Endurance Test System

K2

ENDURANCE2
Instruction Manual

IMV CORPORATION

№.１６５５

Type of Document :	Instruction Manual
System Applied :	K2/K2Sprint
	Software <ENDURANCE2 > later than Version 10.0.0
	※K2/BMAC is necessary to use this application.

Japanese Edition

Version	Date	Contents
1.0.0	2009.06.26	First edition
1.0.1	2009.07.01	Correction of statements about output contact at state of test end
6.0.0	2010.10.21	Correspondence to Windows7
6.1.0	2013.03.29	Additional description of “Specify schedule number at test restart” in Setup
10.0.0	2013.08.09	Renewal of screen display, modified description of test files, modified description of input channels and additional description of previous project tree conversion

English Edition

Version	Date	Contents
6.1.0	2013.03.29	First edition
10.0.0	2013.08.09	Renewal of screen display, modified description of test files, modified description of input channels and additional description of previous project tree conversion

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Chapter 1　Outline of the System

1.1 Specifications

1.1.1 ENDURANCE2

This program realizes endurance test by operating excitation repeatedly and observing changes of response data with drive data file created by K2/BMAC, finite-length waveform control system. Therefore, drive data file for excitation must be created and “endurance test” schedule matched with information of those files must be defined to operate this system.

（1） Specification about waveform control

This is a system that realizes excitation functions scheduled based on information of specified drive data file, so it does not carry out control such as iteration.

Therefore, various specifications about waveform control conform to K2/BMAC’s.

（2） Specification about excitation

Excitation is operated based on drive data file created by K2/BMAC. The number of usable output channel conforms to K2/BMAC’s.

1) Scheduling

In case there are some drive data to be reproduced, the order of excitation can be scheduled. This is called “Excitation schedule”.

Drive data of each schedule element needs to correspond to control conditions of K2/BMAC.

2) The number of schedule repeat

Schedule element：Up to 2,147,483,647

Whole excitation schedule：Up to 2,147,483,647

3) Test mode

・Observation data acquisition mode

Operate excitation one time for each with drive waveform of schedule element and acquire observation data.

・Endurance test mode

Endurance test is operated according to excitation schedule.

Excitation mode is below.

Continuous excitation/ Step excitation (Stop at the end of each schedule element)

4) Sampling frequency

It conforms to information of drive waveform file.

5) Repeat interval of schedule element

Interval time at operating repeat excitation for schedule element can be set.

1 excitation time of repeat excitation is based on reference waveform which corresponds to exciting drive waveform. In case repeat interval is set to 0 second, reference waveform length excitation is repeated.

However, settable minimal time in the repeated interval is set according to K2/BMAC control conditions and length of reference waveform as below.

・FFT number of points ≦ at reference waveform length

0[sec]

・FFT number of points ＞at reference waveform length

(FFT number of points－Reference waveform length)／Sampling frequency[sec]

Now, FFT number of points：K2/BMAC control frequency lines×2.56

This results from drive waveform length is longer than reference waveform length in control theory.

In addition, excitation pauses when schedule element is switched.

6) Combine function of drive waveform

This is a function that combines some drive waveforms into one drive waveform. This combined drive waveform can be used as drive data file of schedule element.

Combine interval can be set at drive waveform combine. This specification is same as "repeat interval of schedule element" described above.

However, reference waveform length is the total length of all reference waveform to be combined.

For example, even short reference waveform which cannot be set repeat interval to 0 second can be set combine interval to 0 second, after repeating them and the amount of reference waveform length is over FFT number of points.

Also, when some kinds of drive waveform are combined, K2/BMAC control conditions of each drive waveform needs to correspond.

(3) Specifications about data acquition

The number of input channels to be used for data acquisition and physical quantity to be acquired can be arbitrarily specified without depending on K2/BMAC definition.

The number of usable input channels conforms to K2/BMAC's.

1) Sampling frequency

It conforms to information of drive waveform file.

(4) Specifications about abort functions by response data

Response waveform during endurance test is observed and if abort conditions are fulfilled, excitation is paused and endurance test is aborted.

There are two abort functions below.

- Abort function by abort level
- Abort function by observation data

1) Abort function by abort level

Abort level is spacified in each input channel to be used and test is aborted when abort level is exceeded.

Whether abort is operated or not by abort level can be specified with each input channel.

2) Abort by observation data

Operate excitation one time for each with drive waveform of schedule element before starting endurance test, and acquired response waveform shall be observation data.

Specify tolerance to this observation data , and when response waveform deviates tolerance during endurance test, excitation is aborted. Allowance amount of deviancy can be also specified.

Usually, observation data is acquired before starting endurance test, but it can be acquired again arbitrarily during endurance test.

・Tolerance

Tolerance of observation data with each input channel to be used is specified.

Tolerance is specified by relative value to peak value of observation data.

・Allowance ratio

Allowance amount of deviancy amount from tolerance with each input channel is specified.

When amount of deviancy is over specified value, the test is aborted.

Whether abort is operated or not by observation data can be specified with each input channel.

(5) Display data

1) Observation data waveform
2) Monitor data waveform
3) Drive waveform
4) Operation status

(6) Data Save：

Data is automatically saved during endurance test. Conditions for save is below.

・Save every specified time
・Save at excitation schedule stop
・All save
・Not save

In addition, the unit of data save is excitation result for 1 time of schedule element.

1.2 Attention to version upgrade

1.2 1 Version upgrading to 10.0.0.0 or higher versions

To upgrade the lower ENDURANCE2 versions than 10.0.0.0 to 10.0.0.0 or higher ones, it is needed to convert the project tree format to that for Ver10.0.0.0. or higher versions.

Take the procedure explained in “7.5 Converting the previous project tree” to convert the project tree format, and then start testing.

Chapter 2　Operation System of K2ENDURANCE2

2.1 Outline

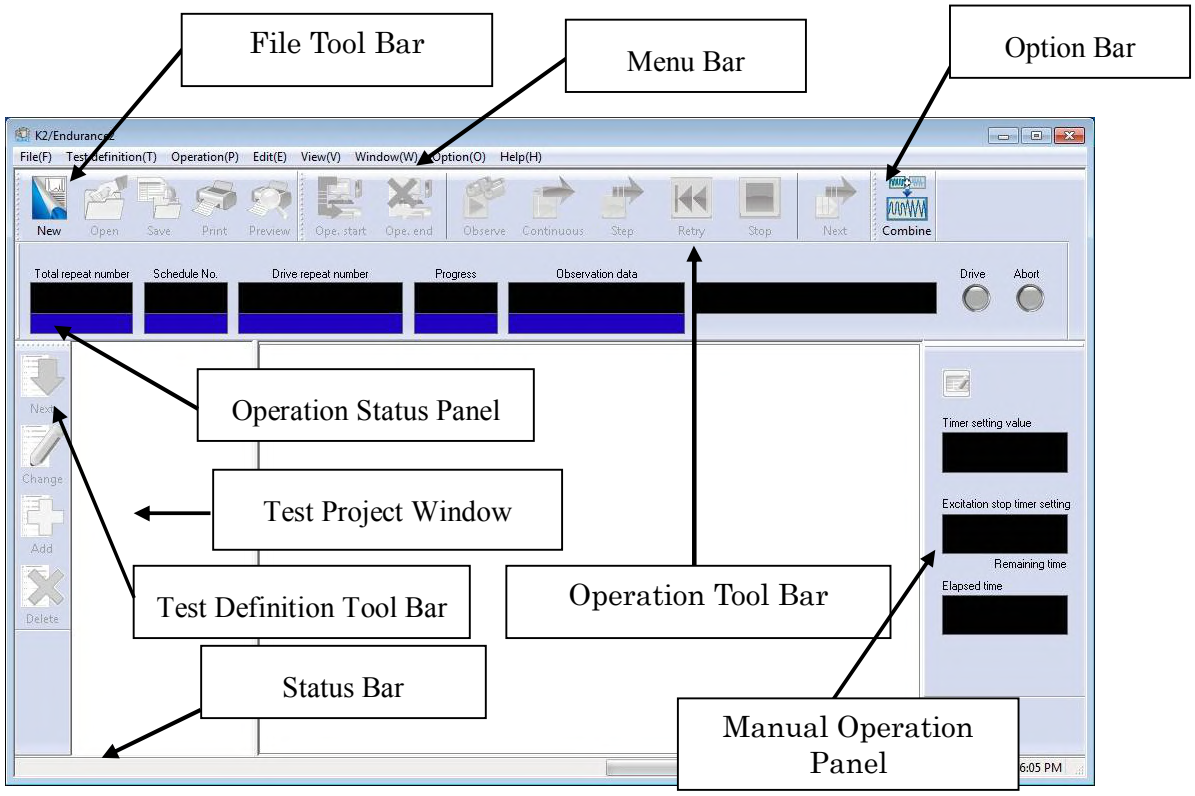
In K2ENDURANCE2, operation after booting up is executed by using a keyboard and a mouse. When this application is started, a window shown as below appears.

All the names of menu in this application are displayed in Menu bar. Each menu is to be opened by clicking on its name and available commands appears as a list.

The commands used frequently are displayed as icons in each Tool bar. A command is executed or a dialog box corresponding to the command is opened when the icon is clicked. Operation status of K2 Controller is displayed in Status bar. The state during the excitation operation is displayed in Operation

status panel.

In K2ENDURANCE2, the excitation test is handled by a unit called the 'project'. The project can be displayed and selected in the test project window.



K2ENDURANCE2 Window

2.2 Test file

Necessary Test Files for test operation

In K2ENDURANCE2, the operator does not have to be conscious of files because the necessary information of test operation is handled by each unit called the 'project'.

The K2ENDURANCE2 file system is described below because there are some cases users had better know what are in the test file.

Following kinds of Test File are available in this system.

・Test Definition File : The file created inVer10.0.0.0 or later
K2 ENDURANCE2 （*.end22）
The file created before Ver10.0.0.0
K2 ENDURANCE2 （*.end）

・Graph Data File : The file created inVer10.0.0.0 or later （*.vdf2）
The file created before Ver10.0.0.0（*.vdf）

・Environment setting File
(I/O Module Configuration Information, Excitation System Information, Input channel Information) : SystemInfo.Dat2

Note 1) Saved in '\IMV\K2_2nd' on System Drive. Deleting inhibited
In K2 of the version before Ver.10.0.0.0, there are saved in '\IMV\K2' on System Drive.
In K2 of the version before Ver.6.0.0.0, there are saved in the Windows folder.

Note 2) If the K2 version is upgraded to Ver10.0.0.0 or later ones from previous ones, the environment setting file will be automatically converted to the format for Ver10.0.0.0 and later ones during installation.

Test File to be created if necessary

・Files to be created when combined drive is set on the combined drive list：
Endurance2UnifiedDrv.dat2

Note 1) Saved in '\IMV\K2_2nd' on System Drive. Deleting inhibited
In K2 of the version before Ver.10.0.0.0, there are saved in '\IMV\K2' on System Drive.
In K2 of the version before Ver.6.0.0.0, there are saved in the Windows folder.

Note 2) If the K2 version is upgraded to Ver10.0.0.0 or later ones from previous ones, the file will be automatically converted to the format for Ver10.0.0.0 and later ones during installation.

Chapter 3　Basic Operation

3.1 Endurance Test

＜Example＞

To operate the endurance test by the following condition ;

＜Assumption conditions＞

- Drive data shall be saved by BMAC in advance.
- Excitation system information and input environment information shall be set in environment setting in advance.

①Excitation system information name　“8Axis”

Excitation group name　Z1, Z2, Z3, Z3, Z4, X1, X2, Y1, Y2

②Input environment information name　“8Input”

Input channel name　Z1, Z2, Z3, Z3, Z4, X1, X2, Y1, Y2

1）Definition mode

[Select input and output environment information]

Excitation system information　“8Axis”

Input environment information　“8Input”

[Drive entry]

No.	Parent project name	Child project name	Drive name
1	EnduranceTest	SineBurst	100%Excitation
2	EnduranceTest	SineBeat	100%Excitation
3	EnduranceTest	MeasuredWaveform	100%Excitation

[Excitation schedule]

No.	Drive name	Repeat times(s)	Repeat interval (s)	Waiting time(s)
1	EnduranceTest /MeasuredWaveform/100%Excitation	3	1	2
2	EnduranceTest /SineBeat/100%Excitation	3	1	2
3	EnduranceTest /SineBurst/100%Excitation	3	1	2

Total schedule repeat times　10 times

Total schedule repeat interval　5 s

Timing signal output　Not do

[Input channel]

No.	Channel name	Assignment	input sensitivity	Type	Tolerance level (+)	Tolerance level(-)	Allowance ratio
1	Z1	000-Ch1	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
2	Z2	000-Ch2	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
3	Z3	000-Ch3	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
4	Z4	000-Ch4	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
5	X1	001-Ch1	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
6	X2	001-Ch2	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
7	Y1	001-Ch3	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%
8	Y2	001-Ch4	100.0 mv/(m/s^2)	Monitor	50%	-50%	10%

※Notice) Please make sure to use input sensitivity of used accelerometer.

[Data save conditions]

Save conditions　　Save the data at excitation stop and data 1 time before from excitation stop

2）Operation mode

[Operation control]

① Observation data measurement start

② Continuous excitation start

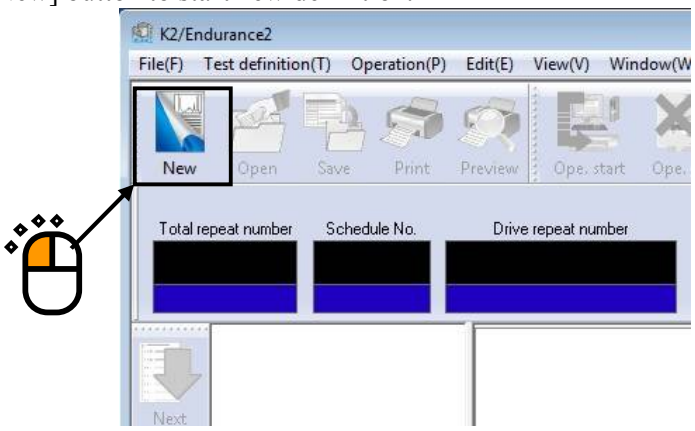
③ Operation end

1） Definition mode

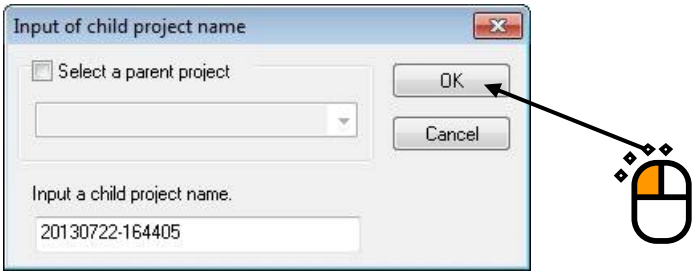
＜Procedures＞

＜Step1＞

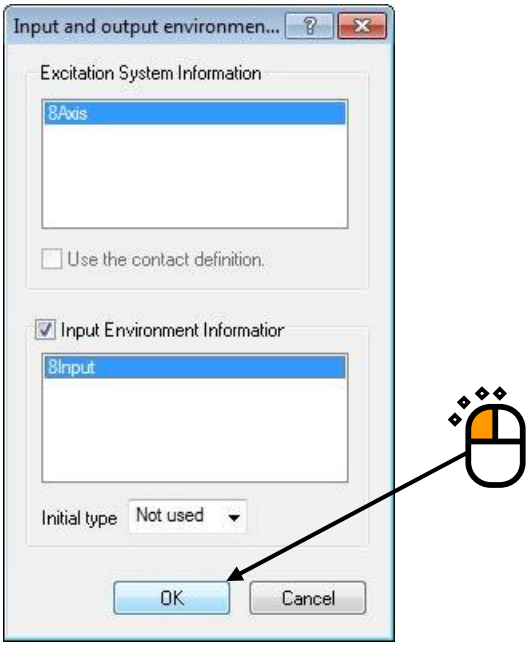
Press the [New] button to start new definition.



