=	→	Logical operator, Bigger/Smaller comparison
==, !=	→	Logical operator, Equivalent comparison
&&	→	Logical operator, Logical multiply
||	→	Logical operator, Logical add

■ Embedded function

In the constant input section [Constant] and the formula input section [Y=], conbination of Table 8-5 functions can be used.

Table 8-5 Embedded Function

Function	Description
sin(arg), cos(arg), tan(arg)	Triangle functions. Arguments are in radians.
atn(arg)	Arctangent function. Returns the angle in radians whose tangent is the argument.
sqr(arg)	Returns the positive square root of the argument.
exp(arg)	Exponential whose base is e (base of natural logarithm)
log(arg)	Returns natural logarithm.
log10(arg)	Returns common logarithm.
power(arg1, arg2)	Returns the magnitude of the complex vector whose real part is the 1st argument and imaginary part is the 2nd.
phase(arg1, arg2)	Returns the angle of the complex vector whose real part is the 1st argument and the imaginary part is the 2nd.
tri(arg1, arg2)	Triangle wave whose angle is the 1st argument and slope (symmetry) is the 2nd. The 2nd argument is optional. When omitted, it is regarded as 50%.
sqw(arg1, arg2, arg3)	Square wave whose angle is the 1st argument, duty ratio is the 2nd, transition is the 3rd. The 2nd and the 3rd arguments are optional. When omitted, the 2nd is regarded as 50% and the 3rd regarded as 0%. The 2nd argument cannot be omitted when the 3rd is specified.
rnd()	White noise whose magnitude is uniformly distributed within ±1. No argument is specified.

■ Examples of waveform function formulas

This section shows several examples of waveform function formulas.

In the example consisting of only page 1, the range is whole range of the horizontal axis, and descriptions are omitted.

- One cycle of a sine wave (unit of the horizontal axis: address 0 to 4096, unit of the vertical axis: data ±32767)

Page 1	[Constant]	[fs=32767;]	
		[s=2*pi/4096;]	← Address 4096 corresponds to 2π
	[Y=]	[fs*sin(x*s)]	

- One cycle of a sine wave (unit of horizontal axis: time 0ms to 1ms, unit of vertical axis: voltage ±10V)

Page 1	[Constant]	[fs=10;]	
		[s=2*pi/1e-3;]	←1 ms is 2π
	[Y=]	[fs*sin(x*s)]	

- One cycle of a sine wave (unit of horizontal axis: user-defined unit 0 to 1, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	[s=2*pi;]
	[Y=]	[sin(x*s)]

- One cycle of a sine wave (unit of horizontal axis: user-defined unit 0 to 6.283185, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	(None)
	[Y=]	[sin(x)]

- One cycle of a square wave (unit of horizontal axis: user-defined unit 0 to 6.283185, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	(None)	
	[Y=]	[((sin(x)>=0) –0.5)*2]	←Obtain a square wave of 0/+1 using the logical operator ">=" to convert into ±1.

- DC sweep waveform (unit of horizontal axis: user-defined unit 0 to 1, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	(None)
	[Y=]	[(x–0.5)+sin(2*pi*x*32)/2]

- Damped wave (unit of horizontal axis: user-defined unit 0 to 6.283185, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	(None)
	[Y=]	[exp(–x)*sin(x*64)]

- DSB waveform (unit of horizontal axis: user-defined unit 0 to 6.283185, unit of vertical axis: user-defined unit –1 to +1)

Page 1	[Constant]	[a=19.5;]
		[b=20.5;]
	[Y=]	[(sin(a*x)+sin(b*x))/2]

8.8.5 Created Arbitrary Waveforms Examples

■ Standard waveform

As an example of standard waveform, we will create a triangle wave of 30% symmetry.

Step 1:	Click Create button on Select Item Panel. You can also click [Tool] - [Create] to obtain the same result. Select Item Panel is changed to [New Arbitrary Waveform Editing Panel].
Step 2:	Click ▼ button on the right side of [Wave], and then click [Triangle] in the list.
Step 3:	In value input section on the right side of [Symmetry], change the value from [50] to [30], and then press ENTER key. This specifies a triangle wave of 30% symmetry.
Step 4:	Click All-Page OK to close [New Arbitrary Waveform Editing Panel] and display the generated waveform in the waveform display section.

Description 1: In this example, a waveform is generated over entire horizontal axis (X). In the "Arbitrary waveform editing tool", a waveform can be divided into two or more pages, for example, the first 1/4 of a waveform to page 1, the last 1/2 to page 2, and others. In this case, specified effective waveforms on multiple pages can be executed all at once by clicking All-Page OK button. If you want to execute only the waveforms displayed on the current page, click Page OK button. In the example above, since page 1 is the only page specified, the result is same for clicking either button.

Description 2: You can select sine wave, square wave (variable duty ratio), noise, DC, and waveform definition by a formula (waveform function), as well as triangle wave.

