Myway

Integrated Development Environment for Power Electronics

PE-ViewX

User's Guide

Digital Control System for Power Electronics

PE-Expert4

131170-A2-055B

Myway Plus Corporation

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4. Environments where there is possible contact with chemicals, and environments where chemicals tend to evaporate
5. Environments with an unspecified power supply, such as use in a foreign country, or use with other than a commercial power supply

Table of Contents

Chapter 1 Outline

This Chapter describes the features and operating environment of PE-ViewX.

1.1 Features

PE-ViewX is an integrated development environment for Power Electronics control programs.

This software provides the functions required for control program, such as project management, program development and various debugging functions.

It also generates batch files for compiling automatically according to the source file which constitutes a project.

It also links the library dedicated for PE-Expert4 (hereinafter referred to as the PE library), which is specialized in the development of power electronics.

Using this environment allows the user to easily perform a series of work from editing of a source file, compiling, downloading programs and execution to efficient debugging by Wave, etc.

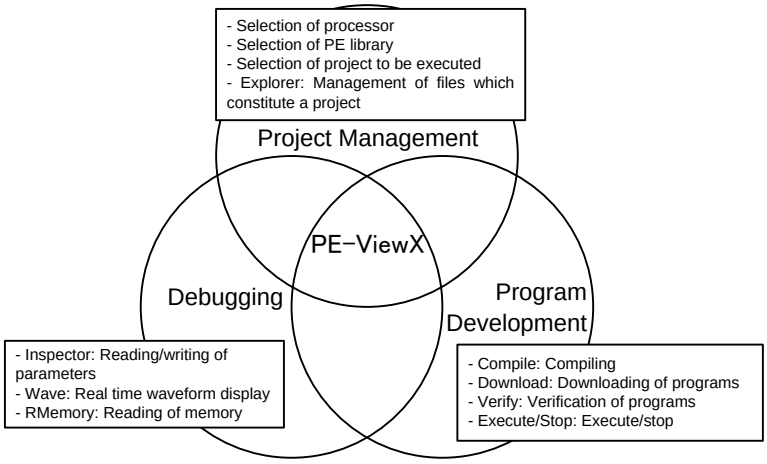


Figure 1:**Outline of Functions of Integrated Development Environment PE-ViewX**

1.2 Operating Environment

The following chapter shows the recommended operating environment of the PE-ViewX.

● OS

Windows 7 operating system (Japanese/English) (32bit/ 64bit)

Windows 10 operating system (Japanese/English) (64bit)

● Hard Disk

Available memory of above 1GB

● Display

1366x768 bits and above

● CPU

Condition	Dual core and above Operating frequency of above 2.0GHz ➔ (At least Intel Core i3 5th generation or equivalent, ie: i3-5005U)
Recommended Operating System	Dual core and above Operating frequency of above 2.2GHz ➔ (At least Intel Core i5 5th generation or equivalent, ie: i5-5200U)

● RAM

Condition	Above 4GB
Recommended Operating System	Above 8GB

1.3 Regarding License

○ DockPanel Suite

This package uses DockPanelSuite. The license is MIT, refer to details in license.txt.

○ Open CV

Thie package uses OpenCV. There are 3 BSD licenses, refer to the details in LICENSE.

1.4 Regarding Connection to PE-Expert4

Please connect Media Converter and PC directly for PE-Expert4 communication.

Chapter 2 Screen Structure

This chapter describes the screen structure of PE-ViewX.

2.1 Outline

The screen structure of PE-ViewX is as follows:

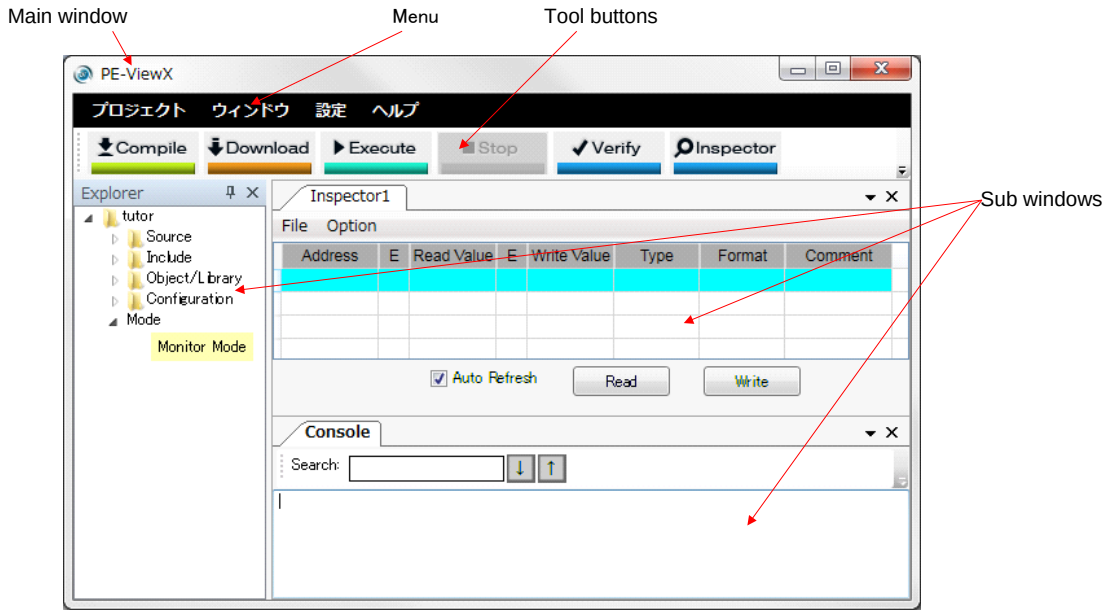


Figure 2:**Screen Structure**

As shown in the above figure, the screen consists of a main window, multiple sub windows, menu and tool buttons.

The following describes each component of the structure.

2.2 Main Window

This is the main window which constitutes PE-ViewX and all sub windows are started from the main window. When the main window is closed, PE-ViewX will be closed.

2.3 Menu

The menu is arranged on the main window.

Figure 3:**Menu**

The structure of the menu is as follows:

Table 1: Menu of Main Window

Main Items	Sub Items	Functions
Project	Create	This is for creating a new project.
	Open	This is for opening an existing project.
	Copy	This is for copying the project currently selected.
	Properties	This is for displaying the properties of the project currently selected.
	Exit	This is for closing PE-ViewX.
Window	Show Window	This is for displaying the selected window.
	Reset Window	This is for resetting the display of the window. Explorer/Inspector/Console will be displayed during a reset.
	Close All Window	This is for closing all the sub windows.
	Save Current Layout	This is for saving current layout
	Load Current Layout	This is for opening the layout which has been saved previously
Setting	TCP/IP	This is for setting the IP address and re-connecting to PE-Expert4.
	Editor	This is for setting the editor to be used. When the source file in Explorer is double-clicked, the default editor will start.
	Tool Button	This is for setting the tool buttons to be displayed.
	Compiler	This is for setting the path of the compiler and library.
	Samples	This is for setting the path to copy PEOS samples
	External Coupling	This is for setting integration with external tools
Help	About PE-ViewX	This is for displaying the version information of PE-ViewX.

See "3.3 Project Settings" for the details of the **Project** menu. See "3.2 Various Settings" for the details of the **Setting** menu.

Click the **Help** menu → **About PE-ViewX** to start the following dialog.
The version information will be displayed.

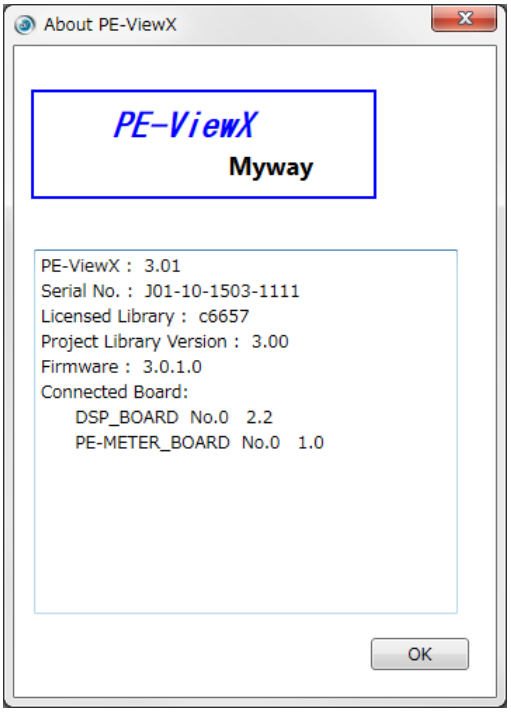


Figure 4:**Version Information**

The items displayed are as follows:

Table 2: Version Information Items

Items	Contents
PE-ViewX	The version information of PE-ViewX.
Serial No.	The serial number for license key.
Licensed Library	The version information of PEOS for license key.
Project Library Version	The version of PEOS for current project
Firmware	The version information of the kernel of PE-Expert4.
Connected Board	The boards which are connected to DSP board.

2.4 Tool Buttons

The tool buttons are arranged on the main window.

Figure 5:**Tool Buttons**

The structure of the tool buttons is as follows.

Click the **Setting** menu → **Tool Button** to toggle display/hide of each tool button.

Table 3: Tool Buttons

Names	Functions
Compile	Executes a compile
Download	Executes a downloading of a program
Execute	Changes a program to the executable state
Stop	Stops the program
Verify	Verifies the downloaded program
Inspector	Starts Inspector
Memory	Starts Memory
WAVE	Starts WAVE
Data Rec	Starts Data Recorder
PE-Meter	※Starts PE-Meter

See "Chapter 4 Sub Windows" for the details of Inspector/Memory/WAVE/Data Rec.

※ Users will need to purchase an additional METER board for PE-Meter functions. The functions include power analysis, torque data, and temperature analysis. Please refer to separate manual for PE-Meter

2.5 Sub Windows

The sub windows are started from the main window.

In PE-ViewX, each of the functions such as WAVE, Inspector is provided in the form of a sub window.

The structure of the sub windows is as follows.

Click the **Window** menu → **Show Window** to display each of the sub windows.

Table 4: Functions of Sub Windows

Names	Functions
Explorer	Displays the files which constitute a project. Double-clicking the currently displayed file starts the editor and allows you to edit it.
Memory	Displays the contents of the memory of the specified address.
Inspector	Reads/writes the specified parameters.
WAVE	Displays the waveform of the specified parameters in real time. Performs an FFT analysis of the read waveform data and displays the data.
Data Recorder	Displays waveforms of specified parameters and save the values
Console	Displays the output character string from the compile log and PE-Expert4.
PE-Meter	Displays measurements of power, torque, temperature and global variables. An additional METER board is necessary for operation. Refer to the separate manual for more information

As shown below, sub windows can be arranged inside or outside of the main window.

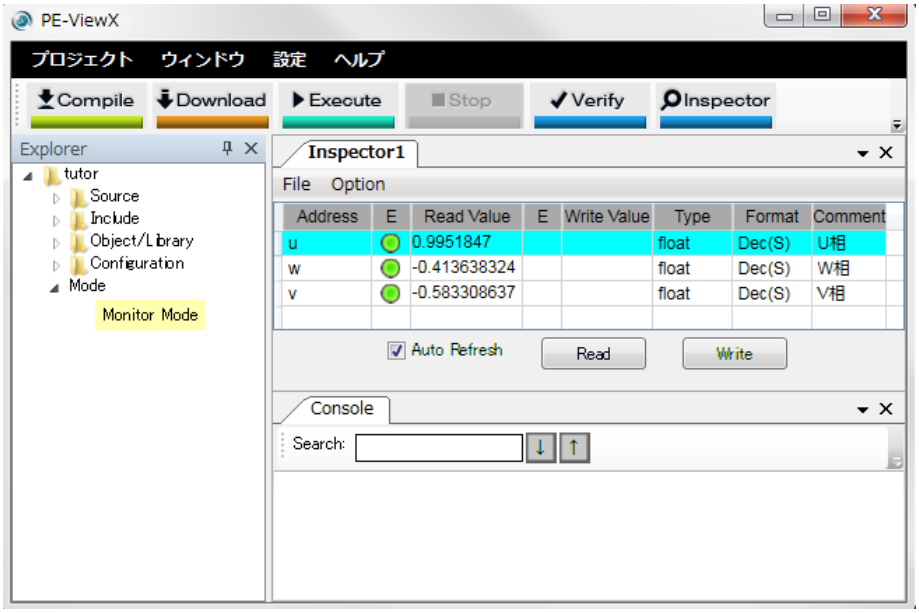


Figure 6:**Sub Windows Arranged in Main Window**

Double-clicking or dragging the tab of a sub window allows you to move it outside of the main window as shown below:

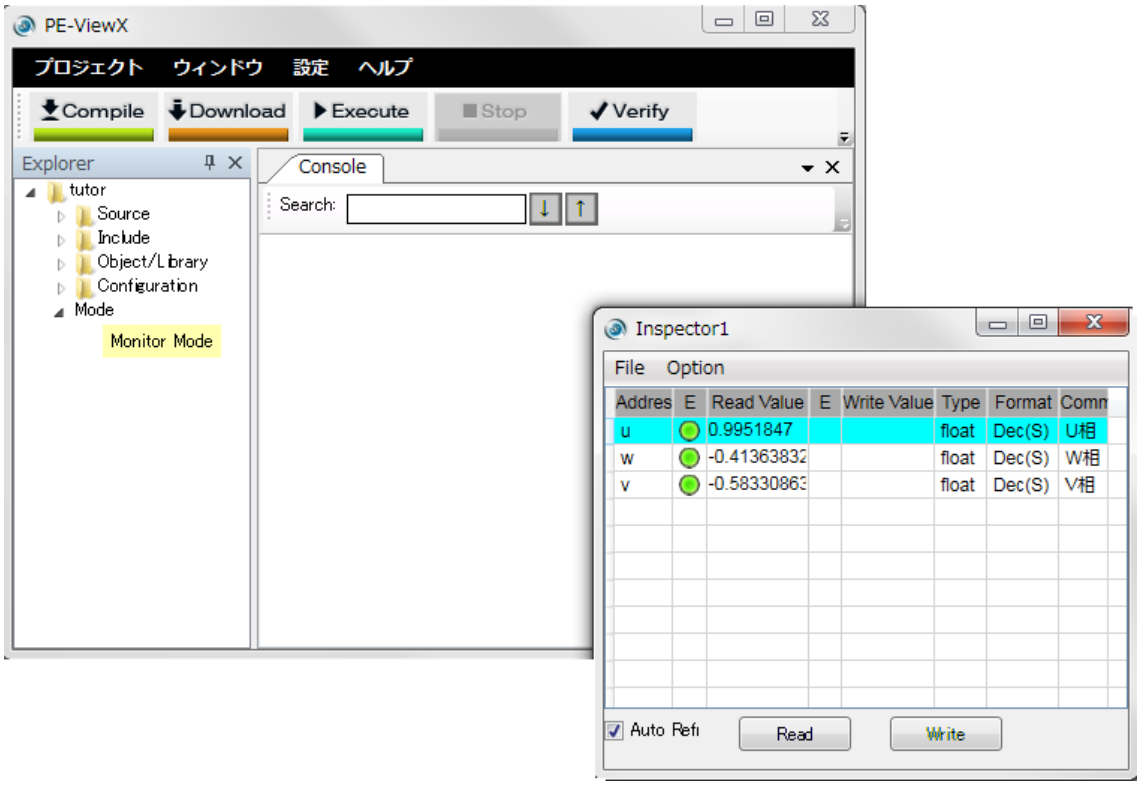


Figure 7:**Sub Window Arranged Outside of Main Window**

Double-click the tab of the main window again to return the sub window into the main window.

The sub windows can be docked by overlapping the sub windows arranged outside of the main window as follows:

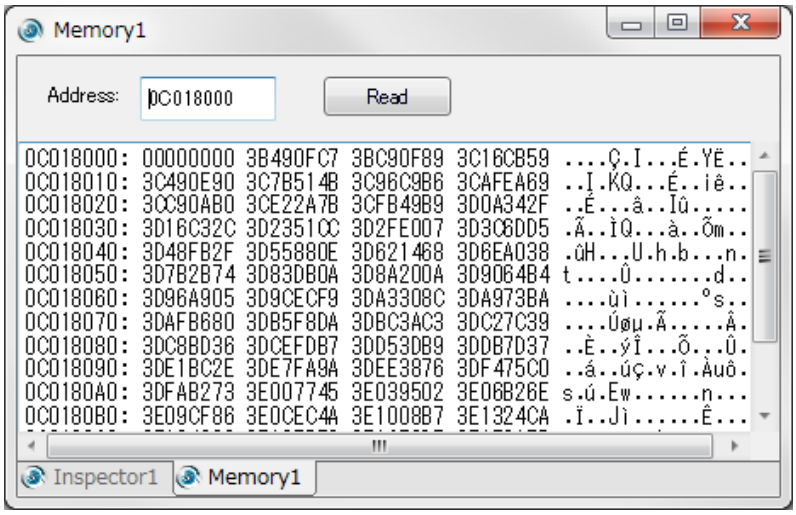


Figure 8:**Docked Sub Windows Arranged Outside**

See "Chapter 4 Sub Windows" for the details of the sub windows.

Chapter 3 Program Development Procedure

This Chapter describes the procedure to develop a program using PE-ViewX.

The following items are described according to an actual development procedure.

- Starting PE-ViewX
- Various settings
- Project settings
- Edit source files, etc.
- Compile
- Download
- Verify
- Execute/Stop
- Debug function

See "Chapter 4 Sub Windows" for the details of the functions of each sub window as needed.

3.1 Starting PE-ViewX

Start PE-ViewX according to the following procedure:

Connect the license key provided with PE-ViewX to the USB port of a PC.

The [Hasp key] of SafeNet is used as the license key.

In order for the PC to recognize the license key, a driver must be installed.

See the "Installation Instructions Manual" for the installation method of the license key driver.

After the driver is installed, when the license key is connected to the USB port of a PC, the license key will be recognized automatically.

After the license key is recognized, the following will be displayed in the universal serial bus controller of the device manager.

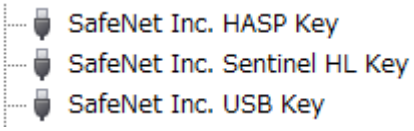


Figure 9:**License Keys Displayed in Device Manager**

After the license key is recognized, a red LED will turn ON.

After the license key is connected, PE-Expert4 will start.

See the "Installation Instructions Manual" for starting PE-Expert4.
Then start the application.

On the Windows menu, click **All Programs** → **Myway Plus** → **PE-ViewX** → **PE-ViewX** to start the application.
Regarding the starting sequence, be sure to start PE-ViewX after PE-Expert4 is started.

3.2 Copy Samples

PE-ViewX is defaultly stored under [Program Files]. It is necessary to perform PEOS installation for operation. In this section, copy the PEOS samples into a desired path. There are 2 methods to do so.

(i) Copy the samples when activation

When PE-ViewX is first stated, the dialog will appear as follows. Set the directory for PEOS samples to be copied. The dialog will only appear when you start PE-ViewX for the first time. If [Cancel] is executed, the samples will not be copied.

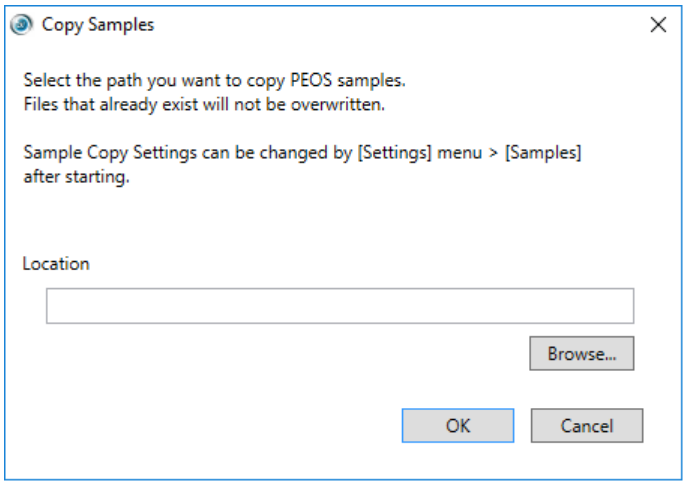


Figure 10: **Select directory for samples to be copied to**

(ii) Copy the samples after opening PE-ViewX

Open PE-ViewX, Settings → Samples, the dialog will appear as below.

Set a directory for the samples.

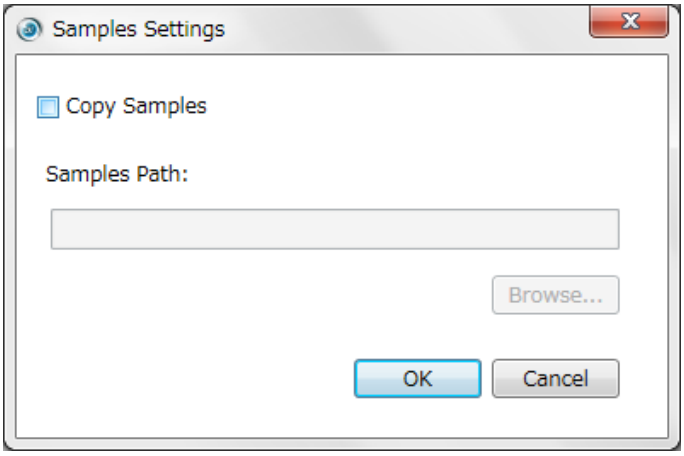


Figure 11: **Select directory for samples to be copied to (after opening PE-ViewX)**

Table 5: Items in Sample Copy Dialog

Items	Contents
Copy Samples	Copy samples
Samples Path	Set directory for samples
Browse	Select a direct
OK	Click to copy samples
Cancel	Click to cancel

※For each new version of PEOS installed, the new version of samples will be automatically copied. Click on OK when the above dialog is displayed.

3.3 Various Settings

To use PE-ViewX, it is necessary to perform various settings in advance.
This section describes the following items:

- IP address
- Editor
- Tool buttons
- Compiler path
- Sample copy
- Link to external tools

Once the above items are set, it can be used as they are unless there are changes in the set items. For PE-ViewX, different accounts can be used in 1 PC. Refer to the following settings

Table 6: Settings for different accounts

Association	Settings
Common settings in all accounts	・IP address ・Compiler path
Individual setting in each account	・Editor ・Tool buttons ・Sample copy ・Link to external tools

For example, the IP addressis is the same for all accounts. If one user changes IP address, the IP of others will also change.

3.3.1 IP Address

PE-Expert4 and PE-ViewX are connected via LAN.

Therefore, the IP address must be set.

The setting procedure is as follows:

1) Setting procedure

Click the **Setting** menu → **TCP/IP** to start the following dialog.

Set the IP address, etc. of PE-Expert4 in this dialog.

PE-ViewX is connected to the IP address set here.

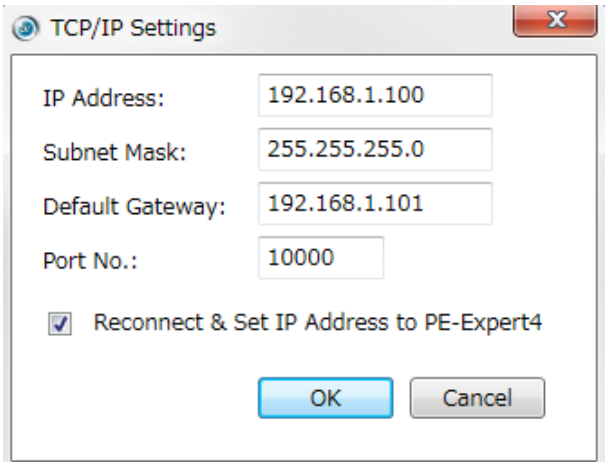


Figure 12: **IP Address Setting Dialog**

The setting items are as follows:

Table 7: Setting Items of IP Address Dialog

Items	Contents
IP Address	IP address of PE-Expert4
Subnet Mask	Subnet mask of PE-Expert4
Default Gateway	Default gateway of PE-Expert4
Port No.	Port number of the board of PE-Expert4
Reconnect & Set IP Address to PE-Expert4	Enable: Reconnects to PE-Expert4 and writes the set contents. Disable: Does not reconnect to PE-Expert4 or write. Only the IP address saved in PE-ViewX will be changed.

Click the **OK** button to update the set items.
Clicking the **Cancel** button will not update the set items.

The values of each address at factory settings are as follows:

IP Address : 192.168.1.100
Subnet Mask : 255.255.255.0
Default Gateway : 192.168.1.101
Port No. : 10000

2) Notes:

- The IP address set here becomes enabled when both PE-ViewX and PE-Expert4 are restarted the next time.
- Set the IP address set in PE-ViewX as the IP address to be used on your PC.
  The detailed procedure is as follows:

Click **Control Panel** of the PC → **Network and Sharing Center** → **Change Adapter Settings** to open the properties of the applicable network.
Select **Internet Protocol Version 4 (TCPipv4)**, and confirm the IP address of the PC.
As shown below, change the values enclosed in red to the same values set in PE-ViewX.
Set the values enclosed in blue to values different than the values set in PE-ViewX.

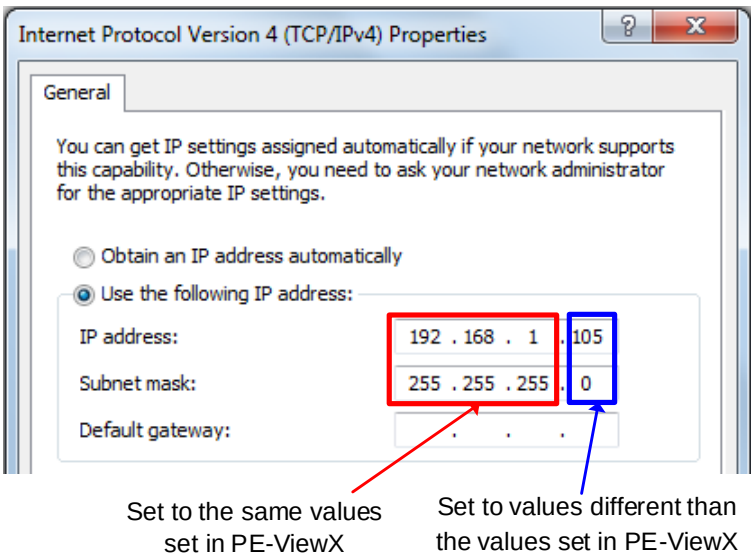


Figure 13: **Internet Protocol Version 4 (TCPipv4) on PC**

When starting up PE-ViewX, there may aniti-vius warning on TCIP/IP port.
There is no problem in operation, clear the error.

3.3.2 Editor

The editor to edit source files, etc. can be set. The setting procedure is as follows:

Click **Setting** menu → **Editor** to start the following dialog.
In this dialog, set the path of the editor to be used.

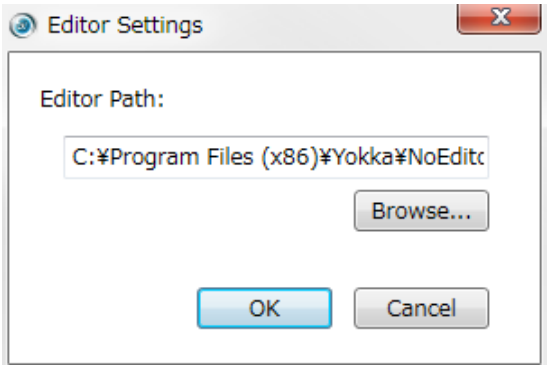


Figure 14: **Editor Settings Dialog**

Click the **Browse...** button to select the editor to be used.

To edit a source file, etc., select the file from the **Explorer** window described later, and double-click to start the editor.
Click the **OK** button to update the set items.
Clicking the **Cancel** button will not update the set items.

3.3.3 Tool Buttons

The tool buttons displayed on the main window can be set. The setting procedure is as follows:

Click the **Setting** menu → **Tool** button to start the following dialog.
In this dialog, select the tool buttons to be displayed.

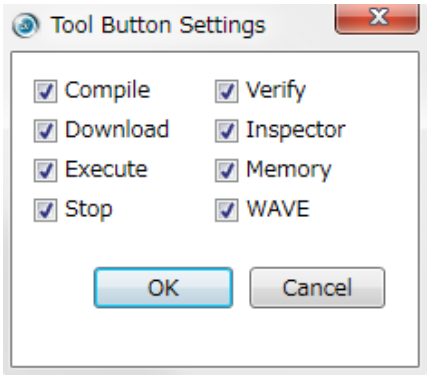


Figure 15: **Tool Button Settings Dialog**

Click the **OK** button to update the set items.
Clicking the **Cancel** button will not update the set items.

The set contents will be reflected in the main window as shown below:

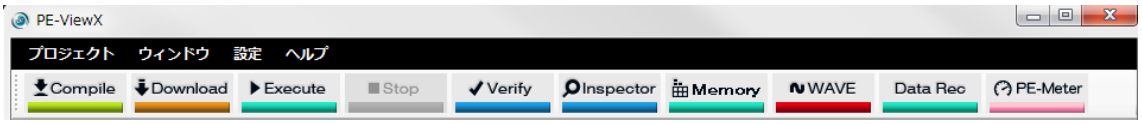


Figure 16: **Tool Buttons Displayed on Main Window**

3.3.4 Compiler Path

First, it is necessary to set the path of the compiler and the library to be used. The setting procedure is as follows:

1) Setting procedure

Click the **Setting** menu → **Compiler** → **(Processor name)** to start the following dialog. In this dialog, set the path of the compiler and the library.

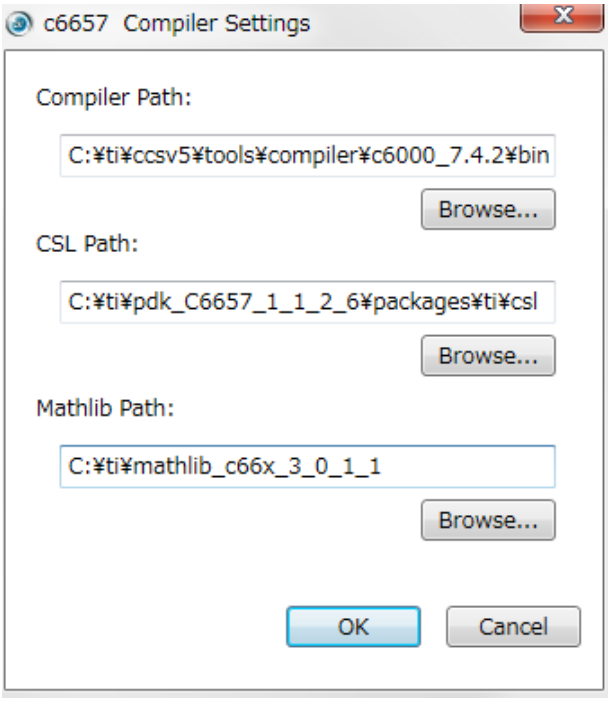


Figure 17: **Compiler Settings Dialog**

The settings are as follow:

Table 8: Settings of Compiler Setting Dialog

Items	Contents
Compiler Path	This is for setting the compiler path. Specify the [bin] folder. The folder where the compiler (cl6x.exe) is saved.
CSL Path	This is for setting the path of CSL (Chip Support Library). Specify the [csl] folder. The folder where csl.h is saved.
Mathlib Path	This is for setting the mathlib (floating point arithmetic library). Specify the [mathlib_xxxx] folder.

The following shows an example of setting a path when the compiler and library are installed in the "c:¥ti" folder.

Compiler Path：
C: ¥ti¥ccsv5¥tools¥compiler¥c6000_x.x.x¥bin
CSL Path：
C: ¥ti¥pdk_C6657_x_x_x_x¥packages¥ti¥csl
Mathlib Path：
C: ¥ti¥mathlib_c66x_x_x_x_x

* The "x" represents the version information.

Click the **OK** button to update the set items.
Clicking the **Cancel** button will not update the set items.

2) Notes:

● Use half-width characters only to set the path of the compiler and library.
Do not add spaces.
If a path includes full-width characters or spaces, it cannot be compiled normally.

3.3.5 Copy Samples

The directory to copy samples of PEOS can be selected. Refer to 3.2 Copy Samples for more details.

3.3.6 External Coupling

External coupling refers to introducing .txt files into PE-ViewX. Follow step 1-6 below for external coupling.

1) First, enable external coupling. Go to **Settings** → **External Coupling.** The following dialog is displayed.

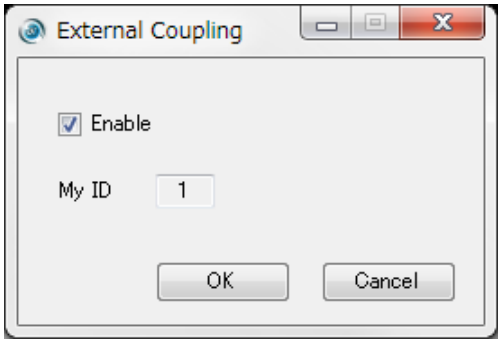


Figure 18: **External Coupling**

The following items are in settings.

Table 9: Settings in External Coupling

Item	Contents
Enable	Check: external coupling enabled Not check: external coupling not enabled
My ID	PE-View X ID. It is fixed at “1”.

Click the **OK** button to refresh items.

Click the **Cancel** button to cancel any changes.

Click on **Enable** button to enable external coupling.

2) **Command**

The external coupling allows a .txt file to give a command to PE-ViewX.

Available commands are as follows.

Table 10: List of available command

Command	Content
fopen	Creates and opens the specified file. If file already exists, the file is overwritten.
fopena	Creates and opens the specified file. If file already exists, opens with append mode.
fclose	Closes the current file.
read	Reads the value of variable and writes it to the current file.
write	Writes the value to variable.
wait	Waits for the specified time.
until	Waits until the value of variable matches the specified value.
execute	Executes user program. (Equivalent to click [Execute] button of PE-ViewX)
stop	Stops user program. (Equivalent to click [Stop] button of PE-ViewX)
exit	Exits PE-ViewX.
rename	Renames the file.
wave	Sets the WAVE trigger and gets the WAVE data. The WAVE data is saved to the current file.
dos	Executes the specified string as MS-DOS Command.
output	Writes the specified string to the current file.

There are a few rules for the command.

○ upper and lower case words must be differentiated

○ there must be a delimited between parameters

○ the delimiter can either be in comma, half-width space, tab

The delimiter is described as ■ in the following descritption.

fopen■Filename:

- Open specified file.
- Overite any existing file.
- Read command value is recorded in the opened file.
- In case when a folder path is specified, a file will be created.
- In case when a folder path is not specified, a file will be created in selected project folder.

fopena■Filename:

- Open specified file.
- The difference between *fopen* is, if any file is present, a new file will be added instead of overwriting it (append mode)

fclose:

- Close existing file

write■variable name■write value■(variable name■write value):

- Write the value to the variable.
- (): specified multiple parameters.
- A maximum of 200 parameters specified in a line
- Equivalent to [Write] button in Inspector.
- For a smooth flow, insert “wait” or “until” command in between”write” commands.

Error occurs in the following condition:

○ More than 200 parameters in a line.

○ Specifying a variable name which is not in project.

○ Writing a decimal value for integer.

○ “wait” or “until” is not present in between “write” commands.

※ There are two ways to write to the linear array.

1)write■array name■#write value#writevalue#write value

Writes the value from the top of linear array.

2)write■array name[Index]■#write value#writevalue#write value

Writes the value from the specified index of linear array.

In write command, one element of the array is equivalent to one variable.

So values up to 200 elements can be written.

※When multiple parameters are specified, each data will be written, but not in the same time. The operation is equivalent to [Write] button in [Inspector].

read■variable name(■variable name):

- Read specified variable name, and write to the current file.
- (): specified multiple parameters.
- A maximum of 200 parameters specified in a line
- Equivalent to [Read] button in Inspector.
- For a smooth flow, insert “wait” or “until” command in between”read” commands.

Error occurs in the following condition:

○ File is not opened.

○ More than 200 parameters in a line.

○ Specifying a variable name which is not in project.

○ “wait” or “until” is not present in between “read” commands.

※There are three ways to read from the linear array.

1)read■array name

Reads the data from all element of linear array.

2)read■array name[Index]

Reads the data from the specified index of linear array.

3)read■array name[Index]@Length

Reads the data from the specified index of linear array for the specified length.

In read command, one element of the array is equivalent to one variable.

So values up to 200 elements can be written.

※When multiple variable names are specified, each data will be read, but not in the same time. The operation is equivalent to [Read] button in [Inspector].

wait■value:

- wait in specified time, in msec. The value must not be smaller than 200.

unti■parameter value:

- The specified parameter waits to reach the assigned value.

  Error occurs in the following condition:

  ○ Stating a parameter which is not in project.

  ○ Writing a decimal value for integer.

execute:

- Execute PE-ViewX

stop:

- Stop PE-ViewX

exit:

- Exit PE-ViewX
-

rename■original file name■new file name:

- rename file.
- In case when fold path is not specified, the file of current selected project will be renamed.

wave■variable name■(variable name)■Type=trigger type■TrgCH=trigger channel
■Sampling=sampling period■Record=record length■TrgPos=trigger position
■TrgLevel=trigger level■Edge=trigger edge:

Set WAVE trigger and write the WAVE data to the current file.
This command is equivalent to [Run] button of WAVE window.
(): specified multiple variable names.
A maximum of 16 variable names can be specified in this command.

Error occurs in the following condition:
○ File is not opened.
○ Specifying a variable name which is not in project.
○ “wait” or “until” is not present in between “wave” commands.

※[WAVE] window of PE-ViewX and this command are exclusive.
This command cannot be executed while [WAVE] window is running.
And [WAVE] window cannot be runned while this command is executing.

Setting items are as follows.

Table 11: List of setting item of wave command

Item	Content
variable name	Specify variable names. Up to 16 variables can be specified.
Type	Specify trigger mode Auto: Auto mode Single: Single mode
TrgCH	Specify trigger channel 1 to 16: 1 to 16 channel 17 : ext channel
Sampling	Specify sampling period. (us) The setting range is as follows. 5 to 10000: variable count is 1 to 8 10 to 10000: variable count is 9 to 16

Record	Specify record length. The setting range is as follows. 50 to 524288
TrgPos	Specify trigger position by decimal. (0 to 100%) For example, if you specify 50%, pre trigger time and post trigger time are equal.
TrgLevel	○ Specify trigger level by decimal.(-4 billion to 4 billion) ○“TrgCH=17” means Ext channel. In this case, trigger level is 0.5.(fixed) ○ The following suffix can be specified. G: Giga M: Mega k: Kilo m: Milli u: Micro n: Nano
Edge	Specify trigger edge. Rise: Rise Edge Fall: Fall Edge

○ Example is as follows.

wave■u■v■w■dwt■Type=Auto■TrgCH=1■Sampling=10■Record=10000■
TrgPos=10%■TrgLevel=1.7■Edge=Rise

○ The output is as follows.

TrgTime(s), u, v, w, dwt
-0.001000, -7.356457e-002, 9.013488e-001, -8.263211e-001, -8.263211e-001
-0.000959, -1.980984e-001, 9.475856e-001, -7.491364e-001, -8.263211e-001

○ The format of above output is as follows.

TrgTime(s) variable name (variable name)
Time value (value)

Time value is as follows.

Auto mode: Starts from 0.

Single mode: The index of trigger position is 0.

dos■'XXXX':

Execute any string (XXXX) enclosed by single quotation (‘) as MS-DOS Command.

○ Enclose with double quotation when specifying the path including space.
Example)

dos■'cd “C: \Users\1115\folder 1”'

○ Specify “&&” between commands when writing multiple commands.
Example)

dos■'cd “C: \Users\1115\folder 1” && copy test.txt “.\sub\test.txt”'

Multiple commands stop if the return value of any command is other than 0.

○ Project directory is regarded as current path if you don’t specify the path explicitly.

○ Only the following MS-DOS commands are supported because those are tested.
Other MS-DOS commands are not supported, so use them at your own responsibility.

cd/ copy/ del/ dir/ fc/ find/ mkdir/ sort/ pipe function/ redirect function / launching bat file

output■'XXXX':

Write any string(XXXX) enclosed by single quotation (‘) to the current file.
This command can be used as outputting comment.

3) Output File

Method of extracting output file from PE-ViewX and external coupling PE-ViewX:

Input file to PE-ViewX: InputToViewX_1.txt

Output file from PE-ViewX: OutputFromViewX_1.txt

Input or output files are objects from selected project folder.

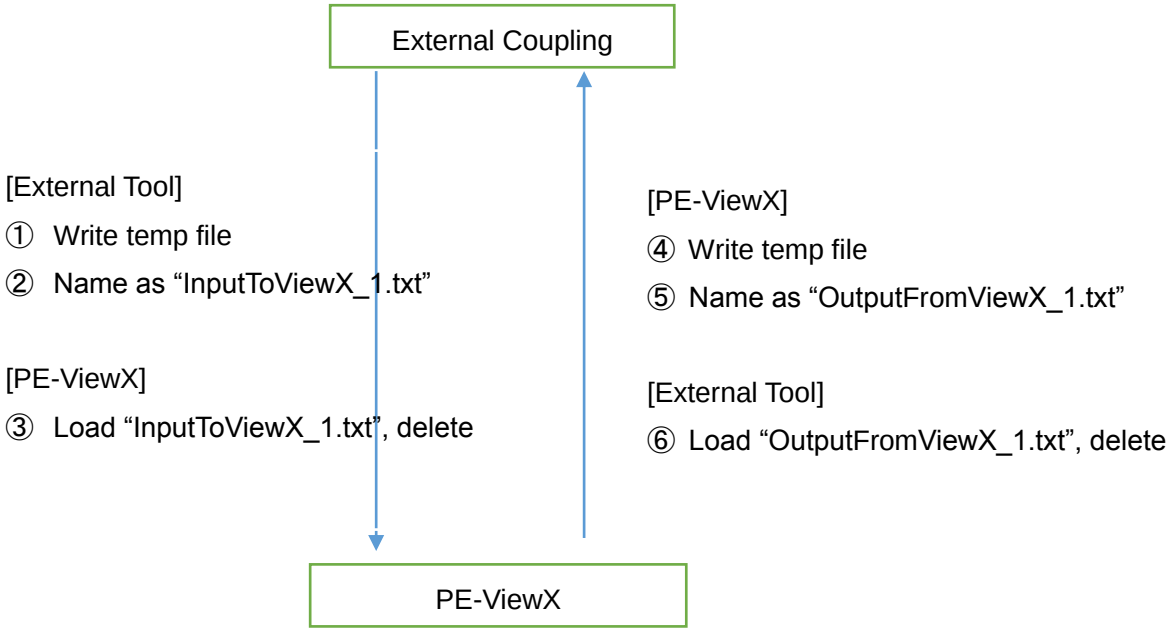


Figure 19: **File Input/Output**

The explanation of the above is as follow:

① The external tool will generate a temporary file with commands to PE-ViewX. The commands include opening and closing of files, reading and writing of variables.
② When the temporary file is created, it will be named as “InputToViewX_1.txt”.
③ The contents will be loaded after “InputToViewX_1.txt” is named in project folder. The temporary file will be deleted.
④ PE-ViewX executes the commands in “InputToViewX_1.txt”. the following commands need to be present in the file:

fopen “temp file name”
Arbitrary commands
fclose

rename “temp file name” OutputFromViewX_1.txt

At the point of executing *fclose*, temporary file creation is completed.

⑤ At the point of executing *rename*, temporary file will be renamed to “OutputFromViewX_1.txt”. When all the commands are executed, “OutputFromViewX_1.txt” will be created in project folder.

⑥ The external tool also monitors any changes to the file.
And the external tool loads after “OutputFromViewX_1.txt” is generated.
After that, “OutputFromViewX_1.txt” needs to be deleted by the external tool.
The external tool determines the next commands based on “OutputFromViewX_1.txt” and issue a command to PE-ViewX. (returns to ①)

4) Sample

The following shows a sample of commands in PE-ViewX. The contents are executed in PE-ViewX.

fopen TmpOutputFromViewX_1.txt
execute
write Start_Flg 1
wait 500
read iw uw vw
fclose
rename TmpOutputFromViewX_1.txt OutputFromViewX_1.txt

The sample follows these operations.