The child project input window appears. With the default setting, date is automatically set for a child project name. Press the [OK] button without entering a child project name, because we intend to create a new parent project in this step.



Next, the screen below is displayed. Select “8Axis” in “Excitation system information”, and ‘8Input’ in “Input environment information”. Then, press the [OK] button.

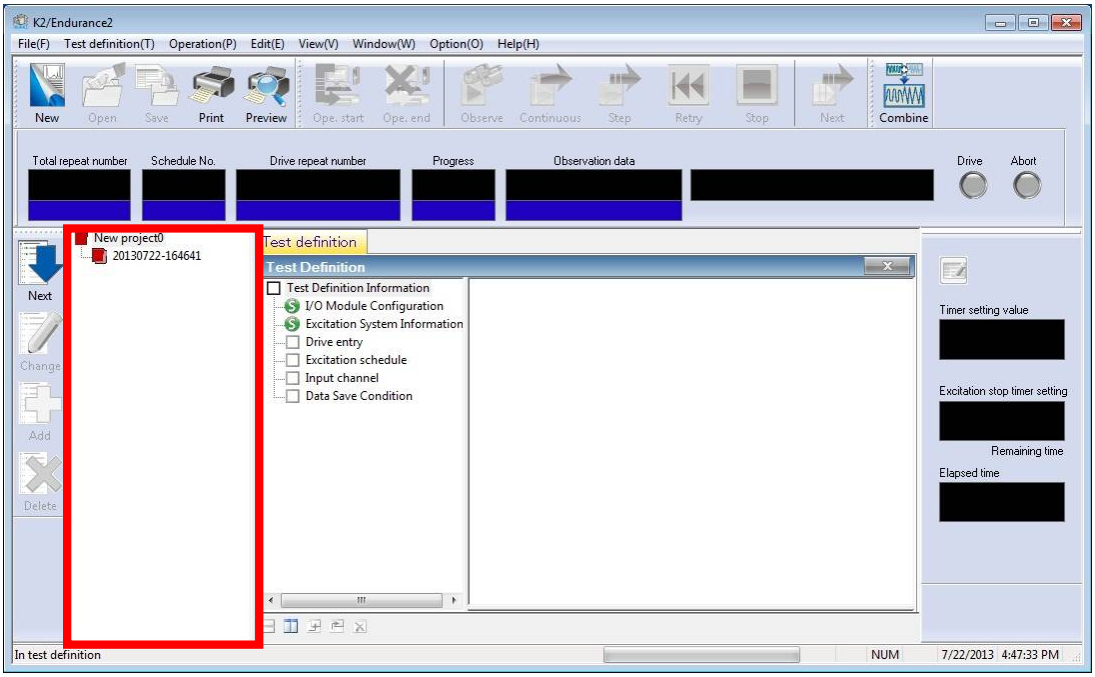


＜Step2＞

A new project is generated automatically by pressing [OK] and displayed in the project window. Also, a child project is generated automatically with date as its name under the new project.

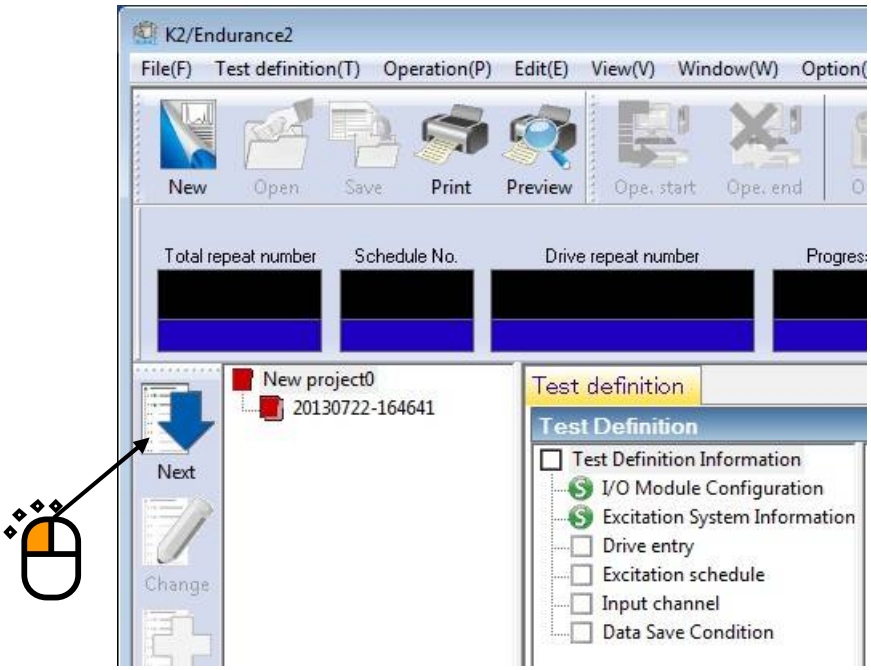
Test definition is defined and handled under each child project.

A new project can manage various children projects having each different test definition (different excitation schedule, etc.).



＜Step3＞

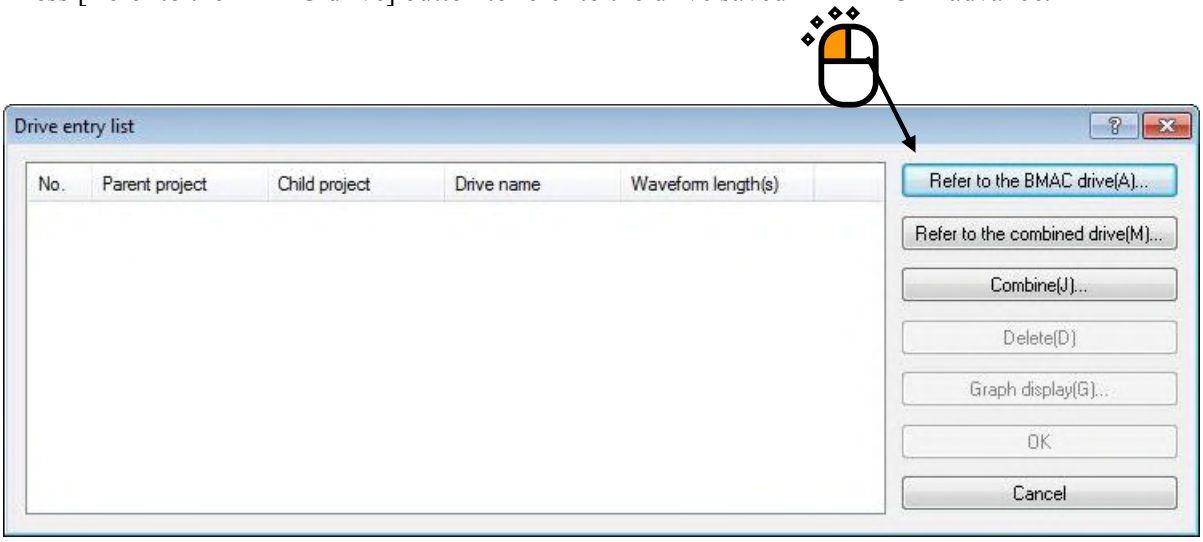
Press the [Go to next definition] button.



＜Step4＞

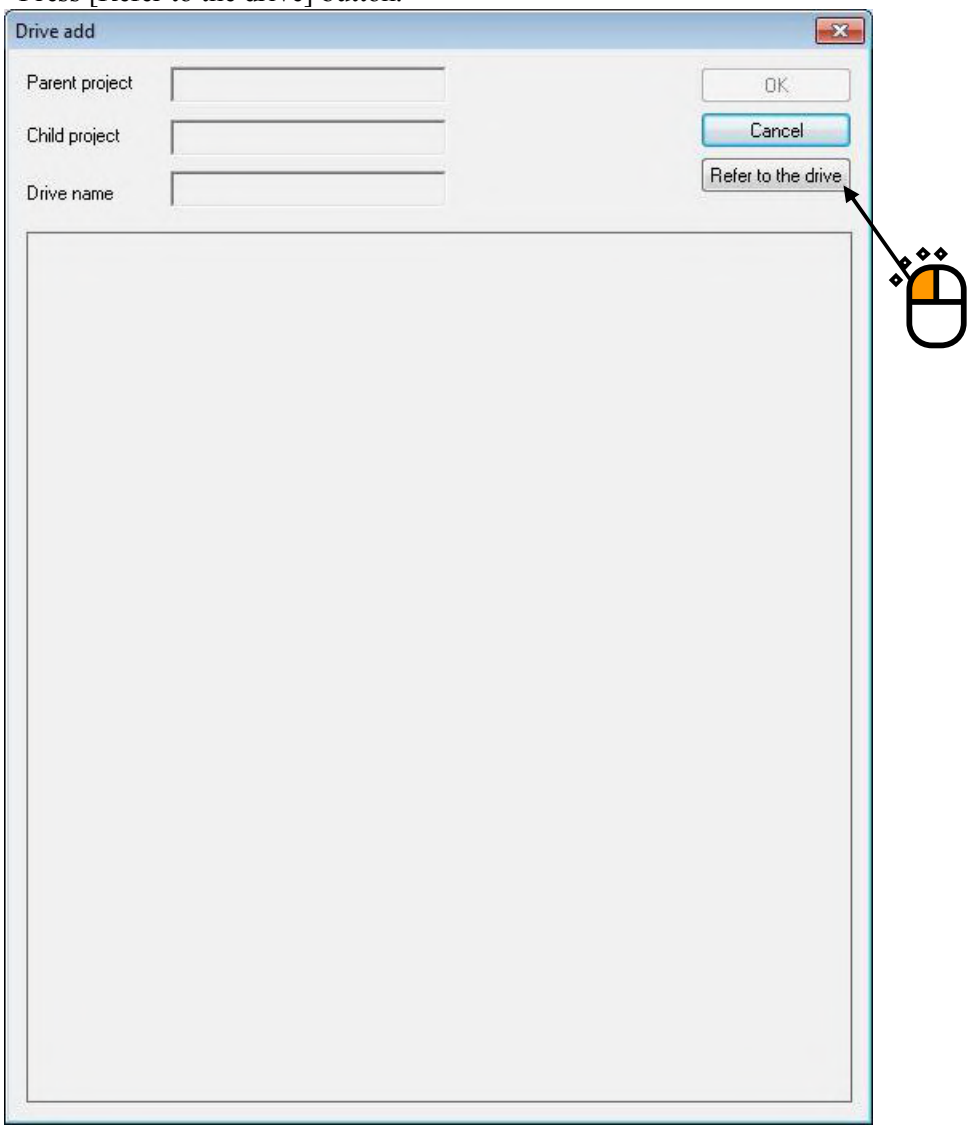
Set drive entry definition.

Press [Refer to the BMAC drive] button to refer to the drive saved in BMAC in advance.



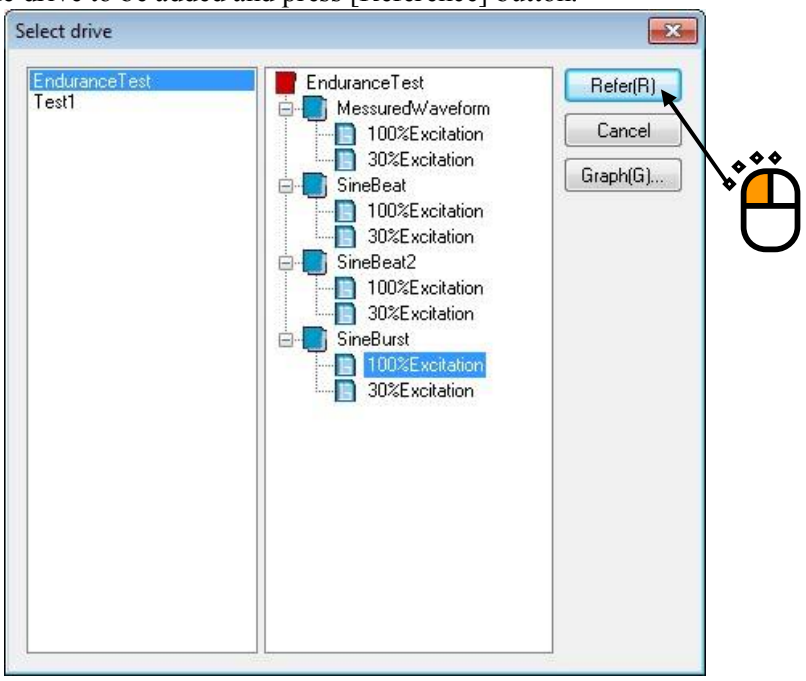
＜Step5＞

Press [Refer to the drive] button.



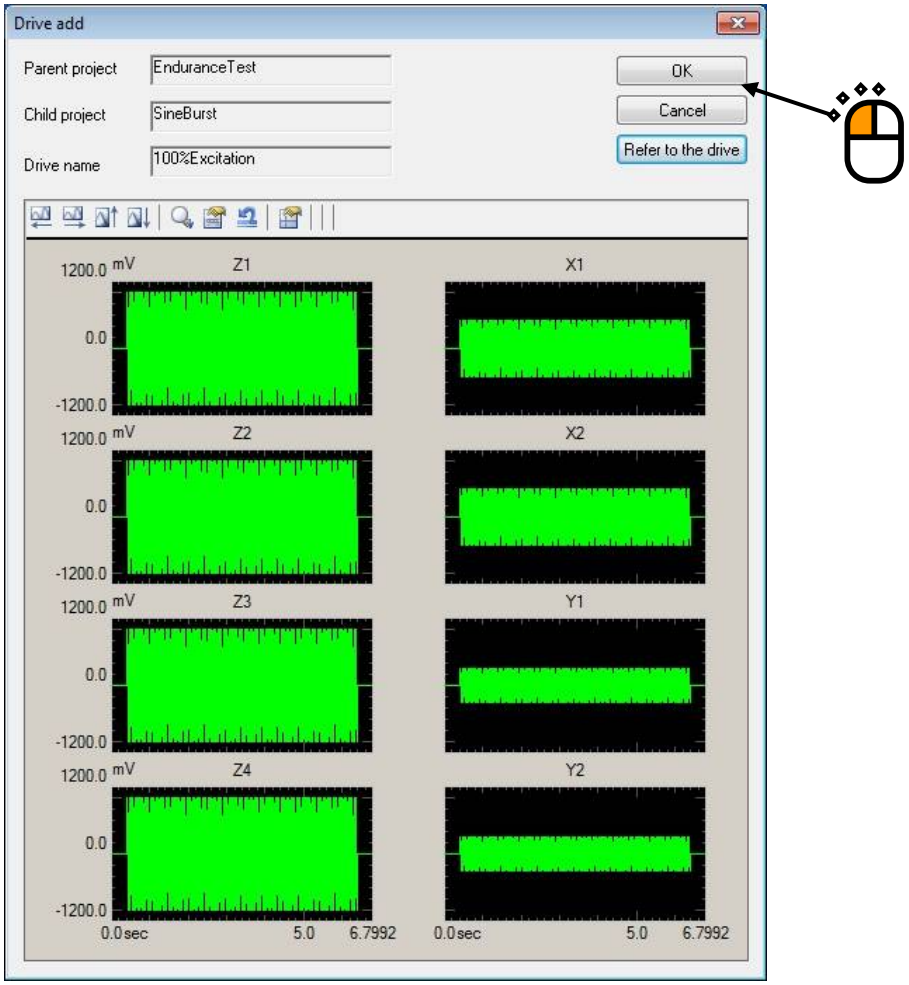
＜Step6＞

Select the drive to be added and press [Reference] button.