■ Formula waveform

As an example of editing an arbitrary waveform by formula, we will create a waveform of a fundamental wave with the 3rd and 5th harmonics waves superimposed.

Step 1:	Select [Set] - [System Setting]. A dialog titled [Unit Setting] appears.
Step 2:	In the [Unit (X)] combo box of [X-axis Unit Setting], click [User]. Leave Min-Max as the initial value of [0.000000 to 1.000000].
Step 3:	In the [Unit (Y)] combo box of [Y-axis Unit Setting], click [User]. Leave Min-Max as the initial value of [0.000000 to 1.000000].
Step 4:	Click OK button to return to waveform display screen.
Step 5:	Click Create button on Select Item Panel. You can also click [Tool] - [Create] to obtain the same result. Select Item Panel is changed to [New Arbitrary Waveform Editing Panel].
Step 6:	Click ▼ button on the right side of [Wave], and then click [Function] in the displayed list.
Step 7:	Enter "s=2*pi;" in the input area on the right side of [Constant]. Enter "sin(x*s)+sin(x*s*3)/3+sin(x*s*5)/5" in the input area on the right side of [Y=].
Step 8:	Clicking Execute button displays a waveform as a calculation result in the Arbitrary waveform editing screen.
Step 9:	Click All-Page OK button to return to waveform display section.

Description 1: Here, entire horizontal axis (X) is processed as the range of 0 to 1 by using the user-defined unit. Also, entire vertical axis (Y) is processed as the range of ±1. One cycle of a sine wave is easily expressed by defining $s=2\pi$ as a constant and specifying [x*s] in the formula.

Description 2: In step 2, if the range of X is set as 0 to 6.283185 (2π) using the user-defined unit, the formula becomes more simple as [sin(x)+sin(x*3)/3+sin(x*5)/5].

8.8.6 Operation of Parameter File for Arbitrary Waveform Editing

Parameter setting of [New Arbitrary Waveform Editing Panel] can be saved as a text file.
Click Save button on the top of [New Arbitrary Waveform Editing Panel] to display a screen titled [Save As].
Select the location where the file will be saved, enter the file name, and click the Save button. The file extension is ".wfn," which can be omitted when entering a file name.
To load a parameter setting file, click Open button on the top of [New Arbitrary Waveform Editing Panel]. The screen titled Open File is displayed. Select the location to save the file and enter the file name, and then click Open button.
Because the setting file for the Arbitrary waveform editing screen is a text file, it can be edited using any text editor. However, we do not recommend to do so. It may result in the situations where "Arbitrary waveform editing tool" is changed to a format that cannot be read. Or if a formula is changed to become too long exceeding the limit, edited file may not be readable. For the information of files that can be processed by "Arbitrary waveform editing tool", see 8.6.

8.8.7 Print

Parameter settings of [New Arbitrary Waveform Editing Panel] can be printed.
Click Print button on the top of [New Arbitrary Waveform Editing Panel] to display the Print dialog.
For details of the print setup, see the instruction manual of your printer.

8.9 Interpolate

[Interpolate Panel] is used to create a waveforms by using various interpolation. A "point" that is set to interpolate is called a "control point."

When you click Interpolate button on Select Item Panel or select [Tool] - [Interpolate] (Alt, T, I), [Interpolate Panel] is displayed.

Just after editing an arbitrary waveform on [Interpolate Panel] and returning to waveform display screen, the generated waveform can be restored to the state before the edited contents were reflected by selecting [Edit] - [Undo] (Alt, E, U), or Ctrl + U.

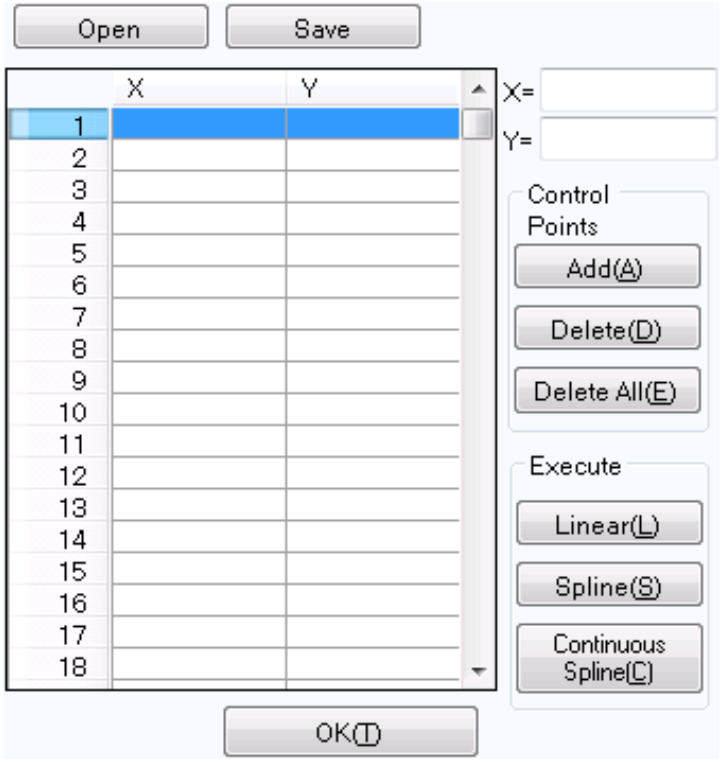

Figure 8-10 Interpolate

Operations to edit interpolation is executed for the selected range. First select the range by using A marker and B marker on waveform display screen.