① Open temporary file “TmpOutputFromViewX_1.txt”
② Execute user program
③ Write “1” to parameter “Start_Flg”
④ Wait 500msec
⑤ Read parameters “iw, uw, vw” from user program. The data will be recorded to temporary file
⑥ Close temporary file
⑦ Rename temporary file to output file “OutputFromViewX_1.txt” to external tool

5) Time Out Processing

In case of no response from PE-ViewX after a certain time period, the external tool can perform timeout processing. The external tool will send a new file “InputToViewX_1.txt” to PE-ViewX. When there is a new file sent to PE-ViewX, the presently executed commands will be terminated, and executed the commands from the new “InputToViewX_1.txt”.

6) Error Porcessing

If an error occurs during command processing on PE-ViewX, the error contents will be displayed in project folder as “error.txt”. When the external tool detected “error.txt”, the errors are processed and the file will be deleted.

7) Sample Files from Excel

The example below shows an external coupling with an excel spreadsheet. It is created with

similarities to Inspector. Excel will first create a file, PE-ViewX will read the file and display acquired data. The operation is in continuous mode, “Start” to begin and “Stop” to stop.

- Write a value to [D7] StartFlag
- Read [D10] StartFlag
- Read [D11] Counter

“TestErr” is for error commands, “error.txt” will be created.

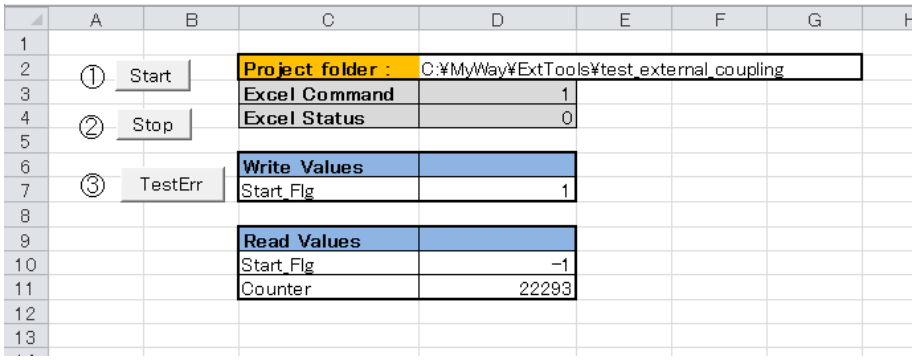


Figure 20: Sample File in Excel

※ Before using Excel files, perform the following.Excel

A) For this sample, use “SampleExcelVBA.xlsm” which is present in “test_external_coupling.prj” for **Download** and **Execute** in PE-ViewX.

B) Set path for project folder in [D2].

3.3.7 Offset of timeout

The offset of communication timeout for PE-ViewX and PE-Expert4 can be set separately.
Communication timeout occurs in the following cases.

[PE-ViewX]
PE-ViewX issues polling command every few seconds.
And PE-ViewX issues data request command when executing WAVE and Inspector, etc.
Communication timeout of PE-ViewX occurs when those commands have no response from PE-Expert4.

[PE-Expert4]
PE-Expert4 waits for any command from PE-ViewX.
Communication timeout of PE-Exert4 occurs when no command is received from PE-ViewX for few seconds.

By setting offset of timeout, time until timeout occurs is extended.
Offset value of PE-Expert4 is saved to Flash ROM, so this value is retained even when turning off PE-Expert4.

[Settings] menu > Click [Offset of Timeout] to display the below dialog

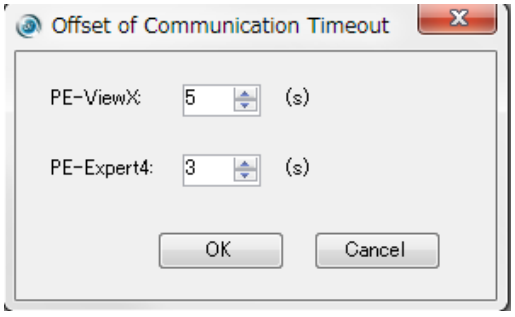


Figure 21: [Offset of Communication Timeout] Dialog

Settings items are as follows.

Table 12: List of settings items

Items	Context
PE-ViewX	Set the offset value of PE-ViewX. Value can be set 0 to 20(s).
PE-Expert4	Set the offset value of PE-Expert4.

	Value can be set 0 to 20(s).

3.3.8 Data Table

Data Table function downloads data table defined by *.csv file to RAM of PE-Expert4.

RAM address is 0x81900000 to 0x81ffffff. (Up to 7M byte)

User program can refer to the data table like torque map etc.

Data table is downloaded only to RAM, so data is cleared when turning off PE-Expert4.

[Settings] menu > Click [Data table] to display the below dialog.

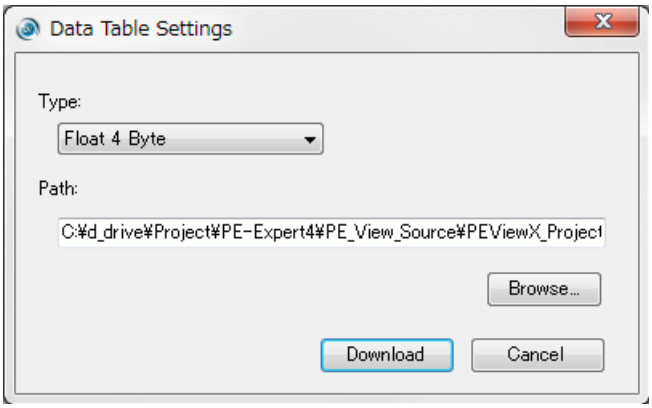


Figure 22: [Data Table Settings] Dialog

Figure 23: List of settings items of data table

Items	Content
Type	Specify the data format of data table. Data table is downloaded with little endian. The format can be selected from the following. Unsinged Integer X Byte: Values separated by comma are interpreted as unsigned decimal number. Signed Interger X Byte: Values separated by comma are interpreted as signed decimal number. Hexadecimal X Byte: Values separated by comma are interpreted as hexadecimal number. Float 4 Byte: Values separated by comma are

	interpreted as single-precision floating-point number. If no value is specified between commas, it is interpreted as 0.
Path	Specify *.csv file of data table path.

3.4 Project Settings

This section describes the following items for setting a project.

- Create
- Open
- Copy
- Properties

3.4.1 Create

1) How to create a new project

Click the **Project** menu → **Create** to start the following dialog.

To create a new project, set the necessary information in this dialog.

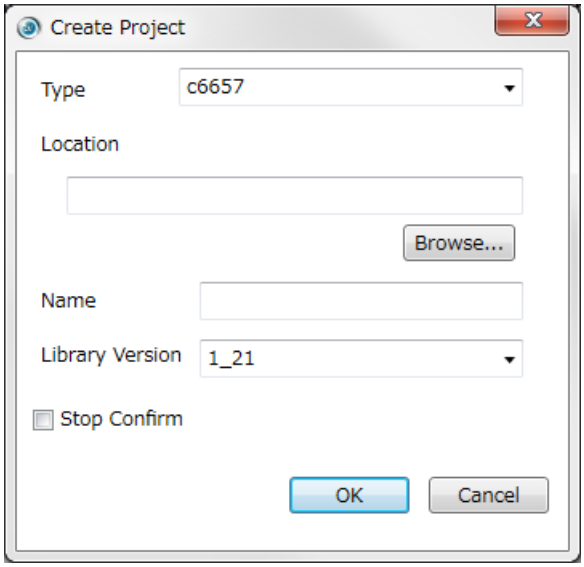


Figure 24: **Create Project Dialog**

The setting items are as follows:

Table 13: Setting Items of Create Project Dialog

Items	Contents
Type	Selects the processor.
Location	Sets the path where the project is to be created. Directly enter the path, or select from the **Browse...** button.
Name	Sets the project name.
Library Version	Selects the version of the PE library to be linked.
Stop Confirm	Enable: When the **Stop** button is clicked, a confirmation message on whether to stop the program will be displayed. Disable: When the **Stop** button is clicked, the program will stop without displaying any message.

Click the **OK** button to create a new project.

Click the **Cancel** button to cancel the creation.

2) Example of creating a new project

As a reference, create a new project with the following settings.

Type : c6657

Location : c:¥MywayPlus¥project¥sample_1

Name : sample_1

Stop Confirm : Disable

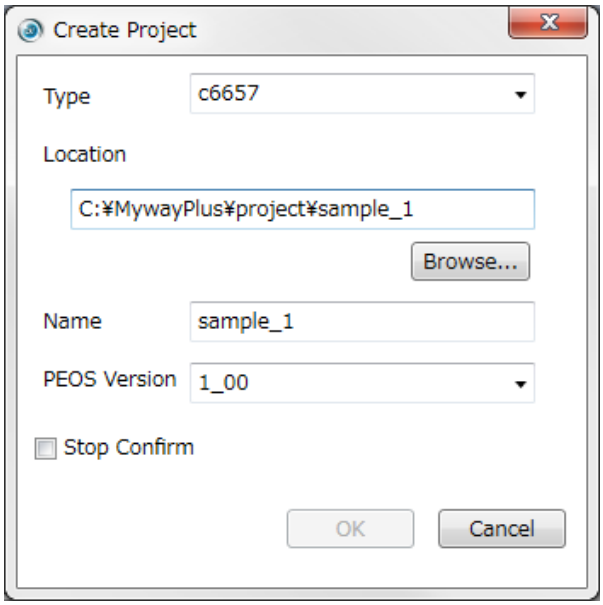


Figure 25: **Create Project Dialog (sample_1 Project)**

After the items are set, click the **OK** button.

A new sample_1 project will be created.

The following files will be created automatically in the sample_1 folder.

Table 14: Files Created Automatically

File Names	Contents
sample_1.prj	The project file for saving the project information.
sample_1.c	The source file where the MW_main() function is described.
sample_1.cmd	The linker script file used when linking.
linker_image.rmd	The configuration file used to create download files.

As shown below, the file structure of a newly created project will be displayed in the **Explorer** window.

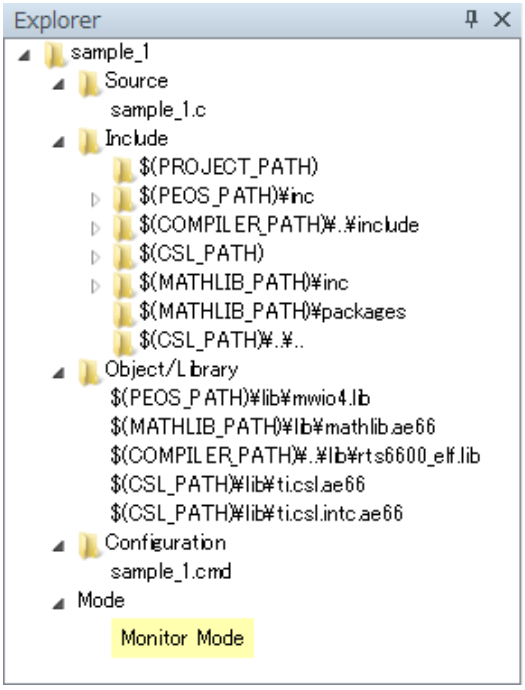


Figure 26: **sample_1 project** displayed in Explorer **Window**

As shown in the above figure, the PE library required for compiling, and CSL library, etc. are linked by default.

Similarly, header files of the PE library and CSL, etc., are also referenced by default.

In this step, clicking **Compile** of the tool buttons will display the compile log in the **Console** window as shown below.

It shows that the compiling was successful.

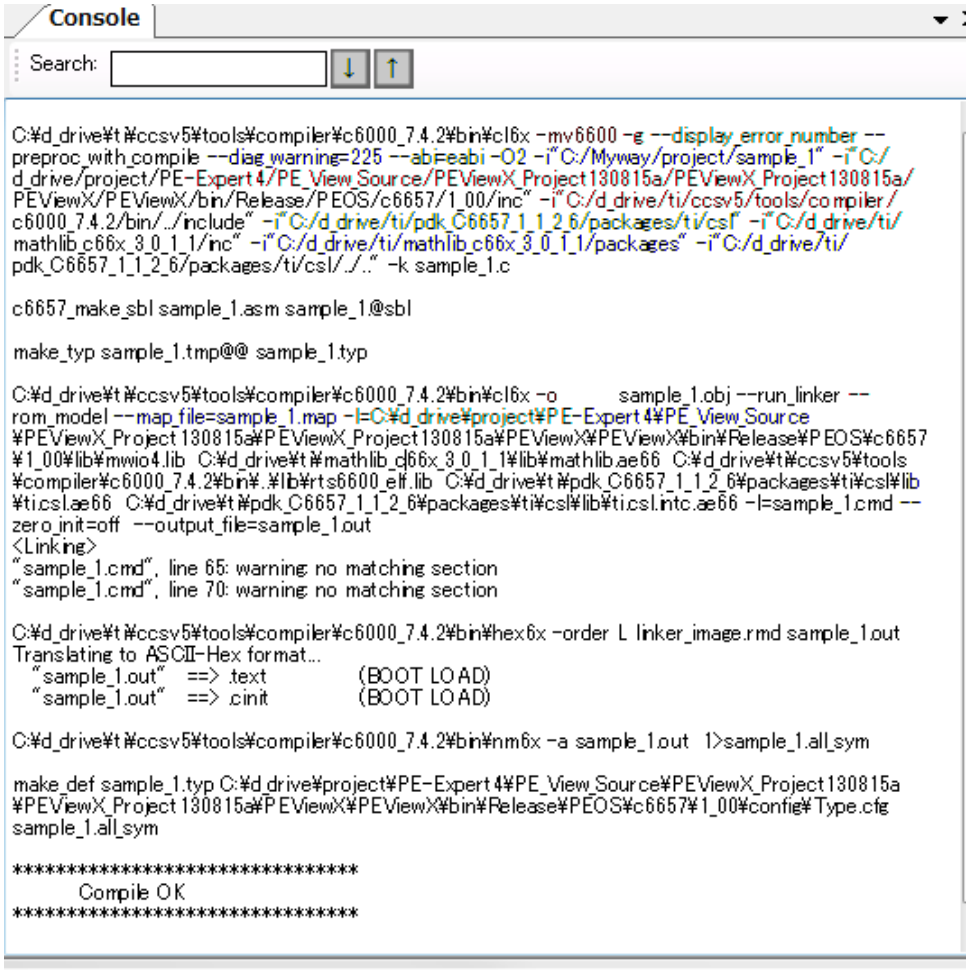


Figure 27: **Compile Log** displayed in Console **Window**

Do not modify the sample_1.prj/ linker_image.rmd file during development.

The sample_1.cmd file will automatically be updated each time a compile is executed.

For cases where a different compilation option is used, set the automatic update function of the batch file to disable, then manually modify the sample_1.cmd file.

See "Chapter 4 Sub Windows" for how to disable the automatic updating function of a batch file.

3.4.2 Open

Click the **Project** menu → **Open** to open an existing project.

As shown below, the Select File dialog will be displayed. Select the project file (*.prj) of the project to be opened.

In the following example, a sample [tutor] project included in the PE library is opened.

(C:¥MywayPlus¥PE-ViewXaa¥PEOS¥c6657¥a_bb¥sample¥tutor)

aa… version of PE-ViewX

a_bb… version of PEOS

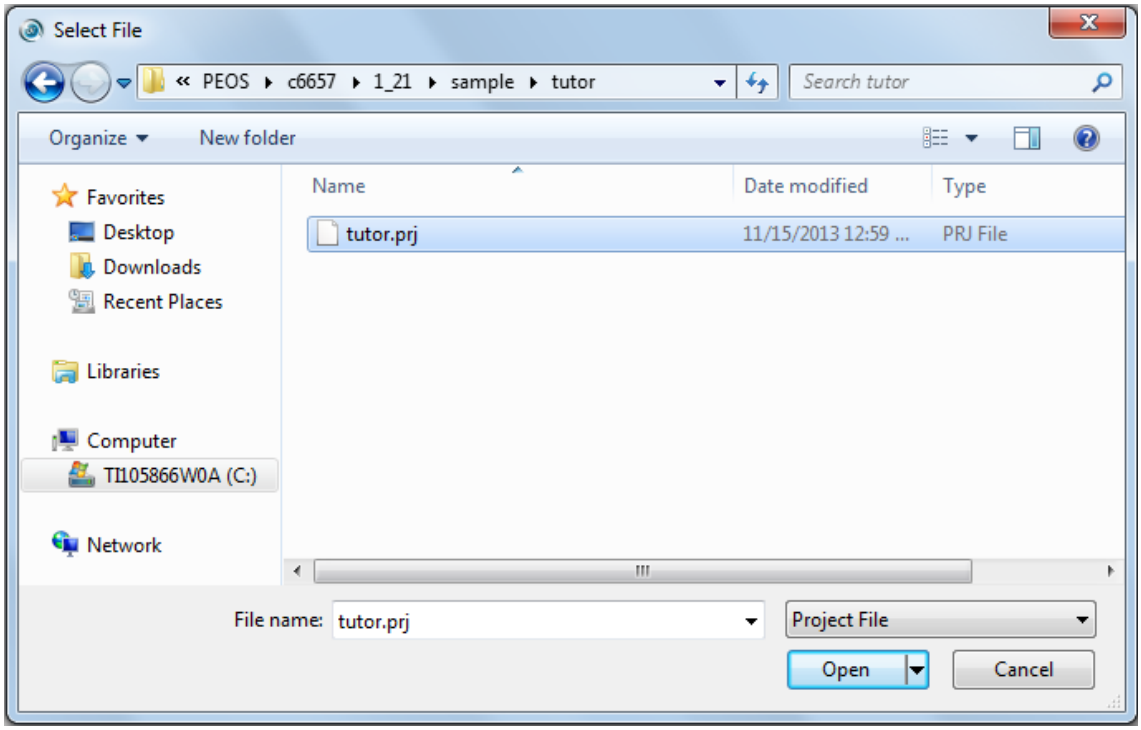


Figure 28: **Selection of Tutor Project**

When the [tutor] project is opened, the following screen will be displayed.

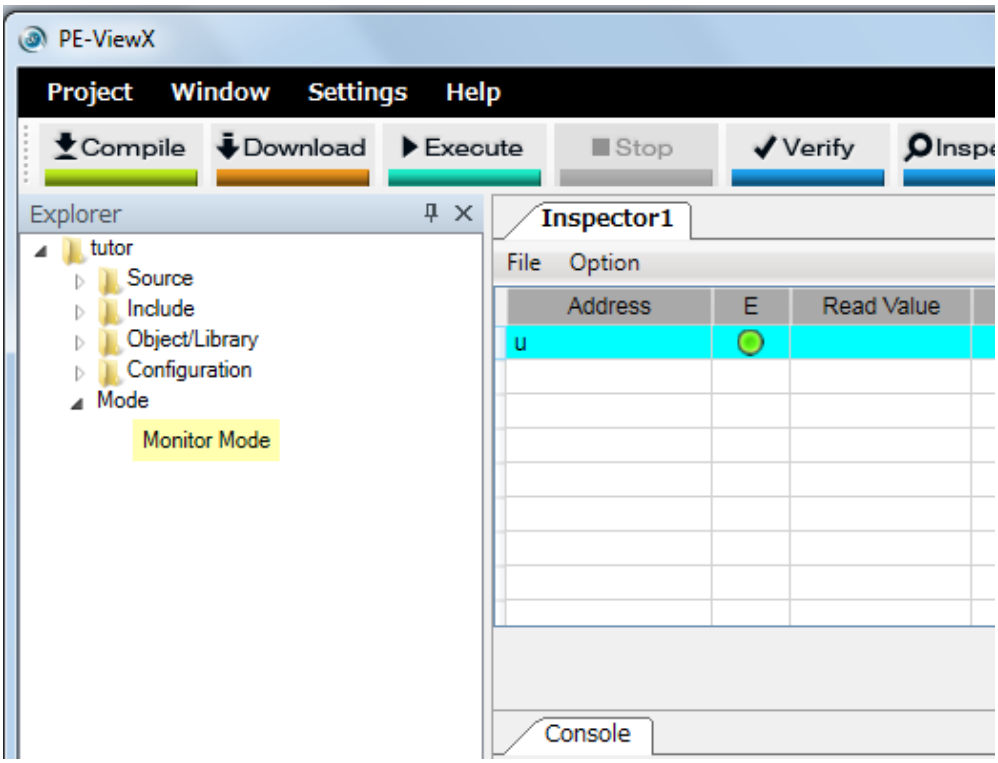


Figure 29: **Completion of Tutor Project Selection**

3.4.3 Copy

Click the **Project** menu → **Copy** to start the following dialog.

To copy the currently selected project, select the path of the copying destination in this dialog.

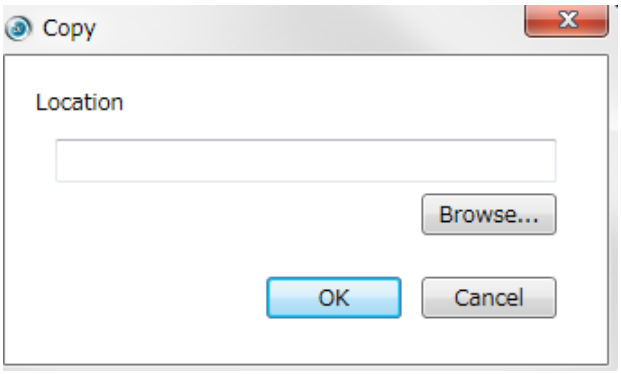


Figure 30: **Copy Dialog**

The settings are as follow:

Table 15: Setting Items of Copy Dialog

Items	Contents
Location	Set the path of the copy destination of the project. Directly enter the path, or select from the **Browse...** button.

Click the **OK** button to copy a new project.

Click the **Cancel** button to cancel the creation.

3.4.4 Properties

Click the **Project** menu → **Properties** to start the following dialog.

The properties of the currently selected project will be displayed.

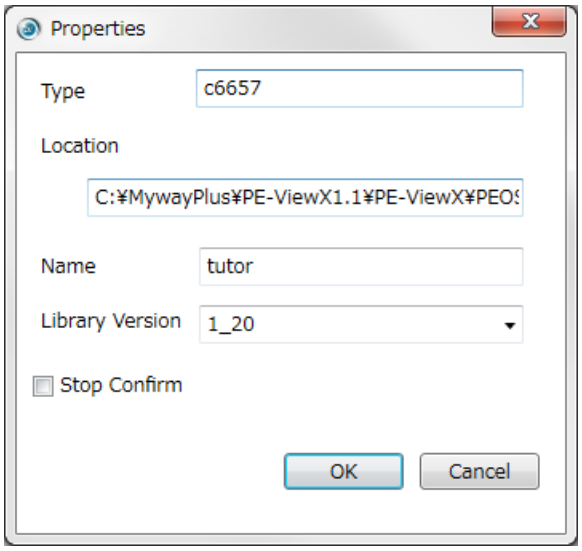


Figure 31: **Properties Dialog**

The settings are as follow:

Table 16: Display Items of Properties Dialog

Items	Contents
Type	Displays the processor
Location	Displays the project path
Name	Displays the project name
Library Version	Displays the version of the linked PE library. It can be changed.
Stop Confirm	Enable: When the **Stop** button is clicked, a confirmation message on whether to stop the program will be displayed. Disable: When the **Stop** button is clicked, the program will stop without displaying any message. It can be changed.

Click the **OK** button to reflect the changes.

Click the **Cancel** button to cancel the creation.

3.5 Editing Source Files, Etc.

This section describes the editing method of a source file, etc.

The file which constitutes a project can be managed from the **Explorer** window.

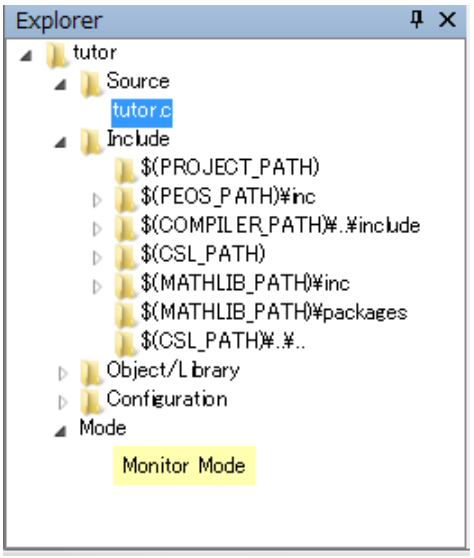


Figure 32: **Explorer Window**

The structure of the **Explorer** window is as follows:

Table 17: Display Items of Explorer Window

Items	Contents
Project	Root directory. Displays the following items which constitute a project.
Source	Displays the source file.
Include	Displays the path of a header file, and the header file in the list.
Object/Library	Displays the library to be linked and the object file.
Configuration	Displays the batch file and linker script file used for compiling.
Mode	Displays the execution status of the project.

3.5.1 Editing Source Files

As shown in the above figure, all the files which constitute a project are displayed in the **Explorer** window.

The source file of a project is displayed in **Source.**

Double-clicking the **Source** file starts the editor set by clicking the **Setting** menu → **Editor** and allows the source file to be edited.

3.5.2 Adding Source Files

There are two methods for adding source files.

Both methods are executed from the context menu of Source.

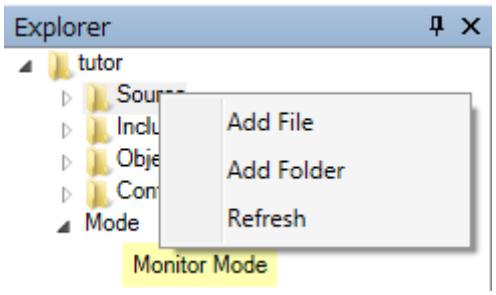


Figure 33: **Source Context Menu**

(i) How to add from **Add File**

Right-click [Source] to display the context menu.

Click **Add File** to start the file dialog.

Select the file to be added to a project in this dialog. The file will be added as a source file.

The file of other folders besides the project can also be added as a source file.

(ii) How to add from **Update**

Right-click [Source] to display the context menu.

Select **Update** to add all c source files (*.c) existing in the project folder to the project as source files.

3.5.3 Adding Reference Destination of Header Files

To add the reference destination of a header file, follow the procedure below:

Right-click **Include** → select **Add Folder** → add the folder of the reference destination from the folder dialog.

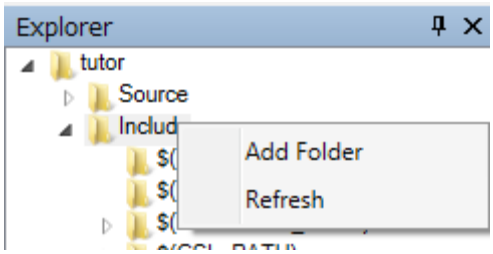


Figure 34: **Include Context Menu**

See "Chapter 4 Sub Windows" for the details of the **Explorer** window.

3.6 Compiling

This section describes how execute a compile.

Click **Compile** of the tool buttons to execute a Compile.

All the files are recompiled each time a compile is performed.

The compile log is displayed on the **Console** window.

Even while the **Console** window is closed, when **Compile** is executed, the **Console** window starts automatically, and displays the log.

When the compiling is successful, "Compile OK" will be displayed as follows:

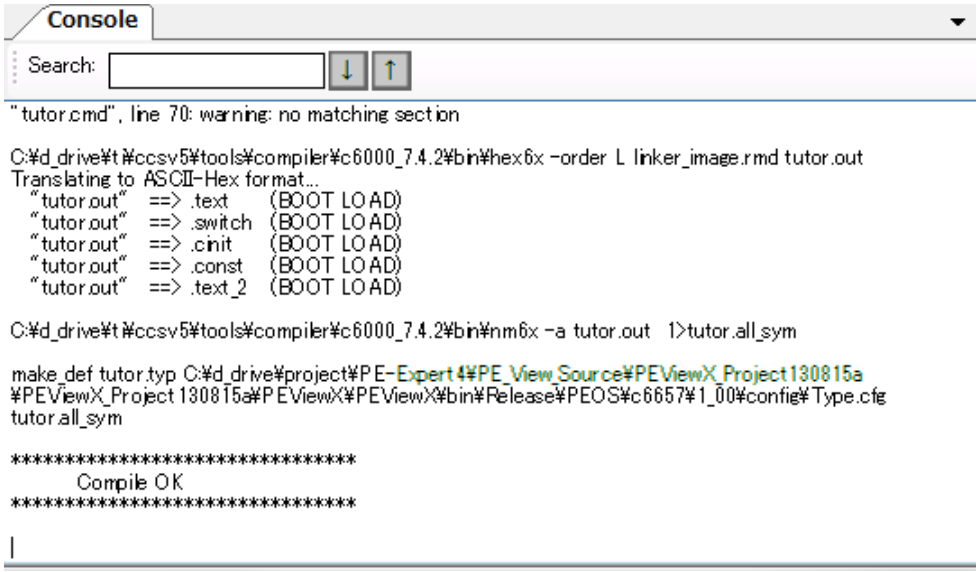


Figure 35: **Display When Compile is Successful**

When an error occurs, "Compile Failure" will be displayed as follows.

The location of the error will also be displayed. Solve the problem, and then execute a compile again.

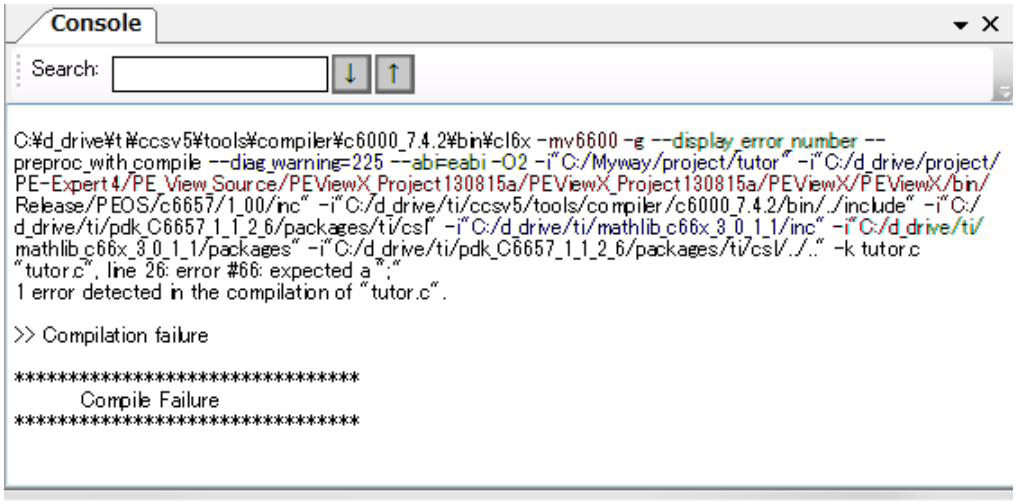


Figure 36: **Compilation Error Display**

* During a compile, the compiling is performed in the EABI mode of the c6000 compiler.
The following types are used in the EABI mode.

Table 18: EABI Mode Type

Types	Size
char	8bit
unsigned char	8bit
short	16bit
unsigned short	16bit
int	32bit
unsigned int	32bit
long	32bit
unsigned long	32bit
float	32bit
double	64bit
pointer	32bit
enum	32bit

3.7 Downloading

3.7.1 Executing Download

This section describes how to execute a download.

On downloading a developed program, it is written to PE-Expert4.

It allows the developed program to be executed on PE-Expert4.

Click **Download** of the tool buttons to execute a download.

The target.btbl file is used for downloading.

This is a file of the program code and data, and is created during a compile.

During a download, the following progress dialog will be displayed.

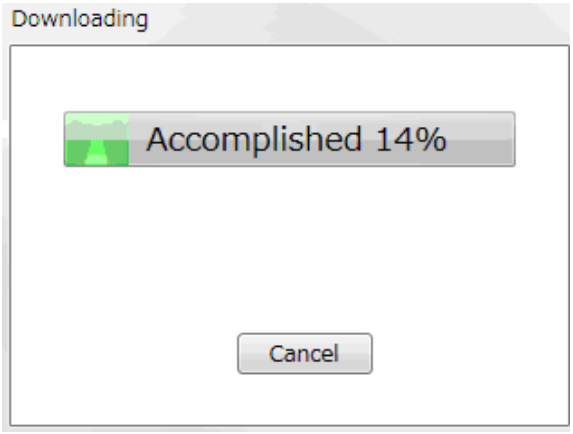


Figure 37: **Download Progress Display**

This progress status shows how much download data has been transmitted to PE-Expert4. The download can be cancelled by clicking the **Cancel** button unless the download has already been completed.

When the progress status reaches 100%, "Flash Writing" and "System Resetting" will be displayed.

While these items are displayed, writing of the Flash rom to PE-Expert4 and resetting of the system are being performed, so the download cannot be cancelled. The **Cancel** button will be in the disabled state.

Do not turn OFF the power supply of PE-Expert4 during this period.

When the download is completed, the dialog closes automatically. “Download Succeeded” will be displayed on the Console. If [Inspector]/[WAVE]/[Data Recorder] is opened before download, the new values will be refreshed in the windows.

The Console will display:

“Variable Information in Inspector Updated”
“Variable Information in WAVE Updated”
“Variable Information in Data Recorder Updated”

After the download is completed, the program can be executed without restarting.

3.7.2 Notes

● Note that the following functions will stop automatically during a download.
- If **Auto Refresh** of **Inspector** is enabled, it becomes disabled. However, the setting returns to enable after the download is completed.
- While Wave is running, the status changes to Stop.
● During program execution, download cannot be executed.
● During data recording, download cannot be executed.

3.8 Verify

3.8.1 Executing Verify

This section describes how to execute the verification.

Verify is for confirming whether the program and data written in PE-Expert4 conform to the contents of the target.btbl file in the project folder.

Click **Verify** of the tool buttons to execute the verification.

During the verification, the following progress dialog will be displayed.

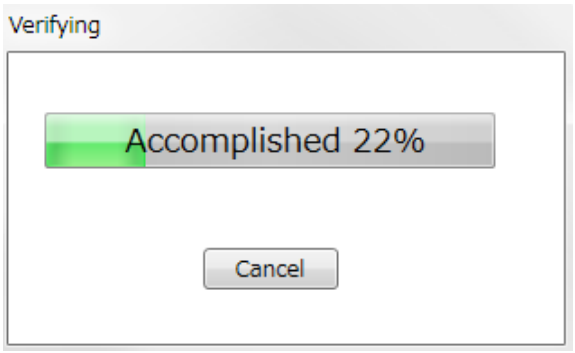


Figure 38: **Verification Progress Display**

This progress status shows how much data for verification has been transmitted to PE-Expert4. The download can be cancelled by clicking the **Cancel** button unless the verification has not been completed.

After the verification is completed, the execution results will be displayed.

When the verification is successful, the following dialog will be displayed.

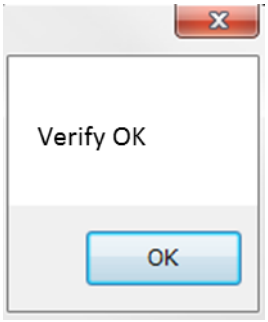


Figure 39: **Display When Verification is Successful**

When an error occurs, the following dialog will be displayed.

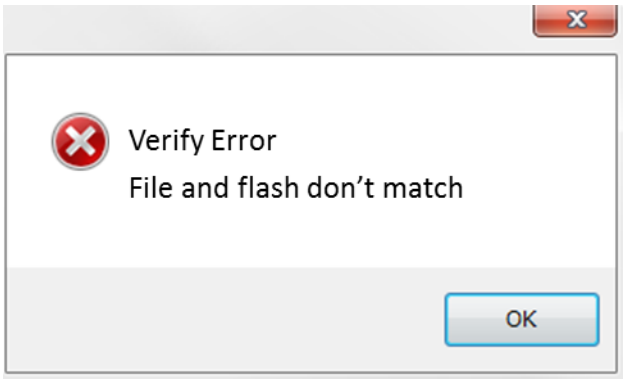


Figure 40: **Verification Error Display**

3.8.2 Notes

● Note that the following functions will stop automatically during verify.

- If **Auto Refresh** of **Inspector** is enabled, it becomes disabled. However, the setting returns to enable after verify is completed.
- While Wave is running, the status changes to Stop.

● During program execution, verify cannot be executed.

● During data recording, verify cannot be executed.

3.9 Execute/Stop

3.9.1 Execute/Stop Functions

This section describes the function of Execute/Stop.

Click **Execute** of the tool buttons to execute the program downloaded to PE-Expert4. Click **Stop** to stop the program.

The program is executed from the beginning each time **Execute** is clicked.

The execution status of the program is displayed in **Mode** of the **Explorer** window as shown below:

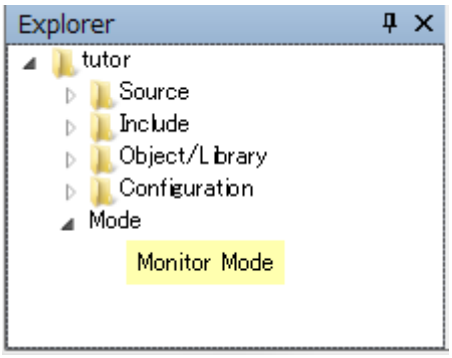


Figure 41: **Running Status Display**

The contents displayed in Mode are as follows:

Table 19: Mode Display Contents

Mode	Contents	Display
Monitor Mode	The user program stopped.	Monitor Mode
Target Program Running	The user program is running. The display will be blinking.	Target Program Running
Disconnected	The LAN is not connected.	Disconnected
Cannot Connect	No response from PE-Expert4.	Cannot Connect

3.9.2 Notes

● If FPGA board is used in PE-Expert4, an internal communication error may occur. In **Mode**, “EMIF ERROR has occurred” will be displayed. Refer to FPGA manual for further details

● PE-Expert4 is working on stand alone mode.

Standalone mode – PE-Expert4 executes program which has been saved into the Flash rom. Program execution begins with **Execute**. To perform this mode, OFF bit2 of SW9 on MWPE4-C6657. Refer to “4.9 Standalone Mode” for more details.

3.10 Debug Functions

This section describes the debug functions.

The following functions are provided in PE-ViewX to debug control programs.

Each function is provided in the form of a sub window.

Table 20: Debug Functions

Names	Functions
Memory	Displays the contents of the memory of the specified address.
Inspector	Reads/writes the specified parameters.
WAVE	Displays the waveform of the specified parameters in real time. Performs an FFT analysis of the read waveform data and displays the data.
Data Recorder	Displays the waveform of the specified parameters. Save the data of parameters

There are two methods to debug this function:

- Start the applicable sub window from the tool button.
- Click the **Window** menu → **Display Window** to start the applicable sub window.

For **Memory** and **Inspector**, up to three sub windows can be started at once.

See "Chapter 4 Sub Windows" for the details of the functions of each sub window.

Chapter 4 Sub Windows

This chapter describes the functions of the sub windows which constitute PE-ViewX.

4.1 Explorer Window

The **Explorer** window is for managing the files which constitute a project.

Addition, deleting, editing, etc. of source files can be performed from this window.

Click the **Window** menu → **Display Window** → **Explorer** to display the following window.

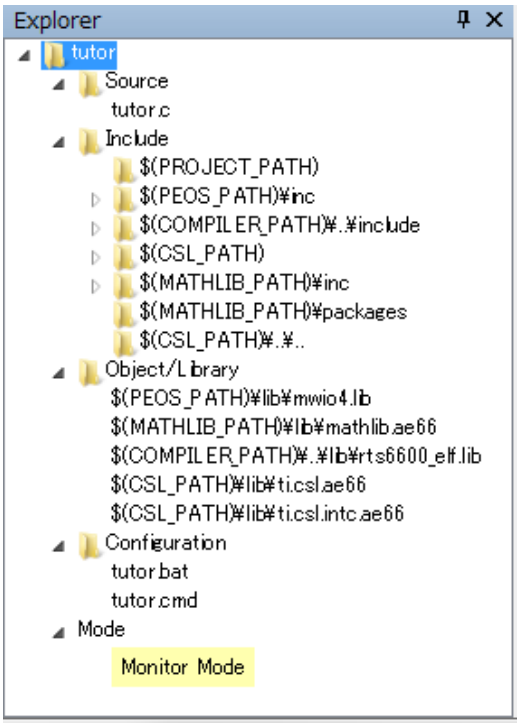


Figure 42: **Explorer Window**

Table 21: Display Items of Explorer Window

Items	Contents
Project	Root directory which displays the following items from a project.
Source	Displays the source file.
Include	Displays the path of a header file, and the header file in the list.
Object/Library	Displays the library to be linked and the object file.
Configuration	Displays the batch file and linker script file used for compiling.
Mode	Displays the execution status of the project.

Double-clicking the files in Source, Include and Configuration starts the files from editor, and allows them to be edited.

The following describes each item of the **Explorer** window.

4.1.1 Project

This is the root directory of a project.

While the cursor is placed on the project, the following operations can be performed.

●Context menu

Right-click to display the following context menu.

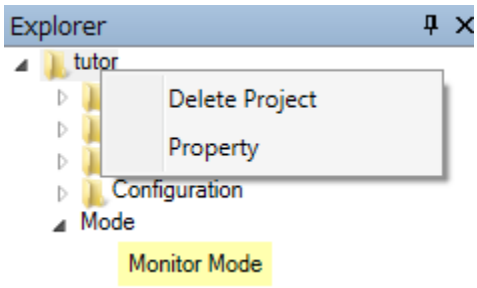


Figure 43: **Project Context Menu**

The items of the context menu are as follow:

Table 22: Project Context Menu

Items	Contents
Delete Project	Deletes the project from the **Explorer** window. This process is just for closing from PE-ViewX, and there is no effect on the file system.
Properties	Displays the properties dialog.

●Delete key

This key executes the same process as **Delete Project** of the context menu.

4.1.2 Source

This function displays the source files which constitute a project.

The source file and subfolder can be displayed in Source as shown below:

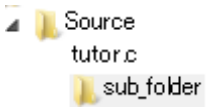


Figure 44: **Source File and Subfolder**

[When the cursor is placed on Source]

While the cursor is placed on Source, the following operations can be performed.

●Context menu

Right-click to display the following context menu.

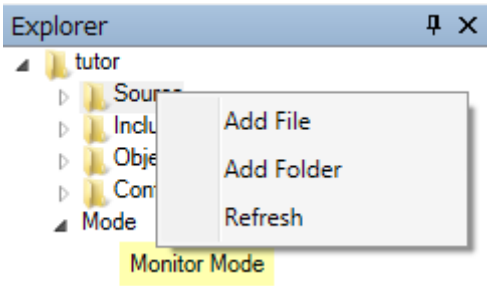


Figure 45: **Source Context Menu**

The items of the context menu are as follow:

Table 23: Source Context Menu

Items	Contents
Add File	Adds a source file to a project. The file dialog will be displayed. The following processes can be performed from this dialog. - Select an existing source file to add to a project. - Create a new source file to add to a project. Follow the procedure below: Select **Create** in the file dialog → select **Text Document** → select the newly created text file to rename the source file (*.c/*.asm) → place the cursor on the source file and right-click to add to a project.
Add Folder	Adds a subfolder to Source. This folder is a virtual folder, and is not created in the file system.
Update	Adds all the source files (*.c/*.asm files) in the project folder to a project.

[When the cursor is placed on a source file in Source]

While the cursor is placed on a source file in Source, the following operation can be performed.

●Context menu

Right-click to display the following context menu.

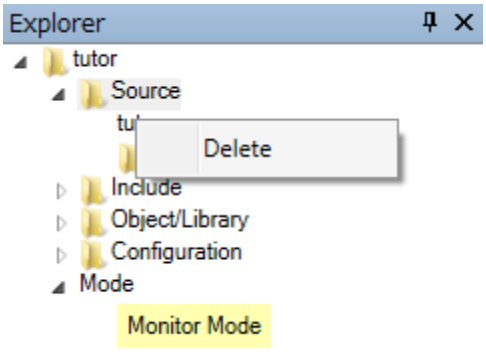


Figure 46: **Context Menu of Source File in Source**

The items of the context menu are as follow:

Table 24: Source File Context Menu

Item	Contents
Delete File	Deletes a source file from a project. When deleting, whether to delete from a project or the file system can be selected.