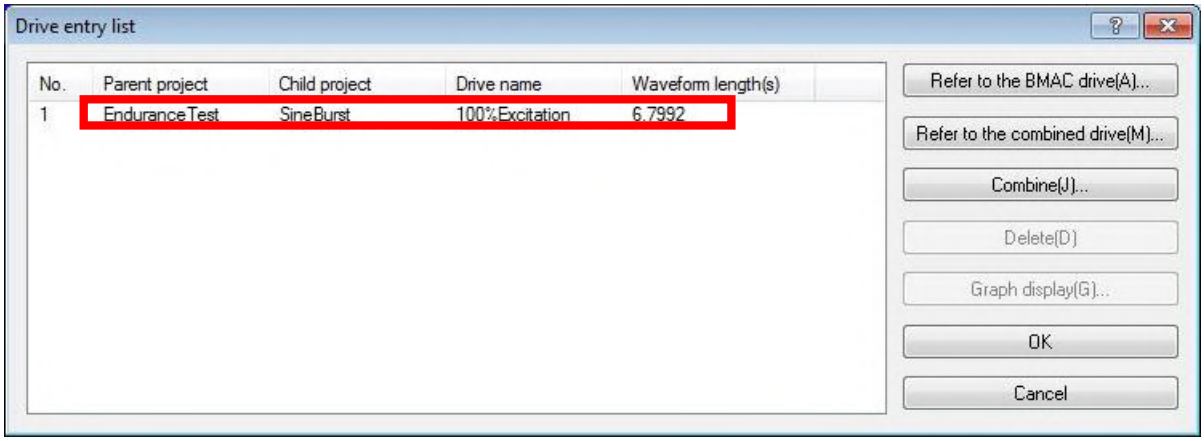


On the [Drive add] screen, selected drive graph is displayed.

Confirm that and press [OK].



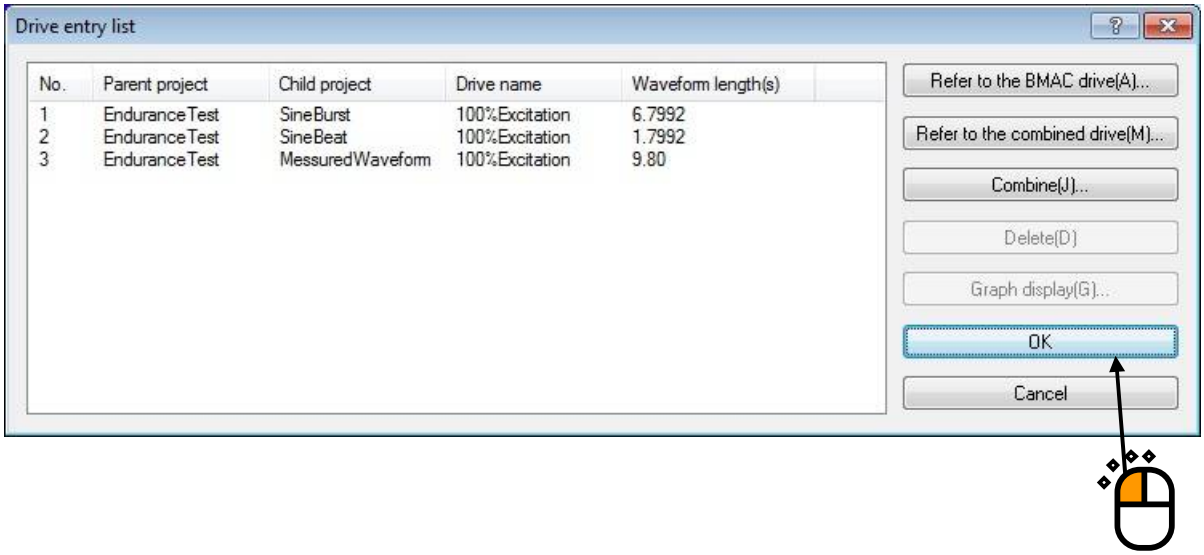
On the [Drive entry list], selected drive is added.



In the same way, by operating from <step4> to this step repeatedly, add drives below.

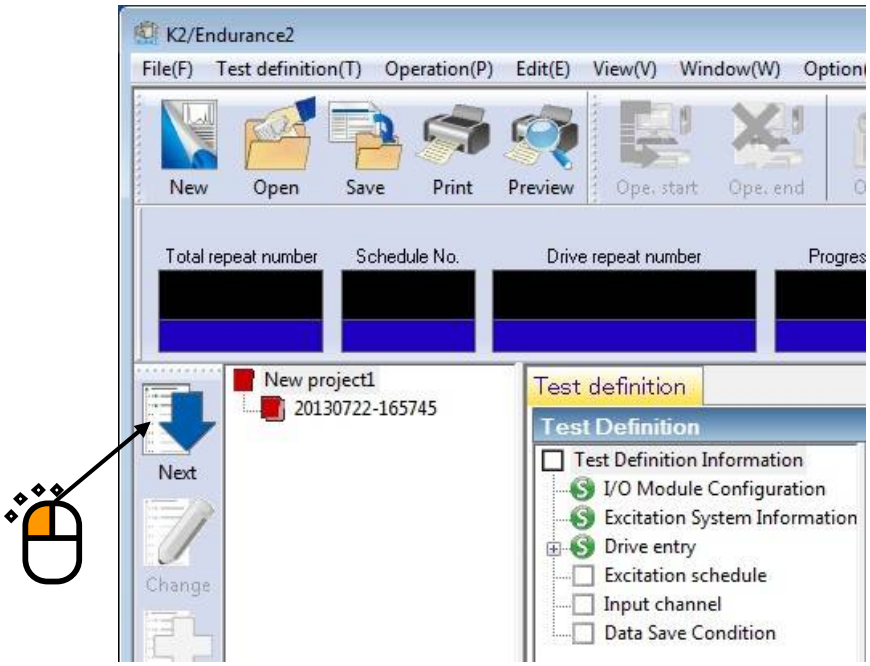
(No.)	(Parent project name)	(Child project name)	(Drive name)
2	EnduranceTest	SineBeat	100% Excitation
3	EnduranceTest	Measuredwaveform	100%Excitation

Confim that these drives are in [the drive entry list], and press [OK].



＜Step7＞

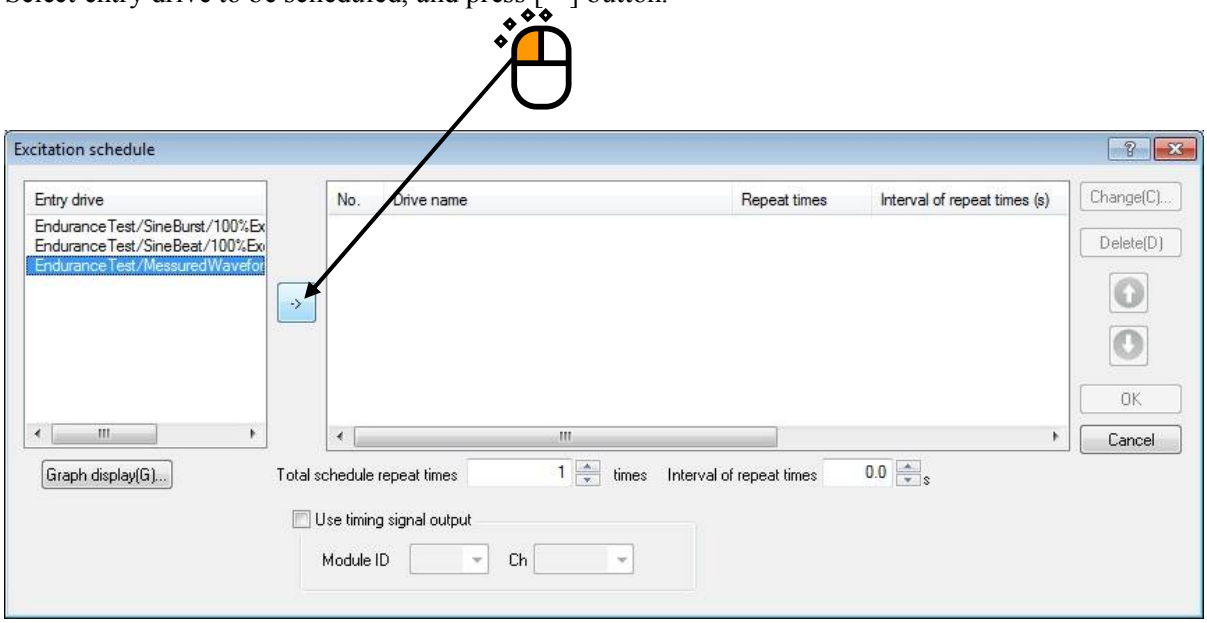
Press the [Go to next definition] button.



＜Step8＞

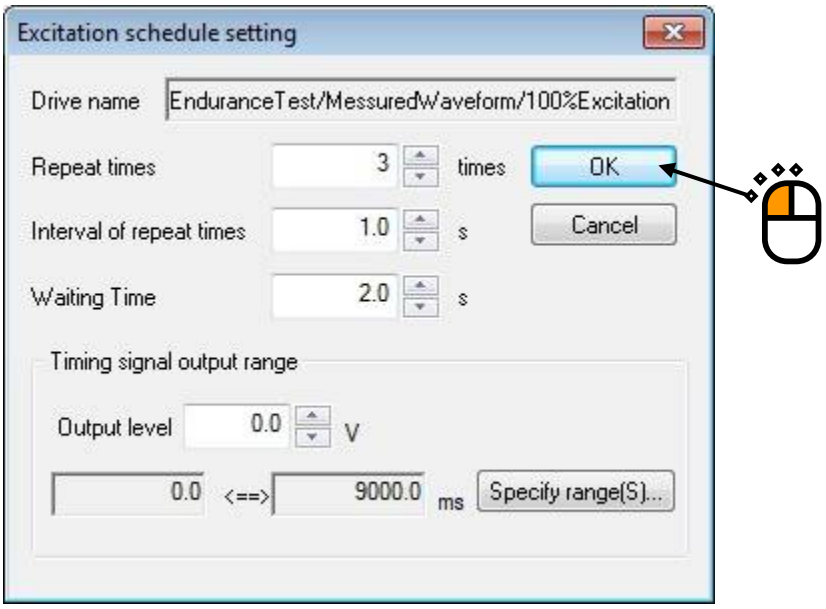
Set excitation schedule definition.

Select entry drive to be scheduled, and press [->] button.

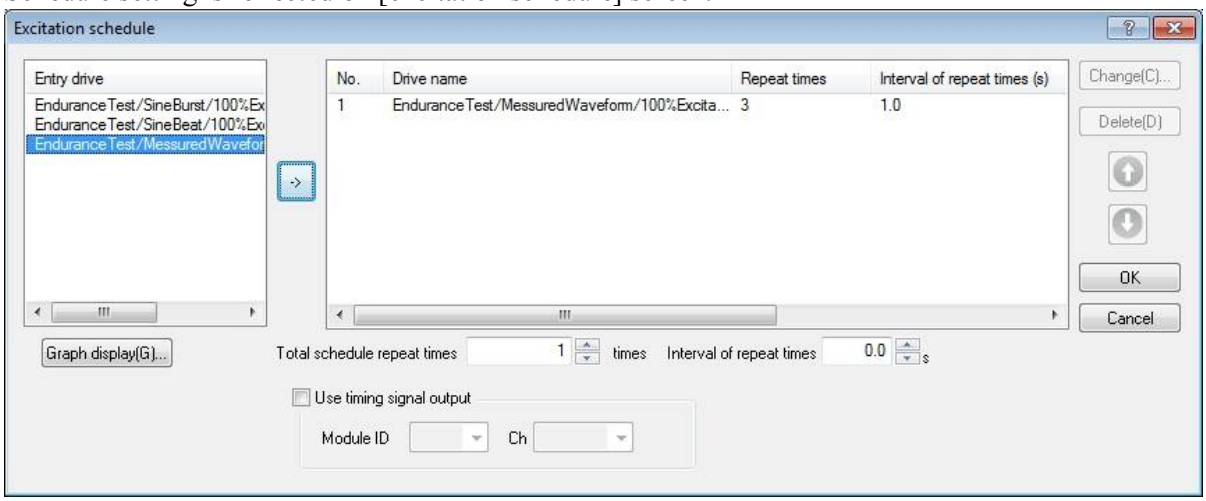


＜Step9＞

Set the Repeat times to ‘3’, the Repeat interval to ‘1.0’, and Waiting time to ‘2.0’. Then press [OK].



Schedule setting is reflected on [excitation schedule] screen.

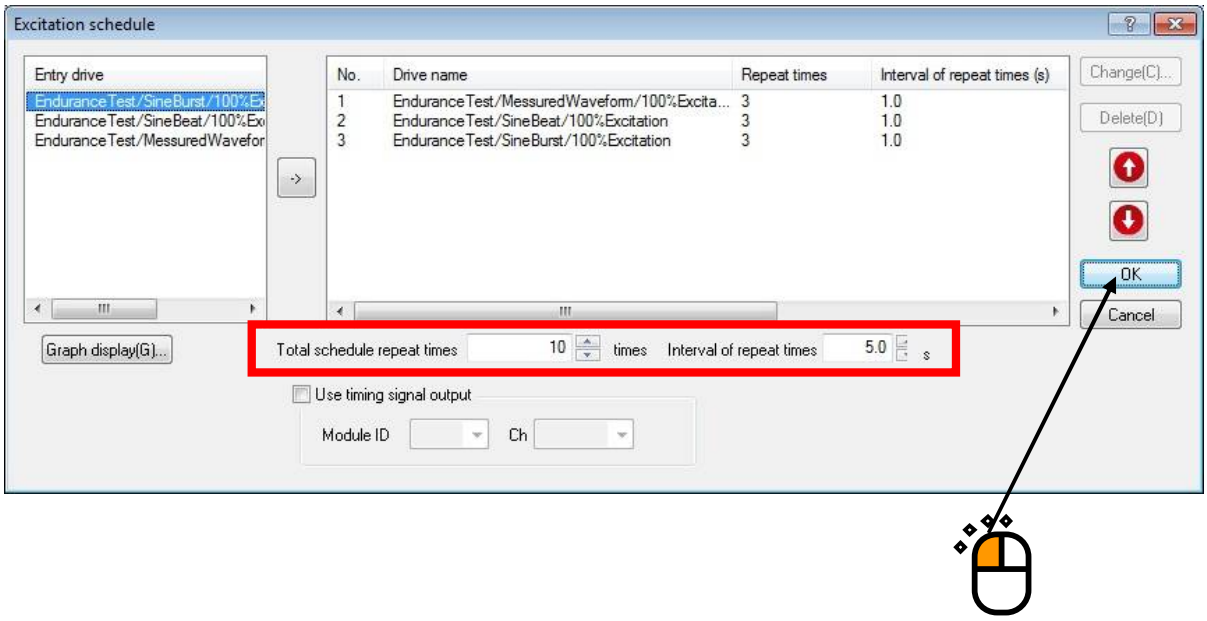


In the same way, by operating <Step8> and this step repeatedly, add schedules below.