8.9.1 Control Point Setting

Interpolation is executed for a range that is selected by markers in waveform display screen.

A control point can be set outside the selected range. However, control points outside the range are ignored when interpolation is executed.

A control point may be set on any location. However, two or more control points cannot be set on one X coordinate.

■ Specify a control point by values

Enter coordinate values in the input area on the right side of [X=] and [Y=] of [Interpolate Panel].

To activate the right side of [X=], click the input area, or press Alt + X.

To activate the right side of [Y=], click the input area, or press Alt + Y.

Click Add button to display the [+] mark at the specified position of the Waveform display section. The positions of the control points are displayed also in the list of control points of [Interpolate Panel] using their values. In the list of the control points, control points are displayed after sorted by the ascending order of their X values.

■ Specify a control point by mouse

If any [+] mark of control points is shown if red (selected), first click in the waveform display area where there is no mark displayed to change all marks to light blue (not selected).

Move the mouse cursor to the position to which you want to add a control point, and then click it while pressing Ctrl key. A control point will be added. You can know approximate position of the mouse cursor in [Cursor] on the top left of the Waveform display section. The added control point is also added to the list of control points in the [Interpolate Panel]. Check the coordinate values.

■ Move a control point by values

When you select (click) any control point from the list of control points in the [Interpolate Panel], the point is selected and the following processes are performed:

- The specified part of the list is displayed inverted.
- In the input area of [X=] and [Y=], the coordinate values of the selected control point are displayed.
- In the Waveform display section, the corresponding coordinate point [+] mark turns to red.

The control point can also be selected by clicking [+] mark in the Waveform display section. However, if the magnification of the screen is lower, the mark may not be caught due to the screen resolution.

While a control point is selected, updating the value of [Y=] and clicking Add button moves the selected control point. Clicking Add button after updating the value of [X=] adds a new control point if the identical coordinate point does not exist, or updates the control point if exists.

■ Move a control point by mouse

A control point can also be moved by dragging [+] mark of the Waveform display section. However, if the magnification of the screen is lower, the mark may not be caught due to the screen resolution.

■ Delete control points

Click Delete button to delete control points being selected at that time.

There is no way to restore control points after delete operation. Caution is required for this function.

■ Delete all control points

Click Delete All button to delete all control points being set at that time.

There is no way to restore control points after all delete operation. Great caution is required for this function.

8.9.2 Execute Interpolation

After the range is selected and the control point is set, execute the interpolation. There are the following three types of interpolation:

- Linear interpolation: interpolates using straight line between control points
- Spline interpolation: interpolates using smoothed curve between control points
- Continuous spline interpolation: interpolates with curved line so that the line forms an unified shape also with the waveforms outside the selected range

To execute linear interpolation, click Linear button, or press Alt + L.

To execute spline interpolation, click Spline button, or press Alt + S.

To execute continuous spline interpolation, click Continuous Spline button.

When a part of the waveform is selected as the range, interpolation is performed by interpolating the both ends of the range and the control points within the range.

When entire waveform is selected, continuous spline interpolation interpolates so that the waveforms would be concatenated smoothly when repeated. In linear or spline interpolation, the first and last value are different resulting in the waveform discontinuous when repeated.

If that exceeds +/– full scale is set as the result of interpolation, the waveform is clipped at +/– full scale.

After executing interpolation, click OK button to return to the waveform display screen.

8.9.3 Created Arbitrary Waveforms Examples

As an example of editing an arbitrary waveform by interpolation, we will create a smoothed pulse waveform.

Step 1:	Select [Set] - [System Setting] to display a dialog titled [Unit].
Step 2:	Click [User] from the combo box on the right side of [Unit(X)]. Leave [Min-Max] as the initial value of [0.000000 to 1.000000].
Step 3:	Click [User] from the combo box on the right side of [Unit(Y)]. Leave [Min-Max] as the initial value of [–1.000000 to 1.000000]. Click OK button to return to waveform display screen.
Step 4:	Set the coordinate value of A marker (read) as [0.2], and then press ENTER key. Set the coordinate value of B marker (blue) as [0.8], and then press ENTER key.
Step 5:	Click Interpolate button on Select Item Panel. You can also click [Tool] - [Interpolate] to obtain the same result. Select Item Panel is changed to [Interpolate Panel].
Step 6:	Enter 0.5 as the coordinate value of [X=], and 1 as the coordinate value of [Y=], and then click Add button.
Step 7:	Click the Continuous Spline button. The interpolated waveform is displayed in the Waveform display section.
Step 8:	Click OK button to return to waveform display section.