●Delete key

This key executes the same process as **Delete File** of the context menu.

[When the cursor is placed on a subfolder in Source]

While the cursor is placed on a subfolder in Source, the following operation can be performed.

●Context menu

Right-click to display the following context menu.

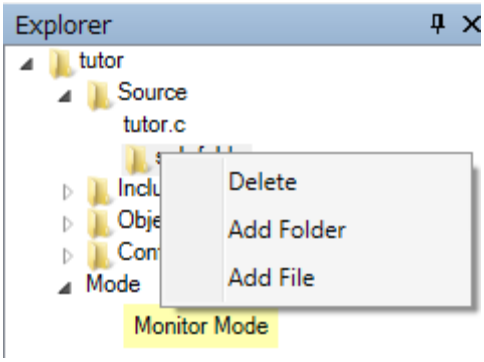


Figure 47: **Context Menu of Subfolder in Source**

The items of the context menu are as follow:

Table 25: Subfolder Context Menu

Items	Contents
Delete Folder	Deletes a subfolder from a project. During this process, the source file in the subfolder will also be deleted from a project. There is no effect on the file system.
Add Folder	Adds additional subfolders to a subfolder. This folder is a virtual folder, and is not created in the file system.
Add File	Adds source files to a subfolder.

●Delete key

This key executes the same process as **Delete Folder** of the context menu.

4.1.2 Include

This function displays the header path of the project being referred to. The following is displayed.

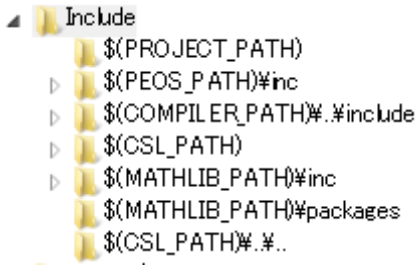


Figure 48: **Structure of Include**

The contents of the environment variables displayed in the above figure are as follows:

Table 26: Contents of Environment Variables

Environment Variables	Contents
PROJECT_PATH	Refers to the project path currently selected.
PEOS_PATH	Refers to path of the PE library in which the currently selected project is linked.
COMPILER_PATH	Refers to the path of the "Compiler Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.
CSL_PATH	Refers to the path of the "CSL Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.
MATHLIB_PATH	Refers to the path of the "Mathlib Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.

As shown below, clicking the folder of the header path displays all the header files (*.h) in the folder.
Double-clicking the header file starts the editor and allows it to be edited.

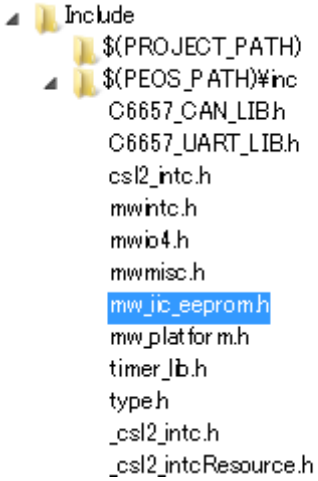


Figure 49: **Header File in Header Path**

[When the cursor is placed on Include]

While the cursor is placed on Include, the following operations can be performed.

●Context menu

Right-click to display the following context menu.

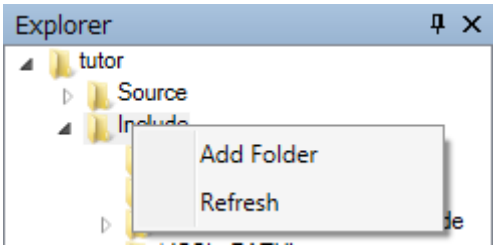


Figure 50: **Include Context Menu**

The items of the context menu are as follows:

Figure 51: **Include Context Menu**

Items	Contents
Add Folder	Adds the header path of the project to be referred to.
Update	Updates the display of the header file in the header path. Displays all the header files (*.h) in the header path.

[When the cursor is placed on the header path in Include]

While the cursor is placed on the header path in Include, the following operations can be performed.

●Context menu

Right-click to display the following context menu.

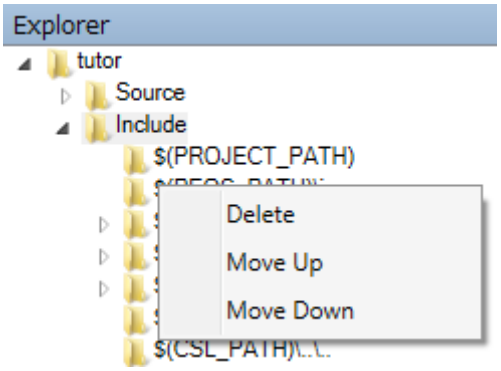


Figure 52: **Context Menu of Header Path in Include**

The items of the context menu are as follow:

Table 27: Header Path Context Menu

Items	Contents
Delete Folder	Deletes the header path from a project. There is no effect on the file system.
Raise	Raises the priority of the reference, when multiple header paths are registered.
Lower	Lowers the priority of the reference, when multiple header paths are registered.

●Delete key

This key executes the same process as **Delete Folder** of the context menu.

4.1.3 Object/Library

This function displays the object files and library files linked to a project. The following is displayed.

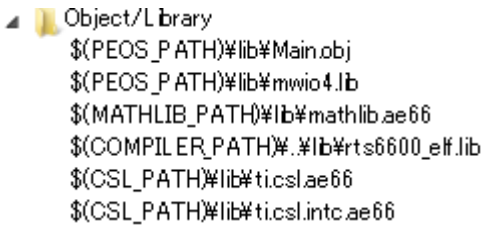


Figure 53: **Structure of Object/Library**

The contents of the environment variables displayed in the above figure are as follows:

Table 28: Contents of Environment Variables

Environment Variables	Contents
PEOS_PATH	Refers to path of the PE library in which the currently selected project is linked.
COMPILER_PATH	Refers to the path of the "Compiler Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.
CSL_PATH	Refers to the path of the "CSL Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.
MATHLIB_PATH	Refers to the path of the "Mathlib Path" set by clicking the **Setting** menu → **Compiler** → **(Processor name)**.

[When the cursor is placed on Object/Library]

While the cursor is placed on Object/Library, the following operation can be performed.

●Context menu

Right-click to display the following context menu.

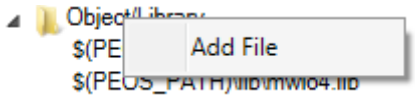


Figure 54: **Context Menu of Object/Library**

The items of the context menu are as follows:

Table 29: Object/Library Context Menu

Items	Contents
Add File	Adds object files and library files to be linked to a project.

[When the cursor is placed on a file in Object/Library]

While the cursor is placed on a file in Object/Library, the following operations can be performed.

●Context menu

Right-click to display the following context menu.

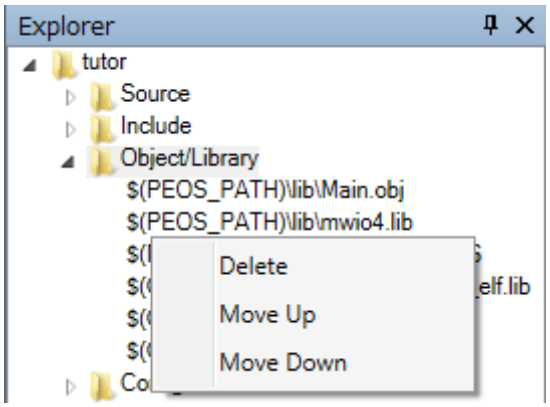


Figure 55: **Context Menu of File in Object/Library**

The items of the context menu are as follow:

Table 30: Context Menu of File in Object/Library

Items	Contents
Delete File	Deletes the object files and library files linked to a project. There is no effect on the file system.
Raise	Raises the priority of the link, when multiple files are registered.
Lower	Lowers the priority of the link, when multiple files are registered.

●Delete key

This key executes the same process as **Delete Folder** of the context menu.

4.1.3 Configuration

This function displays the linker script files and batch files for compiling that are used during a compile. The following is displayed.

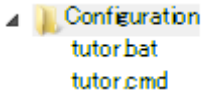


Figure 56: **Structure of Configuration**

The contents of the files displayed in the above figure are as follows:

Table 31: Contents of Configuration File

File Names	Contents
*.bat	Batch file for compile
*.cmd	Linker script file

[When the cursor is placed on Configuration]

While the cursor is placed on Configuration, the following operation can be performed.

●Context menu

Right-click to display the following context menu.

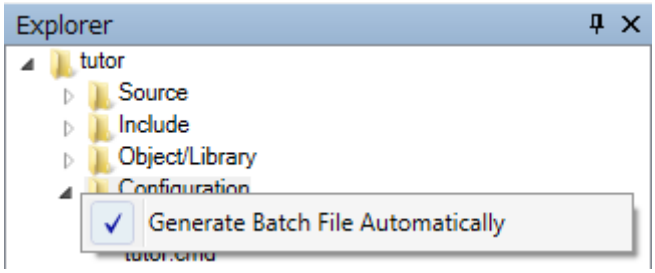


Figure 57: **Configuration Context Menu**

The items of the context menu are as follows:

Table 32: Configuration Context Menu

Items	Contents
Create batch file	Enable: Automatically creates a batch file for each execution of a compile based on the current file structure. Disable: Does not automatically create a batch file during the execution of a compile. The contents of a batch file can be customized and compiled accordingly.

4.1.4 Mode

This function displays the execution status of a project. The following is displayed.

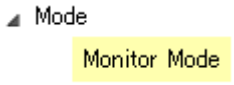


Figure 58: **Mode Structure**

The contents displayed in Mode are as follows:

Table 33: Mode Display Contents

Mode	Contents	Display
Monitor Mode	The user program is stopped.	Monitor Mode
Target Program Running	The user program is running.	Target Program Running
Disconnected	The LAN is not connected.	Disconnected
Cannot Connect	No response from PE-Expert4.	Cannot Connect

●Context menu

Right-click to display the following context menu.

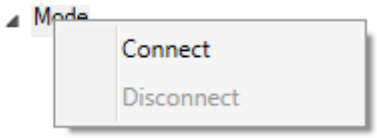


Figure 59: **Mode Context Menu**

The items of the context menu are as follows:

Table 34: Mode Context Menu

Items	Contents
Connect	LAN connection. When status is [Disconnected] / [Cannot Connect], click on it to enable LAN connection.
Disconnect	LAN disconnection. When status is [Monitor Mode] / [Target Program Running], click on it to disable LAN connection

4.2 Console Window

The **Console** window displays the character string output from the compile log and PE-Expert4.

There are two methods to display this window.

- Click the **Window** menu → **Display Window** → **Console** to display the following window.
- During the execution of **Compile**.

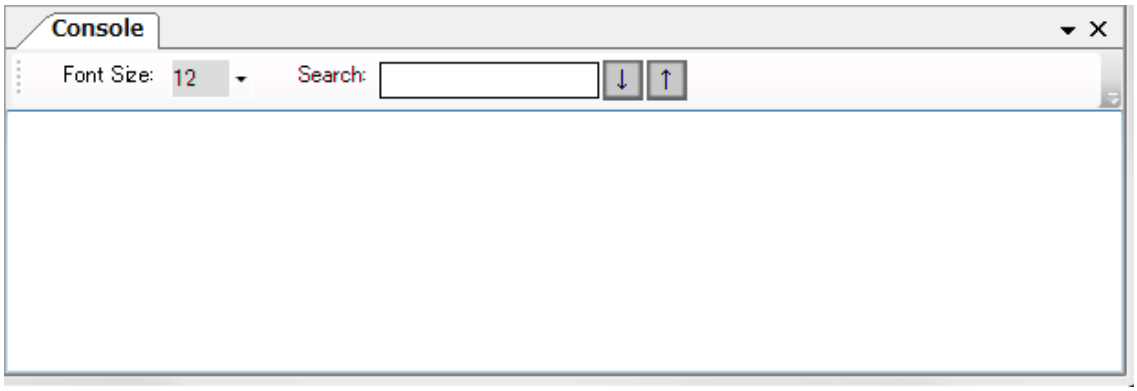


Figure 60: **Console Window**

The compile log will be displayed as shown below:

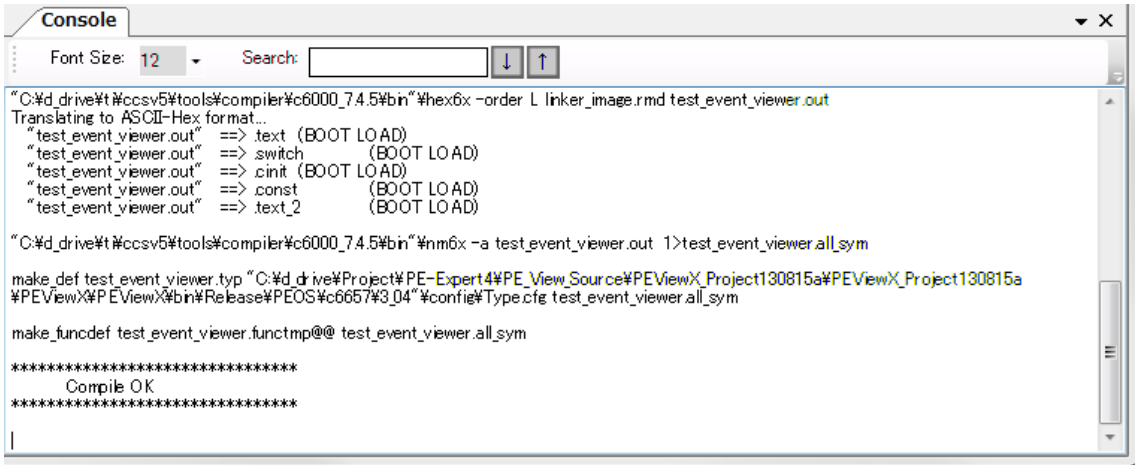


Figure 61: **Compile Log Display**

The following operations can be performed in the **Console** window.

● Context menu

Right-click while the cursor is placed on the **Console** window to display the following context menu.

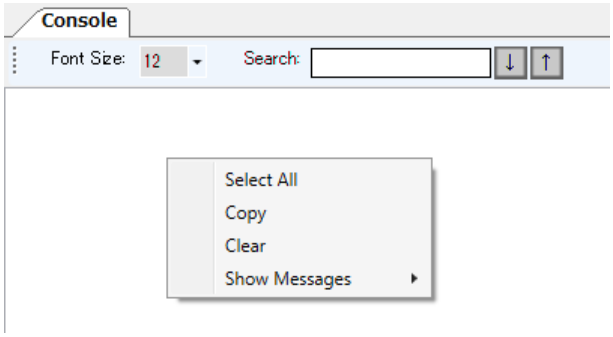


Figure 62: **Context Menu of Console Window**

The items of the context menu are as follows:

Table 35: Context Menu of Console Window

Items	Contents
Select All	Select all currently displayed character strings.
Copy	Copies the selected character string to a clipboard.
Clear	Clears all the character strings currently displayed.
Show Message	Sets the message to display or hide. When a check mark is entered, the message will be displayed, and when not entered, the message will not be displayed. The following items can be set: - Compiler log - Character string output from PE-Expert4

● Searching character strings

The specified character string can be searched from the character string displayed on the **Console** window.

Character strings can be searched from the following locations.

Figure 63: **Searching Character Strings**

The search function of character strings is as follows:

Table 36: Searching Character Strings

Items	Contents
Text box	This box is for entering the character string to be searched.
↑	Searches character strings upwards.
↓	Searches character strings downwards.

When there is a matched character string in the search results, the applicable character string is highlighted as shown below.

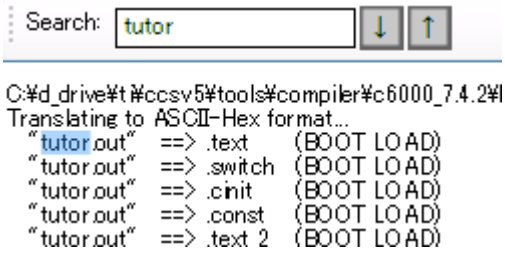


Figure 64: **Search Results Display**

● Changing font size

Font size can be changed as shown below.

Figure 65: Setting font size

4.3 Inspector Window

The **Inspector** window is for reading/writing the specified variables.

There are two methods to display this window.

- Click the **Window** menu → **Show Window** → **Inspector**
- Click **Inspector** of the tool buttons.

The following screen will be displayed.

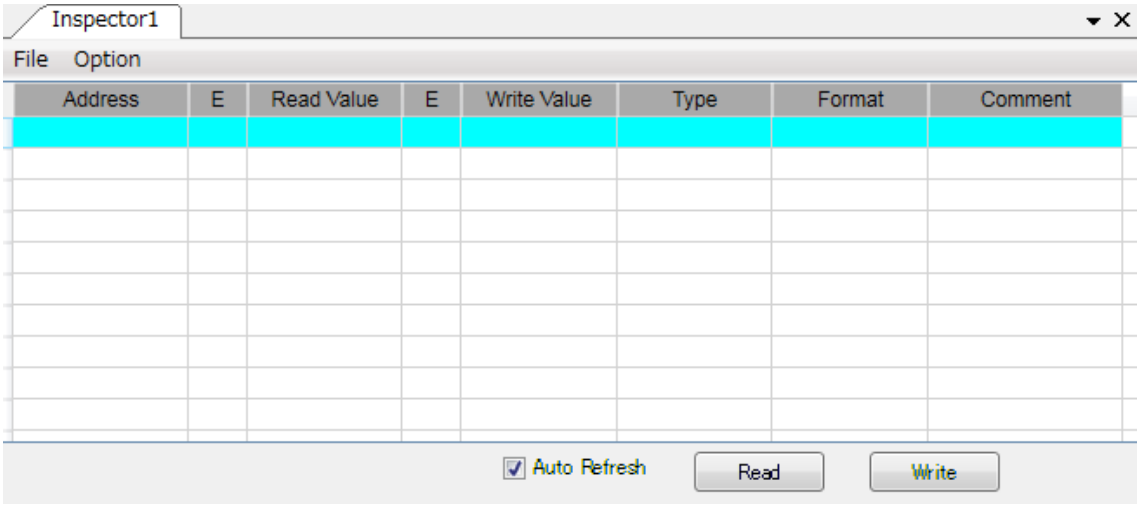


Figure 66: **Inspector Window**

Up to three **Inspector** windows can be displayed at once.

4.3.1 Structure of Fields

The **Inspector** window consists of the following fields.

Table 37: Structure of Inspector Window Fields

Fields	Contents
Comment(1)	For entering comments
Address	For entering a variable name or address. ●Entry of variable name or address [Entry of variable name] Directly enter a variable name, or double-click to select from the variable list. [Entry of address] Enter in a hexadecimal expression like "0x..." ●Pointer variable Read only. [Entry of pointer variable name] Enter a pointer variable name, then address which pointer variable holds is displayed. [Enter of asterisk(*) + pointer variable name] Enter asterisk(*) + pointer variable name, then data which pointer variable points to is displayed. ●Array The following type of linear array can be entered. char/ unsigned char/ short/ unsigned short/ int/ unsigned int/ long/ unsigned long/ float/ double There are three ways to enter a linear aray. (1)Array name only Displayed all elements. Example) c_Array

Fields	Contents
	(2)Array name[index] Displayed from element specified by index. Example) c_Array[3] (3)Array name[index]@length Displayed from element specified by index to length. Example) c_Array[3]@5
E (Read Enable)	For setting the read process to enable/disable. The item set to enable is applicable for reading. Enable:  is displayed Disable: Blank
Read Value	Displays the read value.
Write Enable	For setting the read process to enable/disable. The item set to enable is applicable for writing. Enable:  is displayed Disable: Blank ※ For pointer variable in [Address], [Write] will not be carried out when enabled.
Write Value	For entering the value to be written. The features of this field are as follows: - Displays the written value in red at the time of entry. Then, when the writing is executed by the **Write** button, the value will be displayed in black. - The values which can be entered in this field are linked to the **Format** field. For example, enter 0 to 1 when using binary numbers, and 0 to f when using hexadecimal numbers. - When a decimal number is used in the **Format** field, entry of exponential expression is also acceptable.
Type	Displays the types of variables.

Fields	Contents
	The following variable types can be displayed. char: char type uchar: unsigned char type short: short type ushort: unsigned short type int: int type / long type uint: unsigned int type / unsigned long type float: float type double: double type enum: enum type char＊: char type pointer uchar＊: unsigned char type pointer short＊: short type pointer ushort＊: unsigned short type pointer int＊: int type / long type pointer uint＊: unsigned int type / unsigned long type pointer float＊: float type pointer double＊: double type pointer (for reference) enum＊: enum type pointer Note that both the int type / long type are displayed as int. Similarly, both the unsigned int type / unsigned long type are displayed as uint. When an address is specified, it is displayed as an int type.
Format	For selecting the format to be displayed. The format can be selected from the following: Bin : Binary number expression Dec(S) : Signed decimal number expression Dec(U) : Unsigned decimal number expression Hex : Hexadecimal number expression Note that a floating point expression is common to both Dec(S)/Dec(U) for a floating point format (float/double).

Fields	Contents
Comment(2)	For entering comments

The window is displayed is as follows:

Address	E	Read Value	E	Write Value	Type	Format	Comment
c_Val		10		10	char	Dec(S)	
s_Val		20		20	short	Dec(S)	
i_Val		1133968803			int	Dec(S)	
d_Val		-2.7645904960136713E+252			double	Dec(S)	
u		3.56544683E-06		100	float	Dec(S)	U相
v		6.3613783E+09		200	float	Dec(S)	V相
w		-3.438955E+14			float	Dec(S)	W相
0xc018000		0			int	Dec(S)	アドレス指定

Figure 67: **Example of Variable Display**

The position of the fields can be moved by dragging.

For example, drag **Address** item to move it to the following position.

E	Read Value	E	Write Value	Type	Format	Comment	Address
	10		10	char	Dec(S)		c_Val
	1000		1000	short	Dec(S)		s_Val
	1133968803			int	Dec(S)		i_Val
	-2.7645904960136713E+252			double	Dec(S)		d_Val
	1000000		1000000	float	Dec(S)	U相	u
	200		200	float	Dec(S)	V相	v
	-3.438955E+14			float	Dec(S)	W相	w
	1000000		1000000	int	Dec(S)	アドレス指定	0xc018000

Figure 68: **Example of Moved Address Field**

Array is displayed as follows.

Address	E	Read Value	E	Write Value	Type	Format	Comment
c_Array[0]		10		10	char	Dec(S)	
[1]		20		20			
[2]		0					
[3]		40		40			
[4]		0					
[5]		0					
[6]		0					
[7]		0					
[8]		0					
[9]		0					

Figure 69: display of array

4.3.2 Reading/Writing Variables

This section describes how to read/write the variables.

Follow the procedure below.

The target variables of the reading/writing are the global variables only.

1) Setting the variable name in the Address field

There are three setting methods as shown below:

(i) When selecting a variable name

Place the mouse cursor in a cell of the **Address** field and double-click. The list of variables used for the program selected as the target will be displayed. Select the variable to be read/write.

In this state, the variable can be selected by the following two methods.

- Select a variable name with the mouse.
- When the first character of a variable name is entered, the applicable variable name will be selected automatically.

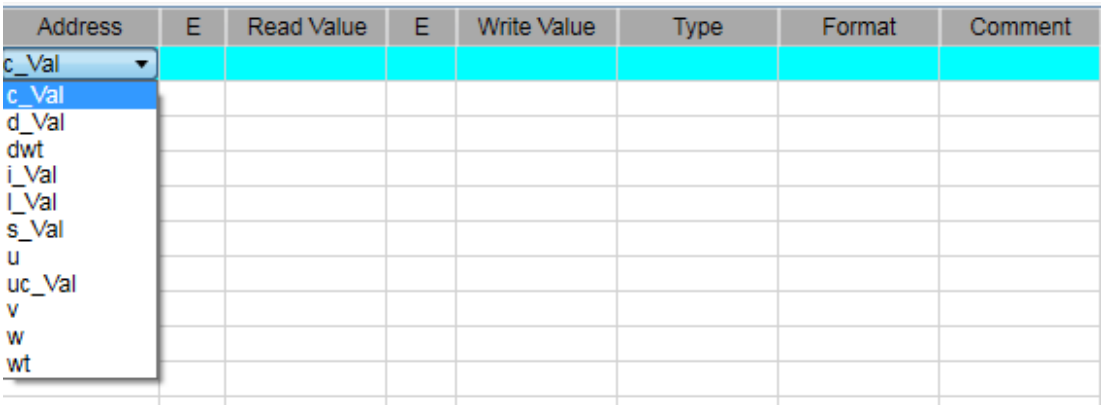


Figure 70: **Variable Name List Display**

(ii) When entering a variable name

Place the mouse cursor in a cell of the **Address** field, and type in the variable name.

After entering, press the Enter key or move the cursor to set the variable name.

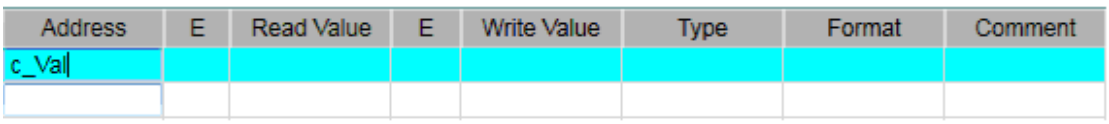


Figure 71: **Variable Name Text Entry**

(iii) When entering an address

Place the mouse cursor in a cell of the **Address** field, and type in the address.

Specify "0x..." in a hexadecimal number expression.

After entering, press the Enter key or move the cursor to set the address.

Address	E	Read Value	E	Write Value	Type	Format	Comment
0xc018000							

Figure 72: **Address Text Entry**

2) Enabling Read/Write

○ Read

Click the **E** field on the left side of **Read Enable** to display  .

Note that the variables of rows without the  will not be applicable for reading.

E	Read Value
	

Figure 73: **Enabling Reading**

○ Write

Click the **E** field on the left side of **Write Enable** to display  .

Note that the variables of rows without the  will not be applicable for writing.

E	Write Value
	

Figure 74: **Enabling Writing**

3) Executing Read/Write

○ Read

Click the **Read** button.

When executing reading at a regular interval, select the check box of **Auto Refresh** located on the lower portion of the screen.

Figure 75: **Execution of Reading**

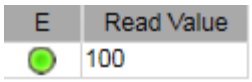


Figure 76: **Reading Completed State**

○ Write

Click the mouse in the **Write Value** field, and enter the value to be written.

When the value is entered, the value in the **Write Value** field will be displayed in red.

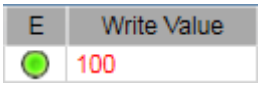


Figure 77: **Status of Entered Value to be Written**

Then, click the **Write** button.

When writing is executed, the value will change to black.

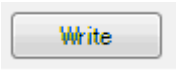


Figure 78: **Execution of Writing**

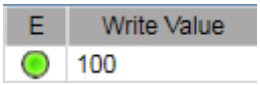


Figure 79: **Writing Completed State**

4.3.3 Changing Display Format

The display format of the read/written values can be changed.

The format can be selected from a binary number, signed decimal number, unsigned decimal number or a hexadecimal number.

When a signed decimal number / unsigned decimal number are selected, the variable of a floating point format (float/double) will be displayed in an exponential expression.

To change the display, double-click the **Format** field to display the list as shown below:

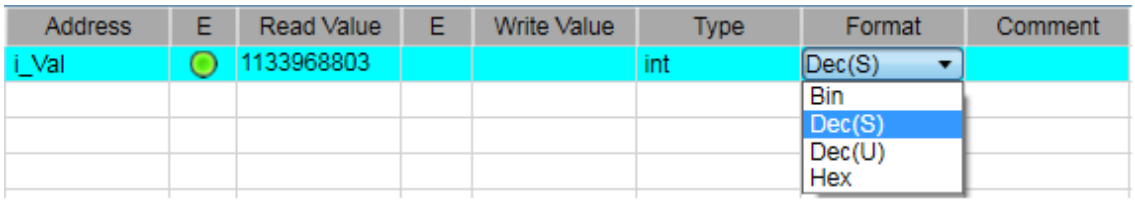


Figure 80: **Changing Display Format**

Both the **Read Value** / **Write Value** follow the contents of the **Format** field.

For example, when "100" is displayed, the value becomes as follows:

- When Bin is selected : "100" of a binary number
- When Dec(S)/Dec(U) is selected : "100" of a decimal number
- When Hex is selected : "100" of a hexadecimal number

4.3.4 Menu

The menu is arranged in the **Inspector** window.

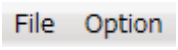


Figure 81: **Menu**

The structure of the menu is as follows:

Table 38: Inspector Window Menu

Main Items	Sub Items	Functions
File	Load Configuration File	Reproduces the saved setting.
	Save Configuration File	Saves the current setting.
Option	Interval Time	When Auto Refresh is set to enable, the interval for reading automatically can be selected from the following: 0.5 sec., 1 sec., 2 sec., 3 sec., 4 sec., 5 sec.
	Display Item	For selecting the field to be displayed in the **Inspector** window.

4.3.5 Context Menu

Right-click to display the following context menu.

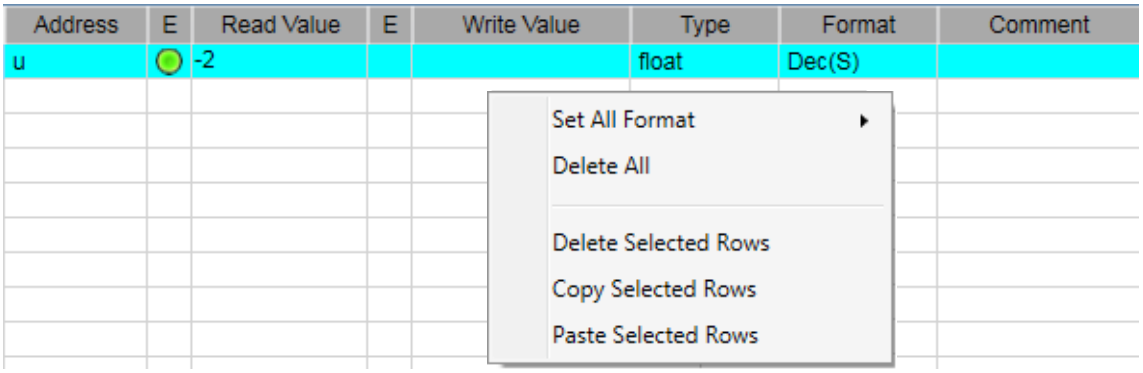


Figure 82: **Context Menu**

The items of the context menu are as follows:

Table 39: Inspector Window Context Menu

Items	Contents
Set All Format	Collectively changes the display format of all the registered variables. The format can be selected from the following: Bin: Binary number Dec(S): Signed decimal number Dec(U): Unsigned decimal number HEX: Hexadecimal number
Delete All	Collectively deletes all the registered variables.
Delete Selected Rows	Deletes the selected variable. Multiple rows can be deleted at once by using the Shift key.
Copy Selected Rows	Copies the selected variable. Multiple rows can be copied at once by using the Shift key.
Paste Selected Rows	Pastes the variable copied by "Copy Selected Rows."

4.3.6 Notes

- Even when **READ**/**WRITE** is executed while multiple items are selected, the data in the processor will not be read or written simultaneously. Pay attention when changing the value of variables which require accurate synchronization.
- The **Inspector** window can be resized.
  When the registered variables are hidden by resizing, a scroll bar will be displayed.
  When **Read Enable** / **Write Enable** set to enable, the hidden variables will also become the target of the reading/writing.
- When an address not disclosed to a user is specified, the value of the **Read Value** will be masked, and "********" will be displayed.
- When the **Inspector** window is turned off, the currently set contents will be saved automatically.
  The saved contents will be reproduced when the system is started the next time.
- If **Inspector** is opened during any recompilation of program or change in variable names, the variables in **Inspector** will not be updated during **Download**. After compilation, “Variable Information in Inspector Updated” will be displayed.
- **Write Enable** is unavailable for all pointer variables. **Read Value** will be displayed.
- At assembler level, variables other than double type are read / written with one instruction, so the values are synchronized (atomic). However, since variables of type double are read / written by 2 instructions, values may be rewritten from the user program between the lower 4 bytes and the higher 4 bytes read / write. Therefore, as for the value of double type variable, it is a reference value because value synchronization (atomic) can not be guaranteed. This applies not only to Inspector, but also to all windows that **Read Value** / **Write Value** of variables in **WAVE** / **Data Rec**.

4.4 WAVE Window

The **WAVE** window displays the waveforms of specified variables in real time.

It also performs an FFT analysis of the read waveform data and displays the data.

In WAVE, variables for up to 16 CH can be registered to display the waveforms.

4.4.1 Starting

There are two methods to display this window.

- Click the **Window** menu → **Show Window** →**WAVE**
- Click **WAVE** on the tool buttons.

When started, the following screen will be displayed.

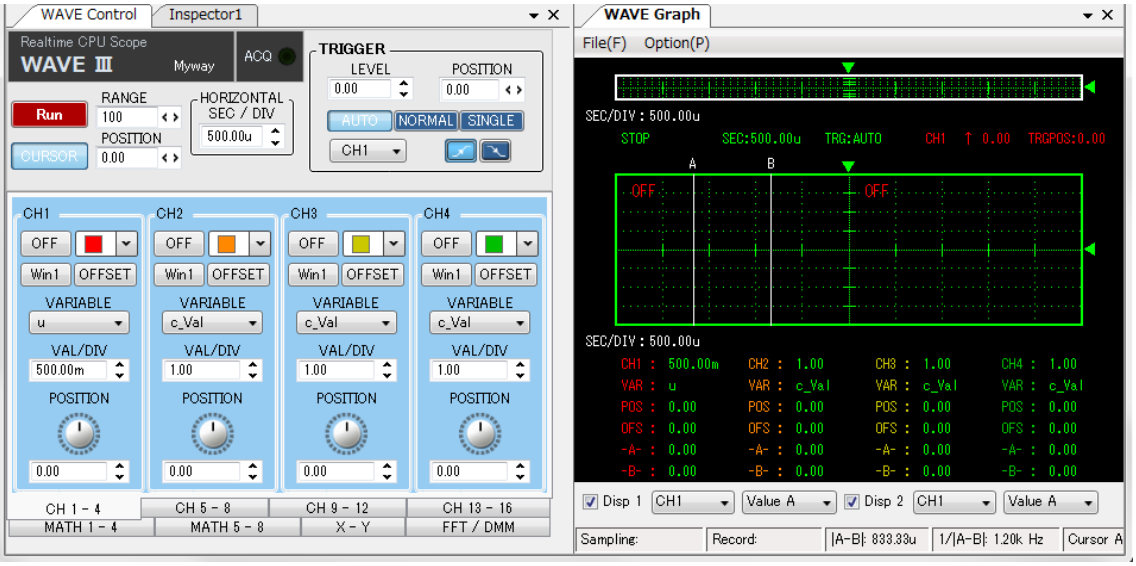


Figure 83: **WAVE Window**

4.4.2 Screen Structure

The screen structure of WAVE is as shown below:

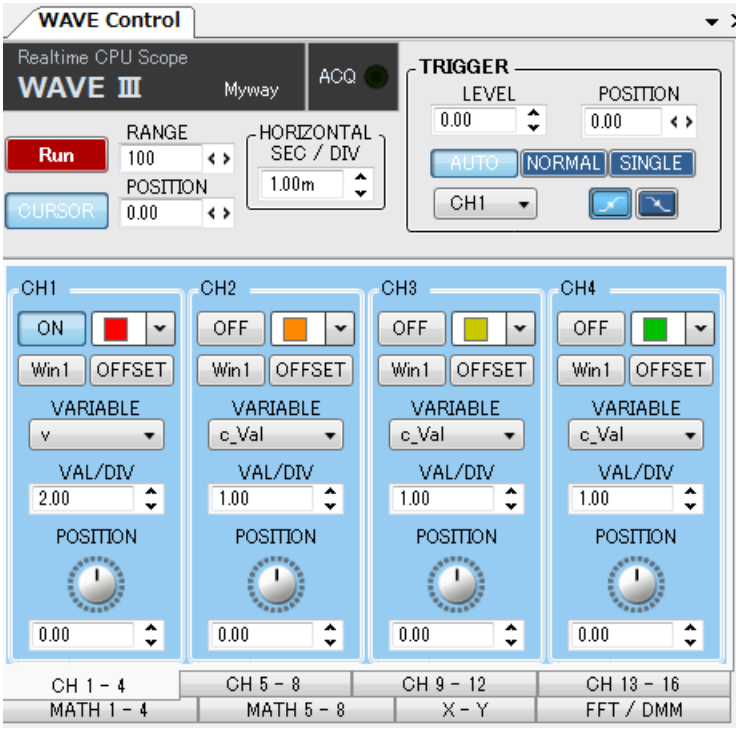


Figure 84: **Control Panel Window**

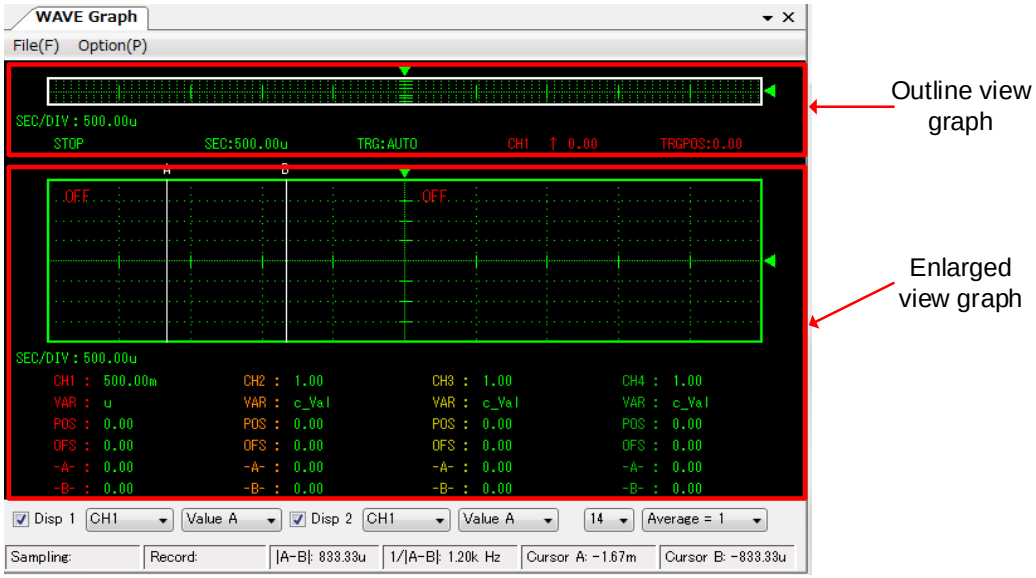


Figure 85: **Graph Window**

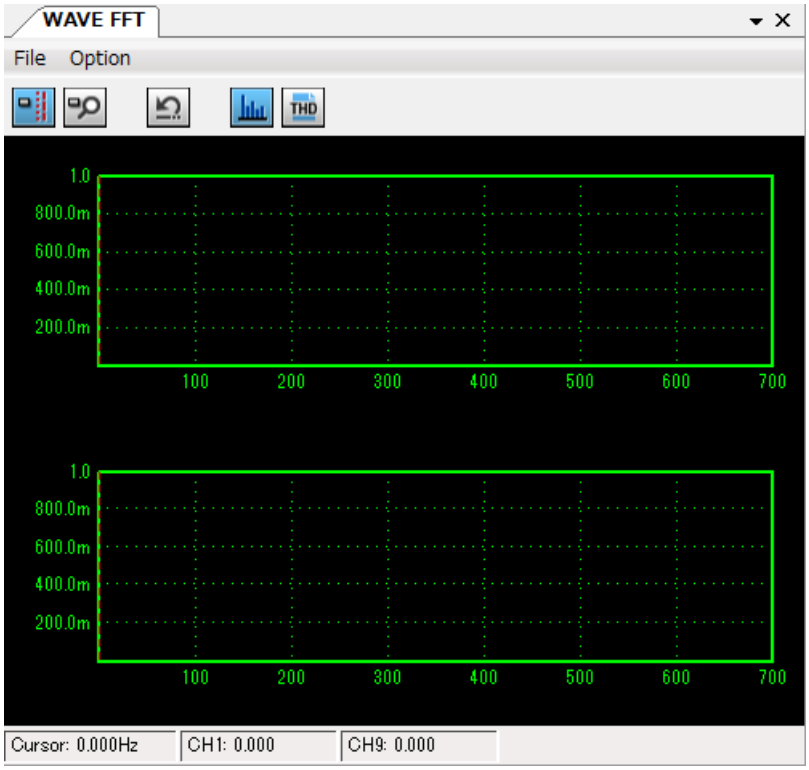


Figure 86: **FFT Window**

The contents of each window are as follows:

Table 40: Contents of WAVE Window

Windows	Contents
Control panel window	This window is for specifying the display conditions and trigger conditions. When this window is closed, the graph window and FFT window will also be closed automatically.
Graph window	Displays the outline view graph and enlarged view graph. The outline view graph displays all the data. The enlarged view graph enlarges and displays the selected data range.
FFT window	Displays the results of the fast fourier transform (FFT) performed for the read waveform data.

4.4.3 Outline of WAVE Function

The WAVE function is provided with several settings that are required to display a waveform. This section describes the outline of these functions. See description of each function for details.

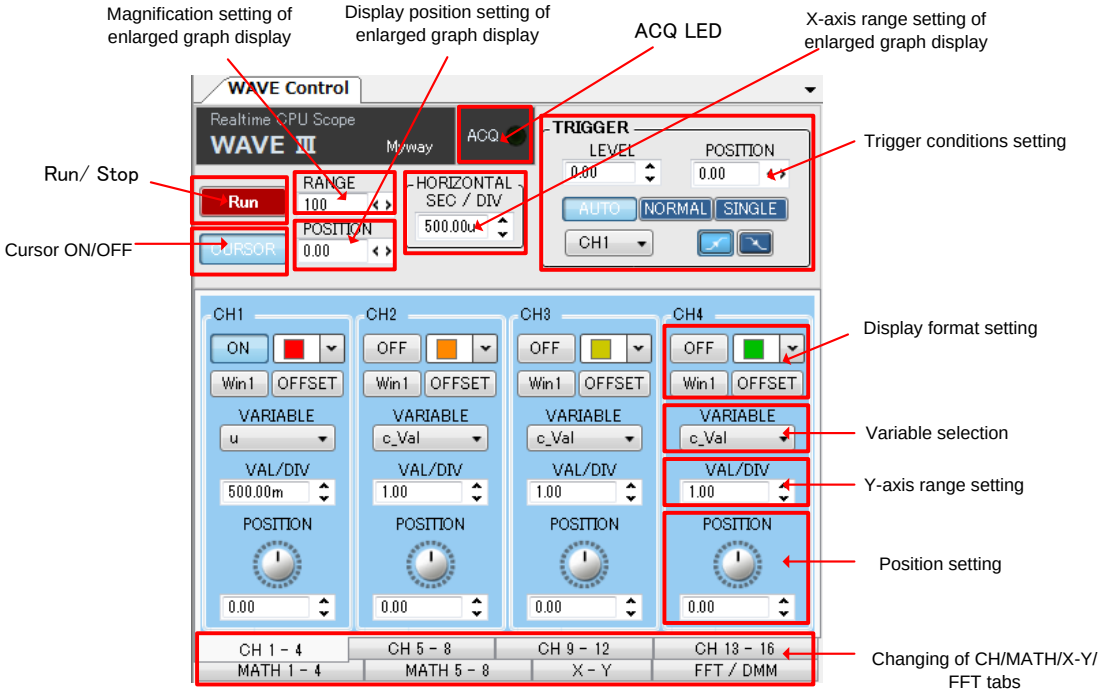


Figure 87: **Explanatory View of Each Function (CH 1 to 16 Screen)**

※ Except that the display of the applicable channels of CH 5 to 16 changes to 5 to 16, the other functions are the same as the above screen.