(No.)	(Drive name)	(Repeat times(s))	(Repeat interval (s))	(Waiting time(s))
2	EnduranceTest/SineBeat/100%Excitation	3	1	2
3	EnduranceTest/SineBurst/100%Excitation	3	1	2

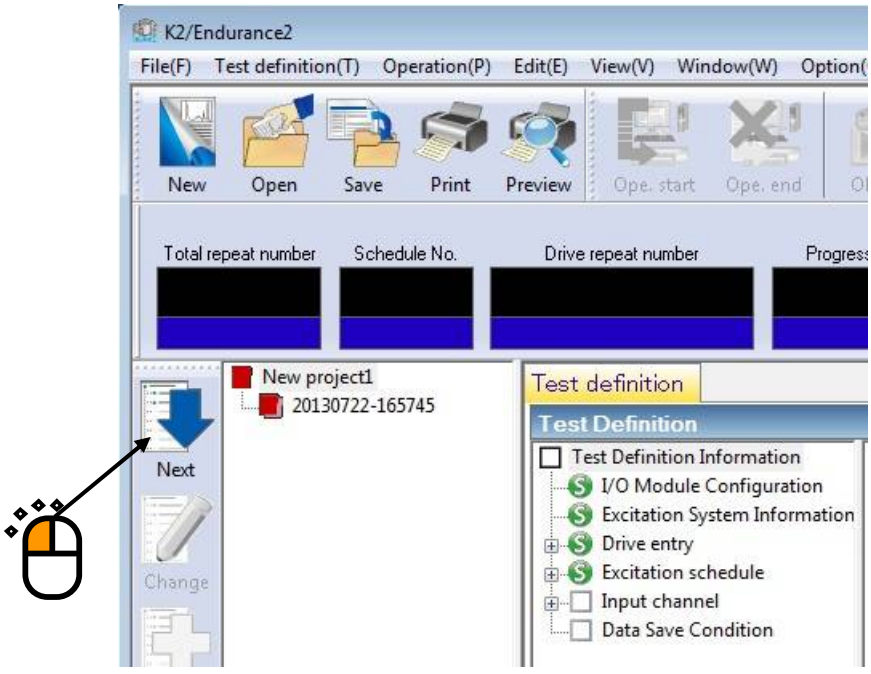
＜Step10＞

Set the Total schedule repeat times to ‘10’ times and the Repear interval to ‘5.0’s, then press[OK].



＜Step11＞

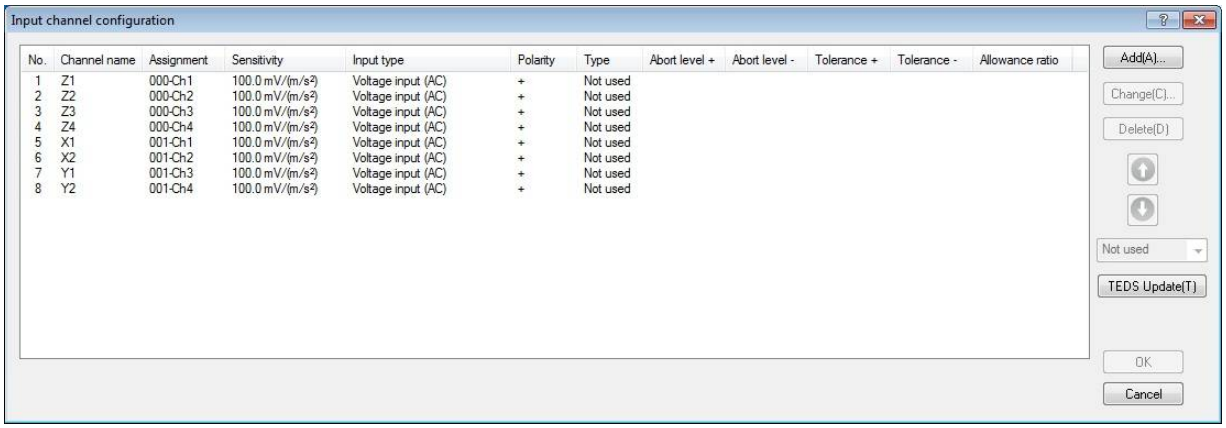
Press the [Go to next definition] button.



＜Step12＞

Set input channel definition.

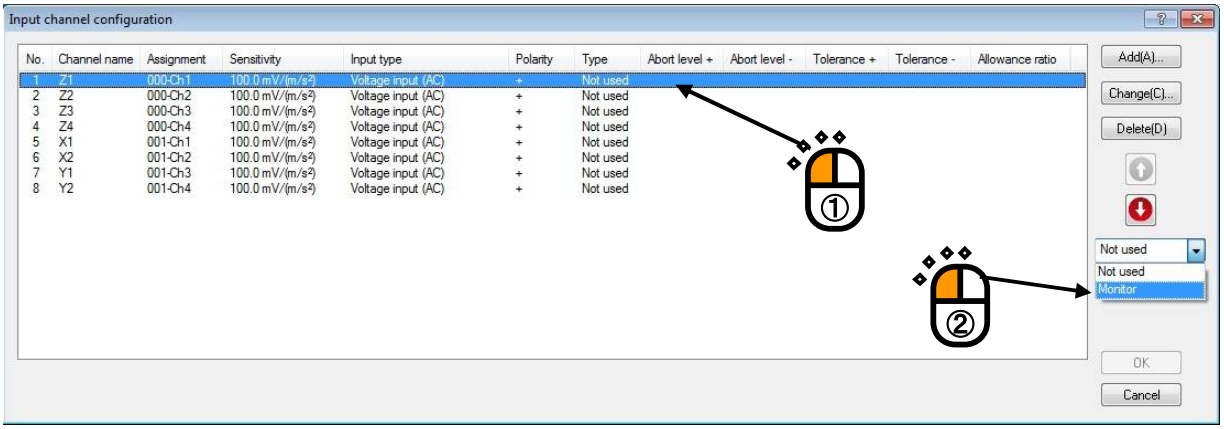
The content of “8 input” in “Input environment information”, selected when project was newly created, is displayed.



In this example, [Type] of all the input channels is set to [Monitor].

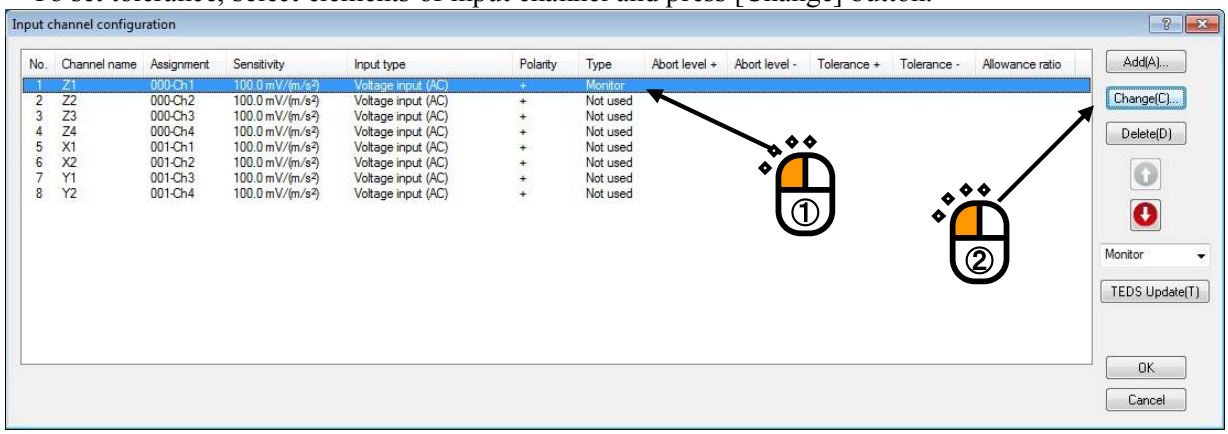
To change [Type], select elements of input channel and set in the lower right screen.

Operate this to all the input channels.



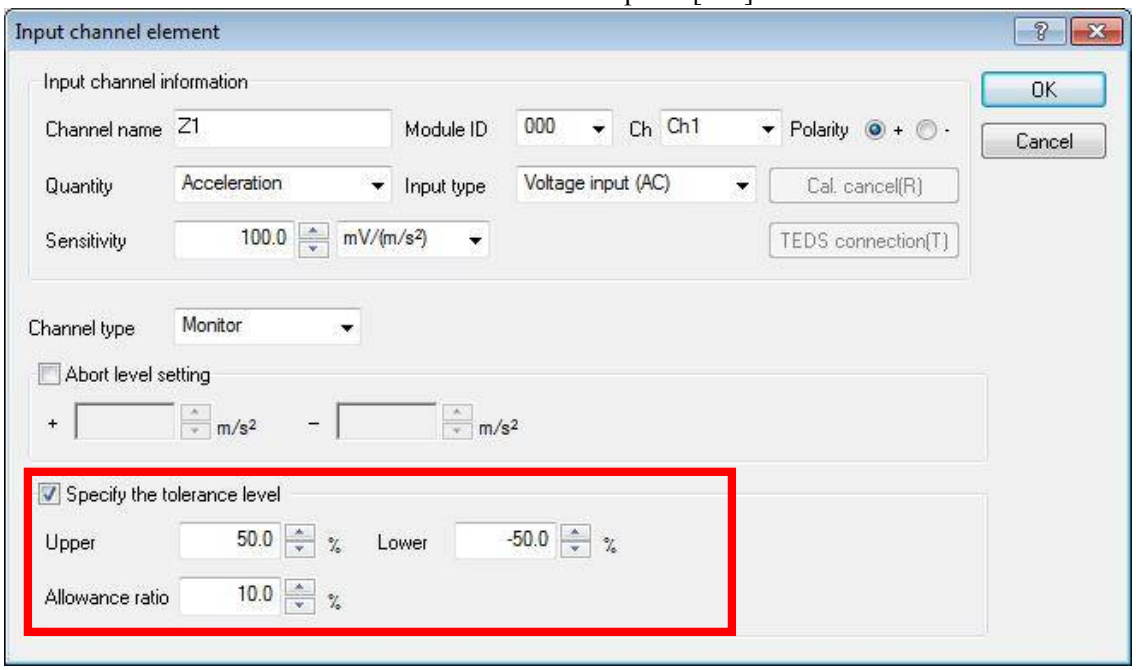
Next, set tolerance level.

To set tolerance, select elements of input channel and press [Change] button.



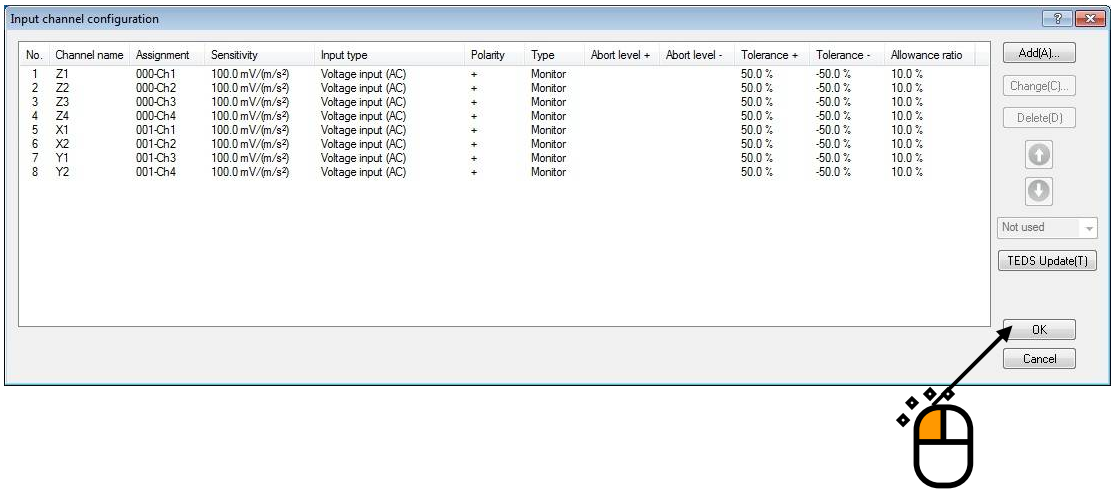
Screen as shown below is displayed.

In this example, set the upper limit level to '50.0' %, the lower limit level to '-50.0' %, and the Allowance ratio to '10.0' % in tolerance level. Then press [OK].



In this example, tolerance level is set to all the input channels in the same way.

Confirm all the input channels setting is completed, and press [OK].

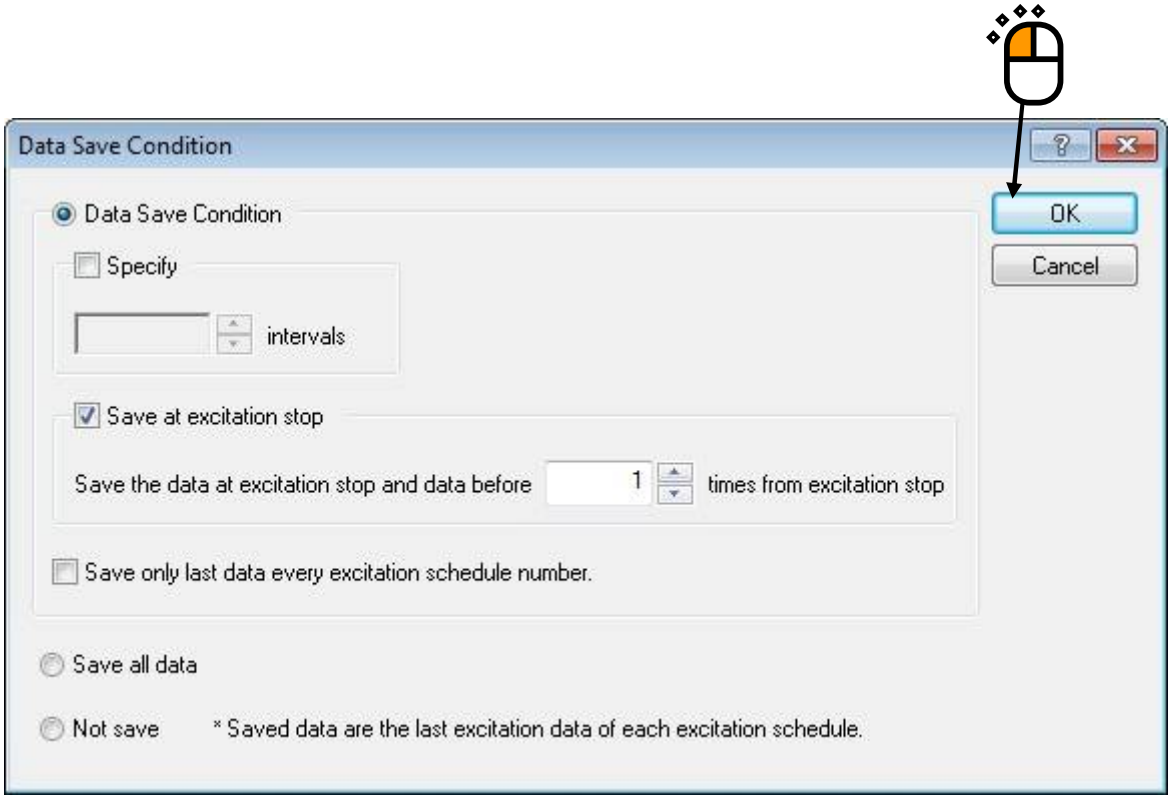


＜Step13＞

Set data save conditions.