Description 1: In the interpolation editing, a point that is set in step 6 is called "control point."

Description 2: In linear interpolation, a waveform is created by interpolating between control points with a straight line.
In spline interpolation, control points are interpolated smoothly with a spline curve.

Description 3: In continuous spline interpolation, interpolation is performed so that the waveform can concatenate also with the vicinity of the selected range smoothly. When all the range is selected, the waveform is interpolated so that the first and last waveform is concatenated smoothly when it is repeated.

8.9.4 Control Point File Operation

Control point setting of [Interpolate Panel] can be saved as a text file.
Click Save button on the top of [Interpolate Panel] to display a screen titled [Save As].
Select the location where the file will be saved, enter the file name, and click the Save button. Select a file extension from ".prn", ".tsv", or ".csv." It can be omitted when entering a file name.

- Extension .prn Control point information file delimited by space
- Extension .tsv Control point information file delimited by tab
- Extension .csv Control point information file delimited by comma

To load a control point setting file, click Open button on the top of [Interpolate Panel]. The screen titled Open File is displayed. Select the location to save the file and enter the file name, and then click Open button.
This file can be read with any text editor or spreadsheet software. Also, a text file created with any text editor or spreadsheet software can be read with the "Arbitrary waveform editing tool." When creating a text file, one line must consist of 2 data elements of X and Y, and be saved in the format same as the file with the above extension.
For the information of files that can be processed by "Arbitrary waveform editing tool", see 8.6.

8.10 Operation

[Operate Panel] has a waveform in selected ranges, and the standard waveform, formula waveform, or the function to execute arithmetical operation on a waveform in clip board to create a waveform.

When clicking Operate button on Select Item Panel, or select [Tool] - [Operate] (Alt, T, O), [Operate Panel] is displayed. Operations on waveform display sections disabled during [Operate Panel] is displayed.

Just after editing an arbitrary waveform on [Operate Panel] and returning to waveform display section, the generated waveform can be restored to the state before the edited contents were reflected by selecting [Edit] - [Undo] (Alt, E, U), or Ctrl + U.

Operation is executed for a range selected by markers. First select the range to edit by using A marker and B marker on waveform display section.

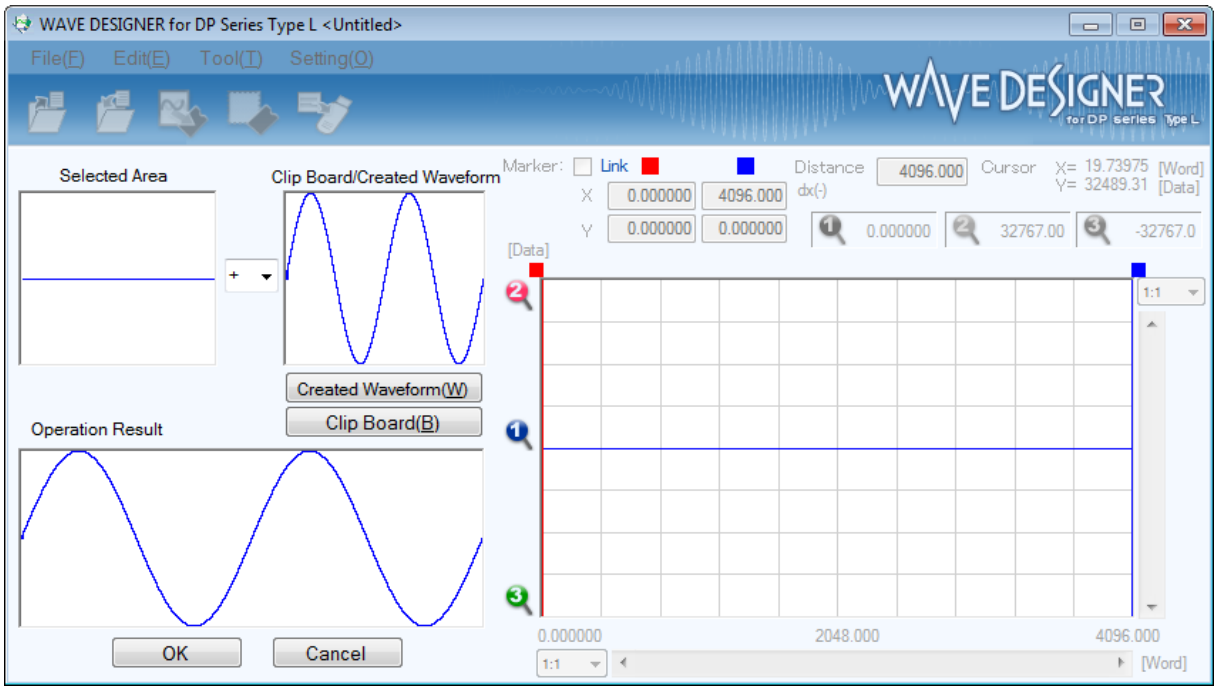

Figure 8-11 Operation

8.10.1 Types of Operation

When clicking ▼ button between [Selected Area] and [Clip Board/Created Waveform], a list of arithmetical operation is displayed. Select an operator by clicking in the list, or pressing ↑, ↓, →, ← key.