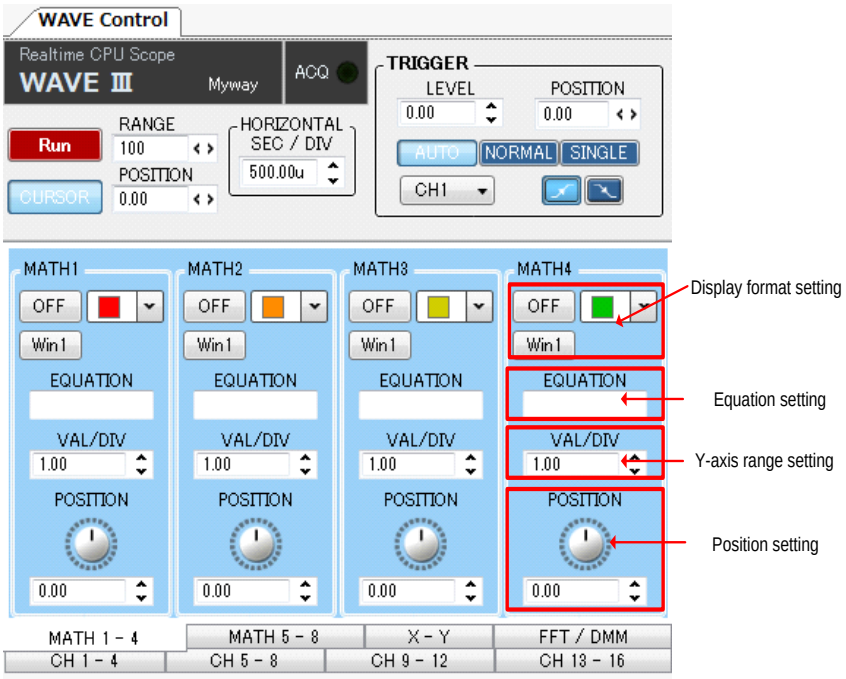


Figure 88: **Explanatory View of Each Function (MATH Screen)**

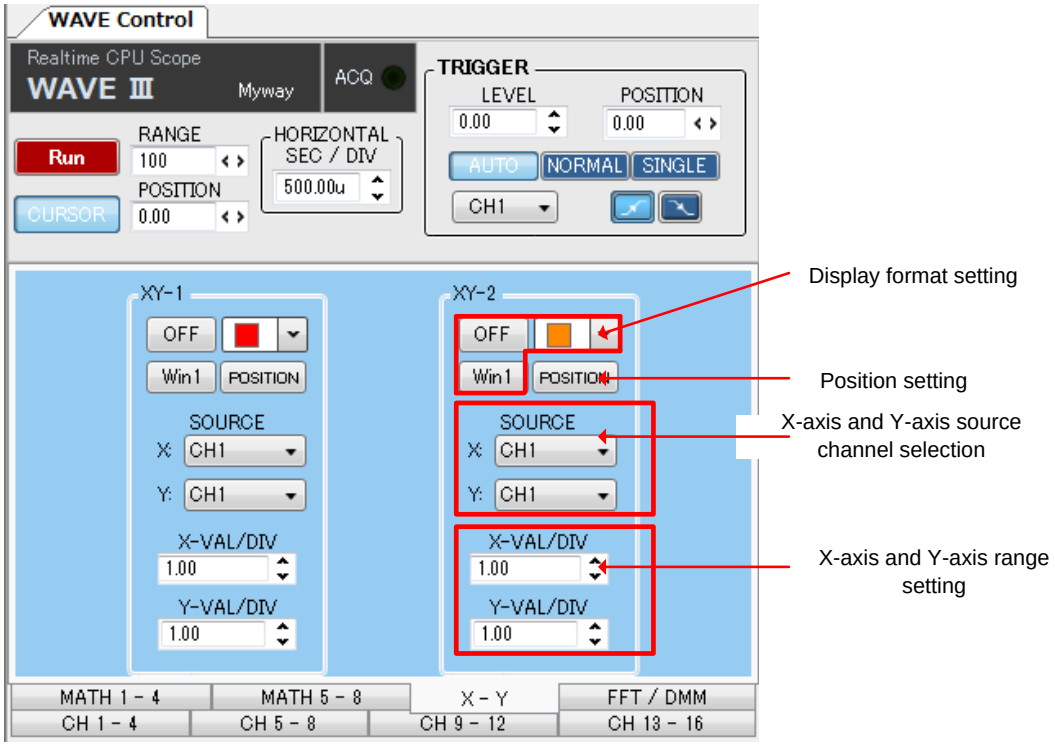


Figure 89: **Explanatory View of Each Function (X-Y Screen)**

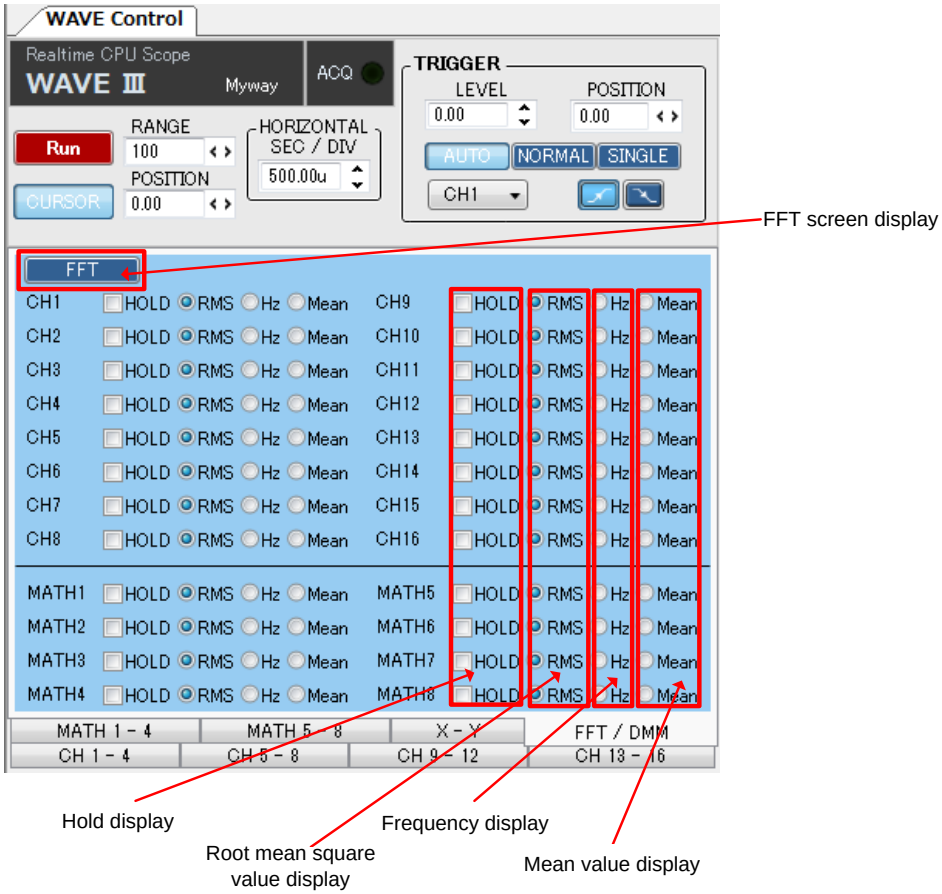


Figure 90: **Explanatory View of Each Function (FFT & DMM Screen)**

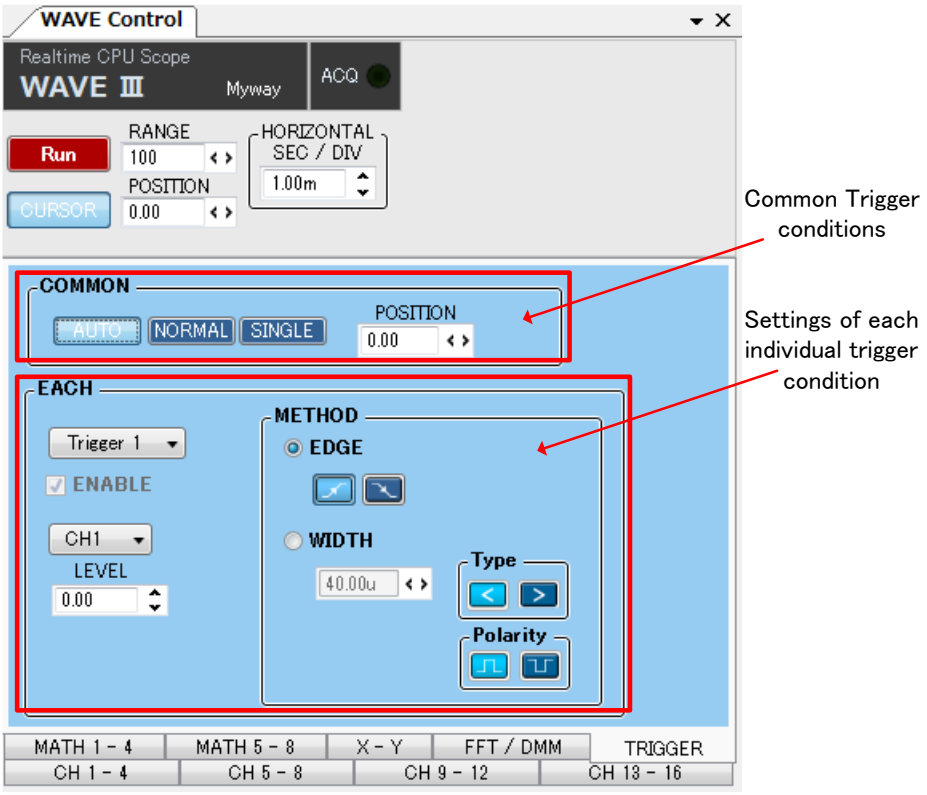


Figure 91: **Explanatory View of Each Function (Trigger Screen)**

4.4.4 Control Panel Window Functions

This section describes each of the functions on the WAVE control panel window.

In the control panel window, the acquisition of waveform data, various display changes, setting of each function, etc. can be performed.

1) Acquiring waveform data

Click the **RUN/STOP** button to acquire the waveform data. Continuous acquisition and single acquisition are performed in the trigger mode.

While running, the status changes to the trigger standby state according to the trigger setting, and when the trigger starts the waveform will be updated. **ACQ** turns ON while data is being transferred.

Figure 92: **Display While Stopped**

The displays changes to the following while running.

Figure 93: **Display While Running**

Click the **RUN/STOP** button again to end the acquisition of the waveform data.

2) Setting enlarged display

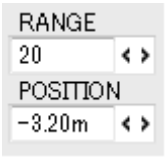


Figure 94: **RANGE and POSITION**

Since the graph window allows the recording of data for a long period, this window consists of an outline view graph that displays the overall outline, and an enlarged view graph that expands a portion of the waveform.

The following describes the settings of the enlarged view of a waveform.

To set the enlarged view, adjust the value of **RANGE** on the control panel window to set the scaling factor to be displayed. The **RANGE** can be set from 0.1% to 100% of the maximum range.

However, the range which can actually be set changes by the value of **HORIZONTAL SEC/DIV**.

Next, adjust the value of **POSITION** to set the offset time from the trigger point.

Click the right or left button of the list box, or directly enter a value in the text box to set the position.

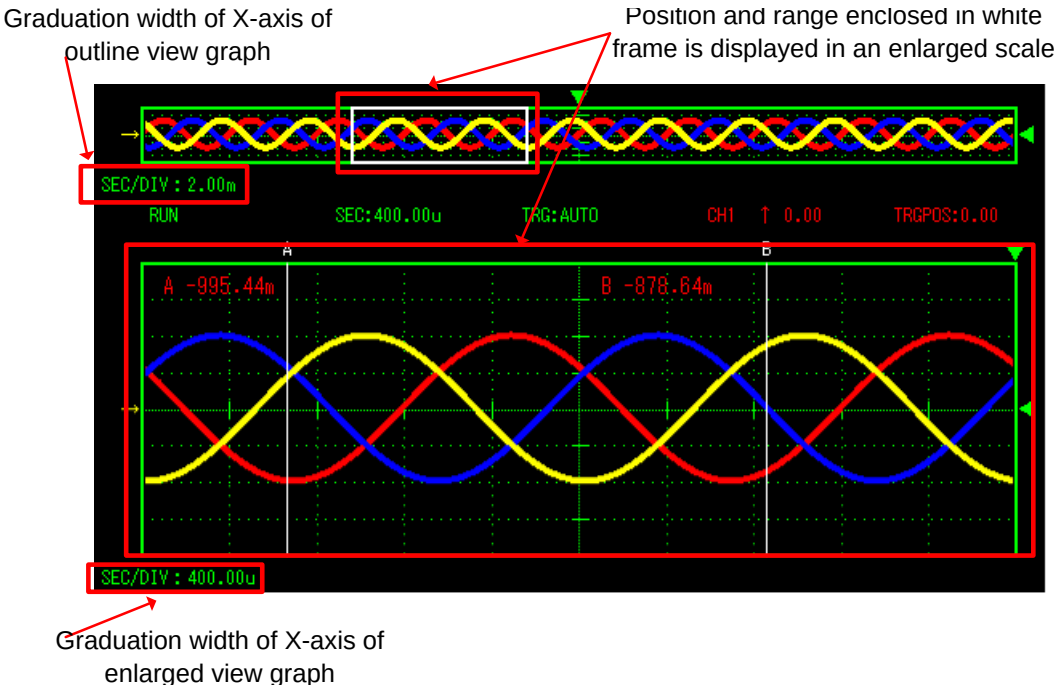


Figure 95: **Enlarged Display of Waveform**

3) Cursor ON/OFF

To display the cursor on the enlarged view graph, click the **CURSOR** button on the control panel window.

When cursor display is OFF

When cursor display is ON

Figure 96: **CURSOR Button Status**

When the cursor display is ON, the values of **Cursor A**, **Cursor B**, **|A-B|** and **1/|A-B|** will be displayed on the status bar of the graph window. In each CH and the MATH area, the cursor values of "-A-" and "-B-" will be displayed on the lower part of the enlarged view graph.
To move Cursor A and Cursor B, move the mouse over the cursor character ("A" and "B") of the enlarged view window, and drag to a position.

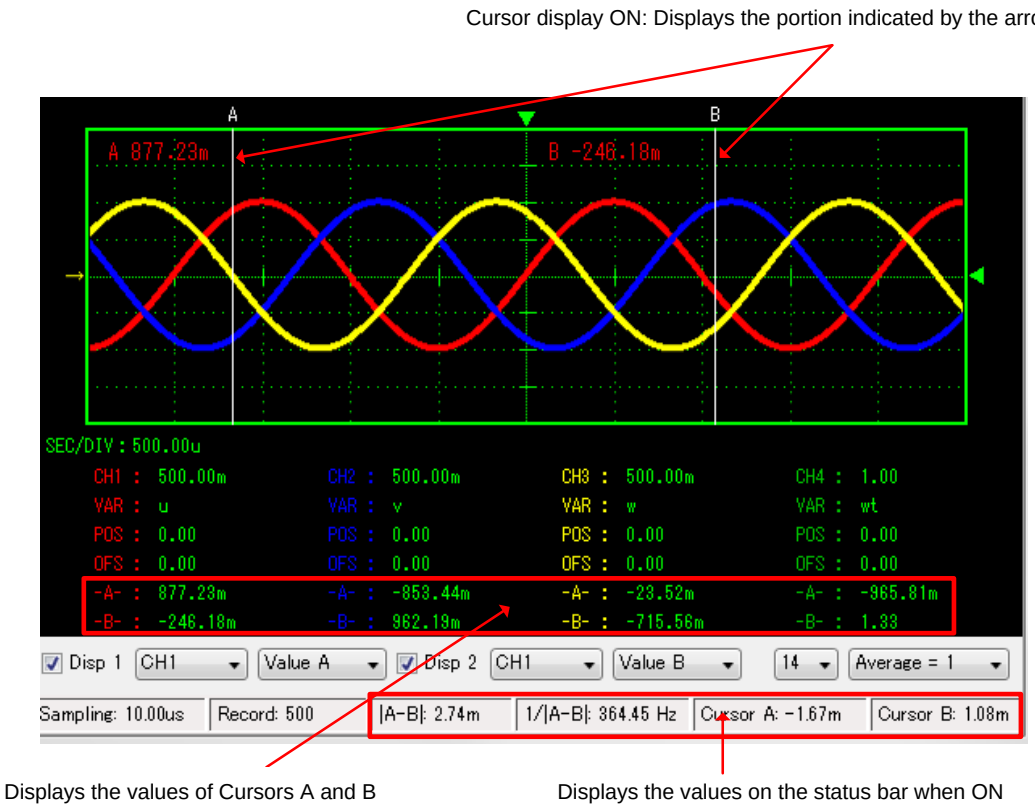


Figure 97: Status When Cursor Display Is ON

For each cursor, different modes will be displayed.

Table 41: Differences in values of cursors

Mode	Display
Interpolation enabled: ([Option] → [Smooth]: ON)	Interpolation data is displayed.
Interpolation disabled: ([Option] → [Smooth]: OFF)	Each data point is displayed. Between 2 points, the data on the left will be displayed when the cursor is present.

4) Changing range of waveform display

To change the range of a waveform display, change the following portions.

(X-axis)

●Change X-axis of CH1 to 16 and MATH1 to 8:

HORIZONTAL SEC/DIV

●Change X-axis of XY-1 and XY-2:

[X-VAL/DIV] of each X-Y function

(Y-axis)

●Change Y-axis of CH1 to 16 and MATH1 to 8:

Each [VAL/DIV] of CH and MATH

●Change Y-axis of XY-1 and XY-2:

[Y-VAL/DIV] of each X-Y function

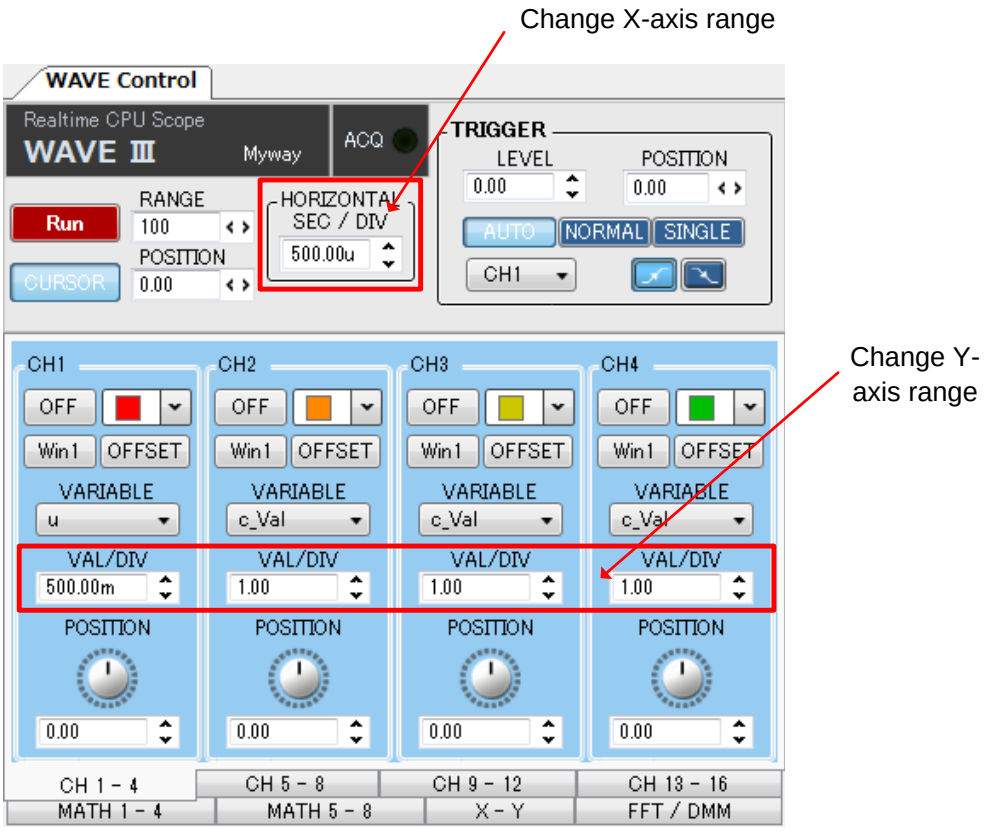


Figure 98: **Changing of Ranges (CH1 to 16 Screen)**

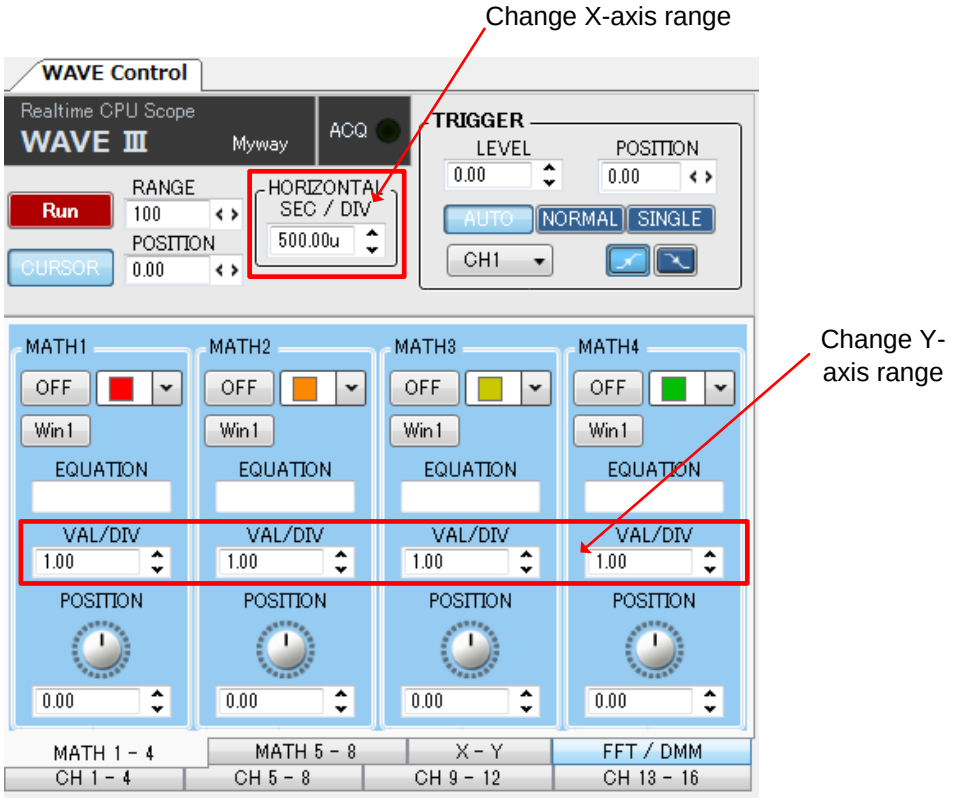


Figure 99: **Changing of Ranges (MATH Screen)**

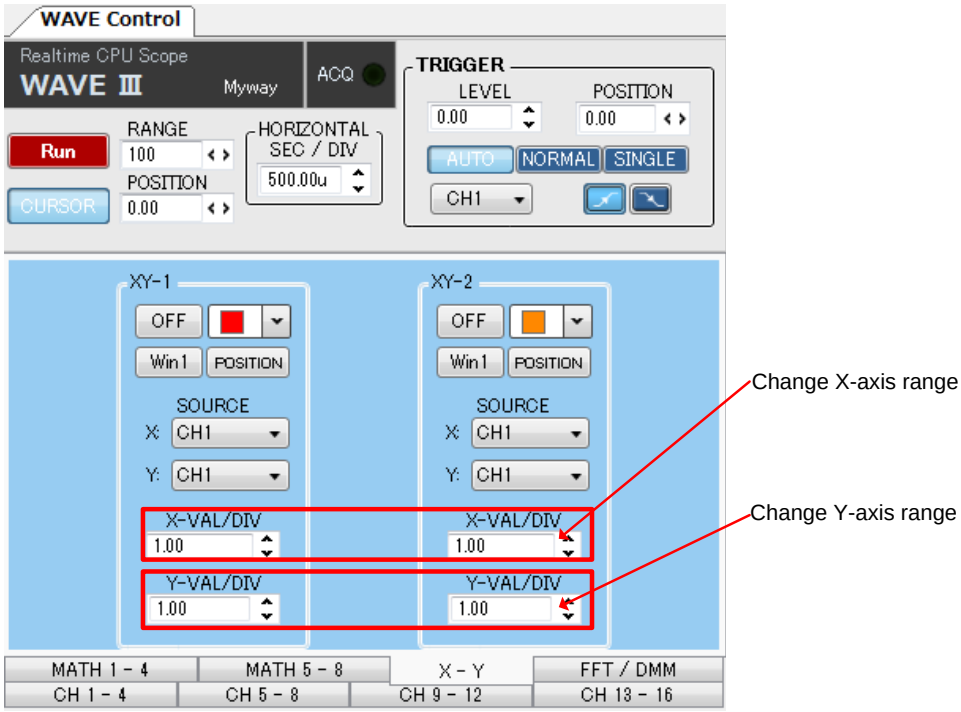


Figure 100: **Changing of Ranges (X-Y Screen)**

Click the up/down button of the list box, or directly enter a value in the text box to set the range.

When entering a value directly, be careful the range width and unit below:

(X-axis) 100us to 200 second/DIV

(Y-axis) 100u to 50 M/DIV

(Units) u: micron 10^{-6}), m: millimeter (10^{-3}), k: kilo (10^{3}), M: mega (10^{6})

● Changing range width and units

If the value is less than 1, use units of (u, m), and only use (k, M) when larger than 1.

5) TRIGGER Settings

Up to 4 triggers can be displayed. For multiple trigger conditions, if any condition is fulfilled,trigger is enabled. (OR condition). Refer to the image below for trigger setting.

[COMMON]

Set the common trigger condition for Trigger 1～4.

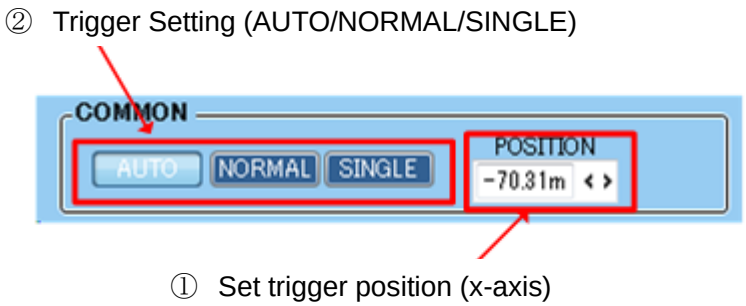


Figure 101: **Common trigger conditions**

[EACH]

Individual setting for each trigger 1～4 is displayed as below.

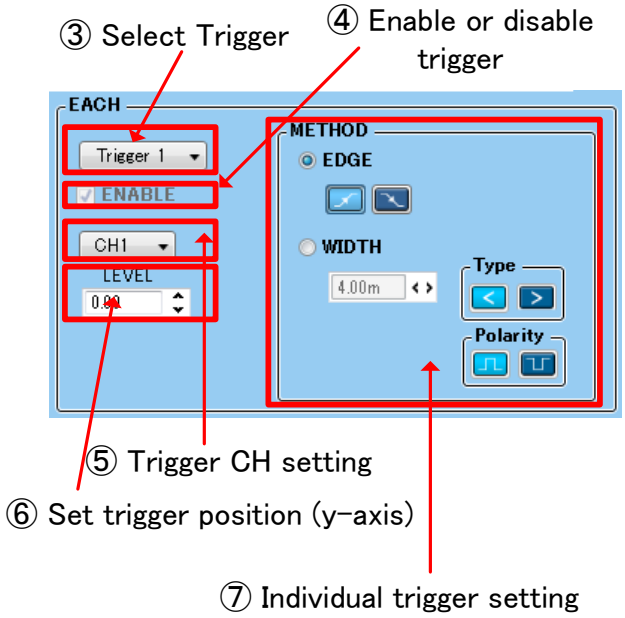


Figure 102: **Individual Trigger Setting**

●Trigger Setting (AUTO/NORMAL/SINGLE) [①]
This item is common for all triggers.

・AUTO
The trigger signal is generated within a certain time (timeout time, approximately one screen of the display). The waveform is displayed in synchronization with the trigger signal and the waveform is automatically captured after the timeout time. In AUTO mode, the waveform has a cycle longer than the timeout time

・NORMAL
The waveform is captured and displayed only when the trigger condition is met during RUN. If the trigger condition is not met, the trigger enters a “wait” state.

・SINGLE
If the trigger condition is met during RUN, the waveform is retrieved once and it stops. If the trigger condition is not met, the trigger enters a “wait” state.

Note that it is possible to change the trigger mode during waveform display (during RUN).

● Set trigger position (x-axis) [②]/ Set trigger position (y-axis)[⑥]

The trigger position for x-axis is common in trigger 1～4.

The trigger position for y-axis is different in trigger 1～4.

When CH1 to 16 is selected as the trigger channel, the trigger point will be set at the point of the intersection of the set trigger level and trigger position (see figure below).

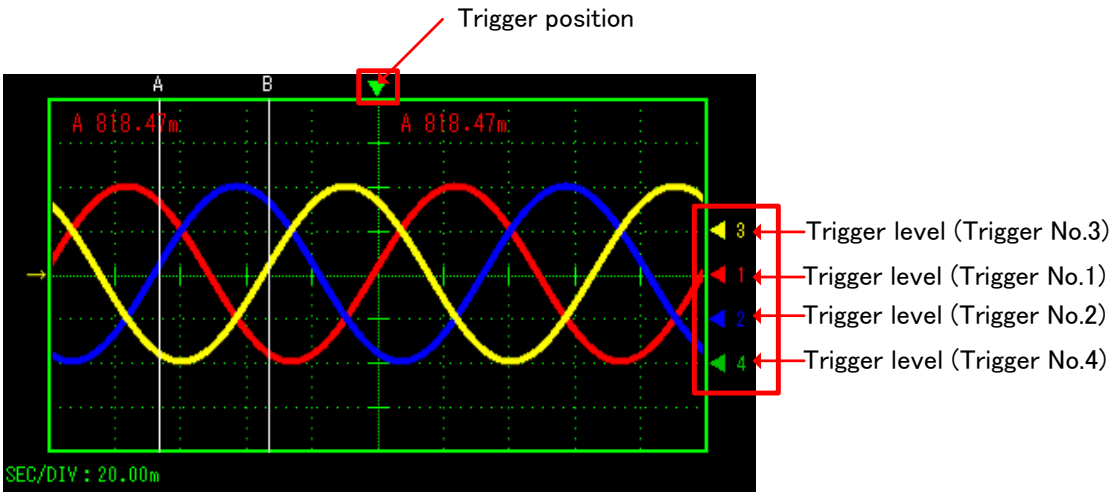


Figure 103: **Explanatory View of Trigger Function**

There are 4 methods to set triggers.

(i) Drag the trigger level and trigger position (▼ mark) in the outline view graph.

(ii) Drag the trigger level (▼ mark) in the enlarged view graph.

(iii) Click the up/down button (trigger level) and the right/left button (trigger position) of the list box on the control panel window to change the value.

Figure 104: **Setting Trigger Level and Trigger Position**

To set the interval which changes the value, move one graduation at a time in the graduation unit of VL/DIV and HORIZONTAL SEC/DIV in each outline view graph.

Ex.: Trigger level VAL/DIV is set to 1.00

→ ..., -1.00, 0.00, 1.00, ...)

Ex.: Trigger position HORIZONTAL SEC/DIV is set to 1.00m

→ ..., -1.00m, 0.00, 1.00m, ...)

※ Generally, the value will changed for each range width set in VAL/DIV and

HORIZONTAL SEC/DIV.

※ The value set in HORIZONTAL SEC/DIV displayed on the control panel window is the setting value in the enlarged view graph. The HORIZONTAL SEC/DIV in the outline view graph is determined by the setting value on the control panel window and the display scaling factor (RANGE).

(iv) Directly enter the value in the list box of the control panel window.

Figure 105: **Setting Trigger Level and Trigger Position**

Note that the trigger position is based on the outline view graph.
Ex.: Trigger level VAL/DIV is set to 1.00

→ Setting range: -4.00 to 4.00

Ex.: Trigger position HORIZONTAL SEC/DIV is set to 1.00m

→ Setting range: -5.00m to 5.00

※ Generally, the range of the trigger level is (-4xVAL/DIV) to (4xVAL/DIV), and the range of the trigger position is (-5xHORIZONTAL SEC/DIV) to (5xHORIZONTAL SEC/DIV).

●Select Trigger [③]

The trigger level position for y-axis is different for each trigger 1～4.

Select the trigger from the list first.

Figure 106: **Select Trigger**

●Enable / Disable Trigger [④]

Each trigger is enabled / disabled individually.

Check each box to enable trigger. For the example below, only Trigger 1 is enabled.

Figure 107: **Enable / Disable**

● Trigger CH Setting [⑤]

Each trigger CH is enabled / disabled individually.

The setting includes CH1-16 and EXT. EXT refers to external trigger. When EXT is selected, rising or falling from external signal is triggered. The range is from 0-5V.

Figure 108: **Trigger CH Setting**

●Individual Trigger Setting [⑦]

The setting for each trigger CH is different..

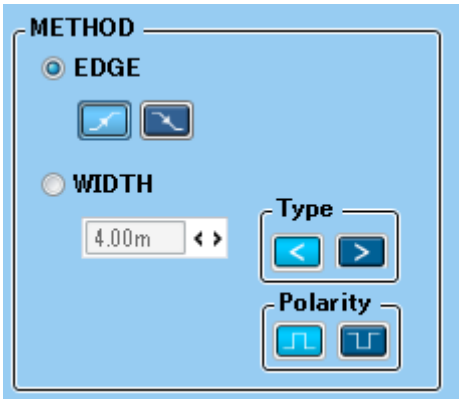
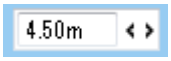


Figure 109: **Individual Trigger Setting**

For each trigger, the following items are displayed.

Item	Contents
EDGE	In EDGE selection, trigger is set in rising/falling edge  rising edge  falling edge ※ When EXT is selected, rising or falling from external signal is triggered. The range is from 0-5V.
WIDTH	When WIDTH is selected, trigger is enabled at pulse width. Pulse width refer to “smallest width between trigger level and cross point” in **WAVE**
	 Set pulse width Min： Sampling frequency x 2 Max： SEC/DIV x 9 (SEC/DIV is the conversion of RANGE=100)
	Type：trigger enabled when value is larger or smaller than pulse width  trigger when larger than pulse width  trigger when smaller than pulse width
	Polarity： trigger enabled in positive polarity / negative polarity  trigger in positive polarity  trigger in negative polarity

● Display of Trigger Information

For each trigger 1～4, the following window will be displayed.

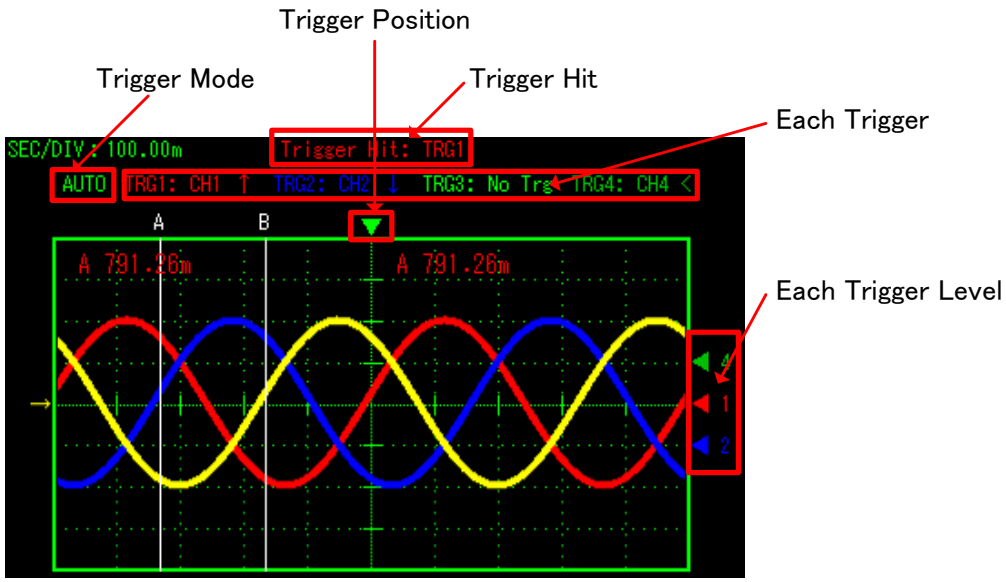


Figure 110: **Display of Trigger Information**

Table 42: Display of Trigger Information

Items	Contents
Trigger Position	Trigger position setting in [POSITION]
Trigger Mode	Display of AUTO/ NORMAL/ SINGLE
Trigger Hit No.	Display of Trigger Hit No. (“TRG1 ～ TRG4”) In AUTO mode, waveforms will be refreshed continuously in defined time. In this caes, ”No Trg” is displayed.
Each Trigger	Each trigger is displayed. ↑: rising edge ↓: falling edge < : trigger pulse is larger than setting > : trigger pulse is smaller than setting
Each Trigger Level	Trigger level setting in [LEVEL]

6) Setting CH1 to 16, MATH and X-Y waveform display to ON/OFF

To change the setting of the waveform display of CH1 to 16, MATH and X-Y to ON/OFF, click the **ON/OFF** button provided for each CH on the control panel window as shown below.

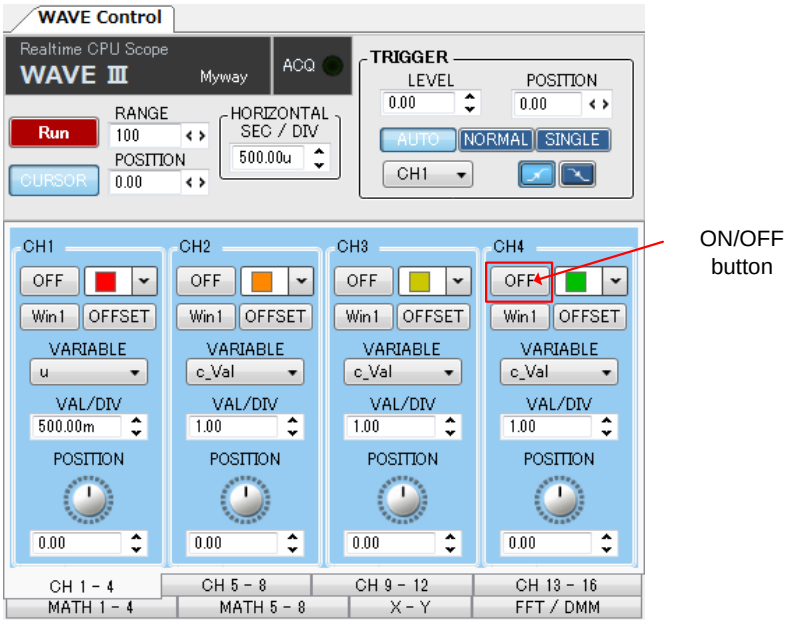


Figure 111: **ON/OFF Button (CH1 to CH16 Screen)**

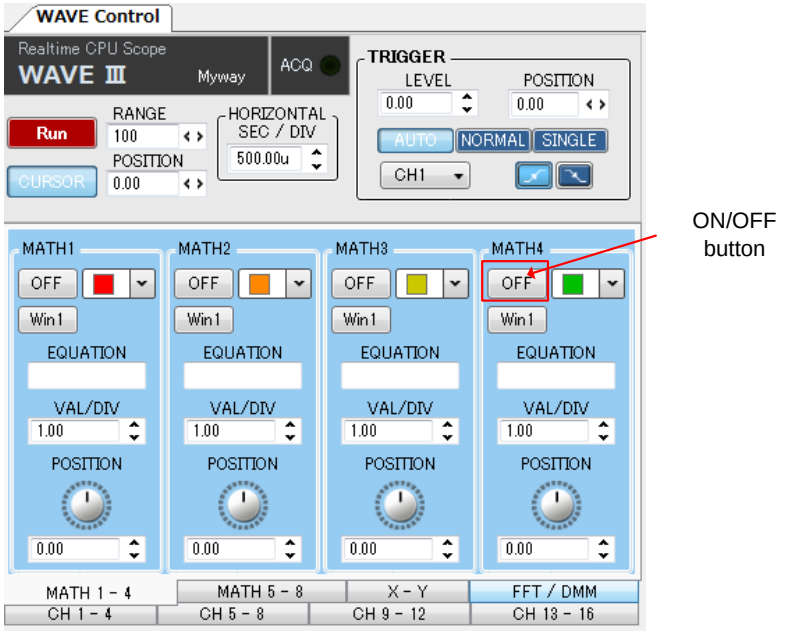


Figure 112: **ON/OFF Button (MATH Screen)**

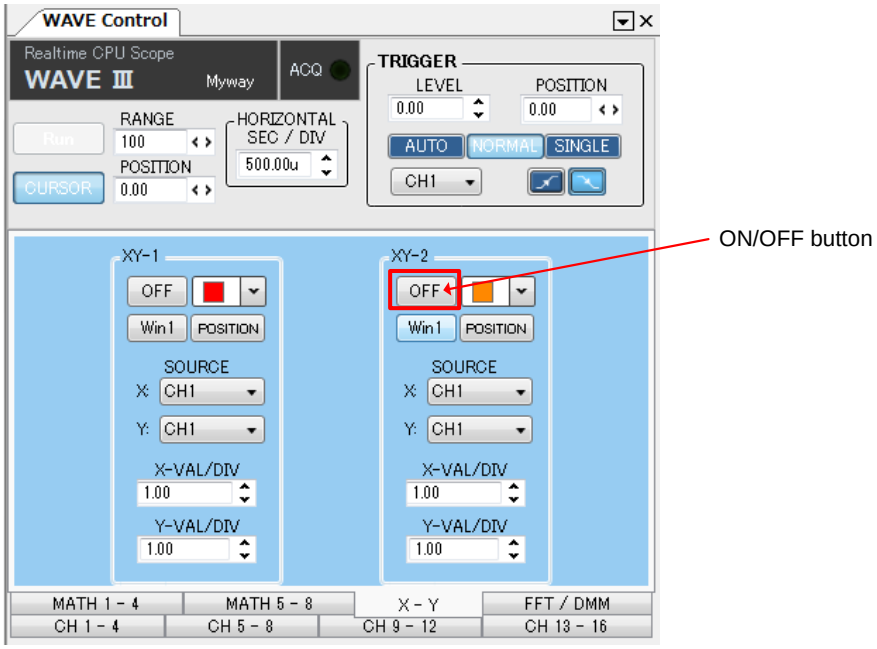


Figure 113: **ON/OFF Button (X-Y Screen)**

7) Extension Window

Up to 4 extension windows can be selected for CH1-16, MATH and X-Y graph. In the image below, click on [Win1] to change the display of waveform. [Win1]～[Win4] can be switched. [Win1]～[Win4]　is displayed in Image 1～Image 4

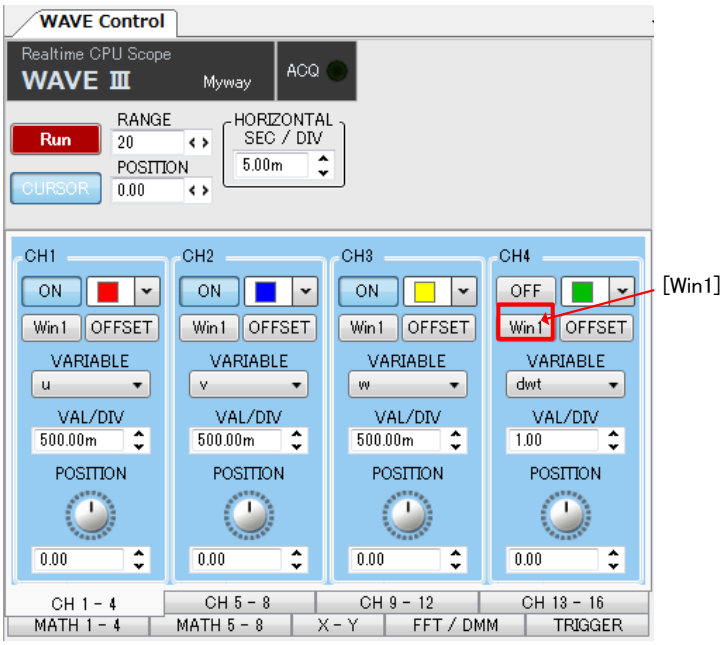


Figure 114: **[Win1] (CH1-16 Display)**

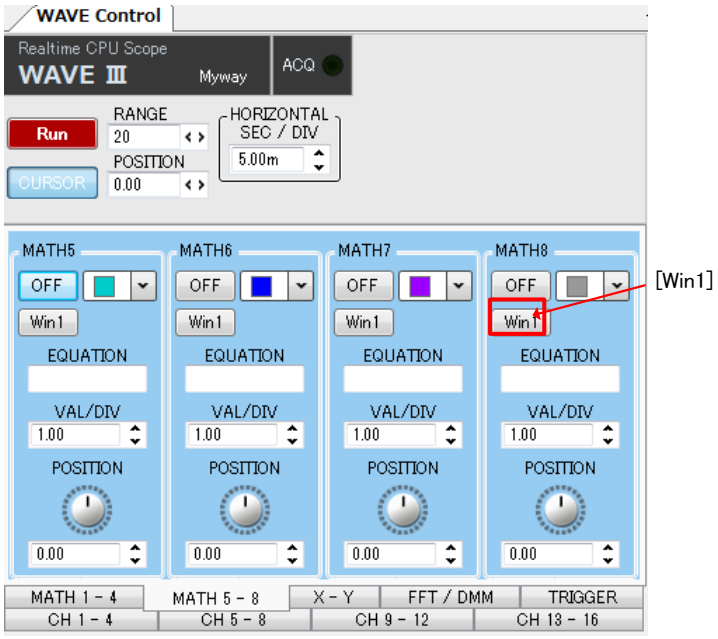


Figure 115: **[Win1] (MATH Display)**

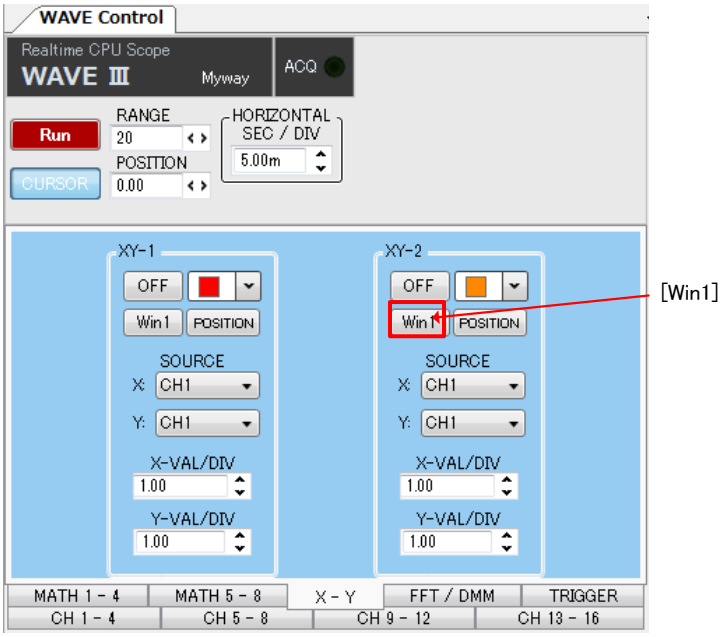


Figure 116: **[Win1] (X-Y Display)**

Extension windows are shown as below.