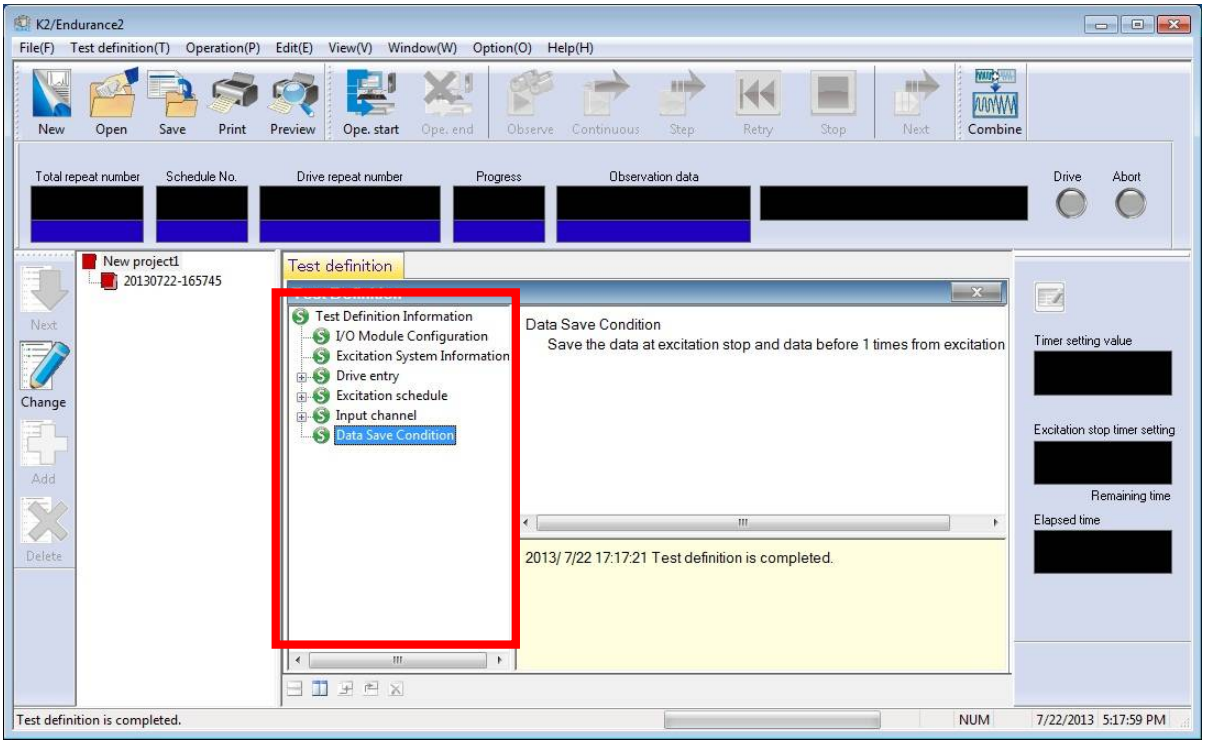
In this example, Set “Save the data at excitation stop and data 1 time before from excitation stop”, but this is the default of “Data save condition” screen, so you do not need to change.

Press [OK].



＜Step14＞

Now, the test definition in this example is completed.



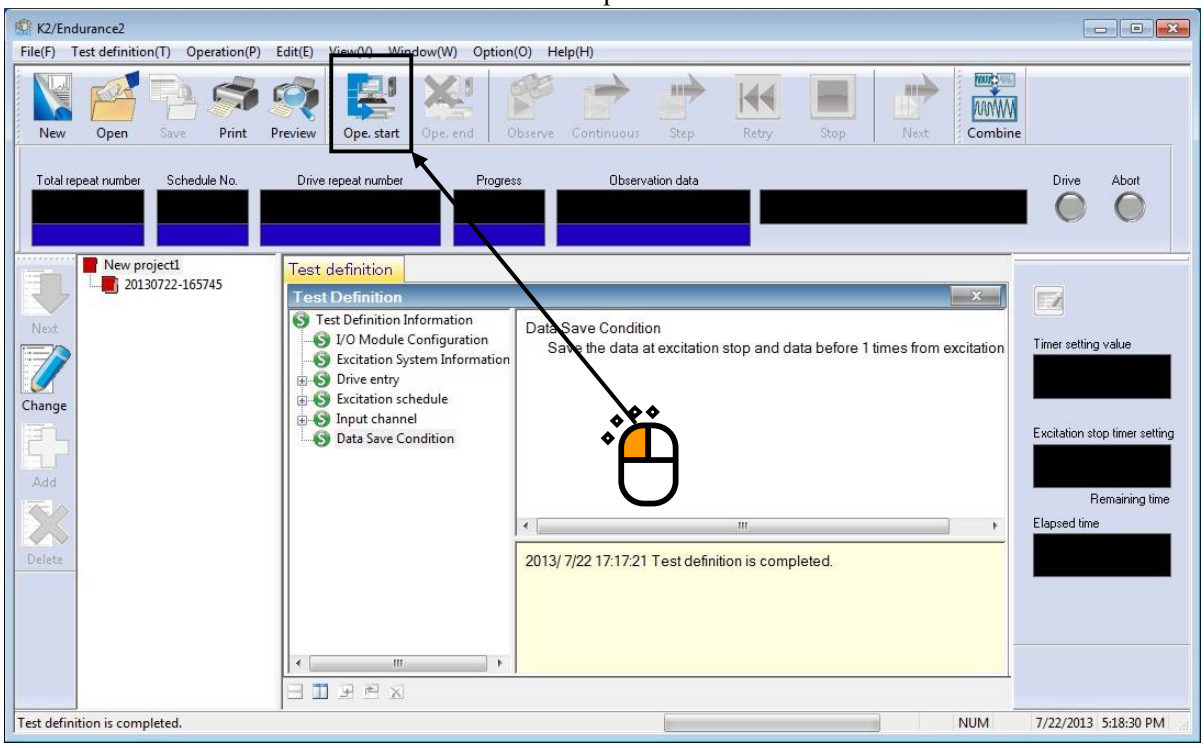
2） Operation mode

＜Step1＞

To operate the test, press [Operation start button].

Operation start can be executed from “Menu→Operation control→Operation start” as well.

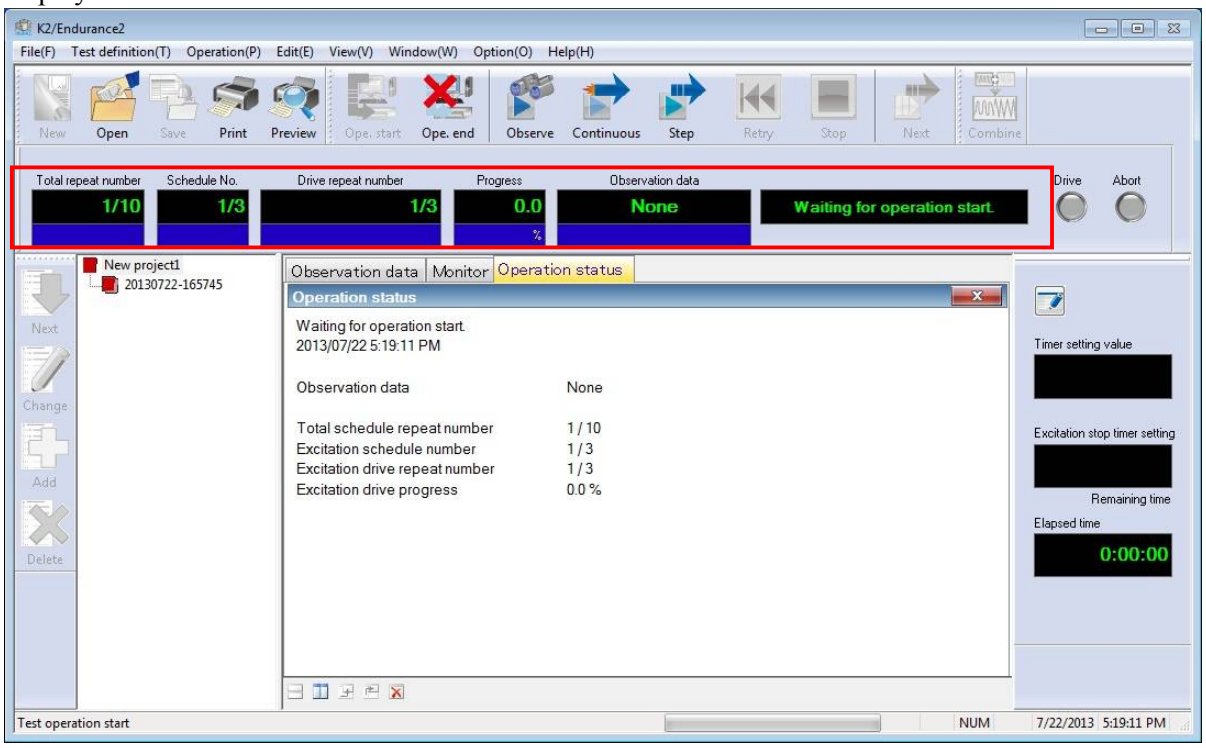
The screen is switched from definition mode into operation mode.



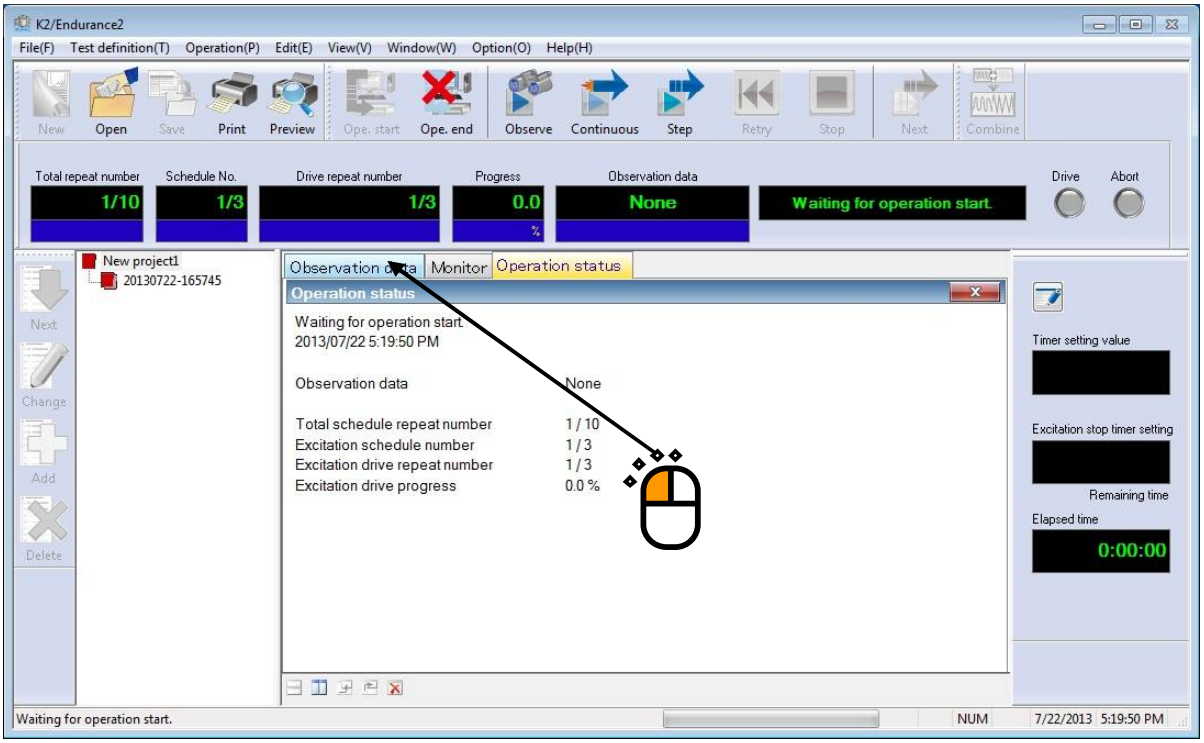
＜Step2＞

Screen as shown below is displayed.

On the operation status panel, various conditions that is set test definitions such as [Total repeat number], [Schedule number], [Drive repeat number], and [Progress] and digest of operation status are displayed.

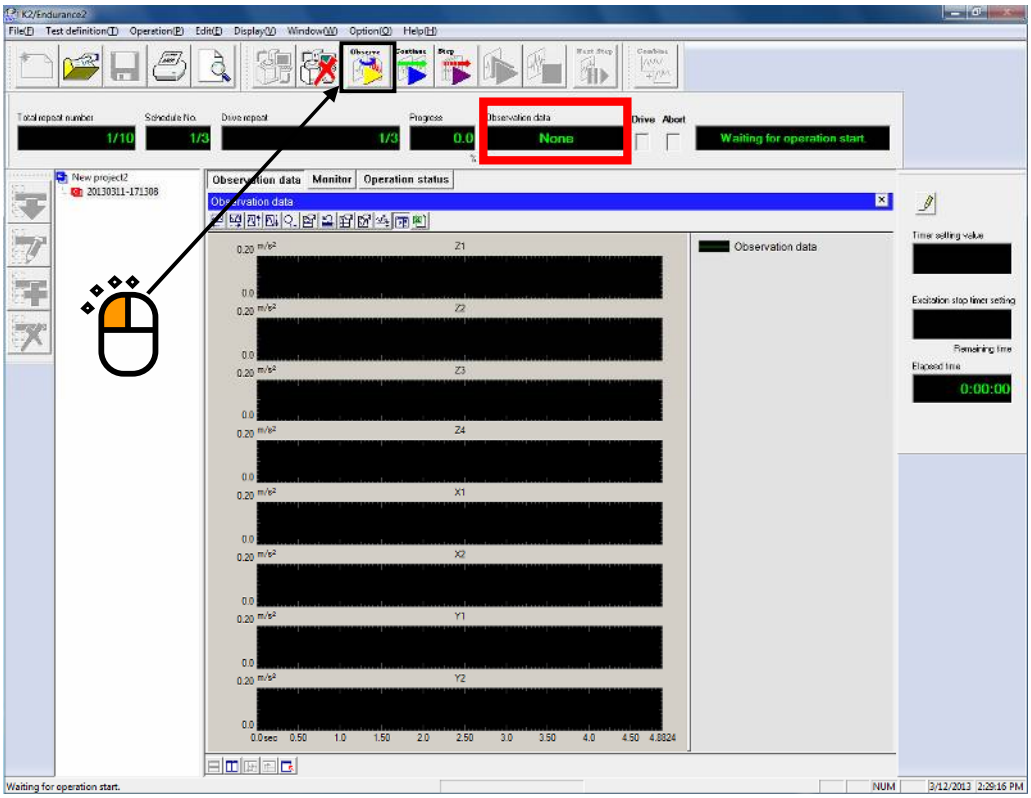


Press [Observation data] tab.