[*] represents multiplication, and [/] represents division.

8.10.2 Set a Operation Target

■ Generated waveform

When clicking Created Waveform button, or pressing Alt + W, the Arbitrary waveform editing screen appears. Operations can be executed according to "Edit a New Arbitrary Waveform" (☞8.8). However, there are the following limitations for an arbitrary waveform editing in operations.

- [Range] or [Size] cannot be changed.
- A range cannot be divided over two or more pages.

After you create a waveform according to "Edit a New Arbitrary Waveform" (☞8.8) and click the Page OK, the created waveform is displayed in [Clip Board/Created Waveform] area.

■ Clip Board

Click Clip Board button or pressing Alt + B to display a waveform stored in clip board in [Clip Board/Created Waveform] area. For operation with the clip board, see 8.5.4.

If the selected range is longer than the data in the clip board, the remained portion is processed as 0.

If the selected range is longer than the data in clip board, the data is used beginning with its front part.

Though the data in the clip board is 16 bit integer, it is converted using the unit of vertical axis before the operations. For example, in the case that the unit of vertical axis is a user-defined unit:−1 to +1, data in the clip board is converted and processed after adjusted to the range of ±1.

8.10.3 Operation Execution

Operation is executed automatically every time the operation type is changed or data in [Clip Board/Created Waveform] is changed.

The result of operation is displayed as a waveform in [Operation Result] area.

To reflect the operation result to the Waveform display section, click OK button. Or, click Cancel button to discard the result of calculation and return to the Waveform display section.

8.10.4 Created Arbitrary Waveforms Examples

As an example of operations, we will create a waveform of sine wave with noise superimposed.

Step 1:	Display [New Arbitrary Waveform Editing Panel]. In its initial state, a sine wave is selected. Change the value on the right side of [Amplitude] from [65534] to [50000] to make the amplitude smaller. Click All-Page OK button to return to waveform display screen.
Step 2:	Click Operate button on Select Item Panel. You can also click [Tool] - [Operate] to obtain the same result. Select Item Panel is changed to [Operate Panel].
Step 3:	Click the Created Waveform button.
Step 4:	Select [Waveform] combo box, and then click [Noise] in the list displayed. Change the value on the right side of [Amplitude] from [65534] to [15000]. Return to [Operate Panel] by clicking Page OK button. In this stage, the result of the addition is displayed in the [Operation Result] field.
Step 5:	Click OK button to return to waveform display section. This produces a waveform of a sine wave with noise superimposed.

Description 1: Subtraction, multiplication, and division are also available as well as addition which was shown in this example.

Description 2: You can operate for only a part of a waveform by selecting that part of the waveform using A and B markers in the waveform display screen beforehand.

Description 3: In this example, the waveform created on the [Arbitrary Waveform Editing Panel] is used for operation.
In step 3, the contents in "clip board" can be used for operation by clicking Clip Board button.

Description 4: When executing multiplication, it is convenient to set the unit of the vertical axis as ±1 of the user-defined unit.
This makes the result of the multiplication between full scale values to a full scale value also.

8.11 Compress/Expand

[Compress/Expand Panel] generates a waveforms by compressing or expanding the waveforms in the selection vertically/horizontally.

When you click the Compress/Expand button in the Select Item Panel or perform [Tool] - [Compress/Expand] (Alt, T, P), [Compress/Expand Panel] is displayed. Operations on waveform display sections disabled during [Compress/Expand Panel] is displayed.

Just after editing an arbitrary waveform on [Compress/Expand Panel] and returning to waveform display section, the generated waveform can be restored to the state before the edited contents were reflected by selecting [Edit] - [Undo] (Alt, E, U), or Ctrl + U.