- For 1 image

(Eg)CH1/ CH2/ CH3/ CH4 -- Win1

Other CH are not displayed

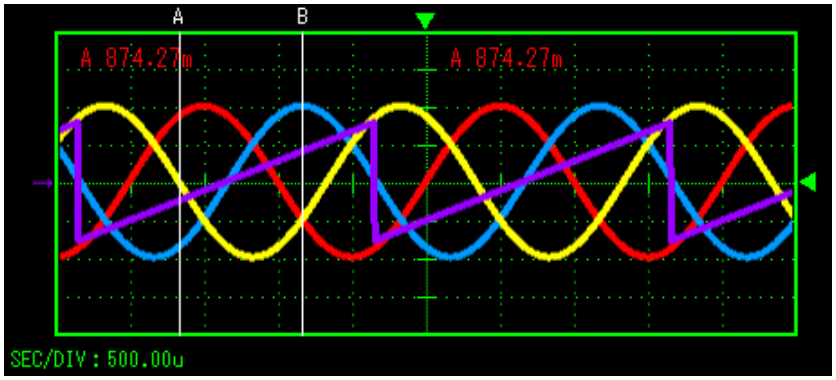


Figure 117: **Magnified Graph (Image 1)**

- For 2 images

(Eg)CH1/ CH2 -- Win1

CH3/ CH4 -- Win2

Other CH are not displayed

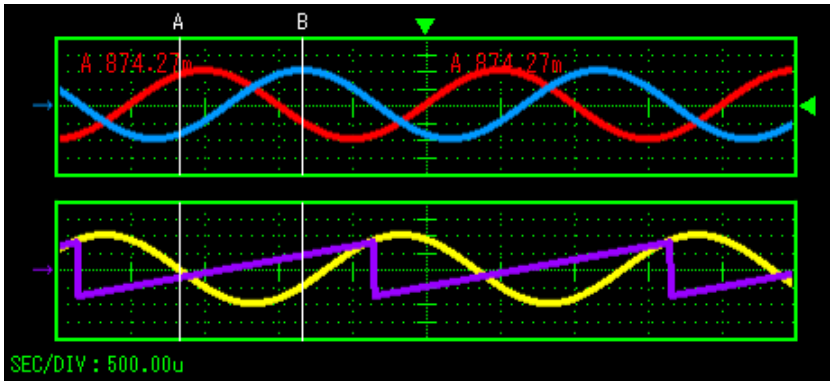


Figure 118: **Magnified Graph (Image 2)**

- For 3 images

(Eg)CH1/ CH2 -- Win1

CH3 -- Win2

CH4 -- Win3

Other CH are not displayed

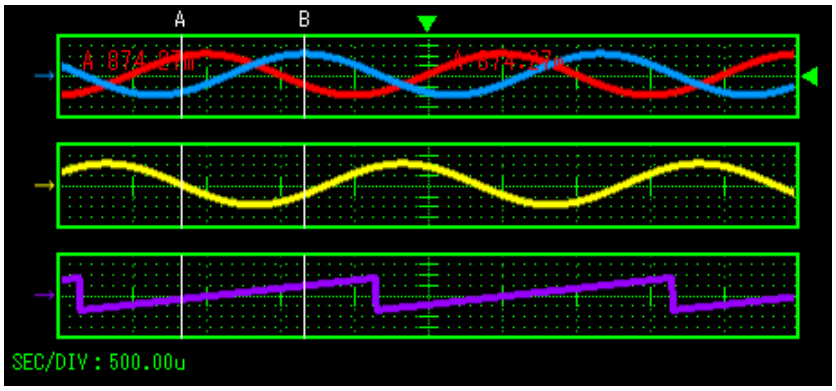


Figure 119: **Magnified Graph (Image 3)**

- For 4 images

(Eg)CH1 -- Win1

CH2 -- Win2

CH3 -- Win3

CH4 -- Win4

Other CH are not displayed

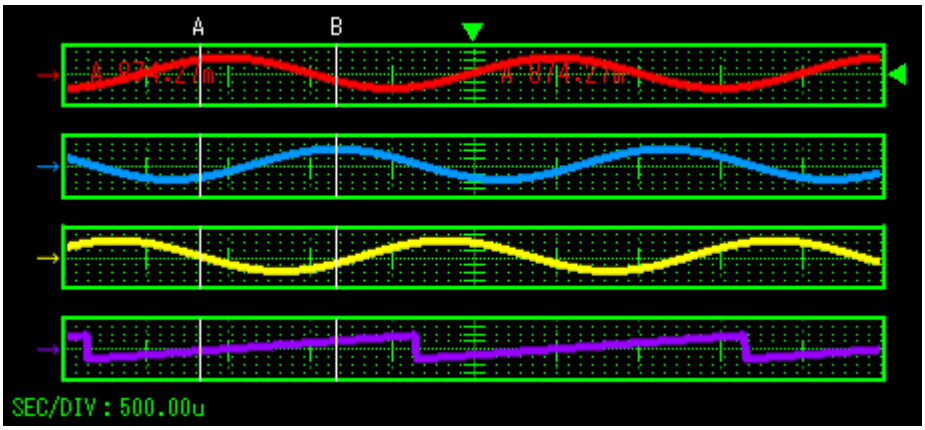


Figure 120: **Magnified Graph (Image 4)**

8) Setting offset

Clicking the **OFFSET** button of each CH (CH1 to 16) displays the following screen and allows the Offset value to be set. To set the value, enter the Offset value directly.

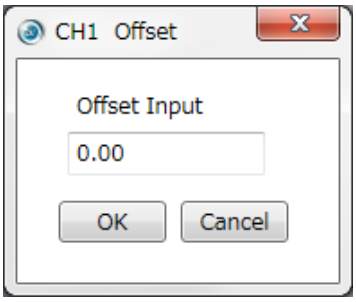


Figure 121: **Offset Value Setting (CH1)**

The Offset function is for displaying the value in which a fixed value (Offset value) is added to the target variable by the waveform display software. All the values used for numerical processing and display by the waveform display software are the values after the Offset is added. Note that each channel data transferred to the MATH function and the X-Y function is also data after the Offset is added.

The example shows that Offset value "1" is added to CH1.

Waveform display and value changes for the amount of Offset added

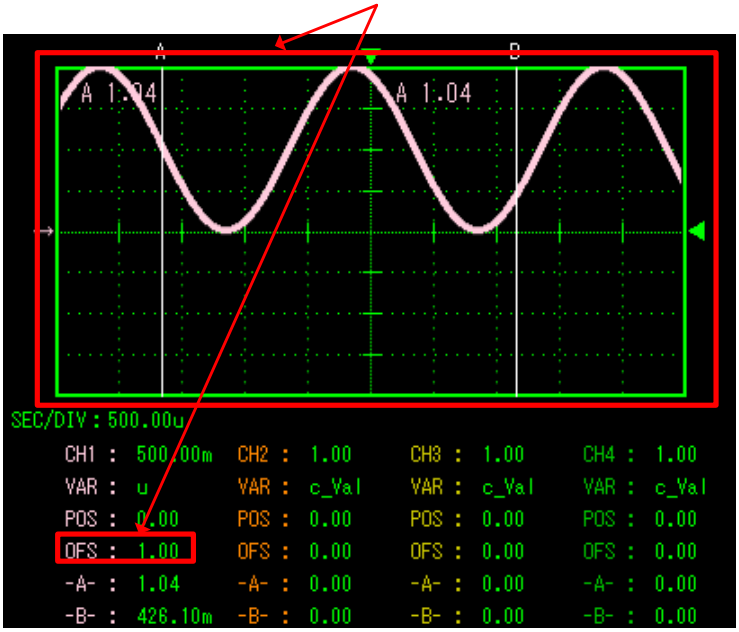


Figure 122: **Offset Value Display (CH1)**

When the X-Y function is displayed in this state, the following X-Y waveforms will be displayed.

Displayed in the state where the Offset value of CH1 is included

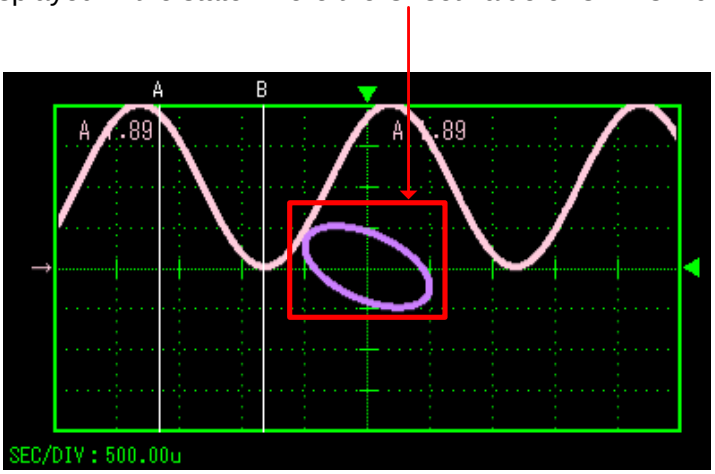


Figure 123: **Offset Value Display (X-Y)**

9) Selecting variable

To select the variable to be displayed, click the pull-down menu (▼ button) of **VARIABLE** on the control panel window.

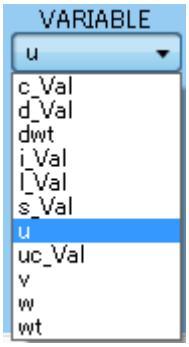


Figure 124: **Variable Selection**

The variable can be selected from the following two methods.

- Select a variable name with the mouse.
- When the first character of a variable name is entered, the applicable variable name will be selected automatically.

The variables listed in **VARIABLE** are displayed based on the variable information file automatically created by PE-ViewX.

10) Selecting display colors of waveform

To set the waveform color of each CH, MATH and X-Y, or the spectral color of the FFT, click the color list. The following color selection dialog will be displayed.

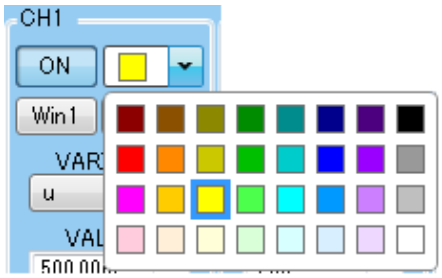


Figure 125: **Waveform and FFT Spectral Color Setting**

11) Setting POSITION

To set the POSITION of CH1 to 16 and MATH, set the value in **POSITION** as follows:

Figure 126: **POSITION Setting (CH1 to 16, MATH)**

The position can be set by the following three methods.

- Place the cursor on the dial, and rotate the mouse wheel.
- Click the Up/Down buttons of the list box.
- Directly enter a value.

※ The setting range is from "(-4xVAL/DIV) to (4xVAL/DIV)."

Click the **POSITION** button for the X-Y function.

The following dialog will be displayed.

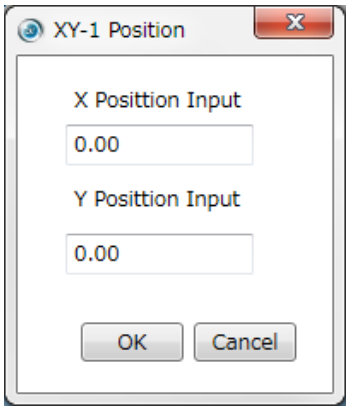


Figure 127: **POSITION Setting (X-Y)**

The following shows the waveform when **POSITION** is set. Use these figures as a reference.

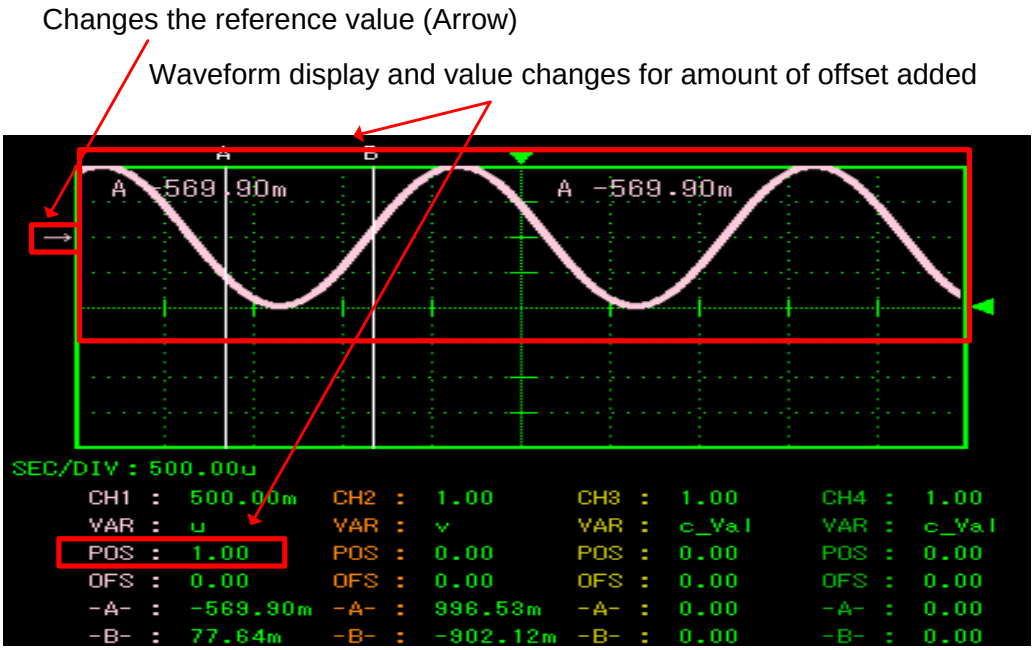


Figure 128: **POSITION Display (CH1)**

12) How to change CH1 to 16, MATH and X-Y screens

On the control panel window, the CH1 to 16, MATH and X-Y screens can be selected. To change the screen, directly click the tab to select, or press the [Tab] key on the keyboard.

13) Setting EQUATION

In the MATH function, there is an EQUATION function which performs calculations using the value and constant of each CH.

The calculation results can be displayed in the waveform. See the following figure for an example of the contents and setting of the EQUATION function.

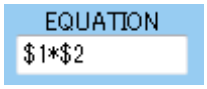


Figure 129: **Example of EQUATION (Case of multiplication of CH1 and CH2)**

Table 43: Specification of Valuation Equation

Function Names	Notations	Description
Input source	$1 to $16	Provides input source used for calculation. The number is equivalent to the channel number.
Time source	$t	Provides time used for calculation by second bit. The reference is the trigger setting position.
Circular constant	$p	Provides circular constant.
Constant	3.14	Provides constant used for calculation. Exponential notations cannot be used. The following notations can be used as a suffix. M: 10^6, K: 10^3, m: 10^{-3}, u: 10^{-6}
Code inversion	-	Can be added to the beginning of an equation. The combinatory rule is based on common mathematic equations.
Four arithmetic operations	+-*/	Performs four arithmetic operations. The combinatory rule is based on common mathematic equations.
Power	^	Calculates the power. The combinatory rule is based on common mathematic equations.
Parenthesis	()	Forces the priority of the four arithmetic operations.
Absolute value	abs(x)	Provides absolute value of given equation x.
Sine function	sin(x)	Provides sine value of given equation x. x is the radian.
	sinh(x)	Provides hyperbola sine value of given equation x. x is the radian.
Cosine function	cos(x)	Provides cosine value of given equation x. x is the radian.
	cosh(x)	Provides hyperbola cosine value of given equation x. x is the radian.
Tangent function	tan(x)	Provides tangent value of given equation x. x is the radian.
	tanh(x)	Provides hyperbola tangent value of given equation x.

Function Names	Notations	Description
		x is the radian.
Inverse tangent function	atan(x)	Provides inverse tangent value of given equation x. x is the radian.
Square root	sqrt(x)	Provides square root of given equation x.
Between cursor A-B	$ab	Provides number of seconds [sec] between cursors A-B.
Root mean square value ※	$rms1～ $rms16	Provides root mean square value of input source n.
Frequency ※	$Hz1～ $Hz16	Provides frequency of input source n.
Mean value ※	$mean1～ $mean16	Provides mean value of input source n.

※ These values conform to the processing results of the multimeter function.

14) Selecting source channel of X-Y screen

The X-Y screen is a function for setting each CH to the X-axis and Y-axis to observe a waverform. Set the CH or the MATH channel to be displayed on the X-axis and Y-axis as shown below in SOURCE on the control window.

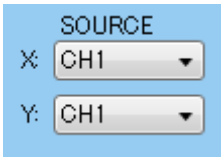


Figure 130: **X-Y Function Source Channel Setting**

15) On-Chip WAVE Settings

Set On-Chip WAVE.

On-Chip WAVE is a function which executes WAVE sampling and saves wave data by PEOS in user program.

It is not necessary to run WAVE window of PE-ViewX.

This function can be used for failure analysis etc.

Saved wave data can be loaded to WAVE window of PE-ViewX and displayed.

Figure 131: Setttings of On-Chip WAVE

Settings items are as follows.

Table 44: List of items of On-Chip WAVE settings

Items	Contents
Save Settings	Saves current trigger conditions of WAVE to PE-Expert4. Trigger conditions are saved to Flash ROM, so it is retained even when turning off PE-Expert4. Saved wave data based on old trigger conditions are cleared when setting new trigger condtions. On-Chip WAVE starts sampling after clicking this button and execute user program.

	Wave data is saved automatically to RAM when meeting the trigger conditions. Wave data in RAM is cleared when turning off PE-Expert4. To save wave data even after turning off PE-Expert4, call PEOS function which saves wave data to Flash ROM. Flash ROM can save wave data up to 1M byte. Wave data exceeding 1M byte is thinned out in Flash ROM.
Retrive Data	Loads saved trigger conditions and wave data to PE-ViewX. If wave data is saved in RAM, PE-ViewX loads it. If wave data is not saved in RAM, PE-ViewX loads it from Flash ROM. If wave data is not saved in RAM and Flash ROM, PE-ViewX loads only trigger conditions.

●To use this function, it is necessary to call PEOS functions in version 3.04 or more.
To save wave data to Flash ROM, call the function which saves
WAVE data to Flash rom.
For more details, refer to [5.1.8 MWPE4-C6657 Board On-Chip WAVE Function Group] in function reference manual.
The kernel version of DSP board needs to be upgraded to version 3.03 or more.

●WAVE window of PE-ViewX has priority over On-Chip WAVE.
On-Chip WAVE cannot be executed while running WAVE window of PE-ViewX.
If the WAVE window of PE-ViewX is ran while executing On-Chip WAVE,
On-Chip WAVE stops.

4.4.5 Graph Window Structure

This section describes the structure of the graph window.

The structure is as follows:

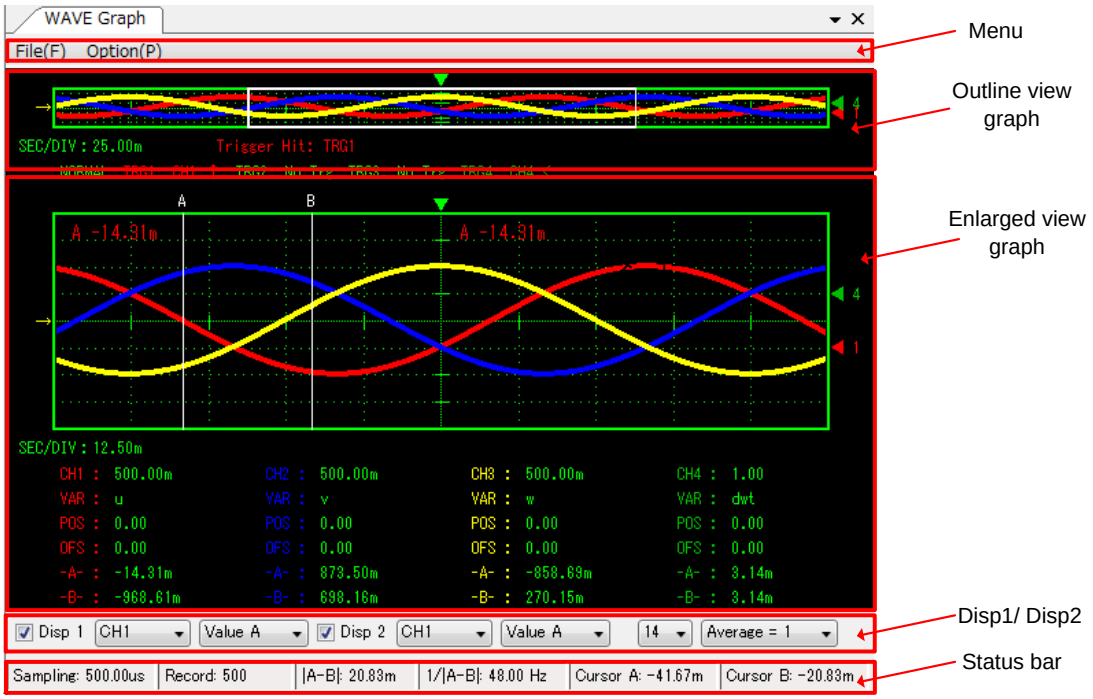


Figure 132: **Graph Window Structure**

1) Menu

The menu consists of **File** / **Option**.

See "4.4.5 Processing Waveform Data (**File** Menu)" and "4.4.6 Waveform Display Related Settings (**Option** Menu)" for the details.

2) Outline view graph

The outline view graph displays all the acquired waveform data.

The details are as follows:

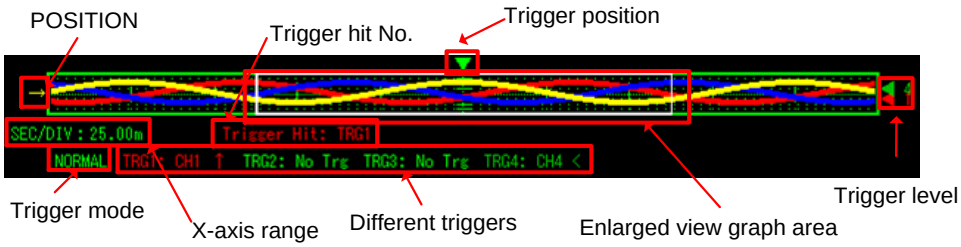


Figure 133: **Outline View Graph Structure**

Table 45: Outline View Graph Structure

Names	Functions
X-axis range	Indicates the range of the X-axis (SEC/DIV) of the outline view graph.
POSITION	Indicates the **POSITION** value set on each CH tab.
Enlarged view graph area	The area enclosed in the white frame in the outline view graph. This area is enlarged and displayed on the enlarged view graph. The range of the white frame is specified by the **RANGE** and **POSITION**.
Trigger position	Indicates where the trigger position is in the acquired waveform. Specified by **POSITION** in the **TRIGGER** field. The trigger position can also be specified by dragging the arrow right and left.
Trigger level	Indicates where the trigger level is in the acquired waveform. Specified by **LEVEL** in the **TRIGGER** field. The trigger level can also be specified by dragging the arrow up and down.
Trigger mode	Displays **AUTO/NORMAL/SINGLE**
Trigger hit No.	TRG1~TRG4 will be displayed as hit number. In case of **AUTO** mode, waveform will be displayed in fixed time despite of hit number.
Different triggers	The different formats of triggers are listed as below. ↑ : rising edge ↓ : falling edge < : pulse trigger, larger than setting > : pulse trigger, smaller than setting [LEVEL] displays the setting for all triggers 1~4.

3) Enlarged view graph

The enlarged view graph enlarges and displays the area specified in the outline view graph.

Up to 4 windows can be displayed.

The details are as follows:

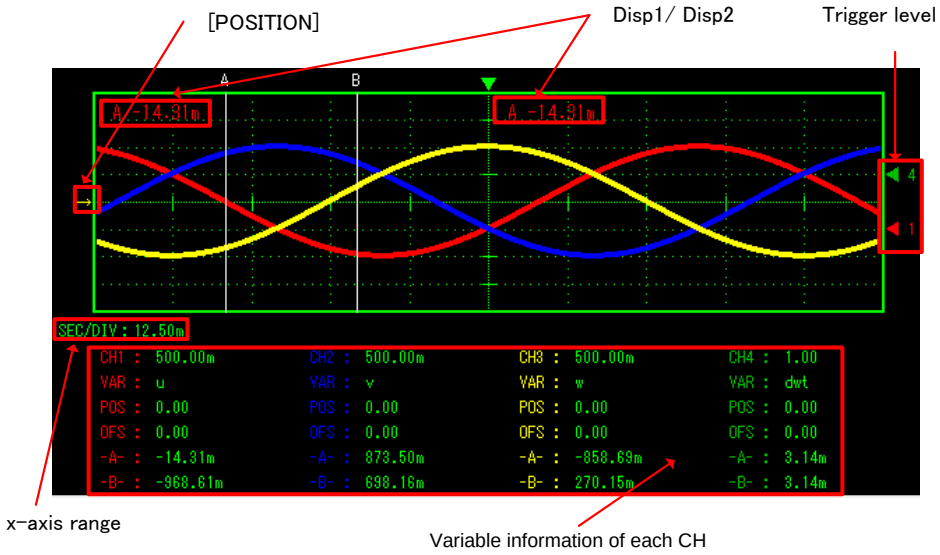


Figure 134: **Enlarged View Graph Structure**

Table 46: Enlarged View Graph Structure

Names	Functions
X-axis range	Indicates the range of the X-axis (SEC/DIV) of the outline view graph.
POSITION	Indicates the **POSITION** value set on each CH tab.
Disp1/Disp2	Displays the values set in the [Disp1/Disp2] fields. See "4) Disp1/Disp2" on the next page the details.
Variable information of each CH	Displays the measurement condition of each CH and the values in cursors A/B. The items which can be set change by the tabs of CH1 to 16, MATH and X-Y.
Trigger level	Displays the trigger level in waveform. The settings are in [TRIGGER,][LEVEL] The trigger level can be adjusted by drag and drop of the arrow.

4) Disp1/Disp2

The contents set in these fields are displayed in the enlarged view graph as described on the previous page.

The details are as follows:

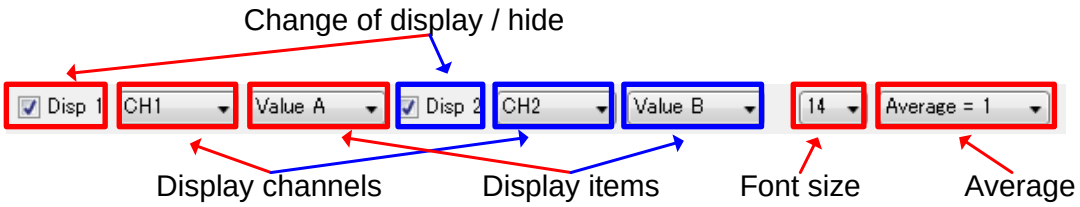


Figure 135: **Disp1/Disp2 Structure**

Table 47: Disp1/Disp2 Structure

Names	Functions
Change of display / hide	Changes between display/hide.
Display channels	For setting the channels to be displayed. Can be selected from CH1 to 16 and MATH1 to 8.
Display items	Can be selected from the following items: Value A: Displays the value of cursor A. Value B: Displays the value of cursor B. Multimeter: Displays the digital multimeter. See "4.4.8 DMM Display" for the digital multimeter.
Font size	For setting the font size.
Average	Used when **Multimeter** is selected. Calculates the average and frequency based on the mean value of the trigger data for the count specified here.

5) Status bar

The status bar displays the following items.

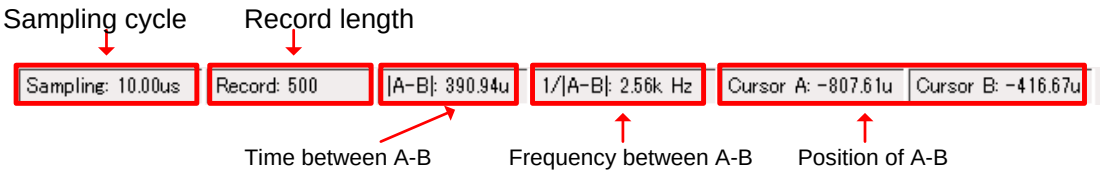


Figure 136: **Status Bar Structure**

Table 48: Status Bar Structure

Names	Functions
Sampling cycle	Displays the sampling cycle of the currently acquired waveform data. The sampling cycle is set based on the record length and the **HORIZONTAL SEC/DIV** value. Sampling frequency = ([**HORIZONTAL SEC/DIV**] x 10) / [Record Length] However, if the calculated sampling frequency falls below the minimum value of sampling frequency, the value remains at minimum value. The minimum sampling frequency is displayed as below: When [Channel Mode] is [16CH]: 10µsec When [Channel Mode] is [8CH]: 5µsec
Record length	Displays the record length (point) of the currently acquired waveform data. Indicates the record length per 1CH.
Time between A-B	Displays the time difference between cursor A and cursor B.
Frequency between A-B	Displays the inverse, i.e. the frequency of the time difference between cursor A and cursor B.
Position of A and B	Displays the position on the time of cursor A and cursor B. The center of the enlarged view graph is 0.

4.4.6 Processing Waveform Data ([File] Menu)

This section describes the functions of the **File** menu of the graph window.
The main functions include the Save/Load functions of waveform data, Save/Load functions of the control panel window, etc. The following describes each of the functions.
Since the **File** menu cannot be used while running, stop the operation before use.

1) Saving waveform display data ([Save WAVE Data])

The waveform display data (waveform data and setting information of the control panel window) can be saved in a file.
Select the **File** menu → **Save WAVE Data File**.
When this function is executed, the following entry dialog of Save Comment will be displayed. Enter the required information, and click the **OK** button.
An Ext. file ".wd6" will be created for the waveform display data.

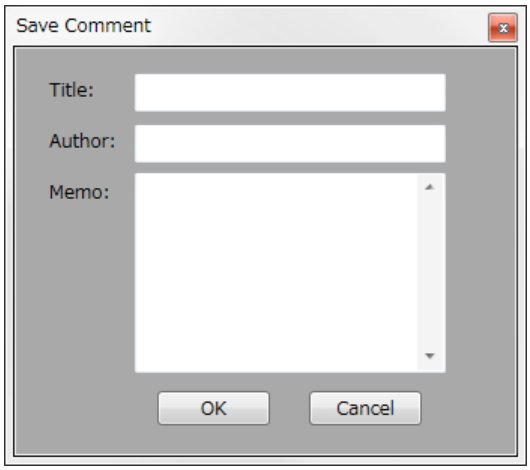


Figure 137: Save Comment Entry Dialog

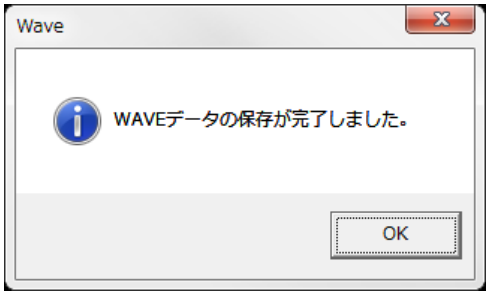


Figure 138: **Waveform Data Saving Completed Dialog**

※ Relationship between the offset function and data saving
The Offset function is for displaying the value in which a fixed value (Offset value) is added to the target variable by WAVE. All the values used for numerical processing and display by WAVE are the values after the Offset is added.
However, the Offset value is not included in the saved waveform data. When the saved waveform data is read to WAVE, the data including the Offset value set when the waveform data is read will be displayed. Pay particular attention to this point.

2) Saving waveform display csv data ([Save WAVE Data as CSV])

The waveform display data (csv data and setting information of the control panel window) can be saved in a file.
Select the **File** menu → **Save WAVE Data as CSV**.
When this function is executed, the following entry dialog of Save Comment will be displayed. Enter the required information, and click the **OK** button.
This file cannot be opened in WAVE.

3) Loading waveform display data ([Load WAVE Data])

The waveform display data file saved by the **Save WAVE Data File** function can be loaded.
Select the **File** menu → **Load WAVE Data File**.
When the file to be loaded is specified, the following dialog will be displayed.
Click the **OK** button to complete the loading.

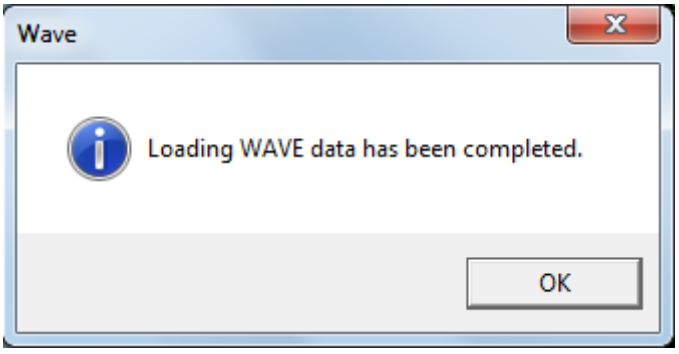


Figure 139: **Waveform Data Loading Completed Dialog**

4) Saving setting information (Save Configuration File)

Information including the variables, range, POSITION settings, etc. set in the control panel window can be saved in a file.
Select the **File** menu → **Save Configuration**.
When this function is executed, the following save comment entry dialog will be displayed.
Enter the required information, and click the **OK** button.

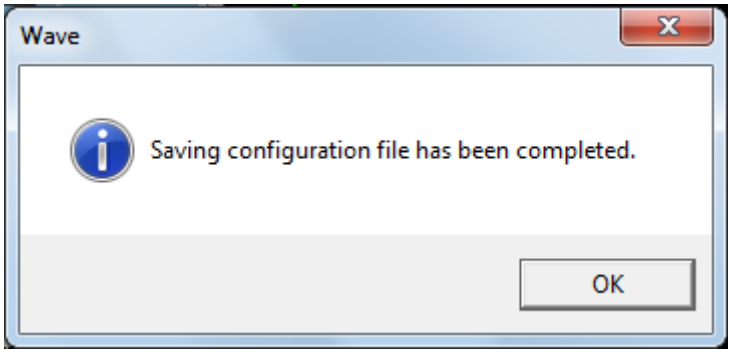


Figure 140: **Configuration File Saving Completed Dialog**

An Ext. file ".cf6" will be created for the variables, range, POSITION settings, etc. set in the control panel window.

※Setting information file (Ext. *.cf6).
The file (Ext.: .cf6) where the setting information is to be saved will be created automatically when the control window is closed, and the contents set in the control window at that time will be saved. The file name created automatically is "project name.cf6."
(Ex.: "tutor" project → "tutor.cf6" will be created)

5) Loading setting information ([Load Configuration])

The setting information file of the control panel window saved by **Save Configuration File** can be loaded.
Select the **File** menu → **Load Configuration**.
When the file to be loaded is specified, the following dialog will be displayed.
Click the **OK** button to complete the loading.

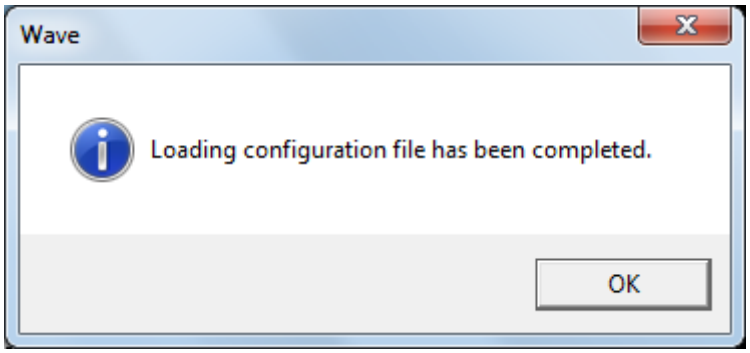


Figure 141: **Configuration File Loading Completed Dialog**

6) Copying to clipboard ([Copy to Clipboard])

The waveform data currently displayed can be copied to a clipboard.
Select the **File** menu → **Copy to Clipboard**.
When pasting, use the paint tool, etc.

7) Saving comments ([WAVE Data Comment])

Comments can be saved to the waveform display data file (Ext. *.wd6) loaded by the **Load WAVE Data File** function.
Select the **File** menu → **WAVE Data Comment**.
This function is only enabled after the waveform display data file is loaded by **Load WAVE Data File**, and it cannot be used for any other purpose.
When this function is executed, the following dialog will be displayed. To update the comment information, click the **Update** button.
Click the **Clear** button to clear all comments.

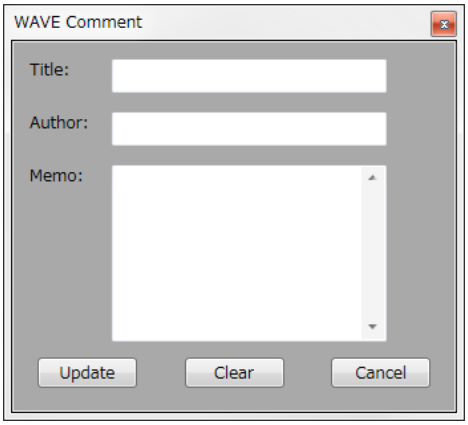


Figure 142: **WAVE Comment Dialog**

8) Printing ([Print])

The contents displayed in the graph window can be printed. Select the **File** menu → **Print**.

9) Print preview ([Print Preview])

The contents to be printed can be previewed. Select the **File** menu → **Print Preview**.

4.4.7 Waveform Display Related Settings ([Option] Menu)

This section describes the functions of the **Option** menu of the graph window.
The settings related to the waveform display are performed in this menu.

1) Setting display color ([Set System Color])

To set the background color and cursor color of the graph window, click the **Option** menu → **Set System Color** to display the following dialog.

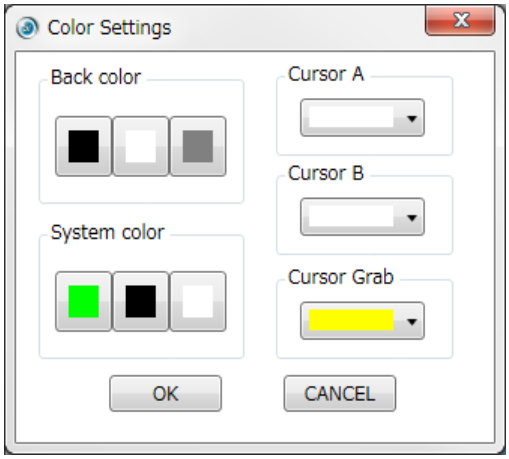


Figure 143: **Background Color and Cursor Color Setting**

Back Color : Background color of graph window
System Color : Grid line color of graph window
Cursor A : Display color of Cursor A
Cursor B : Display color of Cursor B
Cursor Grab : Display color when setting Cursor and Trigger
➔Cursor Grab refers to the color displayed when Cursor A, Cursor B, trigger position and the trigger level are being moved in the graph window while dragging by the mouse.

2) Setting font size ([Font Size])

The font size of the characters displayed in the data portion of the graph window can be set.
Select the **Option** menu → **Font Size**.
The size can be set from **Small**, **Medium** or **Large**.