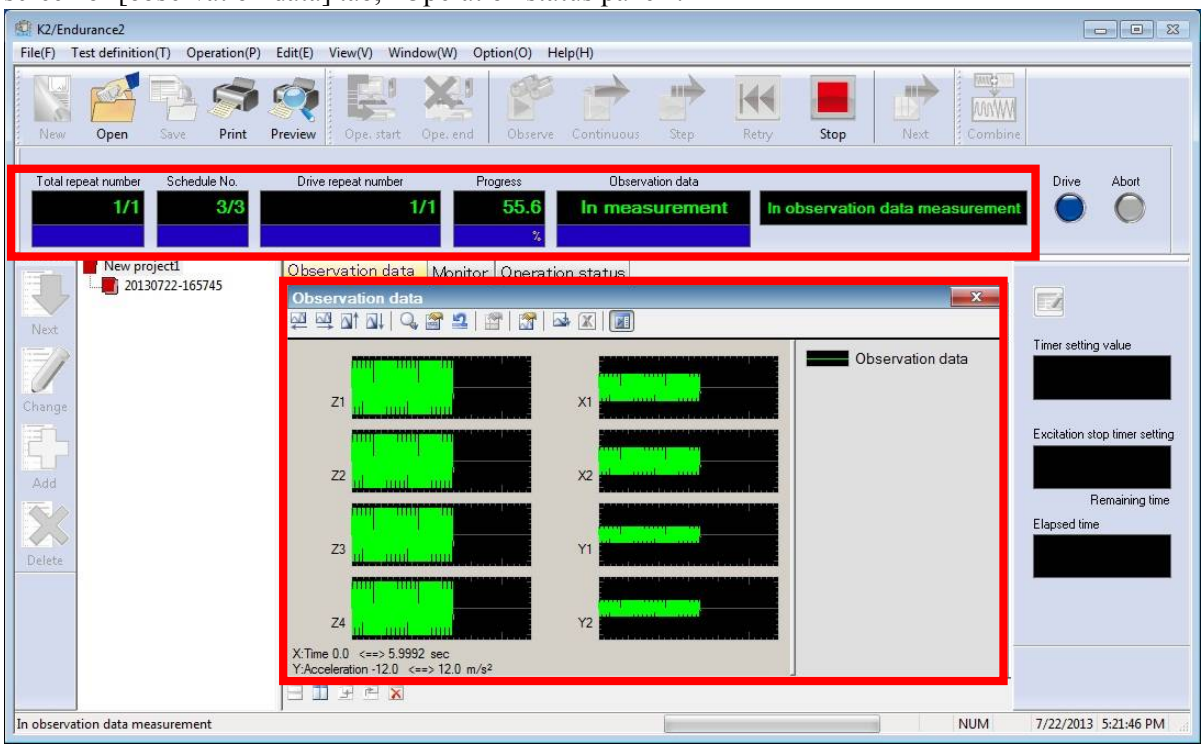


＜Step3＞

To start measurement of observation data, press [Observation data measurement start] button. Measurement of observation data can be executed from “Menu→Operation control→Observation data measurement start” as well.

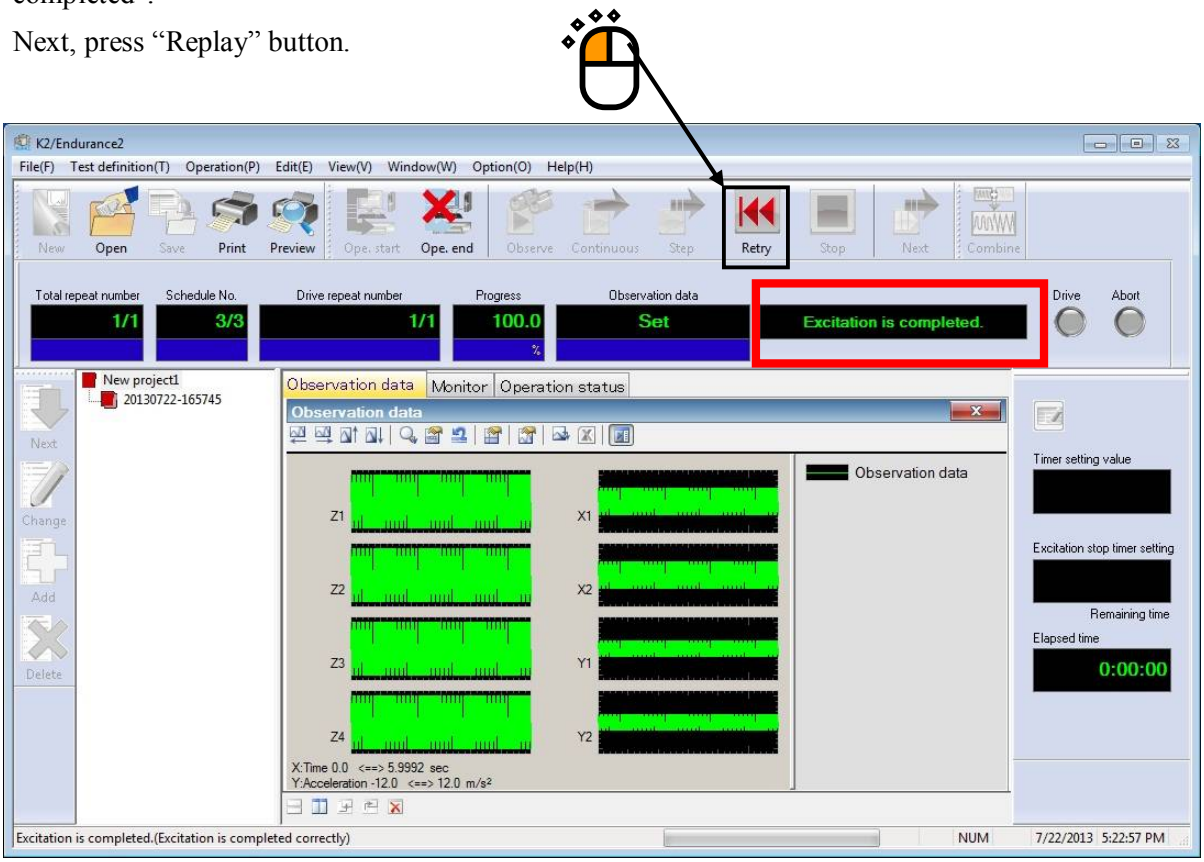


The information of observation data during measuring observation data can be confirmed on graph screen of [observation data] tab, “Operation status panel”.



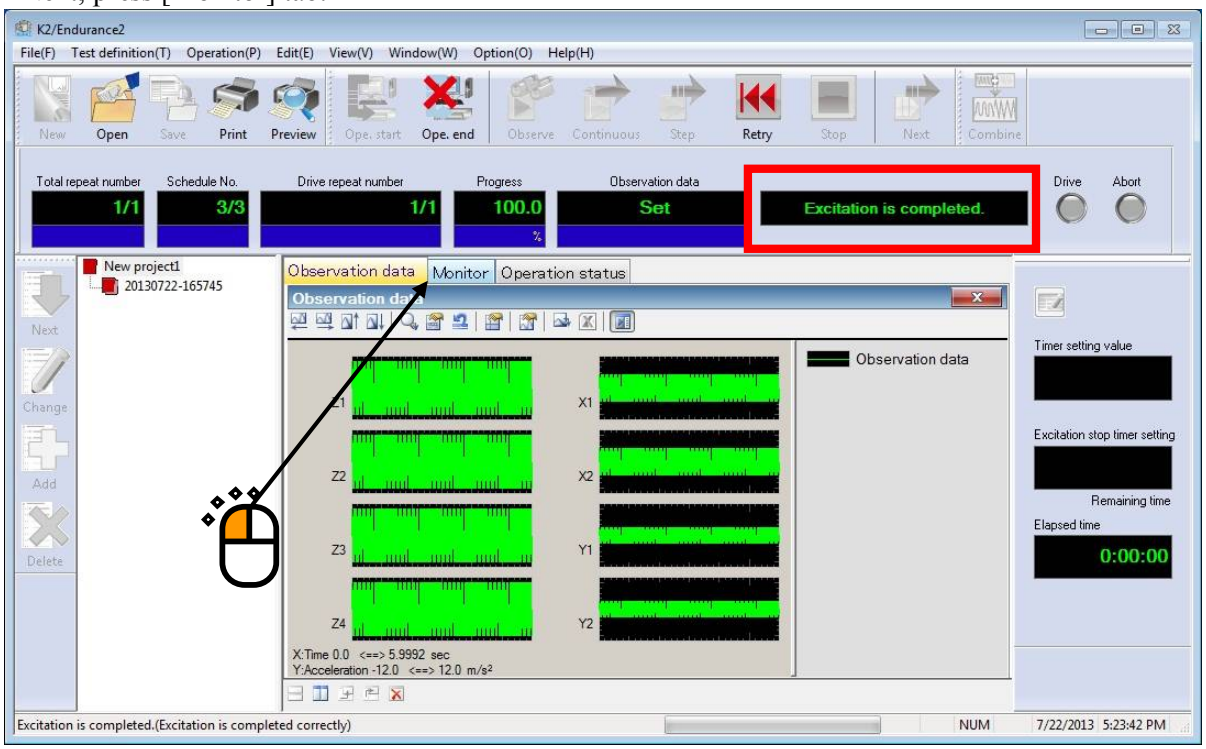
When measurement of observation data is finished, the system will be set to the state for “excitation is completed”.

Next, press “Replay” button.



Now, the system is set to the state for “Waiting for excitation”

Next, press [Monitor] tab.

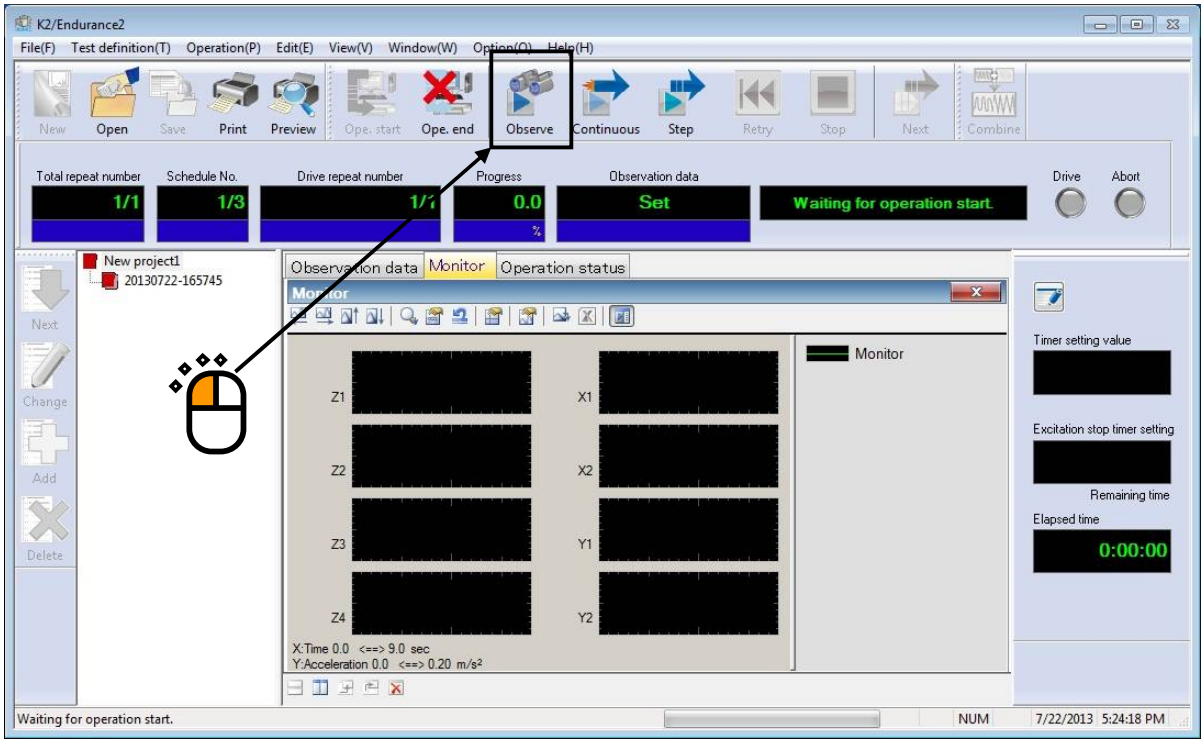


＜Step4＞

In this example, continuous excitation is operated.

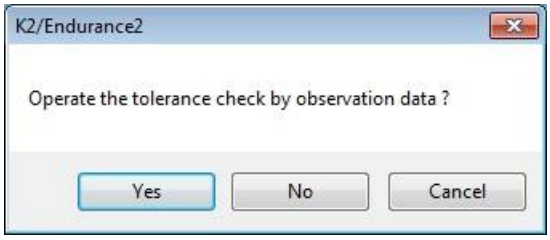
To start continuous excitation, press “Continuous excitation start” button.

Start of continuous excitation can be executed from “Menu→Operation control→Continuous excitation start” as well.

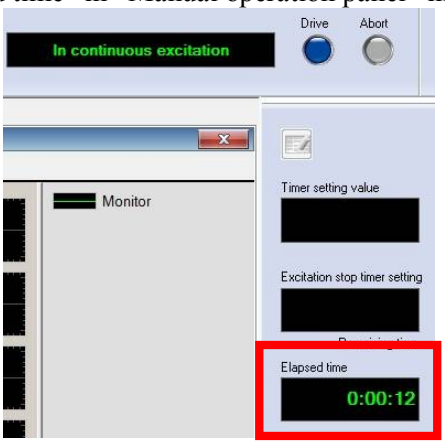


Message as shown below is displayed.