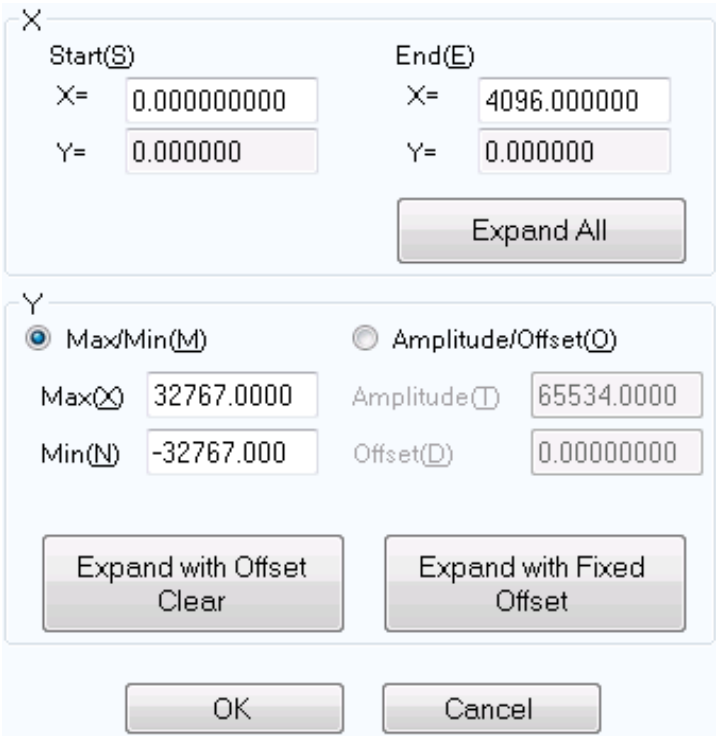

Figure 8-12 Compression/Expansion

8.11.1 Compression/Expansion along Horizontal Axis

Because the compression/expansion operation affects only the selected range by markers, you must set the selection by using markers in the waveform display section (☞ 8.5.3) before you compress/expand along the horizontal axis.

To set the compression/expansion along the horizontal axis, you use the items in the [X-axis] on the Compression/Expansion screen.

■ Compress/expand selection to start/end point

Enter the numeric values in the input areas of the [Start X=] and [End X=] and click OK button.

The waveform in the selection that is already selected by the markers can be compressed/expanded or moved to the selection specified by the start and end points.

The area with no data as the result of the compression/expansion is filled with the data immediately before or after it.

■ Expand selection to fit

Click the Expand All button to expand the selection that is already selected by the markers to the entire waveform data. For example, the actual data collected by the digital oscilloscope usually does not represent an exact one cycle. In this case, you can use this feature to clip one cycle.

■ Notes

Note that when the expansion rate is too high, the distortion may occur in the waveform.

8.11.2 Compression/Expansion along Vertical Axis

Because the compression/expansion operation affects only the selected range by markers, you must set the selection by using markers in the waveform display section (☞ 8.5.3) before you compress/expand along the vertical axis.

To set the compression/expansion along the vertical axis, you use the items in the [Y-axis] on the Compression/Expansion screen.

■ Compression/expansion using maximum/minimum value

When [Max/Min] ○ (option button) is selected (◉), the maximum value and the minimum value in the selected range specified by the markers are displayed on the right of [Max] and [Min], respectively. When you enter the maximum/minimum value for the target in the respective display section after compression/expansion and press ENTER key, the waveform in the display waveform section will be changed.

You can also flip the waveform by setting the maximum value smaller than the minimum value.

When you are satisfied with the generated waveform, click OK button.

To return to the waveform display screen without performing compression/expansion, click Cancel button.

■ Compression/expansion using amplitude/offset

When [Amplitude/Offset] ○ (option button) is selected (◉), amplitude value and offset value in the selection selected by the markers is displayed on the right of [Amplitude] and [Offset], respectively.

The following shows the relationship between amplitude/offset and maximum/minimum value.

amplitude = (width from maximum value to minimum value), offset = (center of maximum value and minimum value)

maximum value = offset + (amplitude / 2), minimum value = offset − (amplitude / 2)

You can also flip the waveform by setting amplitude to a negative value.

When you are satisfied with the generated waveform, click OK button.

To return to the waveform display screen without performing compression/expansion, click Cancel button.

■ Expand selection to max amplitude

Click the Expand with Offset Clear button to expand the selection that is already selected by the markers to the maximum amplitude. If the offset in the selection before expansion is not 0, it will be changed to 0 after the expansion.

By clicking Expand with Fixed Offset button, you can expand the waveform so that the positive or negative peak matches the maximum value without changing the offset.

■ Notes

If that exceeds +/– full scale is set as the result of extension, the waveform is clipped at +/– full scale.

Note that when the expansion rate is too high, the distortion may occur in the waveform.

8.11.3 Created Arbitrary Waveforms Examples

■ Horizontal Compression/Expansion

As an example of horizontal compression/expansion of the waveform, we will generate the burst waveform by compressing a sine wave to the first quarter of the waveform display screen.