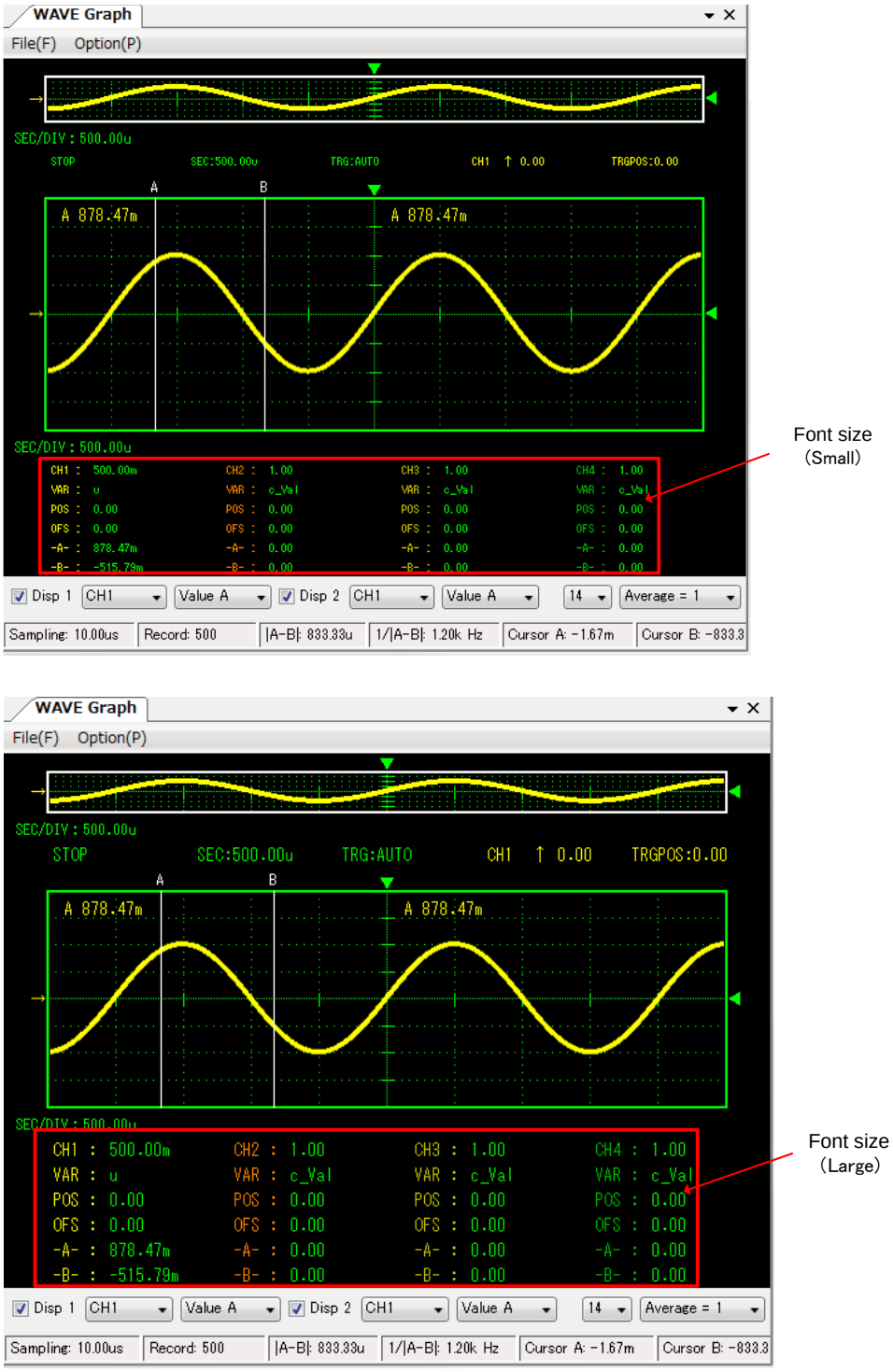


Figure 144: **Font Size Setting**

3) Setting waveform pixel size ([Pixel Size])

The waveform pixel size of the graph window can be set.
Select the **Option** menu → **Pixel Size**.
The size can be set from **Small**, **Medium** or **Large**.

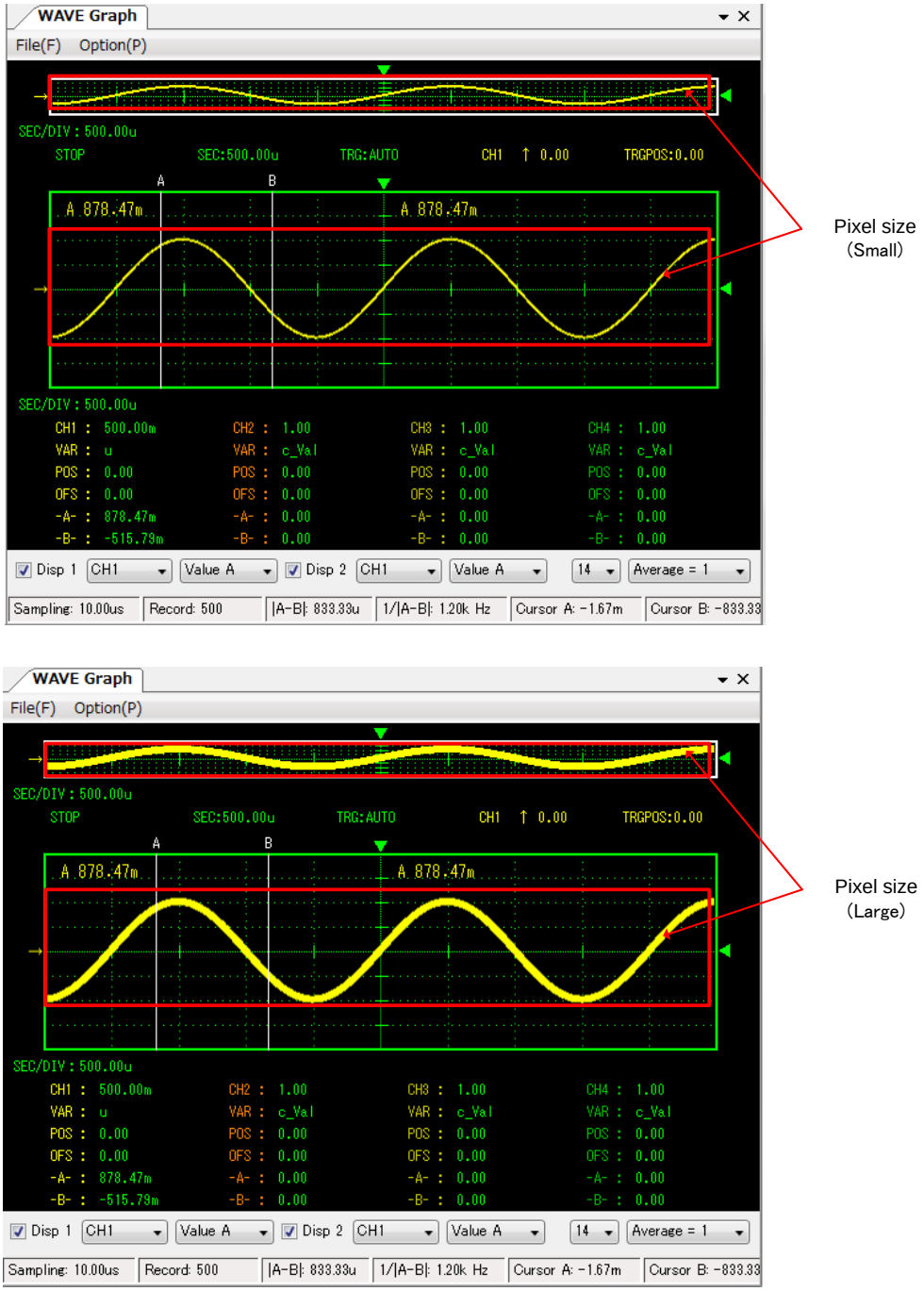


Figure 145: **Pixel Size Setting**

4) Changing interpolation display of waveform ([Smooth])

Whether to interpolate the data for the sampling point of the waveform of the graph window to be displayed can be set.
Select the **Option** menu → **Smooth**.
When this function is set to **ON**, the interpolated waveform data will be displayed as follows:

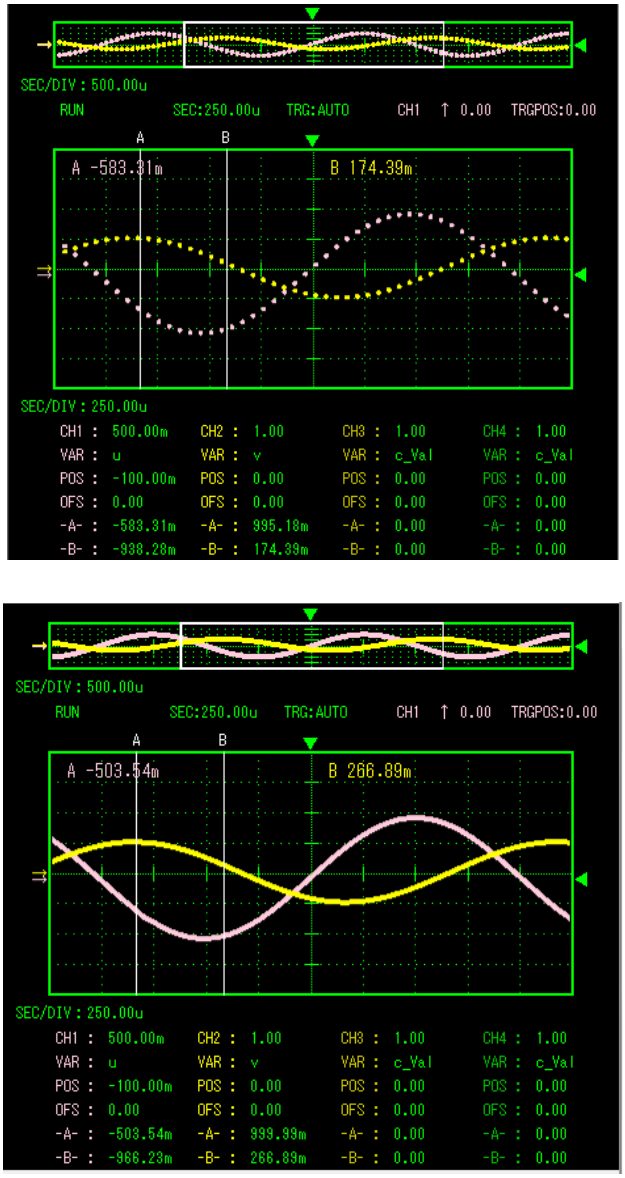


Figure 146: **Smooth Setting OFF (Upper Graph) / Smooth Setting ON (Lower Graph)**

※ In consideration of the effect on the drawing speed, even when the Smooth function is turned OFF, if the number of dots on the outline view graph/enlarged view graph reaches 300 points or more, the interpolated data will be displayed in each graph.

5) Setting graduation lines of waveform ([Grid Type])

The type of graduation line (grid line) of the graph window can be set.
Select the **Option** menu → **Grid Type**.
The type can be set between **Dot** or **Line**.

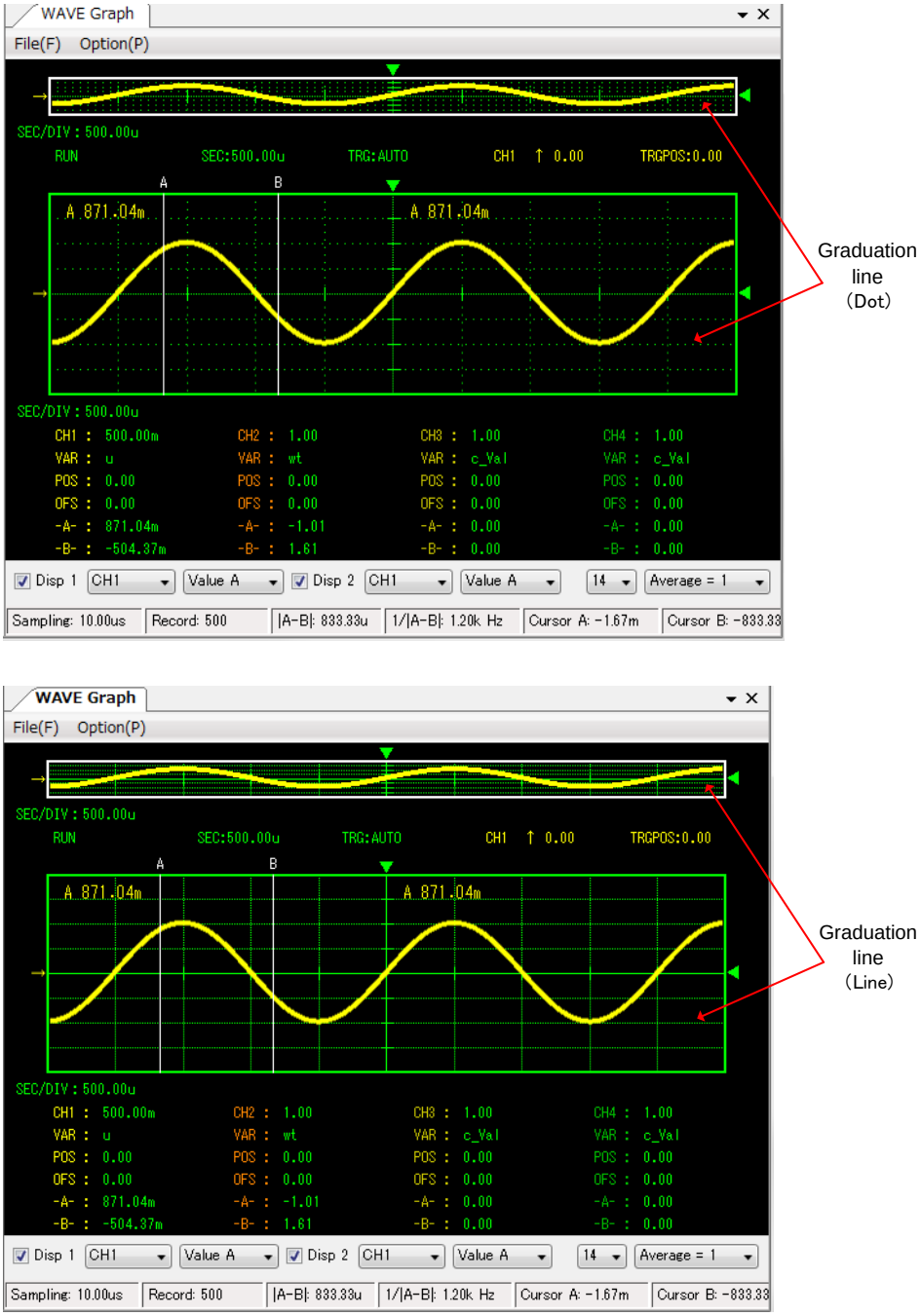


Figure 147: **Graduation Line Setting**

6) Setting display items ([Display Item])

The items displayed on the lower part of the enlarged view graph can be set.

Select the **Option** menu → **Display Item**.

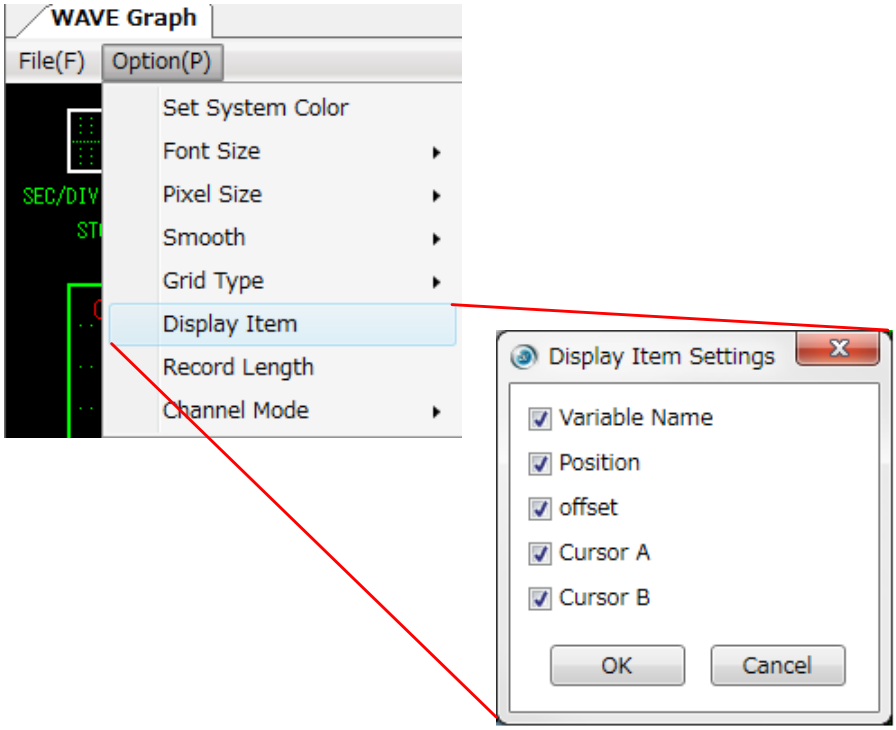


Figure 148: Display Item Setting

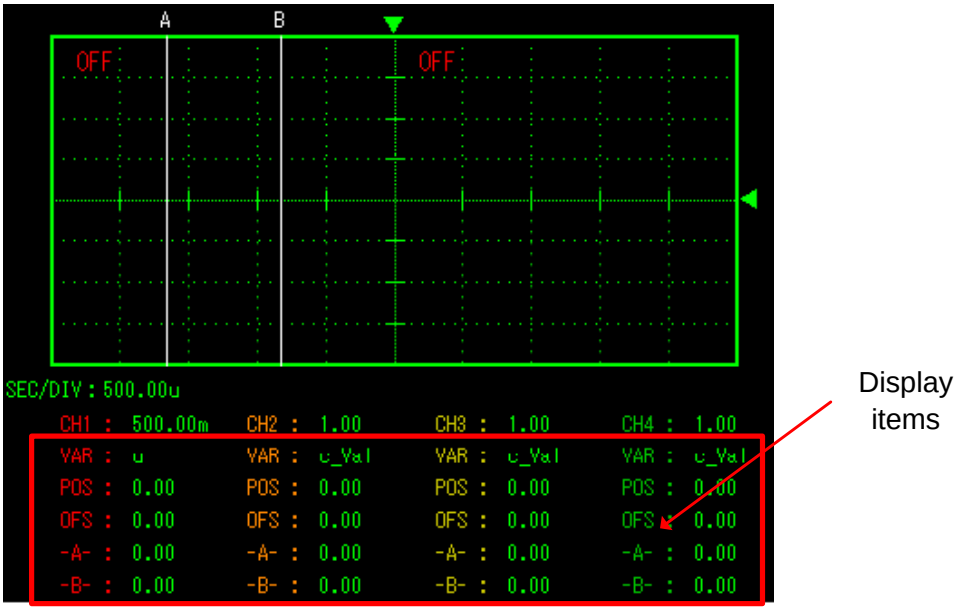


Figure 149: **Display Items which can be set**

7) Setting record length of waveform data (Record Length)

The maximum record length (point) acquired from the waveform data can be set.

Select the **Option** menu → **Record Length**.

The record length can be selected from a range of 50 to 524288.

The value set here becomes the maximum record length per 1CH.

However, since the record length actually acquired will be calculated based on the value specified here and the current measurement conditions, the value may become smaller than the value specified here.

The **record length actually acquired** will be displayed on the status bar of the graph window.

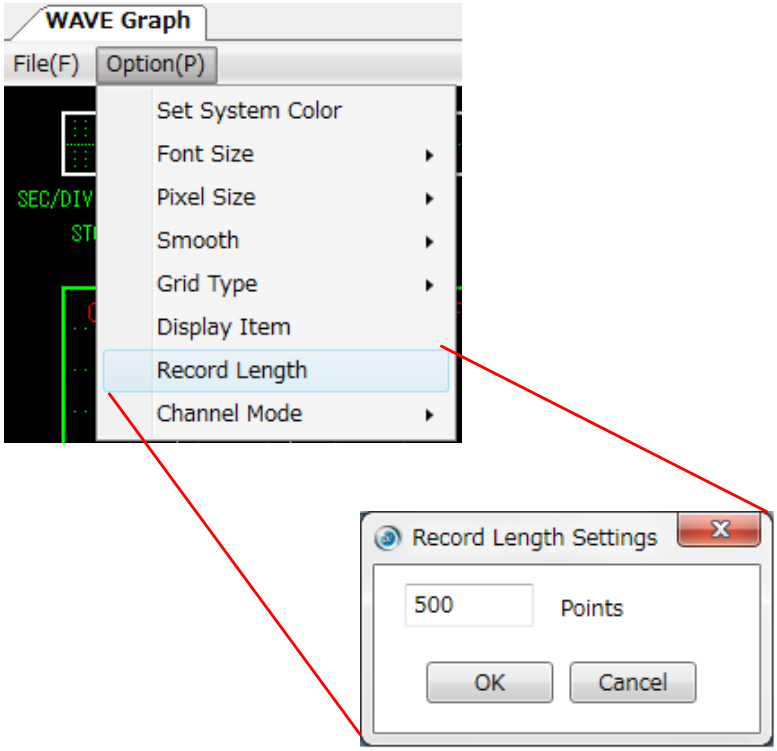


Figure 150: **Record Length Setting**

8) Setting channel mode ([Channel Mode])

The number of channels of waveform data to be acquired can be set.

Select the **Option** menu → **Channel Mode**.

The number of channels can be selected between **16CH** or **8CH**.

[16CH] mode:

The waveform data for 16CH is acquired from the PE-Expert4.

The minimum sampling cycle is 10us.

[8CH] mode:

The waveform data for 8CH is acquired from the PE-Expert4.

The minimum sampling cycle is 5us.

The value of the 9 to 16CH is fixed at 0.

4.4.8 FFT Analysis Display

1) FFT analysis function

The FFT analysis function is for performing a frequency analysis of the read waveform data. Fast Fourier Transform (FFT) is used as the method of the frequency analysis. The power spectral graph and the value of the total harmonic distortion (THD) can be displayed as analysis results.

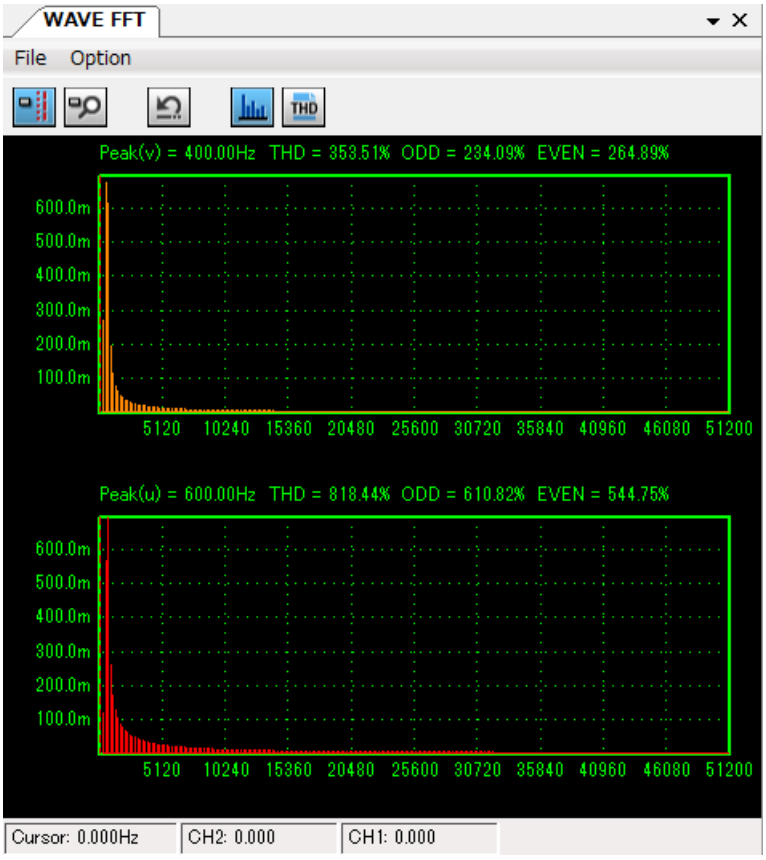


Figure 151: **Spectral Display**

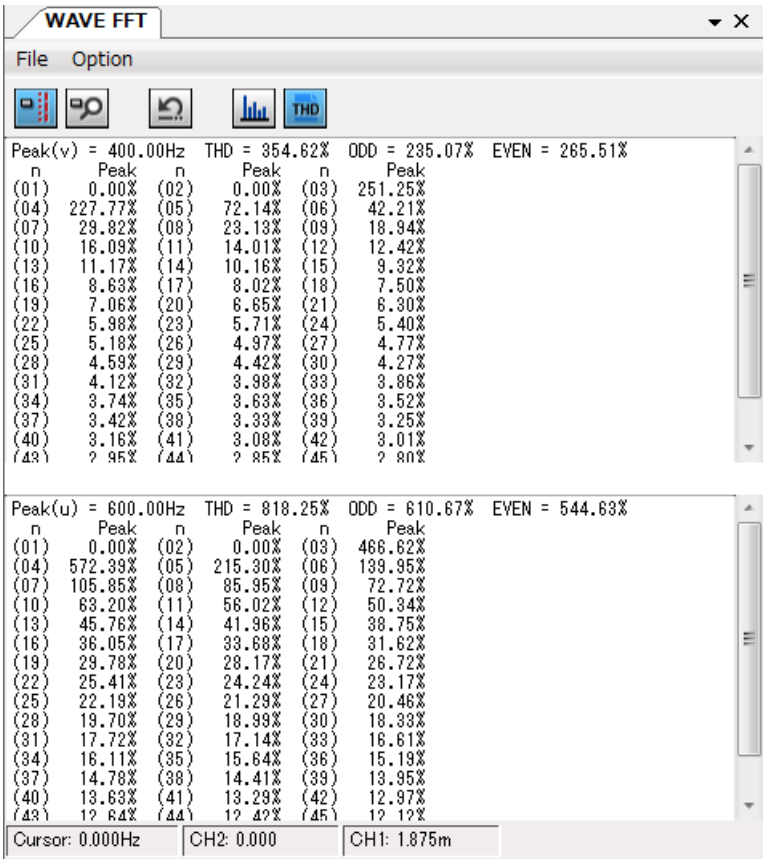


Figure 152: **THD Display**

The range of frequency analysis supports two modes: the full screen mode for one screen of waveform data; the cursor mode for between cursors A-B used on the waveform display (WAVE) screen.
Since the FFT requires the n-th power of 2 (n is a positive integer) as the number of samples, the data is interpolated by linear interpolation before the FFT is performed. An interpolation image is shown below.

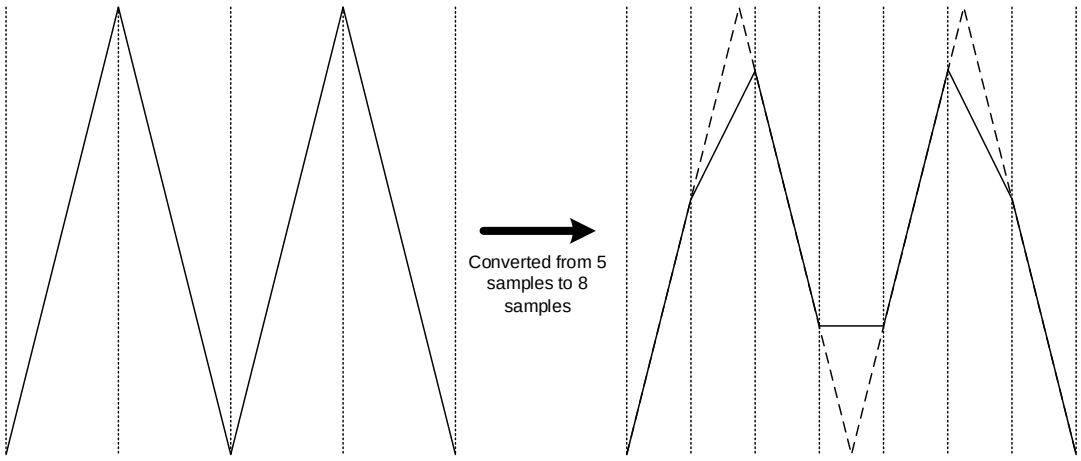


Figure 153: Data Process Before Analysis

※ Window functions

Note that the window functions are not used in the FFT analysis function provided in WAVE.

The components of each order of the FFT are calculated by the following equation:

$$R_k = \sum_{j=0}^{N-1} a_j \cos(\frac{2\pi jk}{N}) \quad (0 \le k < \frac{N}{2})$$

$$I_k = \sum_{j=0}^{N-1} a_j \sin(\frac{2\pi jk}{N}) \quad (1 \le k < \frac{N}{2})$$

$$P_0 = \frac{R_0}{N}$$

$$P_k = 2\frac{\sqrt{R_k^2 + I_k^2}}{N} \quad (1 \le k < \frac{N}{2})$$

Where,

a_j expresses the sample data.

P_k expresses the components of the k-th order.

N expresses the number of samples.

In the power spectral display of the FFT, the DC component is displayed as the 0-th order item.

The first-order component becomes the fundamental wave component. The fundamental wave frequency acts as the data range which performs the FFT process.

In the THD display, the content of the THD and the odd order, content of the even order and the content of each order is displayed.

THD is calculated by the following equation:

$$THD = 100\frac{\sqrt{\sum_{k=2}^{\frac{N}{2}-1}(\frac{P_k}{\sqrt{2}})^2}}{\frac{P_1}{\sqrt{2}}}$$

In the above equation, the content of the odd order is calculated for the odd number of a 3rd-order or higher of Pk.

In the above equation, the content of the even order is calculated for the even number of a 2nd-order or higher of Pk.

The content of each order is calculated by the following equation:

$$HD_k = 100\frac{P_k}{P_1} \quad (2 \le k < \frac{N}{2})$$

2) Tool bar

The following describes the tool bar of the FFT window.

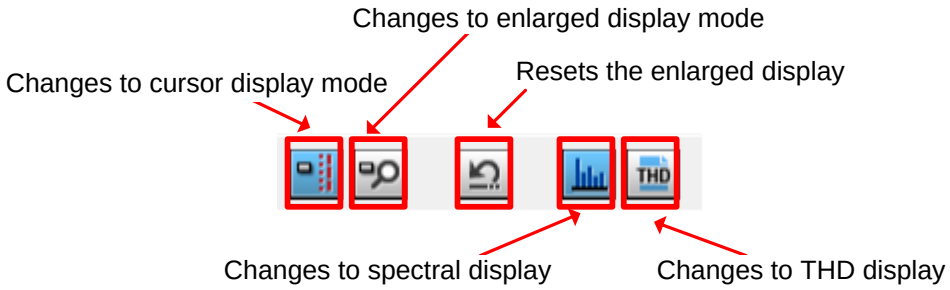


Figure 154: **FFT Window Tool Bar**

The details of each function are as follows:

Table 49: FFT Window Tool Bar

Names	Functions
Changes to cursor display mode (Cursor)	Changes the mouse operation during the spectral display mode to the cursor display mode. Left-clicking on the graph display area moves the cursor to the clicked position, and displays the frequency and its component (amplitude) on the lower left side of the screen. This function can be canceled by changing to the enlarged display mode.
Changes to enlarged display mode (Enlarge)	Changes the mouse operation during the spectral display mode to the enlarged display mode. Dragging the area to be enlarged in the graph display area will enlarge the selected area to be displayed. This function can be cancelled by changing to the cursor display mode.
Resets the enlarged display (Reset Enlarged View)	Resets the enlarged spectral display, and returns to the status where the entire graph is displayed.
Changes to spectral display (Spectrum)	Changes to the spectral display.
Changes to THD display (THD)	Changes to the THD display.

3) Menu

The following describes the menus of the FFT window.

Figure 155: **FFT Function Menu**

The details of each menu are as follows:

Table 50: FFT Function Menu

Main Items	Sub Items	Contents
File	Print	This is for printing the FFT graph.
	Print Preview	This is for previewing the FFT graph.
Option	Display Channel	This is for selecting the CH to be the target of the FFT. Select from CH1 to 16.
	Mode	This is for changing the mouse operation. Select from the following. Cursor: This is the same function as [changes to cursor display mode] of the tool bar. Enlarge: This is the same function as [changes to enlarged display mode] of the tool bar.
	Reset Enlarged View	This is the same function as [resets the enlarged display] of the tool bar.
	View	This is for changing the display. Spectrum: This is the same function as [changes to spectral display] of the tool bar. THD: This is the same function as [changes to THD display] of the tool bar.
	Grid Type	This is for changing the setting method of the graduation of the frequency axis and component axis. Select from the following: Liner: Linear display Log: Logarithmic display

Main Items	Sub Items	Contents
	Analysis Range	This is for changing the target range of the FFT analysis. Select from the following: Full Screen: All waveform data A-B Cursor: Waveform data between cursor A-B of the graph window
	Number of THD	This is for setting the maximum order of the THD which can be displayed while running. All the THD values will be displayed while stopped.

4.4.9 DMM Display

The DMM display function provides the functions of the digital multimeter.
This function displays the mean value, frequency and root mean square value in the enlarged display window.
To use this function, select **Multimeter** in the pull-down menu of the graph window.
In the FFT/DMM screen of the control window, select the DMM type (mean value, frequency, root mean square value).

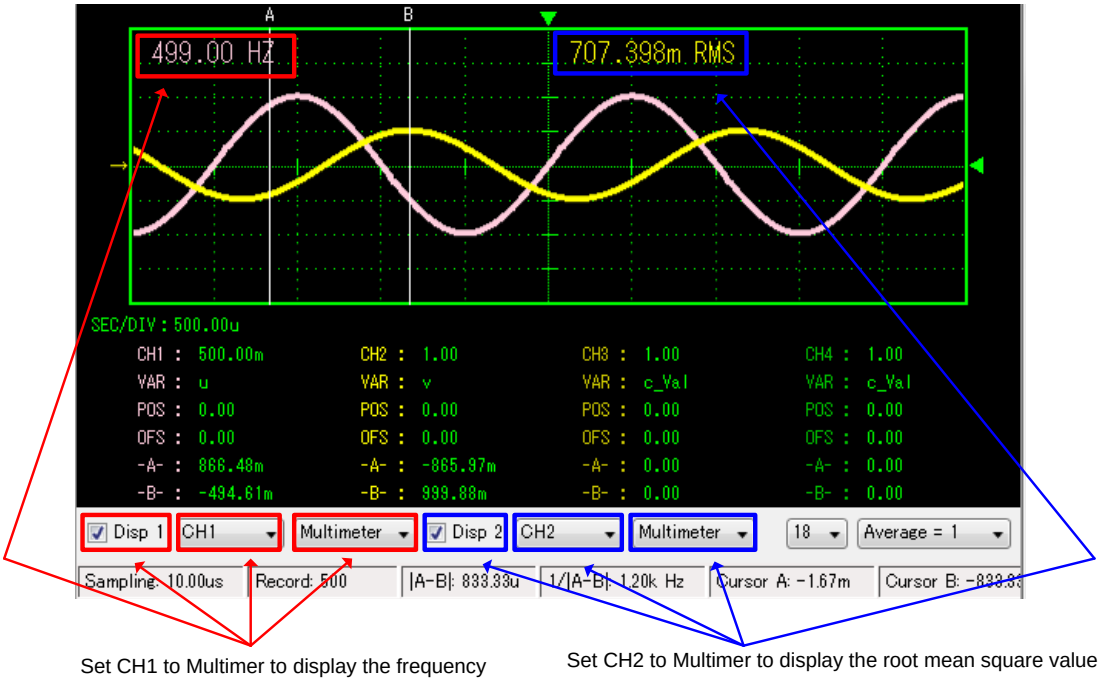


Figure 156: **DMM Settings and Display (Graph Window)**

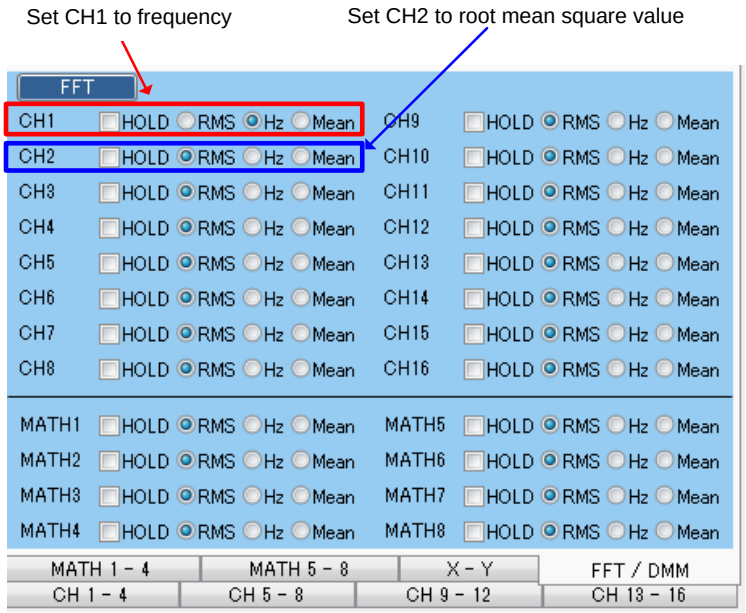


Figure 157: **DMM Type Setting (Control Window)**

There are four types of display modes: **HOLD**, **RMS**, **Hz** and **Mean**.

The details of each function are as follows:

Table 51: DMM Functions

Items	Functions
HOLD	Fixes the display data
RMS	Displays the root mean square value
Hz	Displays the frequency
Mean	Displays the mean value

●HOLD
This function fixes the display when the **HOLD** check box is selected.

●RMS
This function displays the root mean square value each time new data is acquired.
<Calculation method> Displays the root mean square of all the data.

$$RMS = \sqrt{\frac{\sum_{k=1}^{N} D_k^{\,2}}{N}}$$ N = Total number of data, D_k = each data

●Hz
This function displays the frequency each time new data is acquired.
<Calculation method>
1. Calculates the mean value of all data.
2. Subtracts the value of 1. from all data (removes the DC component).
3. Searches all the zero crossing points of each data in a single direction.
(The zero crossing point is determined by the code of the initial data.)
4. Calculates the time interval of the zero crossing point acquired in 3.
5. Sorts the time interval calculated in 4. by time.
6. Determines the median value of the time interval data sorted in 5. as Hz.
When the number of data is an even number, the value with the larger frequency is displayed.

●Mean
This function displays the mean value each time new data is acquired.
<Calculation method> Displays the mean value of all data.

$$Mean = \frac{\sum_{k=1}^{N} D_k}{N}$$ N = Total number of data, D_k = each data

4.4.10 Short-cut Keys

In **WAVE**, a short-cut key is assigned to each function, and can be operated from a keyboard.

The short-cut keys and functions are as follows:

Table 52: MAIN Functions

Keys	Functions
R	Toggles between Run/Stop
C	Toggles the cursor to display/hide
[Tab]	Toggles between the Channels, Math, X-Y and FFT/DMM tabs
[SHIFT] + [Tab]	Toggles between the Channels, Math, X-Y and FFT/DMM tabs (Reverse order of the above)
[Ctrl] + T	Toggles between the control window, graph window and FFT window
[Ctrl] + [SHIFT] + T	Toggles between the control window, graph window and FFT window (Reverse order of the above)

Table 53: ZOOM Functions

Keys	Functions
Z + ←	Enlarges the display area of the enlarged view graph (RANGE value becomes lower)
Z + →	Reduces the display area of the enlarged view graph (RANGE value becomes higher)
P + ←	Moves the display area of the enlarged view graph to the right
P + →	Moves the display area of the enlarged view graph to the left

Table 54: SEC/DIV Functions

Keys	Functions
←	Reduces the SEC/DIV
→	Increases the SEC/DIV

Table 55: VAL/DIV Functions

Keys	Functions
1 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH1
2 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH2
3 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH3
4 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH4
5 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH5
6 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH6
7 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH7
8 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH8
9 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH9
A + 0 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH10
A + 1 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH11
A + 2 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH12
A + 3 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH13
A + 4 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH14
A + 5 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH15
A + 6 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of CH16
[SHIFT] + 1 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH1
[SHIFT] + 2 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH2
[SHIFT] + 3 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH3
[SHIFT] + 4 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH4
[SHIFT] + 5 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH5
[SHIFT] + 6 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH6
[SHIFT] + 7 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH7
[SHIFT] + 8 + { ↑ or ↓ }	Increases/decreases the VAL/DIV of MATH8
[Z] + 1 + { ↑ or ↓ }	Increases/decreases the X-VAL/DIV of XY-1
[Z] + 2 + { ↑ or ↓ }	Increases/decreases the Y-VAL/DIV of XY-1
[Z] + 3 + { ↑ or ↓ }	Increases/decreases the X-VAL/DIV of XY-2
[Z] + 4 + { ↑ or ↓ }	Increases/decreases the Y-VAL/DIV of XY-2

Table 56: Trigger Functions

Keys	Functions
M	Toggles between Single, Auto and Normal
[Shift] + M	Toggles between Single, Auto and Normal (Reverse order of the above)
N + 1	Selects Trigger No. 1
N + 2	Selects Trigger No. 2
N + 3	Selects Trigger No. 3
N + 4	Selects Trigger No. 4
T + 1	Selects 1CH as the trigger channel
T + 2	Selects 2CH as the trigger channel
T + 3	Selects 3CH as the trigger channel
T + 4	Selects 4CH as the trigger channel
T + 5	Selects 5CH as the trigger channel
T + 6	Selects 6CH as the trigger channel
T + 7	Selects 7CH as the trigger channel
T + 8	Selects 8CH as the trigger channel
T + 9	Selects 9CH as the trigger channel
T + A + 0	Selects 10CH as the trigger channel
T + A + 1	Selects 11CH as the trigger channel
T + A + 2	Selects 12CH as the trigger channel
T + A + 3	Selects 13CH as the trigger channel
T + A + 4	Selects 14CH as the trigger channel
T + A + 5	Selects 15CH as the trigger channel
T + A + 6	Selects 16CH as the trigger channel
T + E	Selects EXT as the trigger channel
T + { → or ← }	Increases/decreases the trigger position
T + { ↑ or ↓ }	Increases/decreases the trigger level
K	Toggles between EDGE trigger and WIDTH trigger
E	Toggles between rise/fall
W + T	Toggles between over/under (in case of pulse width trigger)
W + P	Toggles between positive/negative polarity (in case of pulse width trigger)

Table 57: CH, MATH, X-Y Functions

Keys	Functions
[CTRL] + 1	Toggles the waveform display of CH1 to ON/OFF
[CTRL] + 2	Toggles the waveform display of CH2 to ON/OFF
[CTRL] + 3	Toggles the waveform display of CH3 to ON/OFF
[CTRL] + 4	Toggles the waveform display of CH4 to ON/OFF
[CTRL] + 5	Toggles the waveform display of CH5 to ON/OFF
[CTRL] + 6	Toggles the waveform display of CH6 to ON/OFF
[CTRL] + 7	Toggles the waveform display of CH7 to ON/OFF
[CTRL] + 8	Toggles the waveform display of CH8 to ON/OFF
[CTRL] + 9	Toggles the waveform display of CH9 to ON/OFF
[CTRL] + [A] + 0	Toggles the waveform display of CH10 to ON/OFF
[CTRL] + [A] + 1	Toggles the waveform display of CH11 to ON/OFF
[CTRL] + [A] + 2	Toggles the waveform display of CH12 to ON/OFF
[CTRL] + [A] + 3	Toggles the waveform display of CH13 to ON/OFF
[CTRL] + [A] + 4	Toggles the waveform display of CH14 to ON/OFF
[CTRL] + [A] + 5	Toggles the waveform display of CH15 to ON/OFF
[CTRL] + [A] + 6	Toggles the waveform display of CH16 to ON/OFF
[SHIFT] + [CTRL] + 1	Toggles the waveform display of MATH1 to ON/OFF
[SHIFT] + [CTRL] + 2	Toggles the waveform display of MATH2 to ON/OFF
[SHIFT] + [CTRL] + 3	Toggles the waveform display of MATH3 to ON/OFF
[SHIFT] + [CTRL] + 4	Toggles the waveform display of MATH4 to ON/OFF
[SHIFT] + [CTRL] + 5	Toggles the waveform display of MATH5 to ON/OFF
[SHIFT] + [CTRL] + 6	Toggles the waveform display of MATH6 to ON/OFF
[SHIFT] + [CTRL] + 7	Toggles the waveform display of MATH7 to ON/OFF
[SHIFT] + [CTRL] + 8	Toggles the waveform display of MATH8 to ON/OFF
[SHIFT] + [Space] + 1	Toggles the waveform display of XY-1 to ON/OFF
[SHIFT] + [Space] + 2	Toggles the waveform display of XY-2 to ON/OFF

Table 58: File Menu Functions

Keys	Functions
[CTRL] + C	Copies to the clipboard (Copy to Clipboard)
[CTRL] + P	Prints

※ Note that some of the keys may not operate in keyboards that are not equipped with the N key rollover function.

4.4.11 Notes

● During the process of data reading, all CH data are not necessarily synchronized.
Note that there is a time difference of about 0.2μs for reading each CH.

● When closing the **WAVE** window, the currently set contents will be saved automatically.
The saved contents will be reproduced when the system is started the next time.

● Even when a program is compiled and variable information such as the variable name and address was changed while the **WAVE** window is started, the variable information in the **WAVE** window remains the same before compiling. In this case, download the program again, “Variable Information in WAVE Updated” will be displayed in the Console.
When the **WAVE** window is opened again, the information will be updated to the new variable information.

● If the computer goes into sleep mode during measurement, LAN will be disconnected and data recording will be terminated.

4.5 [Memory] Window

The **Memory** window specifies the address, and displays the address for the amount of 256 bytes.

There are two methods to display this window.