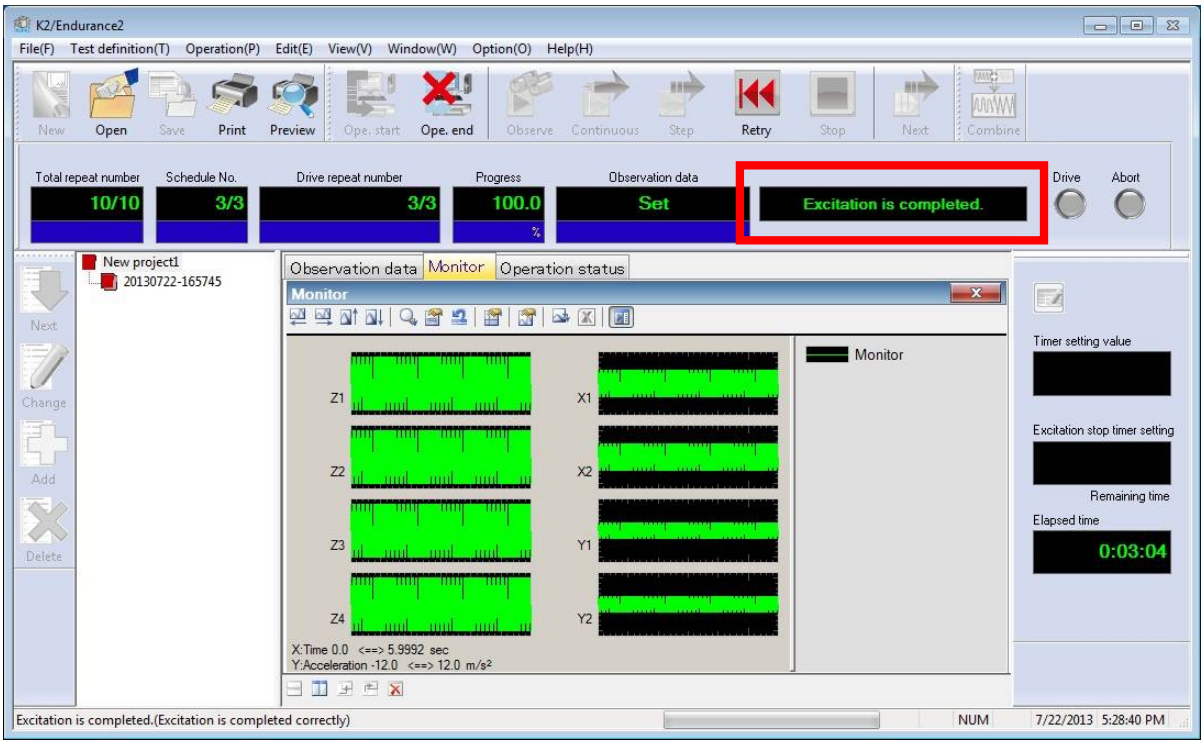
In this example, select “Yes”.



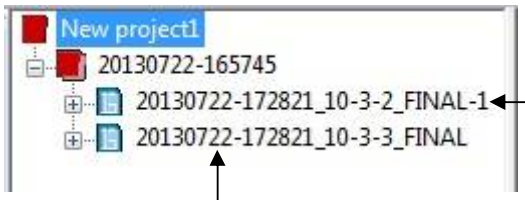
During continuous excitation, elapsed time since when continuous excitation started is displayed in real-time on “Elapsed time” in “Manual operation panel” in the right side.



The screen below appears when the test finishes without response waveform having trouble with "Tolerance level" and "Latitude" which were set in"Input channel" of test definition.



At excitation stop, graph data file is saved following "Save the data at excitation stop and data 1 time before from excitation stop" which is set in test definition "Data save condition" in "Project tree".



Graph data of drive before 1 time from excitation stop is saved.
In this example, graph data of
・Total repeat number 10 / 10
・Schedule repeat number 3 /3
・Drive repeat number 2 / 3
is saved.

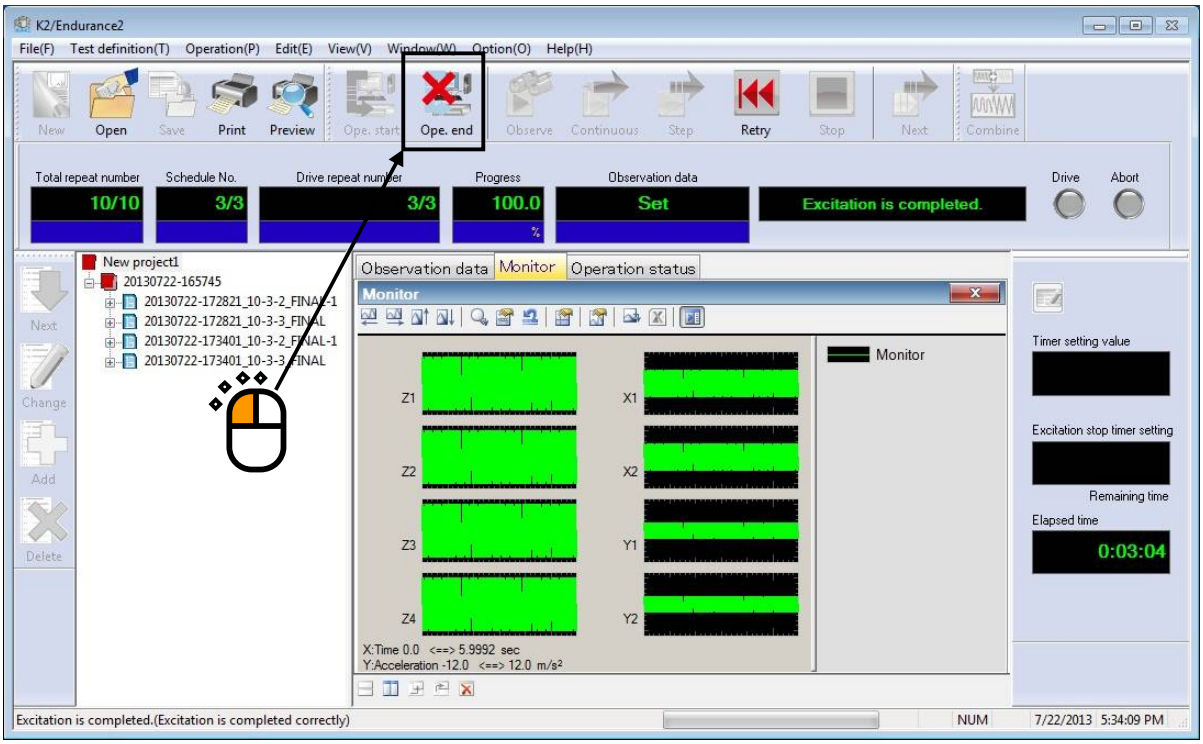
Graph data at excitation stop is saved.
Graph data of
・Total repeat number 10 / 10
・Schedule repeat number 3 / 3
・Drive repeat number 3 / 3
is saved.

＜Step5＞

Finish the test.

To finish the test, press “Operation end” button.

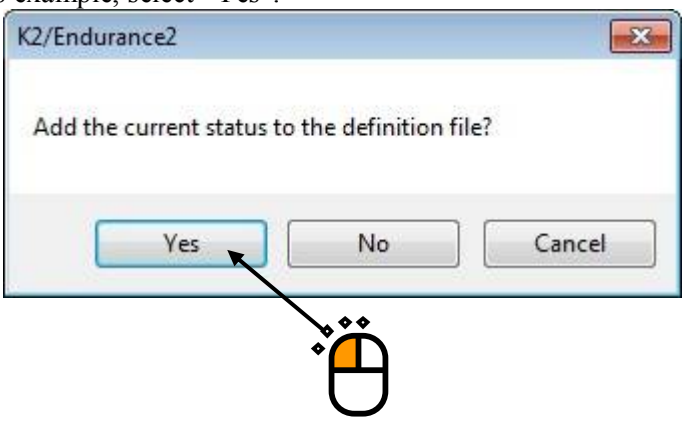
Operation end can be executed from “Menu→Operation control→Operation end” as well.



To add current state into definition file, select “Yes”.

Not to add, select “No”.

In this example, select “Yes”.

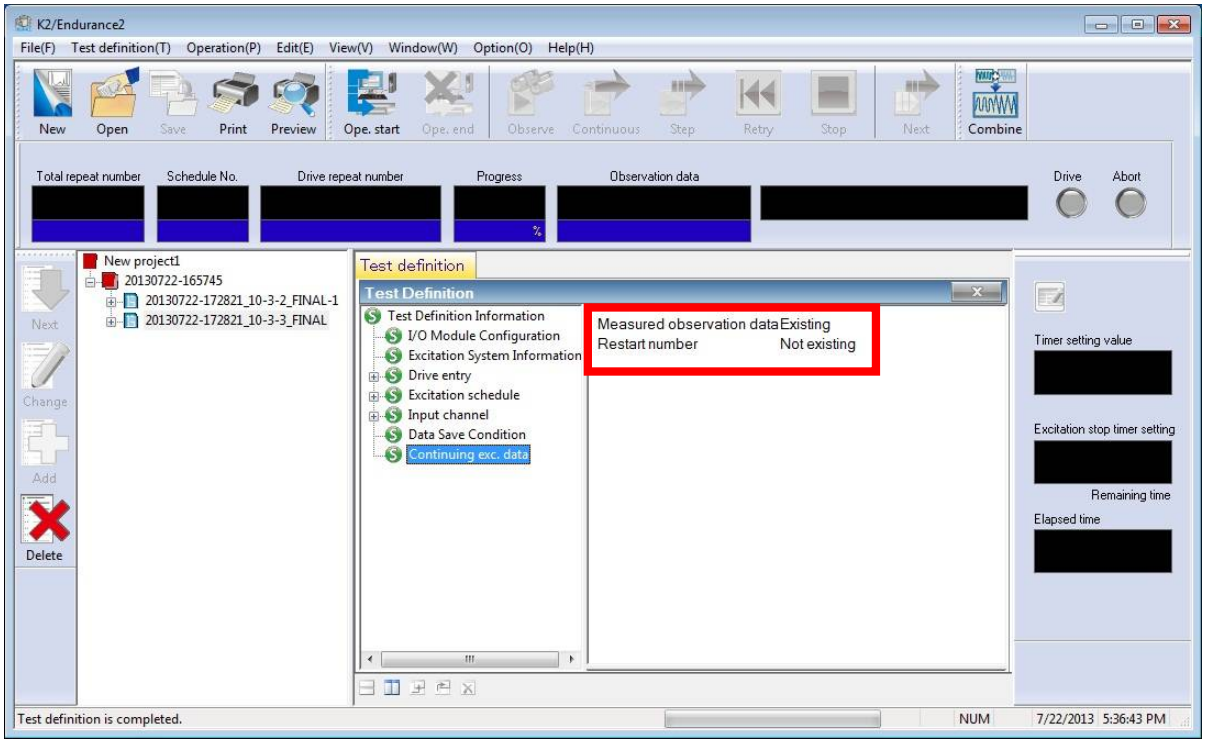


The screen is switched from operation mode into definition mode.

[Continuing excitation data] is saved on the bottom in the test definition.

In [Continuing excitation data], obtained “Observation data” is saved.

Saved observation data can be reused at next test operation.



This is the end of basic operation.

＜Complement: about continuing excitation data＞

Please refer to “4.6 Continuing excitation data” in this manual about continuous excitation data.

Chapter 4 Test Definition

4.1 Outline

In this system, the series of necessary information to operate a test is called ‘Test’.

It is necessary to define a ‘Test’ at first for the test operation when a specified test is wanted to be operated.

Also, to operate ‘Test’ definition, drive data needs to be created in K2BMAC beforehand.

Table.4-1 Information to be defined

Setting Information	
(1) I/O Module Configuration	○
(2) Excitation System Information	○
(3) Drive Entry	○
(4) Excitation Schedule	○
(5) Input Channel	○
(6) Data Save Condition	○
(7) Continuing excitation Data	△

○ : Information that must be defined

△ : Information that is saved in test definition at operation end as necessary

In ENDURANCE2, information of ‘Test’ completely defined is to be controlled in project window and saved in a file as a specified format of ‘Test file’.

Test operation can be executed by loading the file because the information of ‘Test’ defined beforehand is saved as a ‘Project’.

Table 4-1 For “(1) I/O Module Configuration Information”, when project is newly created in ENDURANCE2, information of “Module Configuration Information” from “Menu> Option> Environment setting” is automatically loaded into test definition.

Figure 4-1 That shows setting screen of “Excitation system information”.
Excitation system information is set when project is newly created.
As BMAC and ENDURANCE2 refer to drive data in ENDURANCE2 which is created in BMAC, both application have link relationship.
Therefore, same excitation system information as one defined in BMAC needs to be set in ENDURANCE2.

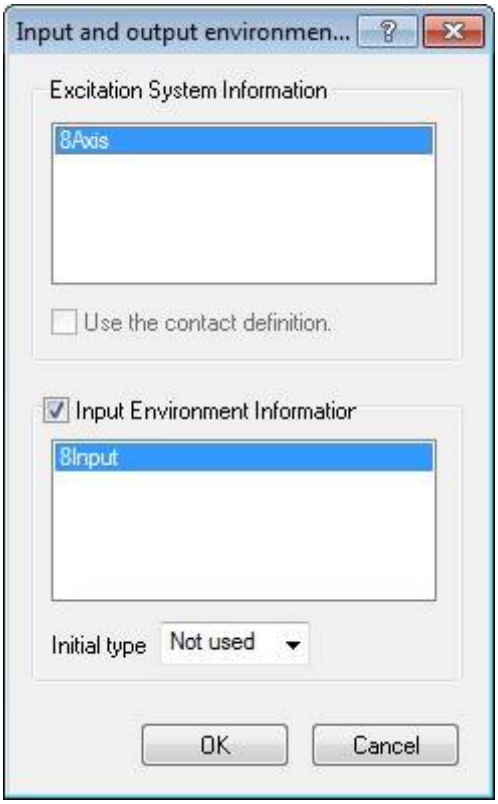
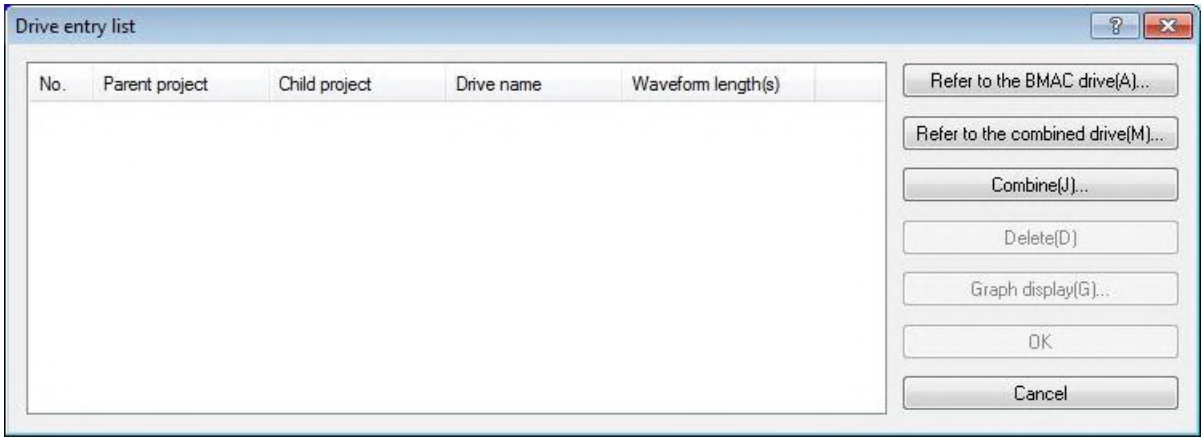


Figure 4-1 ENDURANCE2 Excitation system information Setting screen

4.2 Drive Entry

Drive data beforehand created in BMAC is set.