Step 1:	Display [New Arbitrary Waveform Editing Panel]. In its initial state, a sine wave is selected. Change [1] on the right of [Period] to [4] to make it a sine wave with 4 cycles. Click All-Page OK button to return to waveform display screen.
Step 2:	Click Compress/Expand button on Select Item Panel. You can also click [Tool] - [Compress/Expand] to obtain the same result. Select Item Panel is changed to [Compress/Expand Panel].
Step 3:	[4096.000] is displayed in the lower right of the waveform display screen. Leave the numeric area on the right of [Start X=] as [0]. Enter the quarter of 4096, which is [1024], in the numeric area on the right of [End X=] and press ENTER key. In the waveform display screen, you can see that the sine wave with 4 waveforms which had been displayed in the entire screen is now compressed to the first quarter of the screen.
Step 4:	Click OK button to return to waveform display screen.

Description 1: In this example, because you left [Start X=] as [0], the original waveform was compressed to the first quarter of the waveform in the waveform display screen.
For example, if [Start X=] is set to [1024] and [End X=] is set to [2048], the original waveform is compressed to the first half of the waveform display screen instead of the first quarter.

Description 2: You can also expand the selection of the waveform to the entire waveform.
You must select the portion of the waveform using marker A and B in the waveform display screen in advance.
Then click the Expand All button in the [Compress/Expand] screen to expand the selection to the entire waveform.

■ Vertical compression/expansion

As an example of vertical compression/expansion of the waveform, we will generate a trapezoidal waveform by expanding and clipping the triangle waveform.

Step 1:	Display [New Arbitrary Waveform Editing Panel]. In its initial state, a sine wave is selected. Select [Triangle] from [Wave] combo box. Click All-Page OK button to return to waveform display screen.
Step 2:	Click Compress/Expand button on Select Item Panel. You can also click [Tool] - [Compress/Expand] to obtain the same result. Select Item Panel is changed to [Compress/Expand Panel].
Step 3:	In the numeric area on the right of [Max], change [32767] to [100000], then press ENTER key. In the numeric area on the right of [Min], change [–32767] to [–100000], then press ENTER key. In the waveform display section, you can see that the triangle waveform is expanded vertically and clipped, transforming to a trapezoidal waveform.
Step 4:	Click OK button to return to waveform display screen.

Description 1: You can also use the maximum/minimum numeric values specified in the step 3 to compress the waveform vertically or move the waveform up or down. If the +/– full scale is exceeded as a result of the expansion or movement, the waveform will be clipped at the +/– full scale point.

Description 2: You can compress/expand only a part of a waveform by selecting that part of the waveform using A marker (red) and B marker (blue) in the waveform display screen beforehand.

Description 3: If the +/– full scale is not reached by the waveform, you can expand the waveform to maximum amplitude by clicking Expand with Fixed Offset button or Expand with Offset Clear button.

Description 4: If the maximum is set to [–100000] and the minimum is set to [100000] in the step 3, the waveform will be flipped.

Description 5: While you used [Max/Min] to specify the compression/expansion rate in this example, you can also use [Amplitude/Offset] to do so. Click ○ (option button) on the left of [Amplitude/Offset] to turn it to ◉ (selected). Next, set [Amplitude] to [200000] and [Offset] to 0 to obtain the same result as this example.

Description 6: In this example, you generated the trapezoidal waveform by clipping the triangle waveform. You can generate it more easily by setting [Transition] against the square waveform.

8.12 System Setting

8.12.1 X Axis Unit Settings

In "Arbitrary waveform editing tool," you can use time and user-defined unit in addition to the address of waveform data as a unit for displaying/setting horizontal axis.

Time coordinates with [Frequency].

For a user-defined unit, you can arbitrarily specify the start point and end point of the waveform data and name of the unit.

Some examples of user-defined units for the horizontal axis are listed in Table 8-6.

When you use mathematical expressions to generate the waveform, it is useful to use values from 0 to 6.283185 because the unit of the trigonometric function such as sin() is radian.

Click the ▼ button on the right of [Unit] to display a list of available units for the horizontal axis. Select a unit of horizontal axis by clicking in the list, or pressing ↑, ↓, →, ← key.

Selecting a user-defined unit as the unit of X axis allows you to specify [Name], [Min], and [Max].

In the area on the right of the [Name], enter a string of up to 4 characters (2 two-byte characters) as the name of the unit of horizontal axis.

In the areas on the right of the [Min] - [Max], enter the minimum value (the value at the left end of the waveform) and maximum value (the value at the right end of the waveform) of the user-defined unit.

Table 8-6 Example of User-defined Unit of Horizontal Axis

Range	Name (Description)
0~1	Period
−1~1	(vertical axis user-defined unit: used to adjust to vertical axis range of ±)
0~360	deg (degree, °)
0~400	grad
0~6.283185	rad

8.12.2 Y Axis Unit Settings

In "Arbitrary waveform editing tool," you can use voltage and user-defined unit in addition to waveform data (16 bit: –32768 to +32767) as a unit for displaying/setting vertical axis.
Voltage coordinates with [Amplitude].
For a user-defined unit, you can arbitrarily specify the bottom and top of the waveform data and name of the unit.
When you use mathematical expressions to generate the waveform, it is useful to use values from –1 to +1 because the result of the function such as sin() is within ±1.
Click the ▼ button on the right of [Unit] to display a list of available units for the vertical axis. Select a unit of vertical axis by clicking in the list, or pressing ↑, ↓, →, ← key.
Selecting a user-defined unit as the unit of vertical axis allows you to specify [Name], [Min], and [Max].
In the area on the right of the [Name], enter a string of up to 4 characters (2 two-byte characters) as the name of the unit of vertical axis.
In the areas on the right of the [Min] - [Max], enter the minimum value (the value at the bottom end of the waveform) and maximum value (the value at the top end of the waveform) of the user-defined unit.