- Click the **Window** menu → **Show Window** → **Memory**
- Click **Memory** of the tool buttons.

When started, the following screen will be displayed.

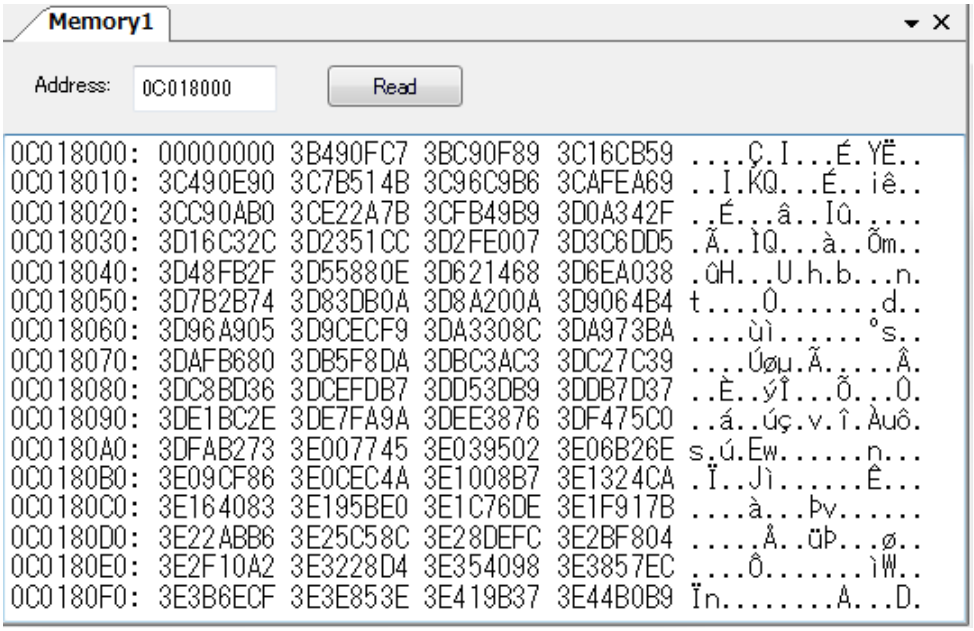


Figure 158: **Memory Window**

Up to three **Memory** windows can be displayed at once.

4.5.1 Reading Memory

Read the memory according to the following procedure:

Figure 159: **Reading Memory**

1) Enter the address in the **Address** field.

Specify by a hexadecimal number.

2) Execute reading

Reading can be executed by the following two methods:

- Click the **Read** button.
- Press the Enter key in the **Address** field.

4.5.2 Context Menu

Right-click to display the following context menu.

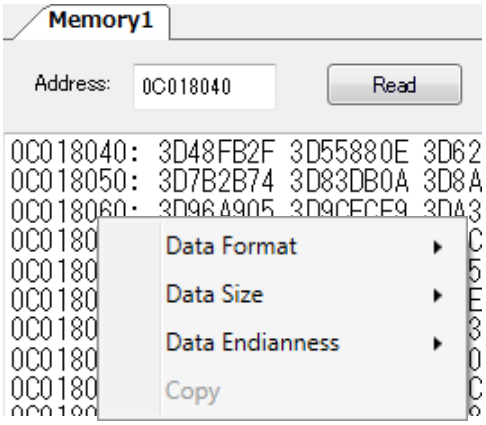


Figure 160: **Context Menu**

The items of the context menu are as follows:

Table 59: Memory Window Context Menu

Fields	Contents
Data Format	This is for selecting the data format to be displayed. The data format can be selected from the following: Bin: Binary number Dec(S): Signed decimal number Dec(U): Unsigned decimal number Hex: Hexadecimal number Float: Floating point (32bit) Double: Floating point (64 bit)
Data Size	This is for selecting the collected size of data to be displayed. The data size can be selected from the following: 1 byte 2 byte 4 byte 8 byte
Data Endianness	This is for selecting the endian to be displayed. The endian can be selected from the following: Little endian Big endian
Copy	This is for copying the selected range to the clipboard.

4.5.3 Notes

● When an address not disclosed to a user is specified, the masked address will be displayed as "********."

4.6 [Data Recorder] Window

The **Data Recorder** window displays the waveforms of specified variables during sampling.

It also saves the sampled data.

In Data Recorder, variables for up to 32 CH can be registered to display the waveforms.

4.6.1 Starting

There are two methods to display this window.

- Click the **Window** menu → **Show Window** → [**Data Recorder]**
- Click **Data Rec** on the tool buttons.

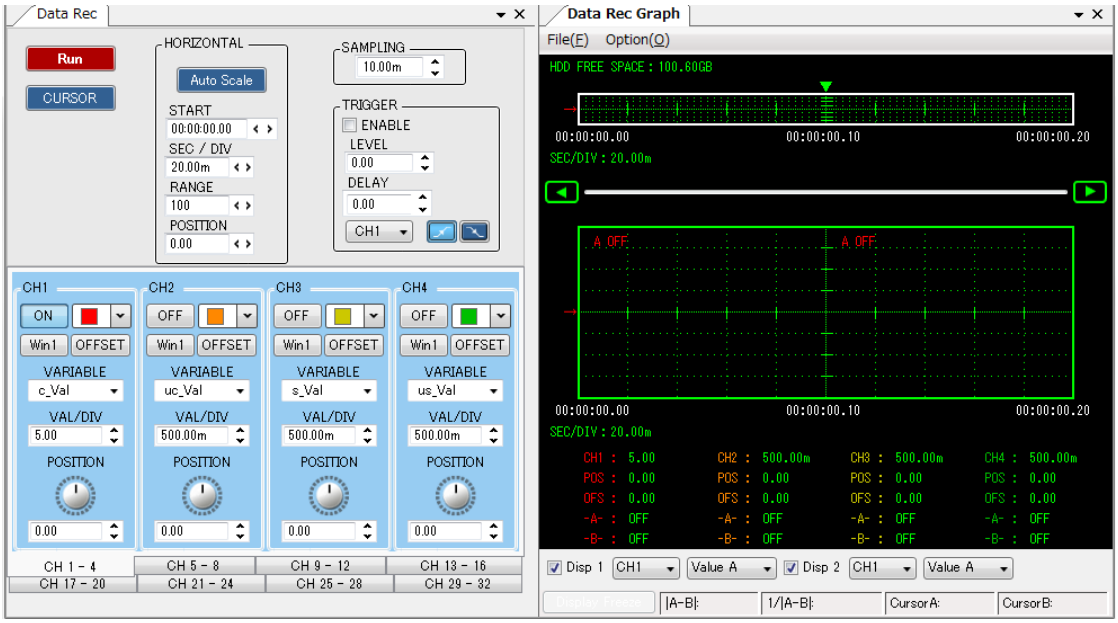


Figure 161: **[Data Recorder] Window**

4.6.2 Screen Structure

The screen structure of Data Recorder is as shown below:

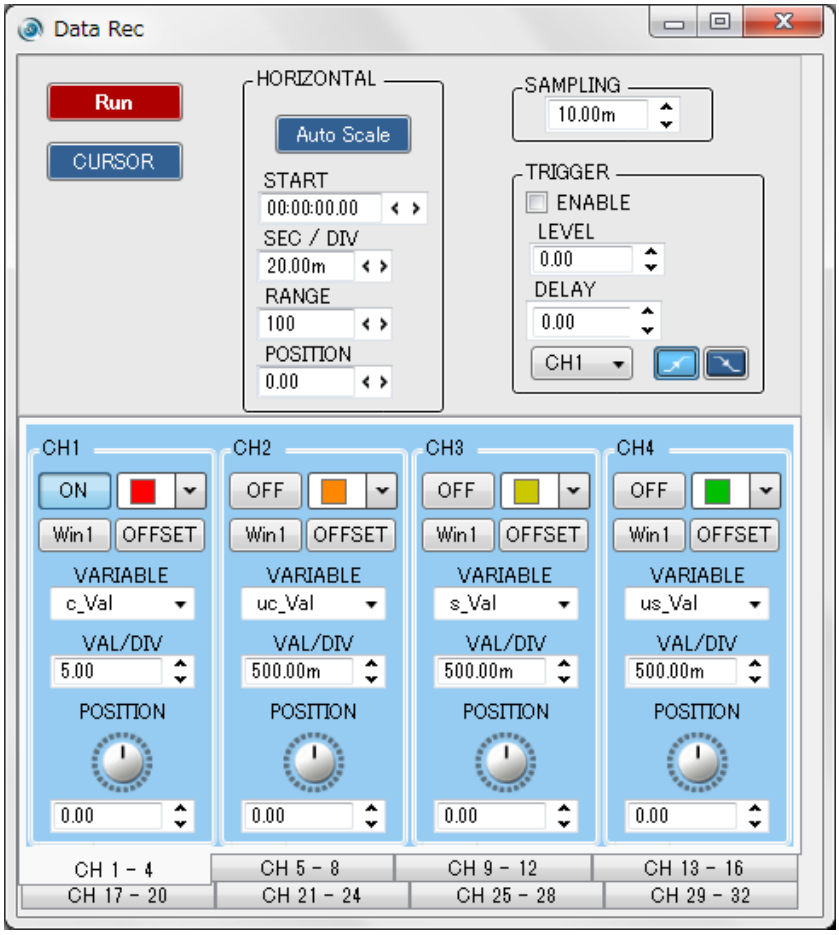


Figure 162: Control Panel Window

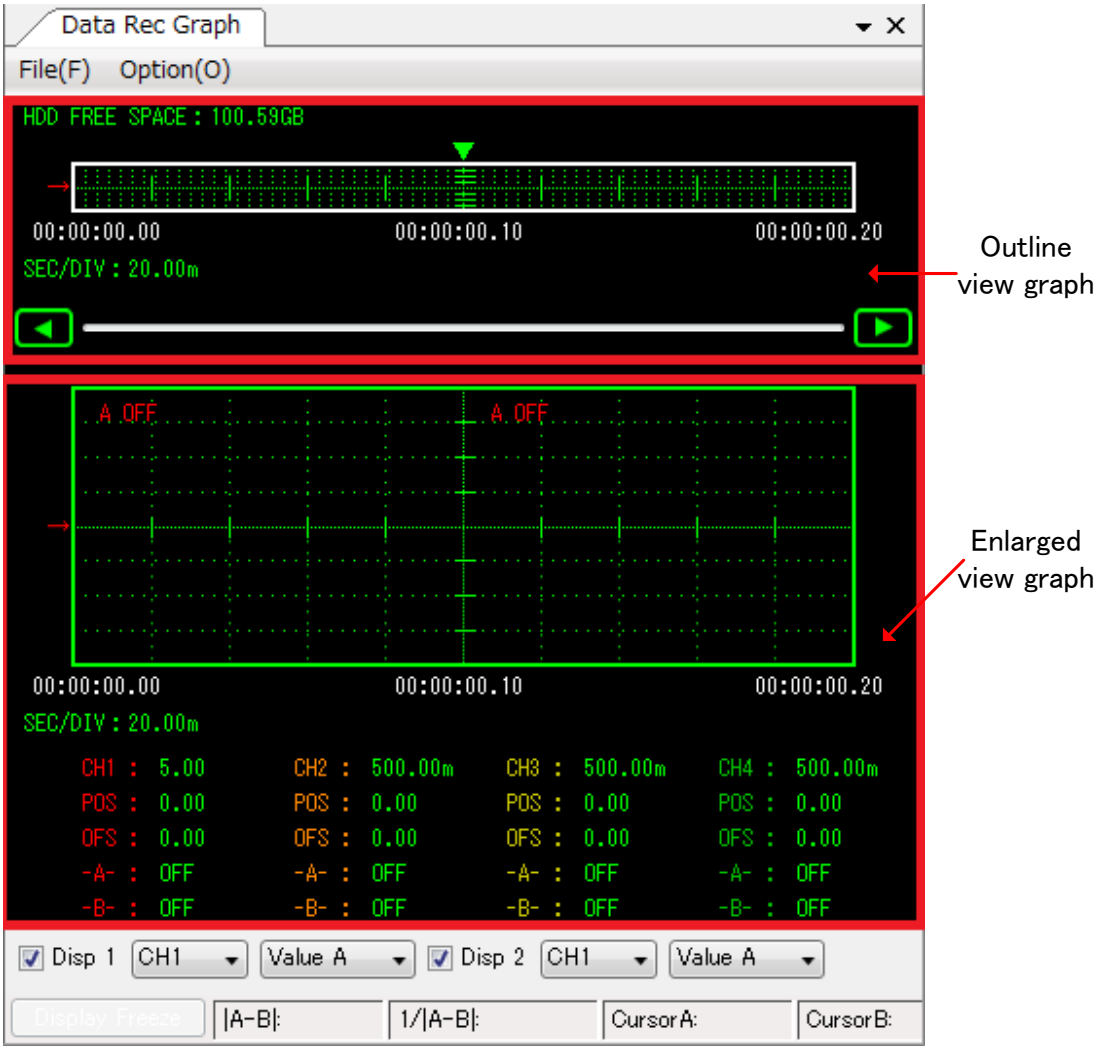


Figure 163: **Graph Window**

The contents of each window are as follows:

Table 60: Contents of Data Recorder Window

Windows	Contents
Control panel window	This window is for specifying the display conditions and trigger conditions. When this window is closed, the graph window and FFT window will also be closed automatically.
Graph window	Displays the outline view graph and enlarged view graph. The outline view graph displays maximum data. [MAXIMUM DISPLAY] displays data in a specified time frame.

4.6.3 Outline of Data Recorder Function

The Data Recorder function is provided with several settings that are required to display a waveform. This section describes the outline of these functions. See description of each function for details.

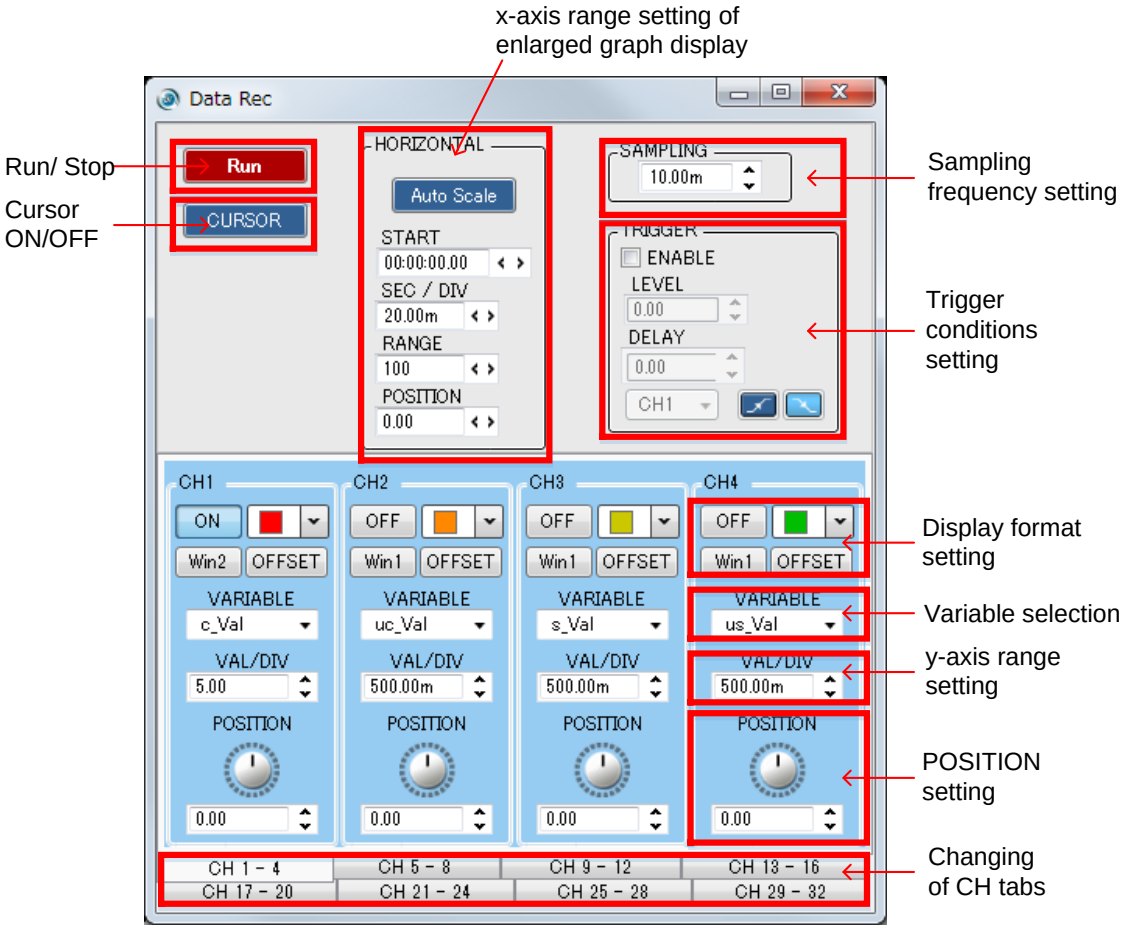


Figure 164: **Explanatory View of Each Function**

※ Except that the display of the applicable channels of CH 5 to 32 changes to 5 to 32, the other functions are the same as the above screen.

4.6.4 Control Panel Window Functions

This section describes each of the functions on the Data Recorder control panel window. In the control panel window, data sampling, various display changes, setting of each function, etc. can be performed.

1) Data Sampling

Click the **RUN/STOP** button to begin data sampling. While running, sampling begins with sampling period settings. However, when waveforms are refreshed, the timing is different from sampling period.

Figure 165: **Display while STOP**

The displays changes to the following while RUN.

Figure 166: **Display while RUN**

Click the **RUN/STOP** button again to end data sampling.

2) Cursor ON/OFF

To display the cursor on the enlarged view graph, click the **CURSOR** button on the control panel window.

The cursor is effective at [STOP] or [Display Hold]

During [Display Hold], data sampling continues in [RUN] mode and waveform doesn't refresh. Sampled data can be displayed in a specified time frame.

When cursor display is OFF

When cursor display is ON

Figure 167: **[CURSOR] Button Status**

When the cursor display is ON, the values of **Cursor A**, **Cursor B**, **|A-B|** and **1/|A-B|** will be displayed on the status bar of the graph window. In each CH area, the cursor values of "-A-" and "-B-" will be displayed on the lower part of the enlarged view graph.

To move Cursor A and Cursor B, move the mouse over the cursor character ("A" and "B") of the enlarged view window, and drag to a position.

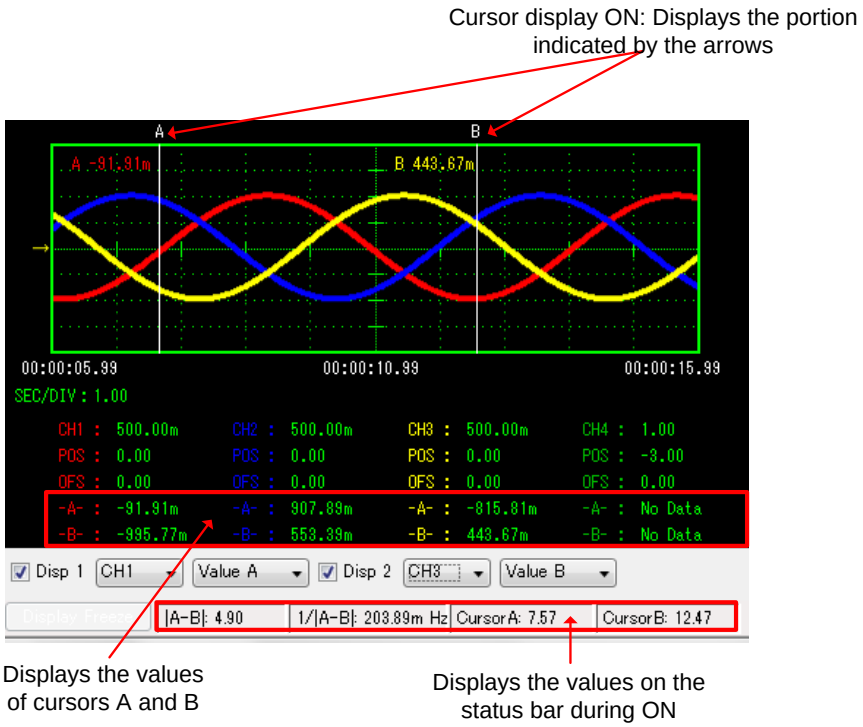


Figure 168: **Status when cursor display is ON**

3) X-axis setting

x-axis settings are displayed in [HORIZONTAL].

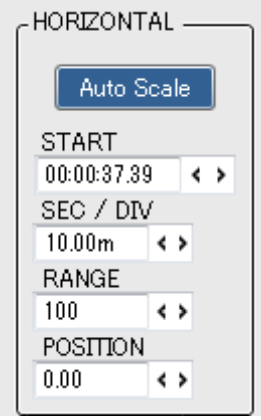


Figure 169: **[HORIZONTAL]**

The following items are displayed under [HORIZONTAL].

Table 61: Items in [HORIZONTAL]

Items	Contents
Auto Scale	Automatic scaling of x-axis for enlarged graph view.
START	Displays the time for x-axis in enlarged graph. This value refers to the starting time of recording. There are 3 ways to change the value: (i) click on the left/right button in the box (ii) key in value directly into textbox (iii) adjust the scroll bar at the bottom of enlarged graph.
SEC/ DIV	x-axis range setting of enlarged graph display.
RANGE	Magnification setting of enlarged graph setting. The white box displayingthe range will be changed. 0.01%~100% can be displayed. However, the actual display will be based on [SEC/DIV].
POSITION	Displays the position setting of enlarged graph display. This value refers to the position of the white box. There are 3 ways to change the value: (i) click on the left/right button in the box (ii) key in value directly into textbox (iii) adjust the marker ▼ at the top of the graph.

The above settings are displayed in the image below.

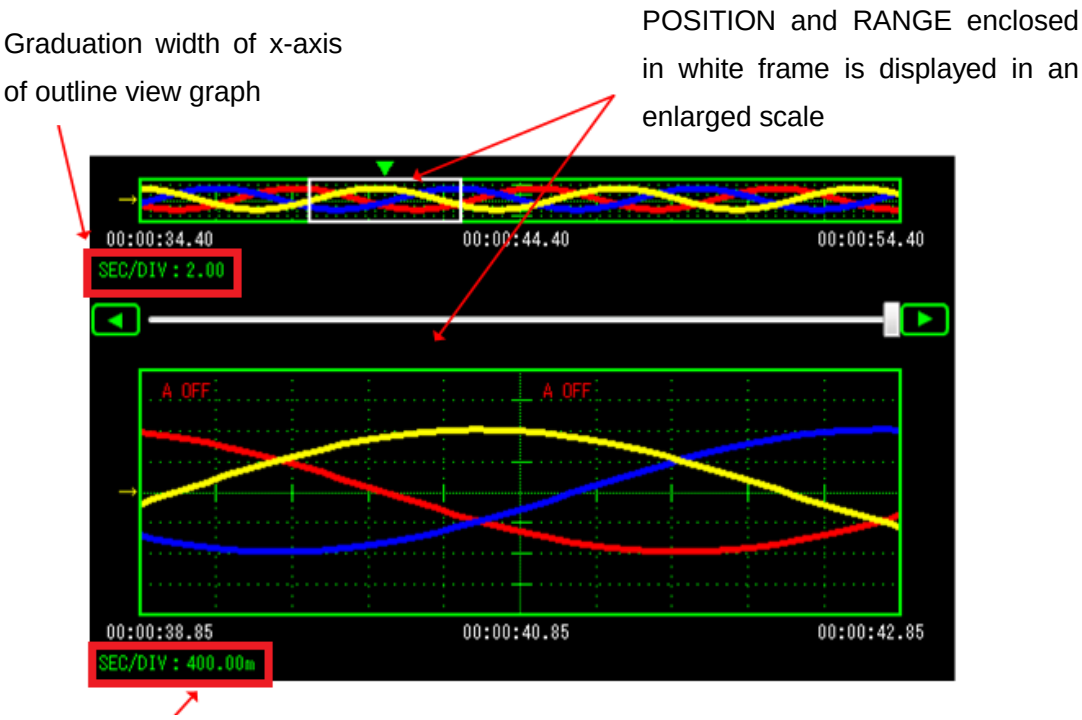


Figure 170: **Enlarged Display of Waveform**

4) Sampling Period Setting

Data sampling period is displayed under [SAMPLING].

Figure 171: **[SAMPLING]**

The sampling period is in the range of 10ms ～ 10s.

※ Take note that when the graphical data is refreshed, the interval is different from sampling period.

5) TRIGGER Settings

Trigger functions are available in Data Recorder. If any trigger condition is met, data sampling stops after the specified time period. Refer to the image below for [TRIGGER] setting.

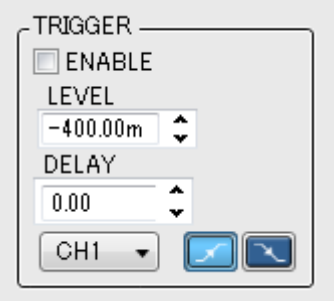


Figure 172: **[TRIGGER] Setting**

The following items are displayed under [TRIGGER].

Table 62: [TRIGGER] Setting

Items	Contents
ENABLE	Enable or disable trigger. Check the box to enable trigger.
LEVEL	Trigger level settings
DELAY	The specified time for data sampling to stop after trigger condition is met.
Trigger CH	Trigger channel settings
Edge	Trigger rise/fall settings

6) CH1-32 Data Sampling Settings

To change the setting of the waveform display of CH1 to 32 to ON/OFF, click the **ON/OFF** button provided for each CH on the control panel window as shown below.

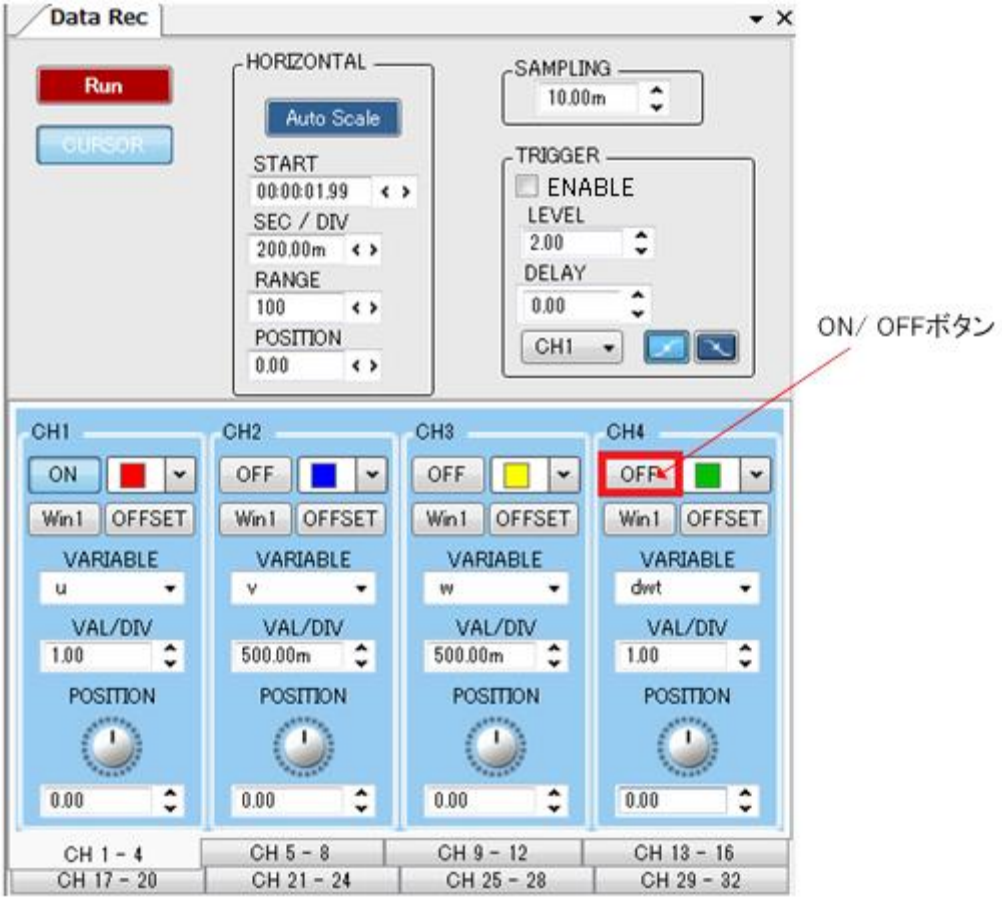


Figure 173: **[ON/ OFF] Key**

7) Extension Window

Up to 4 extension windows can be selected for CH1-32. In the image below, click on [Win1] to change the display of waveform. [Win1]～[Win4] can be switched.

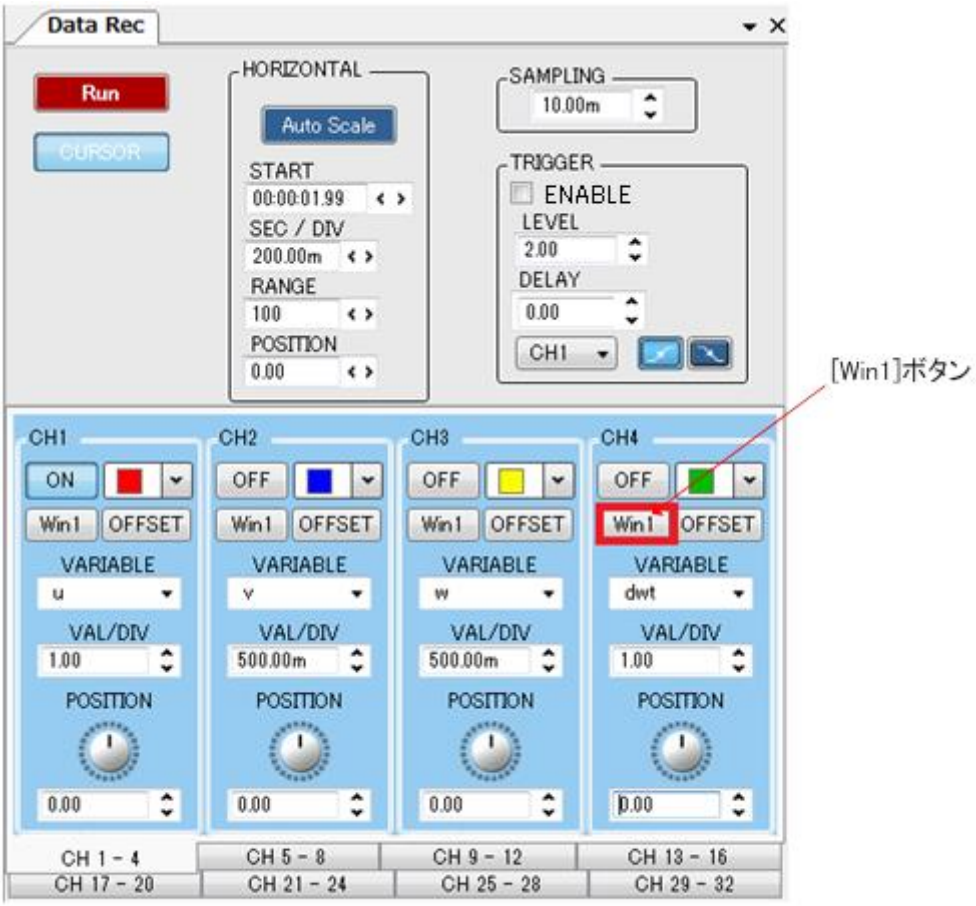


Figure 174: [Win1]

8) Setting Offset

Clicking the **OFFSET** button of each CH displays the following screen and allows the Offset value to be set. To set the value, enter the Offset value directly.

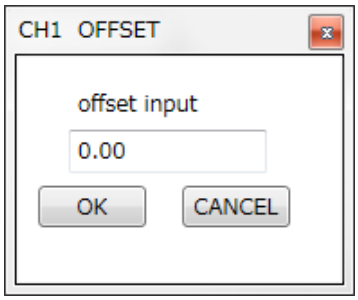


Figure 175: **Offset Value Setting (CH1)**

The Offset function is for displaying the value in which a fixed value (Offset value) is added to the target variable by the waveform display software. All the values used for numerical processing and display by the waveform display software are the values after the Offset is added. Note that offset is also added to trigger level.

9) Selecting Variables

To select the variable to be displayed, click the pull-down menu (▼ button) of **VARIABLE** on the control panel window.

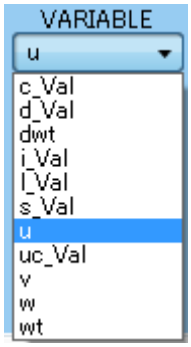


Figure 176: **Variable Selection**

The variable can be selected from the following two methods.

- Select a variable name with the mouse.
- When the first character of a variable name is entered, the applicable variable name will be selected automatically.

The variables listed in **VARIABLE** are displayed based on the variable information file automatically created by PE-ViewX.

10) Selecting display colors of waveform

To set the waveform color of each CH, click the color list. The following color selection dialog will be displayed.

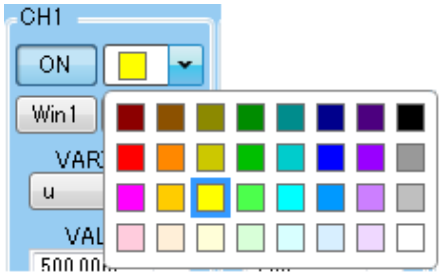


Figure 177: **Waveform Color Setting**

11) Setting POSITION

To set the POSITION of CH1 to 32, set the value in **POSITION** as follows:

Figure 178: **Setting POSITION**

The position can be set by the following three methods.

- Place the cursor on the dial, and rotate the mouse wheel.
- Click the Up/Down buttons of the list box.
- Directly enter a value.

※ The setting range is from "(-4xVAL/DIV) to (4xVAL/DIV)."

4.6.5 Graph Window Structure

This section describes the structure of the graph window.

The structure is as follows:

Figure 179: **Graph Window Structure**

1) Menu

The menu consists of **File** / **Option**.

See "4.6.6 Processing Waveform Data (**File** Menu)" and "4.6.7 Waveform Display Related Settings (**Option** Menu)" for the details.

2) Outline view graph

The outline view graph displays all the acquired waveform data.

The details are as follows:

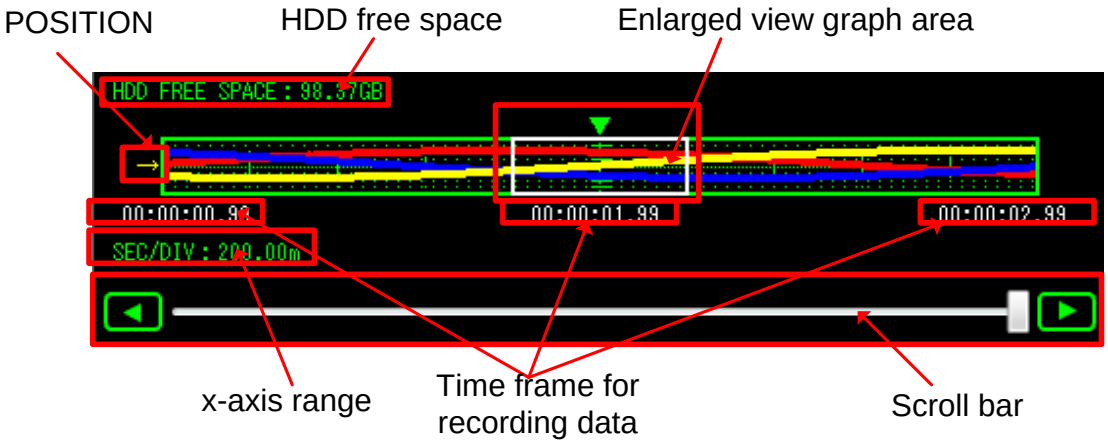


Figure 180: **Outline View Graph Structure**

Table 63: Outline View Graph Structure

Name	Functions
POSITION	Indicates the **POSITION** value set on each CH tab.
HDD free space	Real time display of HDD free space. Data sampling storage depends on HDD free space.
Enlarged view graph area	The area enclosed in the white frame in the outline view graph. This area is enlarged and displayed on the enlarged view graph. The range of the white frame is specified by the **RANGE** and **POSITION**. Up to 4 windows can be displayed.
x-axis range	Indicates the range of the x-axis (SEC/DIV) of the outline view graph.
Time frame for recording data	Displays the time frame of outline graph.
Scroll bar	In case when the range of sampling data (x-axis range x 10) exceeds the range, move the scroll bar to display desired data.

Data Recorder saves the outline graphical data in memory when data sampling begins. Hence, there is a maximum limit of storage. The setting is under **Option** → **Maximum Display**.

3) Enlarged view graph

The enlarged view graph enlarges and displays the area specified in the outline view graph.

Up to 4 windows can be displayed.

The details are as follows:

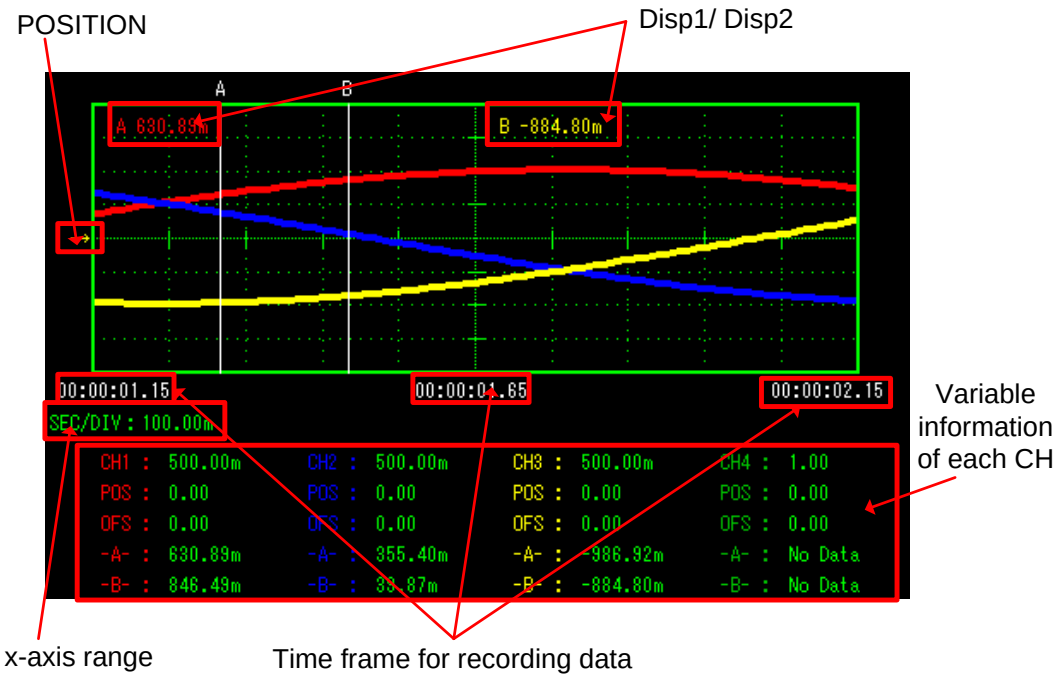


Figure 181: **Enlarged View Graph Structure**

Table 64: Enlarged View Graph Structure

Name	Functions
POSITION	Indicates the **POSITION** value set on each CH tab.
Disp1/ Disp2	Displays the values set in the [Disp1/Disp2] fields. See "4) Disp1/Disp2" on the next page for details.
x-axis range	Indicates the range of the X-axis (SEC/DIV) of the outline view graph.
Time frame for recording data	Displays the time frame of outline graph.
Variable information of each CH	Displays the measurement condition of each CH and the values in cursors A/B.

4) Disp1/Disp2

The contents set in these fields are displayed in the enlarged view graph as described on the previous page.

The details are as follows:

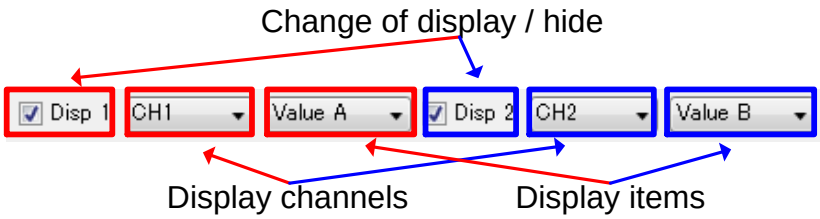


Figure 182: **Disp1/Disp2 Structure**

Table 65: Disp1/Disp2 Structure

Name	Functions
Change of display / hide	Changes between display/hide.
Display channels	For setting the channels to be displayed. Can be selected from CH1 to 32.
Display items	Can be selected from the following items: Value A: Displays the value of cursor A. Value B: Displays the value of cursor B.

5) Status bar

The status bar displays the following items.

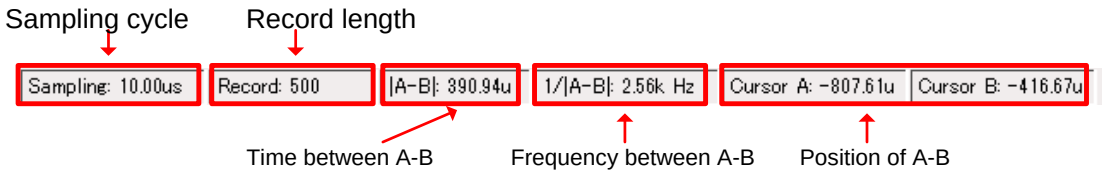


Figure 183: **Status Bar Structure**

Table 66: Status Bar Structure

Name	Functions
Time between A-B	Displays the time difference between cursor A and cursor B.
Frequency between A-B	Displays the inverse, i.e. the frequency of the time difference between cursor A and cursor B.
Position of A and B	Displays the position on the time of cursor A and cursor B.

6) Display Hold/ Display Resume

During data sampling, only waveform refresh can be terminated. Move the scroll bar to desired time frame to observe data. By clicking [Display Hold] on left side of status bar, data refresh is terminated.

Figure 184: **[Display Hold]**

Click [Display Resume] to refresh waveform. The latest waveform will be updated.

Figure 185: **[Display Resume]**

[Display Hold]/ [Display Resume] are only effective during RUN. They are disabled during STOP.

Figure 186: **During disabled condition**

4.6.6 Processing Waveform Data ([File] Menu)

This section describes the functions of the **File** menu of the graph window.
The main functions include the Load and Save function of sampled data. The following describes each of the functions. Since the **File** menu cannot be used while running, stop the operation before use.

1) Loading sampling data ([Load Data...])

The sampling data can be loaded. Select the **File** menu → **Load Data….** When the file to be loaded is specified, the following dialog will be displayed. Click the **OK** button to complete the loading.

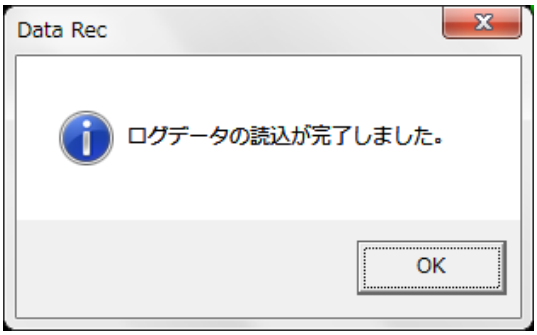


Figure 187: **Sampling Data Loading Completed Dialog**

※ Relationship between the offset function and data saving
The Offset function is for displaying the value in which a fixed value (Offset value) is added to the target variable by Data Recorder. All the values used for numerical processing and display by Data Recorder are the values after the Offset is added.
However, the Offset value is not included in the saved waveform data. When the saved waveform data is read to Data Recorder, the data including the Offset value set when the waveform data is read will be displayed. Pay particular attention to this point.

2) Save Sampling Data Settings ([Log Settings])

All sampled data can be saved in a file. Before sampling, go to **File → Log Settings → Log Settings**. The following dialog is displayed.