8.13 Memory

"Arbitrary waveform editing tool" allows you to transfer the generated waveform data to the DP power source.

8.13.1 Memory Transfer

Select [Tool] - [Memory Transfer] or click Memory Transfer button on the Tool Bar to display the [Memory Transfer] dialog.
Specify the memory number on the DP power source you want to set. Click the OK button to start the waveform data transmission to the DP power source.

8.13.2 Memory Clear

Select [Tool] - [Memory Clear] or click Memory Clear button on the Tool Bar to display the [MemoryClear] dialog.
Specify the memory number on the DP power source you want to clear. Click the OK button to clear the data for the selected memory number in the DP power source.

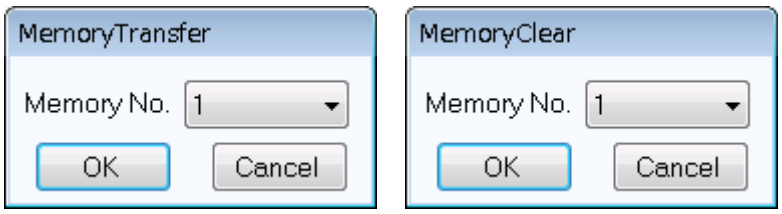

Figure 8-13 Memory Transfer/Memory Clear Dialog

9. Maintenance

9.1 CD-ROM Management ····· 95
9.2 Replace Damaged CD-ROM ····· 95
9.3 Check Version ····· 95

9.1 CD-ROM Management

CD-ROM should be handled carefully paying attention to the followings.

Do not store your CD-ROM under direct sunlight or in high temperature or humidity.

- Store and use the CD-ROM avoiding dusty environment.
- Do not touch the recording surface. It may cause damage or error.
- When the recording surface gets dirty, wipe the surface with dry soft cloth. Do not use solvent such as benzene.
- Store the CD-ROM horizontally and vertically to avoid twisting or curving.
- Use a felt pen when you write letters to the label surface of the CD-ROM (do not use a pen such as ball-point pen or pencil of which tip is hard).

9.2 Replace Damaged CD-ROM

If your CD-ROM has been damaged, contact NF Corporation or our agent.

For a fee, we will replace it with new one.

9.3 Check Version

The version of this software is displayed in the upper right of the dialog window which appears when you press [System Setting].

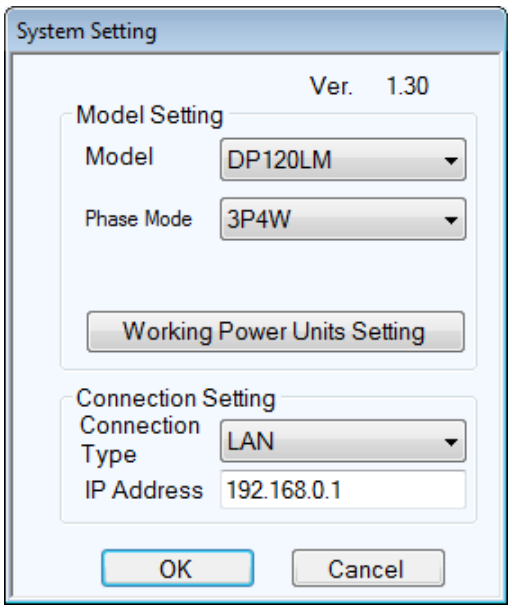

Figure 9-1 System Setting Dialog Window

WABUN: (DA00057716)

NOTES

- No part of the contents of this instruction manual may be reprinted or reproduced without prior permission from us.
- The information in this instruction manual is subject to change without notice.
- We have taken enough care upon creating this instruction manual. However, should you notice any doubtful or wrong statement, or lack of description, please contact us or our agent.

Control Software for DP series Type L Instruction Manual

NF Corporation
6-3-20 Tsunashima Higashi, Kohoku-ku, Yokohama 223-8508, Japan
Phone: +81-45-545-8111 (Main)
http://www.nfcorp.co.jp/
ⓒ Copyright 2016-2018, **NF Corporation**

http://www.nfcorp.co.jp/

NF Corporation

6-3-20, Tsunashima Higashi, Kohoku-ku, Yokohama 223-8508 JAPAN