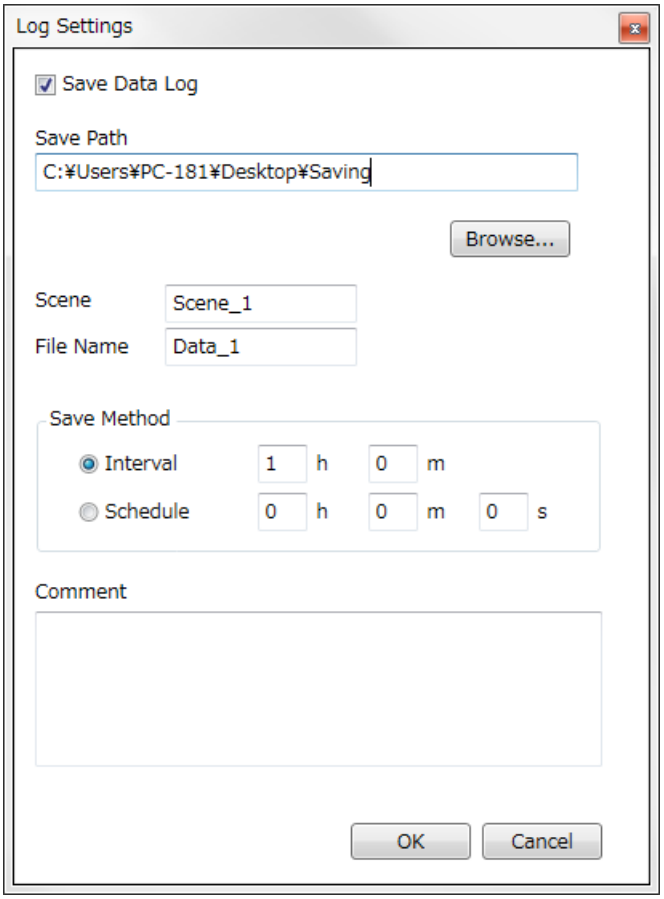


Figure 188: **[Log Settings] Dialog**

The following items are displayed under [Log Settings].

Table 67: [Log Settings] Dialog Items

Items	Contents
Save Data Log	Sampling data will be saved in this setting. Check to save file.
Save Path	Set path for saving.
Scene	Set scene for saving.
File Name	Set name for saving.
Save method	Set method of saving. Interval: save at specified interval. Range of 1s ～ 99h59m59s. Schedule: save at specified time frame. For example, once a day.
Comment	Set comments for scene. It will be displayed in **File** → **Log Management**.

The file will be saved in the following format.

[Save Path]¥[Scene]¥[File Name]_YearMonthDayTime_Number.csv

The sequence starts from zero, in order of data recording.

For example)

Save Path：c:¥log

Scene：Scene_1

File Name：Data_1

==> c:¥log¥Scene_1¥Data_1_ YearMonthDayTime_0.csv

c:¥log¥Scene_1¥Data_1_ YearMonthDayTime_1.csv

c:¥log¥Scene_1¥Data_1_ YearMonthDayTime_2.csv

….

3) Save file management ([Log Management])

File → Log Managementment → Log Management for file management. The dialog will appear as below.

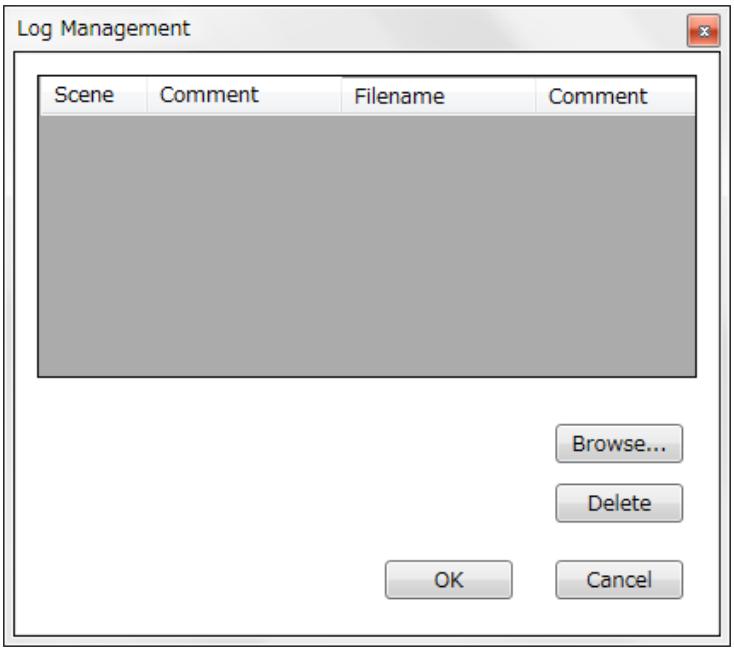


Figure 189: **[Log Management] Dialog**

The following items are displayed under [Log Management].

Table 68: [Log Management] Dialog Items

Item	Contents
Scene	Displays scene name.
Comment (Left)	Displays comments for Scene.
Filename	Displays filename includuing Scene name.
Comment (Right)	Displays/refreshes comments for each file.
[Browse…]	Selects path for saving file. The settings are under [Save Path]. This displays all files in this path.
Delete	Deletes selected files.

The image below displays an example.

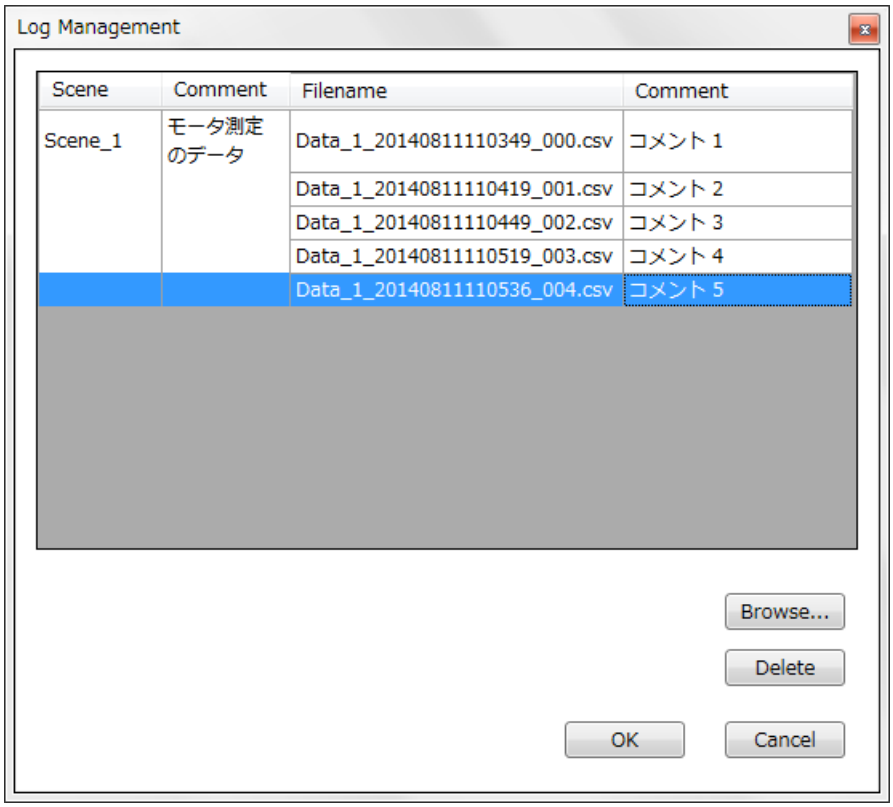


Figure 190: **An example of Log Management**

4) Printing ([Print])

The contents displayed in the graph window can be printed.
Select the **File** menu → **Print**.

5) Print preview ([Print Preview])

The contents to be printed can be previewed.

Select the **File** menu → **Print Preview**.

4.6.7 Waveform Display Related Settings ([Option] Menu)

This section describes the functions of the **Option** menu of the graph window.
The settings related to the waveform display are performed in this menu.

1) Sampling Data Search

The image below displays the search for sampling data when the conditions are fulfilled. To search, go to **Option** → **Search**. The dialog appears as below.

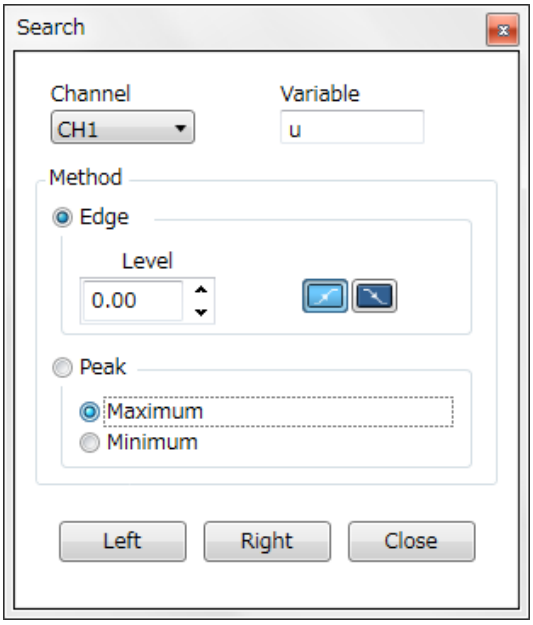


Figure 191: **[Search] Dialog**

The following items are displayed under [Search].

Table 69: [Search] Dialog Items

Item	Contents
Channel	Selects channel
Variable	Displays variables for selected channel.
Method	Setting for search method as follows: Edge: Search for Rise/Fall. Reference value is determined in [Level]. Peak: Search by Maximum/Minimum Click [Left] to search for maximum/minimum in the left direction. Click [Right] to search for maximum/minimum in the right direction.
Left	Search towards the left, with center based on outline graph view.
Right	Search towards the right, with center based on outline graph view.
Close	Close dialog.

A red line will appear as below when the search conditions are met.

The example shows a search example for rising edge at Level 0.5.

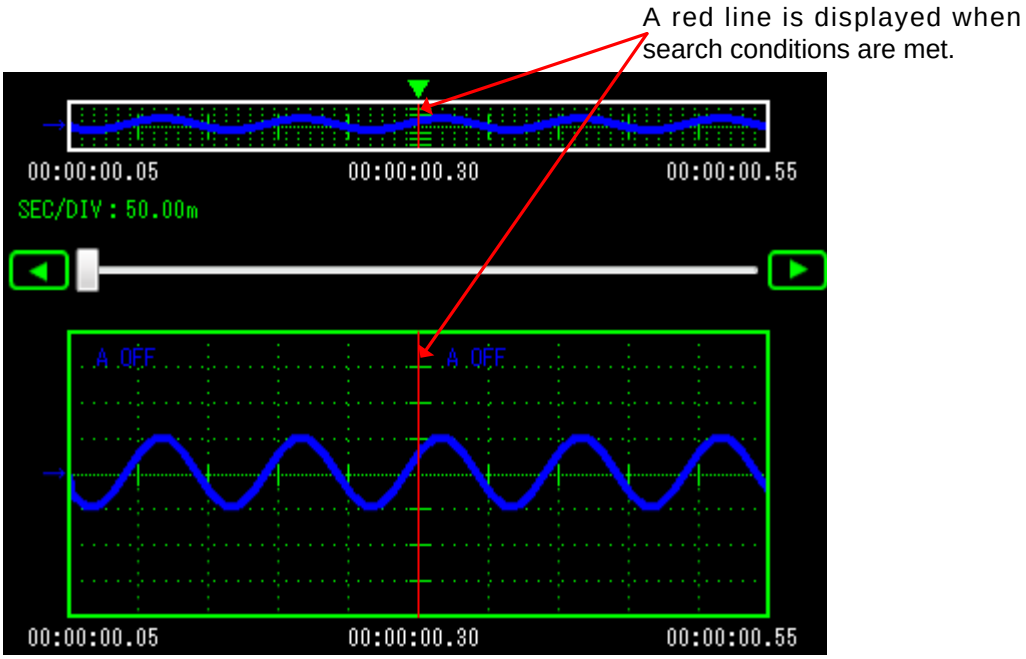


Figure 192: **Example of search results**

2) Maximum time frame setting ([Maximum Display])

The setting for maximum time frame for graphical display is under **Option → Maximum Display**. For example, when the setting is 3 hour, the maximum of 3 hour data can be displayed. The older data will not be reflected. The dialog is displayed below.

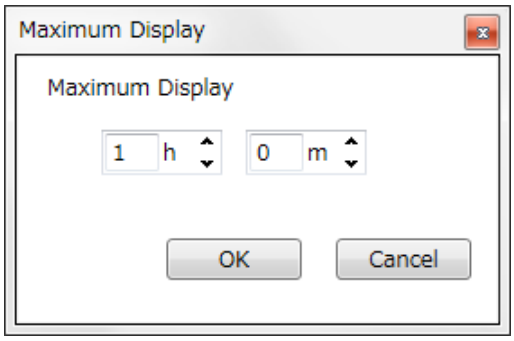


Figure 193: **Maximum Display**

※ Data Recorder saves sampling data from the start in the time frame memory. The memory size is related to the following parameters.

- [Maximum Display]: maximum time for recording
- [SAMPLING]: sampling period

In case when memory is insufficient, the error message will occur. Reduce [Maximum Display] or increase the interval of sampling period.

3) Setting display color ([Set System Color])

To set the background color and cursor color of the graph window, click the **Option** menu → **Set System Color** to display the following dialog.

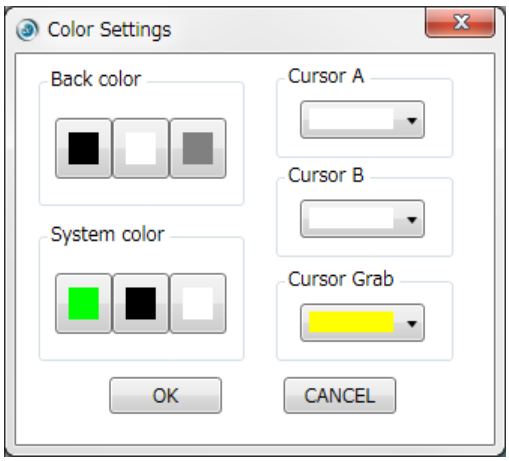


Figure 194: **Background Color and Cursor Color Setting**

Back Color	: Background color of graph window
System Color	: Grid line color of graph window
Cursor A	: Display color of Cursor A
Cursor B	: Display color of Cursor B
Cursor Grab	: Display color when setting Cursor and Trigger

➔Cursor Grab refers to the color displayed when Cursor A, Cursor B, trigger position and the trigger level are being moved in the graph window while dragging by the mouse.

4) Setting waveform pixel size ([Pixel Size])

The waveform pixel size of the graph window can be set.
Select the **Option** menu → **Pixel Size**.
The size can be set from **Small**, **Medium** or **Large**.

5) Changing interpolation display of waveform ([Smooth])

Whether to interpolate the data for the sampling point of the waveform of the graph window to be displayed can be set.
Select the **Option** menu → **Smooth**.
When this function is set to **ON**, the interpolated waveform data will be displayed

6) Setting graduation lines of waveform ([Grid Type])

The type of graduation line (grid line) of the graph window can be set.
Select the **Option** menu → **Grid Type**.
The type can be set between **Dot** or **Line**.

7) Setting display items ([Display Item])

The items displayed on the lower part of the enlarged view graph can be set.

Select the **Option** menu → **Display Item**.

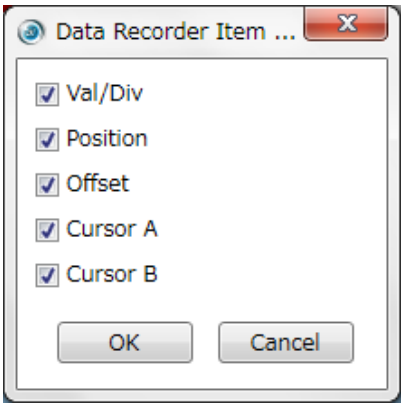


Figure 195: **[Display Item] Dialog**

4.6.8 Notes

● During the process of data reading, all CH data are not necessarily synchronized.
Note that there is a time difference for reading each CH.

● When closing the **Data Rec** window, the currently set contents will be saved automatically.
The saved contents will be reproduced when the system is started the next time.

● Even when a program is compiled and variable information such as the variable name and address was changed while the **Data Rec** window is started, the variable information in the **Data Rec** window remains the same before compiling. In this case, download the program again, “Variable Information in WAVE Updated” will be displayed in the Console.
When the **Data Rec** window is opened again, the information will be updated to the new variable information.

● If the computer goes into sleep mode during measurement, LAN will be disconnected and data recording will be terminated.

4.7 [Event Viewer] window

[Event Viewer] window acquires events, which are data that is registered to the program code, and displays them.

This window displays the execution history of the functions in the program.

4.7.1 Starting

There are two ways to display this window.

●[Window] menu > [Show Window] > [Event Viewer]

●Click [Event] button in tool buttons

The below window is displayed.

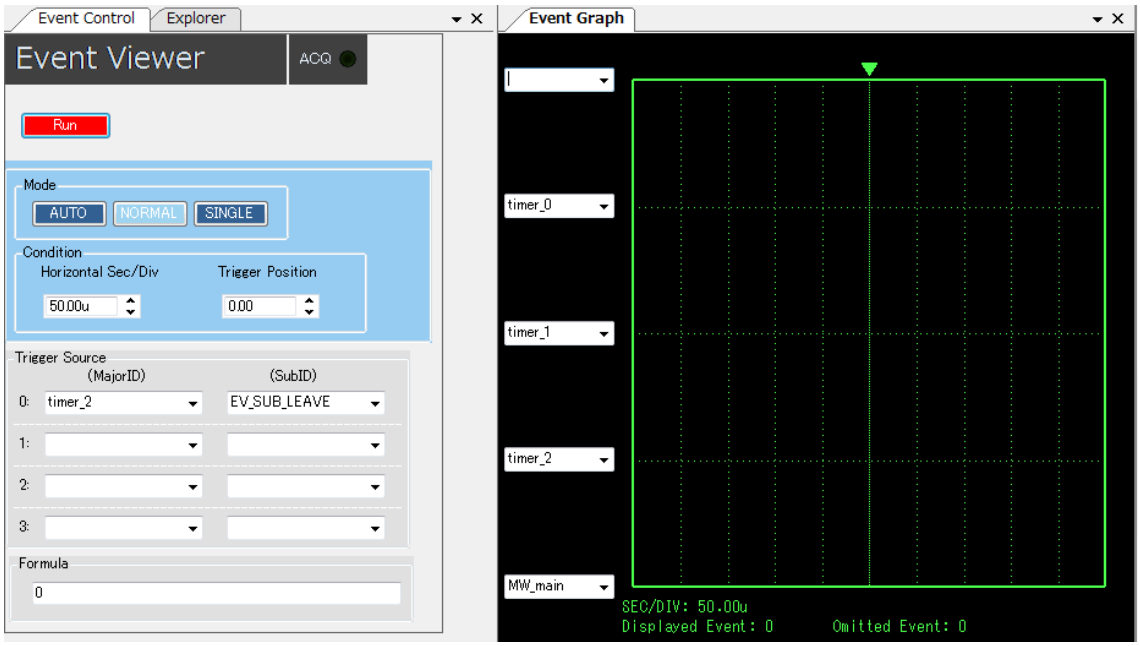


Figure 196: [Event Viewer] Window

4.7.2 Screen Structure

Screen structure of Event Viewer is as follows.

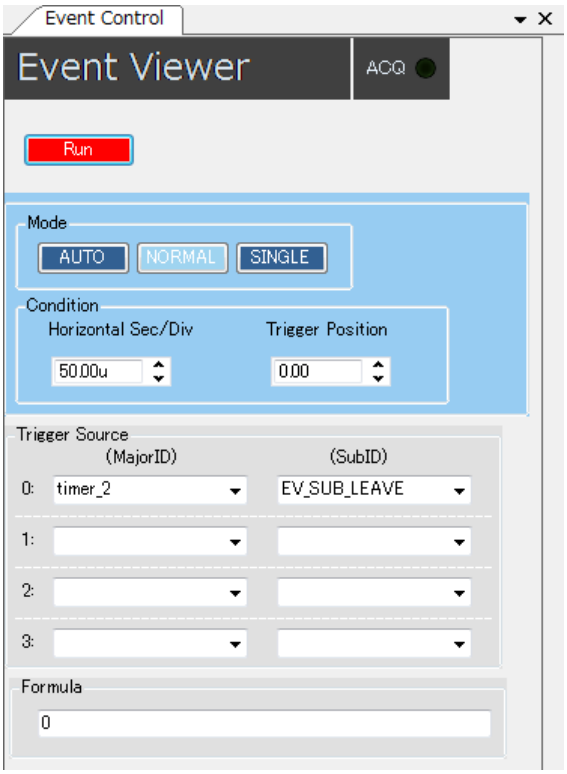


Figure 197: Control Pannel Window

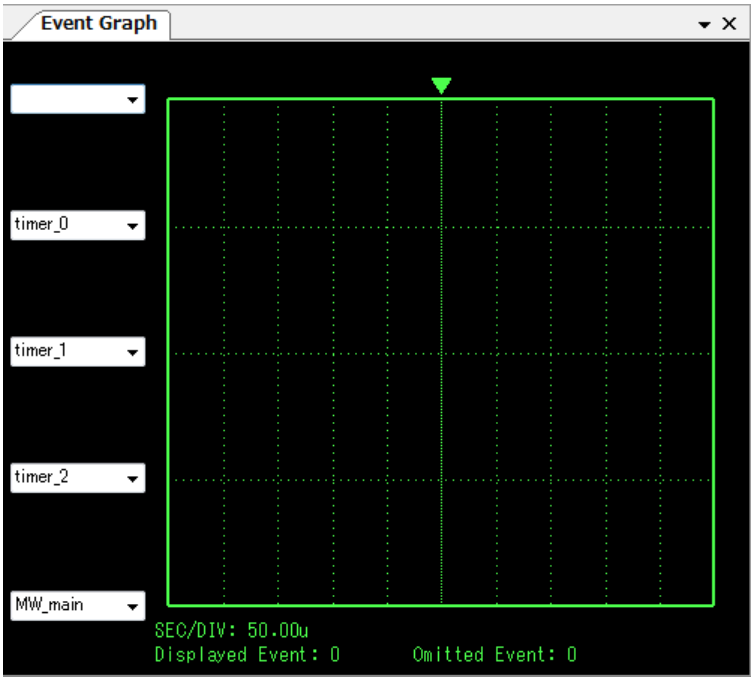


Figure 198: Graph Window

The contents of each window are as follows.

Figure 199: Screen structure of event viewer

Window	Contents
Control panel window	Set the trigger conditions, and start/ stop event viewer. Graph window closes when closing this window.
Graph window	Display events graph.

4.7.3 Control Panel Window Functions

This chapter describes functions about control panel window.

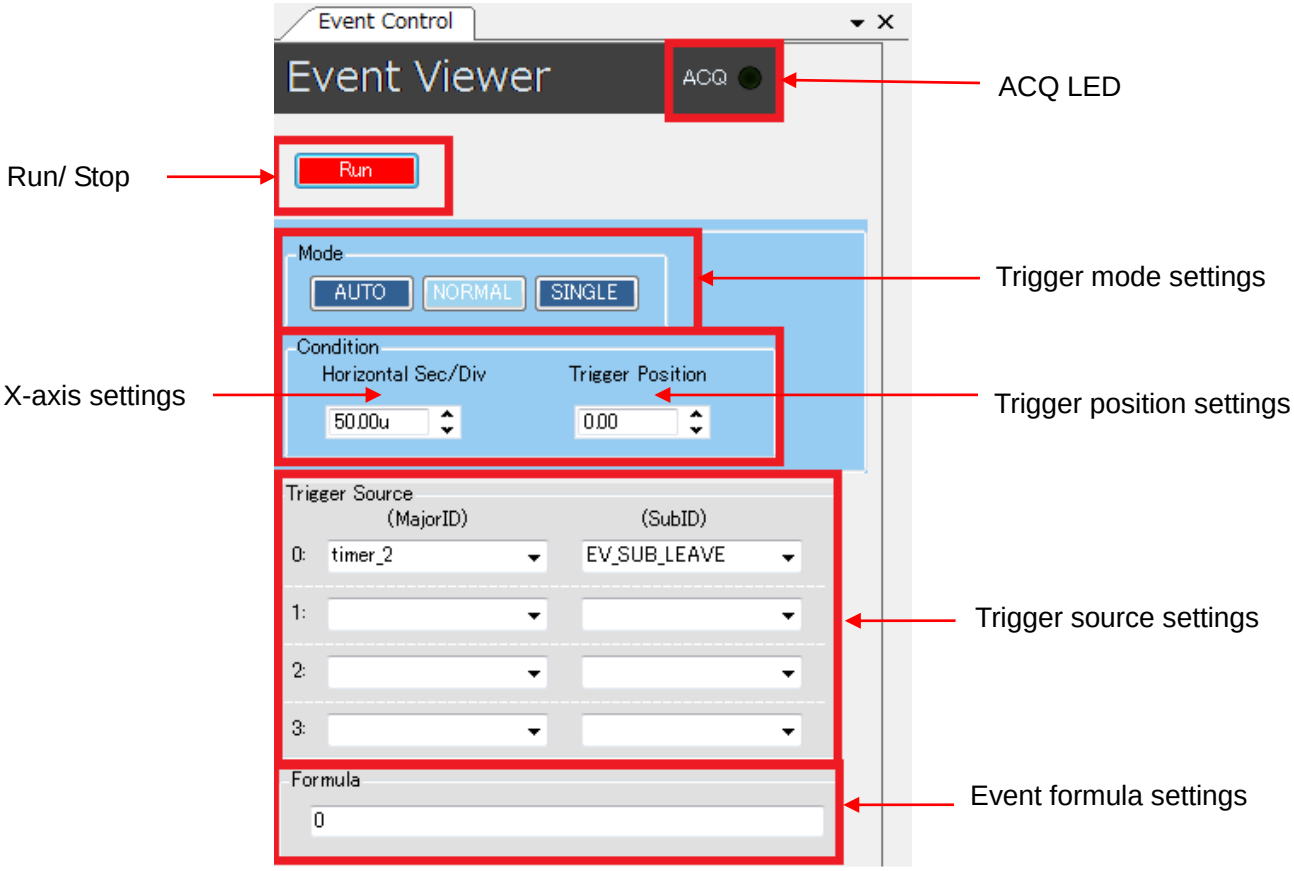


Figure 200: Each functions

1) Acquiring Event

Click the RUN/STOP button to acquire events. Continuous acquisition and single acquisition are performed in the trigger mode.

While running, the status changes to the trigger standby state according to the trigger setting, and when the trigger starts the waveform will be updated. ACQ turns ON while event is being transferred.

Figure 201: Display While Stopped

The displays changes to the following while running.

Figure 202: Display While Running

Click the RUN/STOP button again to end the acquisition of the event.

2) Trigger mode settings

●AUTO

The wave form is updated in synchronization with the trigger signal if the trigger signal occurs within a certain time (equivalent to one screen time). If the trigger signal doesn't occur, the wave form is updated after a certain time.

●SINGLE

If the trigger condition is met during RUN, the waveform is retrieved once and it stops. If the trigger condition is not met, the trigger enters into a “wait” state.

Note that it is possible to change the trigger mode during running.

3) X-axis settings

Set the range of the X-axis (equivalent to time).

The setting is from 1(us) to 2(s).

The total X-axis time of graph screen is 10 times this value.

4) Trigger position settings

Set the trigger position.

This value defines the ratio of pre-trigger and post-trigger.

5) Trigger source setttings

Trigger source is an execution point which is registered to the program.

The items of trigger source are as follows.

Table 70: List of trigger source

Items	Contents
MajorID	Specify Major ID which is registered to the program. Set the following. ●Function name ●32bit value(decimal number or hexadecimal number) Add “0x” to the top when specifying hexadecimal number. All function names are registered to list box.
SubID	Specify Sub ID which is registered to the program. Set the following. ●EV_SUB_ENTER(= 0) ●EV_SUB_LEAVE(= 1) ●32bit value which is 3 or more. (decimal number or hexadecimal number) Add “0x” to the top when specifying hexadecimal number. “EV_SUB_ENTER”/ “EV_SUB_LEAVE” is registered to list box.

For more details about Major ID/ Sub ID, refer to the [5.1.9 MWPE4-C6657 Board and other Functions] in Function Reference Manual.

6) Event formula settings

Event formula is a formula which defines the trigger search condition.

The following event formulas can be used.

Table 71: Event formula

Event formula	Contents
Trigger source (0 to 3)	Trigger occurs when meeting specified trigger source.
or(Trigger source A, Trigger source B)	Trigger occurs when meeting either “Trigger source A” or “Trigger source B”.
delay(Trigger source, Time)	Trigger occurs after specified time from meeting first trigger source. Time is second. The following suffix is available. n: nanosecond u: microsecond m: millisecond
delay2(Trigger source, Time)	Trigger occurs after specified time from meeting last trigger source. Last trigger source is judged if next trigger source doesn’t meet within specified time. Time unit and suffix is the same as “delay()” event.
over(Trigger Source A, Trigger Source B, Time)	Trigger occurs if “Trigger source B” doesn’t meet within specified time after meeting “Trigger source A”. Time unit and suffix is the same as “delay()” event.

The above 2) to 6) can be changed while running Event Viewer.

Then new trigger condition is applied.

4.7.4 Graph Window Functions

This chapter describes the functions of Graph window.

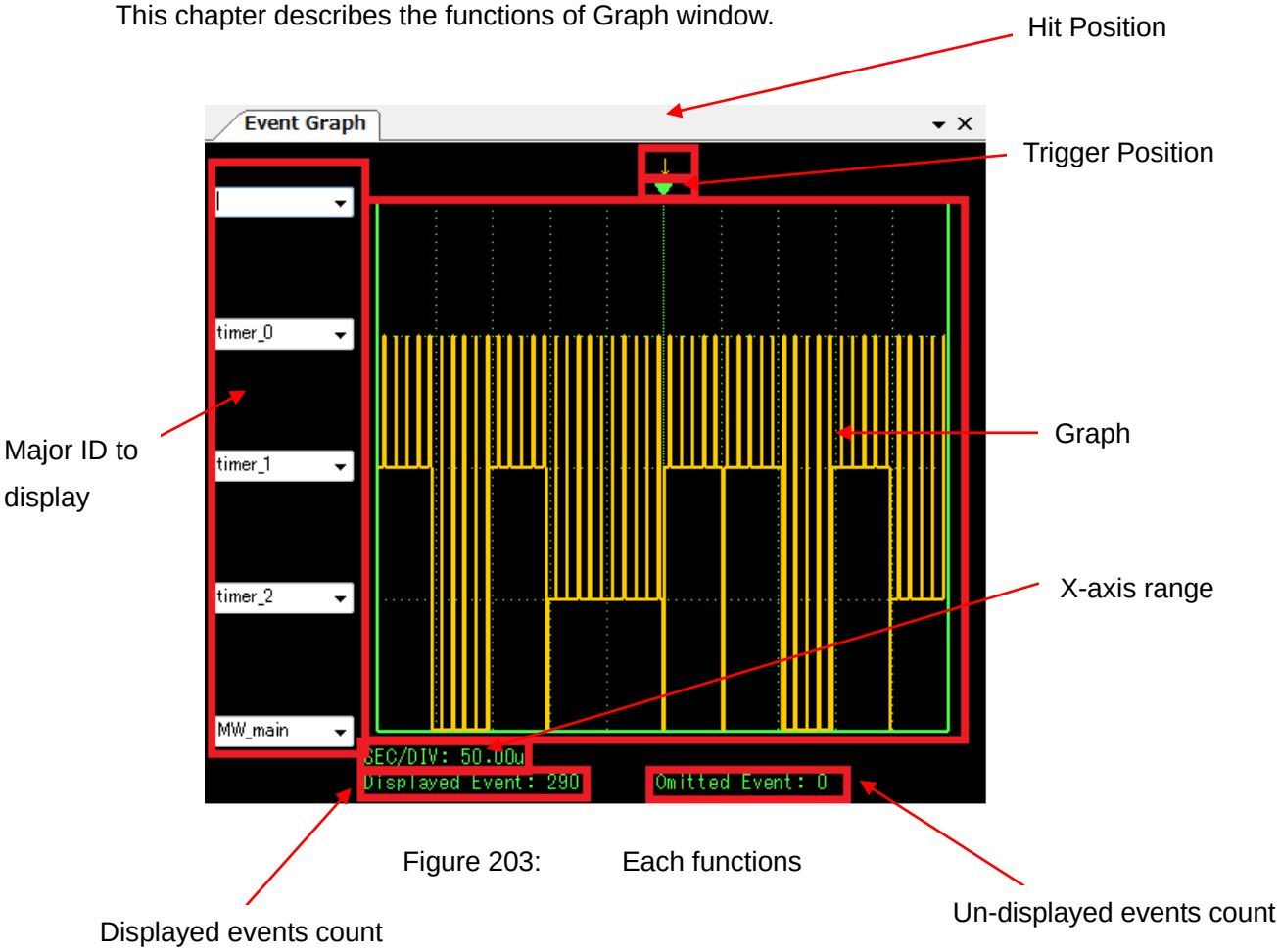


Figure 203: Each functions

1)Major ID to display

Specify Major ID on Graph.

All functions are registered to the list box.

Other than functions, 32bit value can be specified.

(Decimal or hexadecimal number.)

Add “0x” to the top when specifying hexadecimal number.

2)Trigger position

Displayed trigger position specified by control panel window.

3)Hit position

Displayed trigger hit position in the current wave.

4)Graph

Displayed graph based on received events.

5)X-axis range

Displayed X-axis range.

Total graph time of x-axis is 10 times this value.

6)Displayed events count

Displayed events count on graph from the received events.

8000 or less points are displayed.

X-axis direction is aligned based on hit position, so some points may be excluded from graph, and excluded points are not displayed.

7)Un-displayed events count

Un-displayed events count on graph from the received events.

More than 8000 points are not displayed.

And as described 6), some points may be not displayed by aligning x-axis direction.

8)Context Menu

Right-click to display the below context menu.

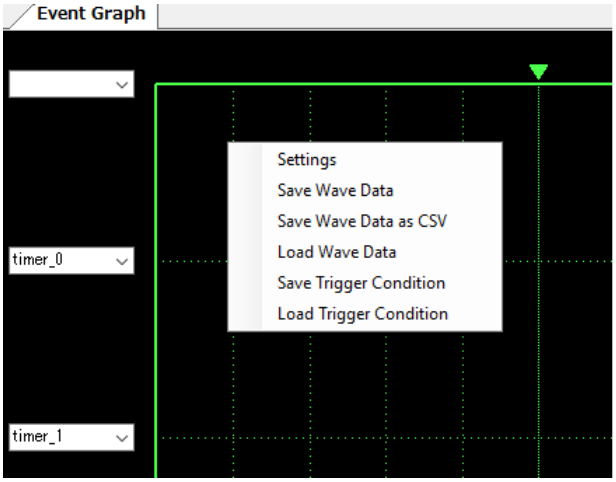


Figure 204: Context menu

Items of context menu are as follows.

Figure 205: Context menu

Menu	Contents
Settings	Set display conditions. [Graph Settings] dialog displayed.
Save Wave Data	Save displayed events.
Save Wave Data as CSV	Save displayed events as csv format for post-analysis.
Load Wave Data	Load saved events.
Save Trigger Condition	Save current trigger condtions.
Load Trigger Condition	Load saved trigger conditions.

●[Graph Settings] dialog

Right-click > Context menu > Click [Settings] to display [Graph Settings] dialog.

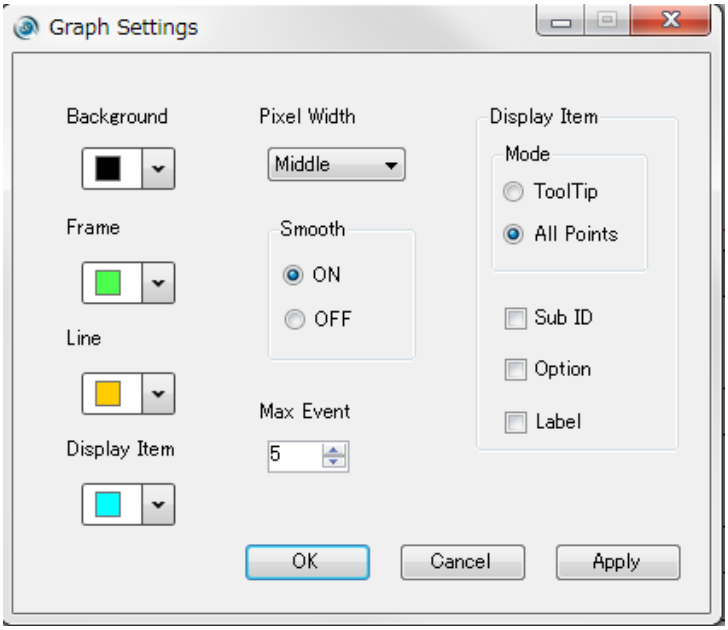


Figure 206: [Graph Settings] dialog

Settings items are as follows.

Table 72: Settings items of [Graph Settings] dialog

Items			Contents
Background			Set the background color.
Frame			Set the frame color.
Line			Set the line color.
Pixel Width			Set the line/ pixel width.
Smooth			Toggle dot diplay/ line display.
Max Event			Set the count of Major ID to display from 2 to 16.
Display Item	Mode	ToolTip	Display parameters of events with tooltip.
		All Points	Dispay all parameters of events on graph.
	SubID		Toggle diplay/ hide of sub ID.
	Option		Toggle diplay/ hide of option.
	Label		Toggle diplay/ hide of label.
OK			Save the settings and close the dialog.
Cancel			Cancel the settings and close the dialog.
Apply			Save the settings.

4.7.5 Notes

To use event viewer, it is necessary to call PEOS functions in version 3.04 or more to initialize and register the execution points.

For more details, refer to [5.12　Debug Function Group] in function reference manual.

The kernel version of DSP board needs to be upgraded to version 3.03 or more.

Chapter 5 Troubleshooting

This chapter describes the troubles which may occur, and the solution.

No.1)

(Phenomenon)

A connection timeout occurred while starting, and the following dialog is displayed.

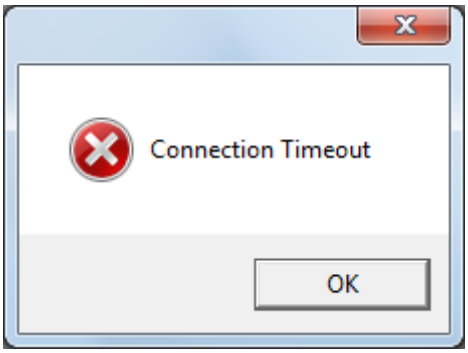


Figure 207: **Connection Timeout**

(Cause and measures)

It is not properly connected to PE-Expert4.

Check the following items:

●Does the LED of PE-Expert4 remain ON normally?

➔

If normal, the 1st, 5th and 6th LEDs from the top should be ON.

Regarding the starting sequence, start PE-ViewX after PE-Expert4 is started.

●Is the IP address connected to PE-Expert4 from PE-ViewX set correctly?

➔

Click the **Setting** menu → TCP/IP → enter the IP address in the TCP/IP Settings dialog.

The default setting of IP address of PE-Expert4 is as follows:

IP Address : 192.168.1.100

Subnet Mask : 255.255.255.0

Default Gateway : 192.168.1.101

Port No. : 10000

●Does the IP address of the PC being used conform to the above address?

➔

Click **Control Panel** of the PC → **Network and Internet** → **Network and Sharing Center** → **Change Adapter Settings** to open the properties of the applicable network. Select **Local Area Connection** and right click, select **Properties**

Select **Properties** of **Internet Protocol Version 4 (TCPipv4)**, and confirm the IP address of the PC.

As shown below, change the values enclosed in red to the same values set in PE-ViewX.

Set the values enclosed in blue to values different than the values set in PE-ViewX.

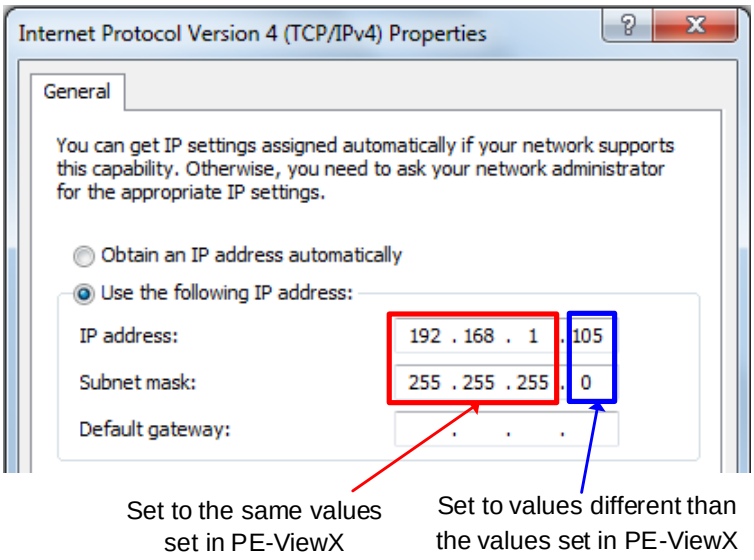


Figure 208: **Internet Protocol Version 4 (TCPipv4) on PC**

●If the connection still cannot be made even after the above setting is set correctly, turn OFF the Internet security and firewall.

There are cases where the connection cannot be made due to the Internet security or firewall.

No.2)

(Phenomenon)

The following dialog "Variable information (*.def file) is not loaded yet. So use of communication function will be limited." is displayed.

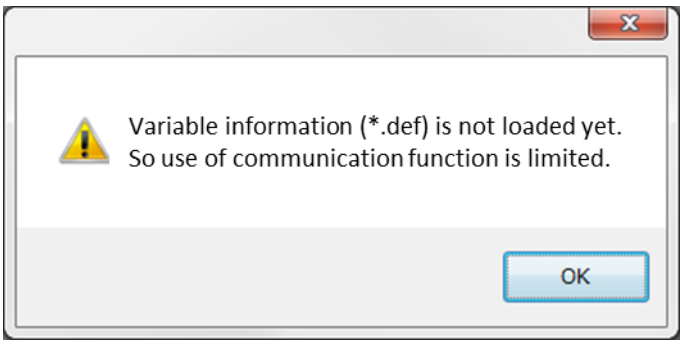


Figure 209: **Variable Information has not been Read**

(Cause and measures)

The variable information is saved in the *.def file which is created automatically during a compile.

This message is displayed at the following timing when a project is not selected, or the *.def file has not yet been created.

- When PE-ViewX is started.
- When WAVE is started.

The *.def file will be created after a project is selected, and the compiling is completed normally. Subsequently, this message will no longer be displayed.

No.3)

(Phenomenon)

The system has been operating normally, but recently, Inspector and WAVE was forced to stop 3~4 times.

(Cause and measures)

There are reports that Raptr software interfered with *.dll (a file which is necessary for PE-ViewX operation) on the same computer. In this case, uninstall Raptr software from Control Panel.

No.4)

(Phenomenon)

No events may be occurred for several milliseconds when using event viewer.

(Cause and measures)

It is due to high CPU usage of DSP board when using event formula (over/ delay/ delay2).

These event formulas increase the probability of losing events.

Then the return value of “ev_log()”/ “ev_logP()” functions are 0.

In this case, stop WAVE or PE-Meter.

This problem will be fixed in later version.

Revision History

Document No.	Revision Date	Revisions
121098-A2-052	2013/10/17	●New document
131170-A2-055A	2016/11/21	●Revised based on 131170-A2-050K
131170-A2-055B	2017/03/17	●Revised based on 131170-A2-050L
131170-A2-055C	2017/09/19	●Added chapter [1.4 Regarding connection to PE-Expert4] ●Added the following commands to "2) command" of chapter [3.3.6 External Coupling] wave dos output ●Added chapter [3.3.7 Offset of timeout] ●Added chapter [3.3.8 Data Table] ●Added description about changing font size to chapter [4.2 Console Window] ●Added "15)On-Chip WAVE settings" to chapter [4.4.4 Control Panel Window Functions] ●Added chapter [4.7 [Event Viewer] window] ●Added "No.4" to chapter [Chapter 5 Troubleshooting] (Based on 131170-A2-050M)

Please refer to our homepage

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