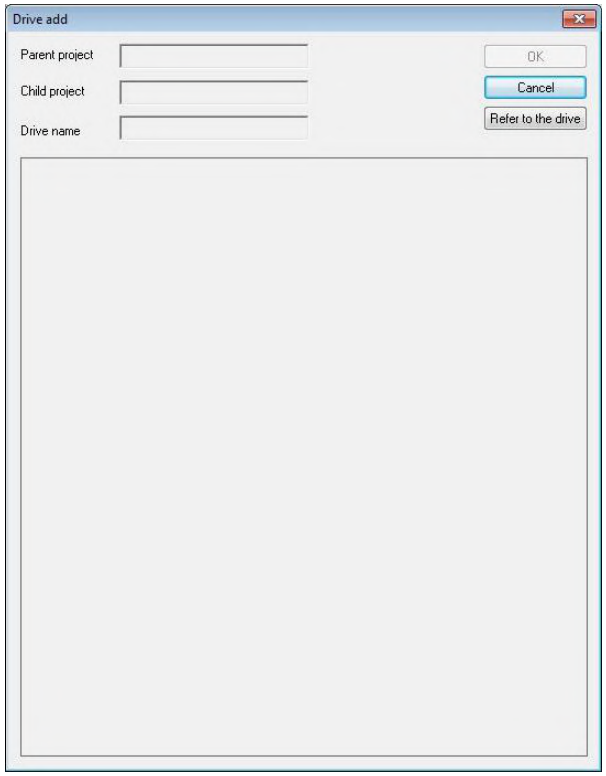
[Refer to BMAC drive]	The screen to refer to drive created in BMAC is opened.
[Refer to combined drive]	“Combined drive list” screen is displayed.
[Combine]	“Drive combine” screen to combine drive is opened.
[Delete]	The selected drive entry is deleted from registration.
[Display graph]	The graph of selected drive entry is displayed.
[OK]	Drive entry list is decided.
[Cancel]	The setting is cancelled.

4.2.1 Refer to BMAC drive

Refer to drive beforehand created in BMAC.

4.2.1.1 Drive add

The screen below is displayed when “Refer to BMAC drive” button is pressed at “Drive entry list” screen.



[Refer to drive] “Select drive” screen is displayed.

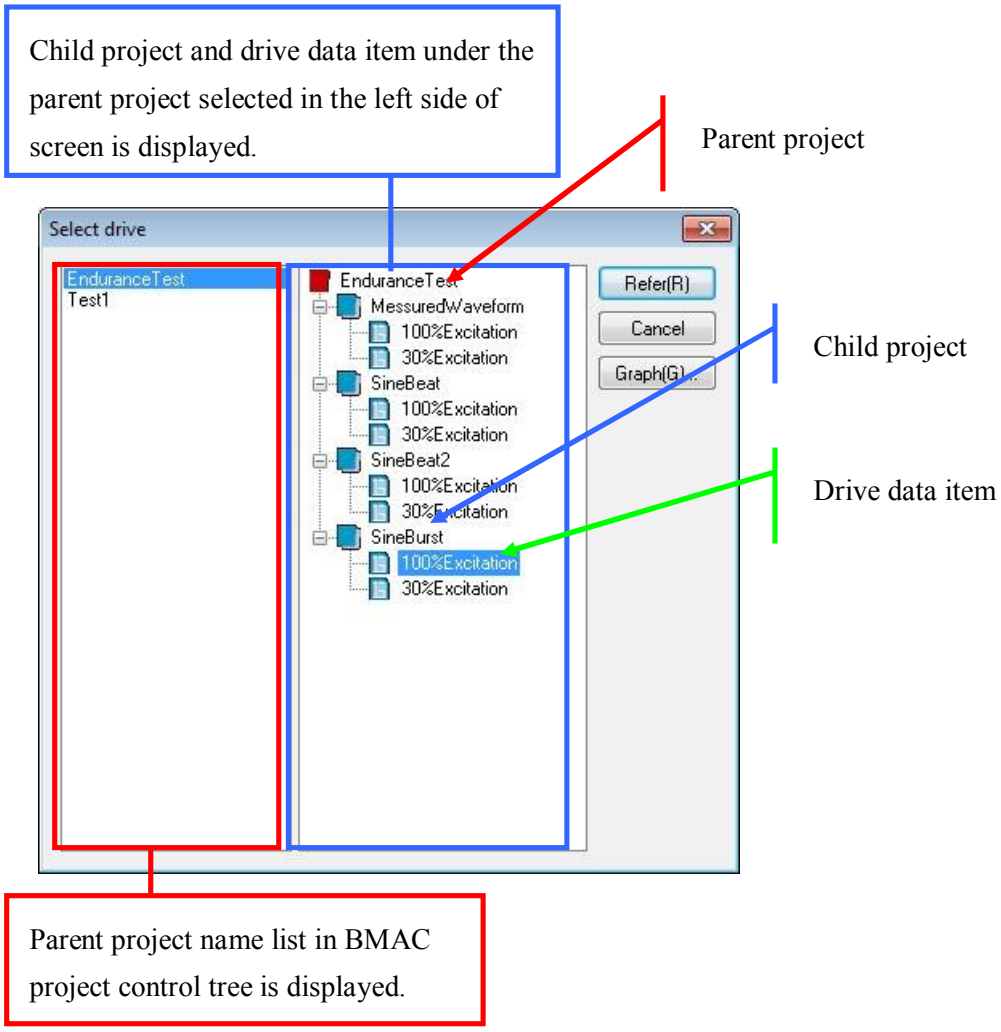
[OK] Drive to be referred is decided.

[Cancel] The setting is cancelled.

When drive is referred, on the list of “Parent project”, “Child project”, “Drive name”, BMAC Parent project name, Child project name and drive name are displayed.

4.2.1.1.1 Drive select

When “Refer to drive” button is pressed at “Drive add” screen, screen below is displayed.



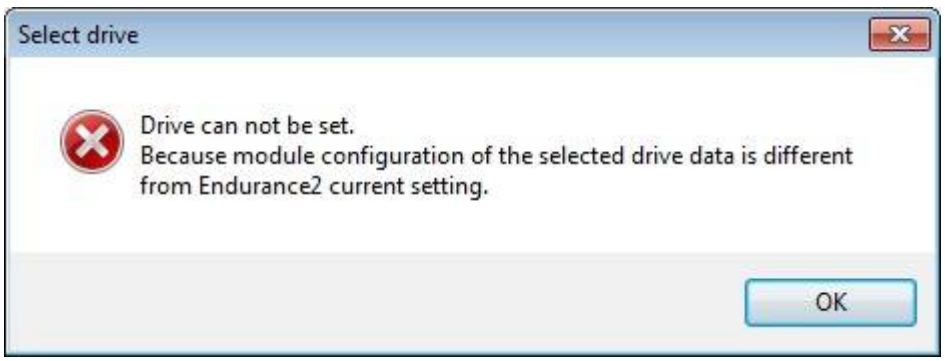
[Refer] Drive to be referred is decided.

[Display graph] The graph of selected drive is displayed.

[Cancel] The setting is canelled.

*About error message displayed when refer button is pressed

Following message content displayed on the screen, please confirm definition of BMAC and ENDURANCE2.



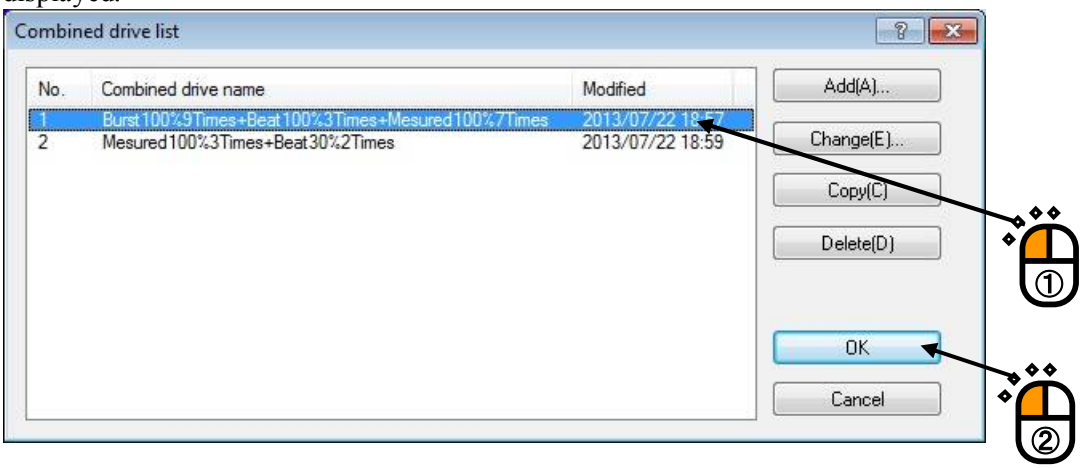
4.2.2 Refer to combined drive

Combined drive beforehand created is referred.

Please refer to “Chapter 6 Combined drive” in this book about how to create combined drive.

4.2.2.1 Combined drive list

When “Refer to combined drive” button is pressed at “Drive entry list” screen, screen below is displayed.



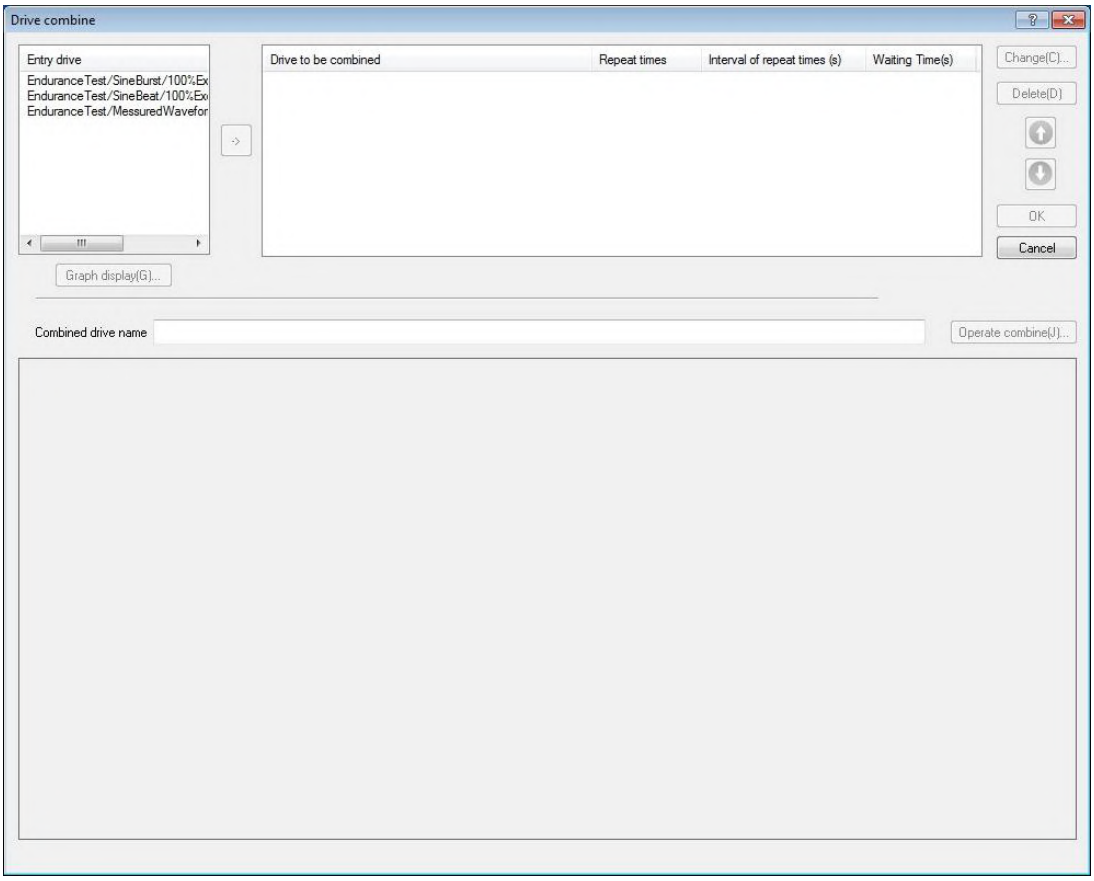
[OK]	Combined drive is decided. Selected combined drive is added to the screen of “Drive entry list”.
[Cancel]	The setting is cancelled.

4.2.3 Combine

Different drive created in BMAC can be combined.

For example, it's effective for seamless excitation of different drive.

When "Combine" button is pressed at "Drive entry list" screen, screen below is displayed.



[－＞] The selected "Entry drive" is added to "Drive to be combined".
When it is added, "Combine schedule setting" screen for setting "Repeat times, repeat interval and waiting time" is displayed.

[Correction] "Combine schedule setting" screen is displayed and combine schedule is corrected.

[Delete] The selected "Drive to be combined" is deleted.

[Up][Down] The selected order of drive to be combined is corrected.
Combine process of drive is operated in order of registration.

[Display graph] The graph of the selected "Entry drive" is displayed.

[Operate combine] Following the "Combine schedule setting (Repeat times, repeat interval and waiting time)", on the line of "Drive to be combined", drive combine is operated.

[OK] Combined drive which was operated "Operate combine" is added to "Drive entry list" screen.

[Cancel] The setting is cancelled.

Example of combining drive is shown below in the section 4.2.3.

<Assumption condition>

・ Drive below shall be set in the test definition “Drive entry list” screen

No.	Parent project name	Child project name	Drive name
1	EnduranceTest	SineBurst	100%Excitation
2	EnduranceTest	SineBeat	100%Excitation
3	EnduranceTest	MeasuredWaveform	100%Excitation

<Basic operation>

1 Combine No.3 drive three times seamlessly.
(Repeat times＝3 times, Repeat interval＝0 second, Waiting time＝0 second)

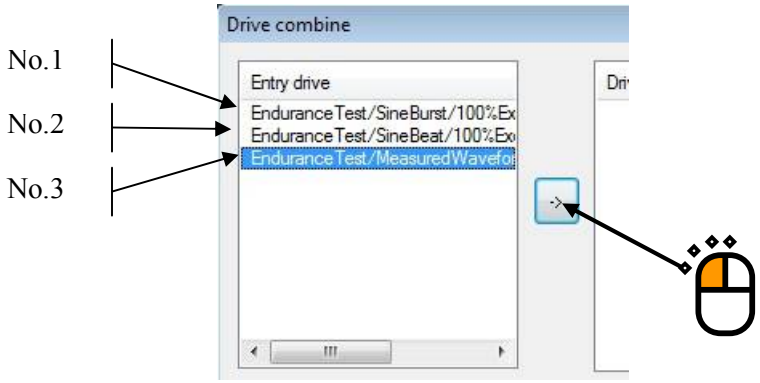
2 Combine No.2 drive three times with 1 second joint and 3 seconds waiting time until combining next drive.
(Repeat times＝3 times, Repeat interval＝1 second, Waiting time＝3 second)

3 Use No.1 drive without change.
(Repeat times＝1 times, Repeat interval＝0 second, Waiting time＝0 second)

4 Combine 2 drive next after 1 drive, and 1 drive next after 2 drive.

＜Step1＞

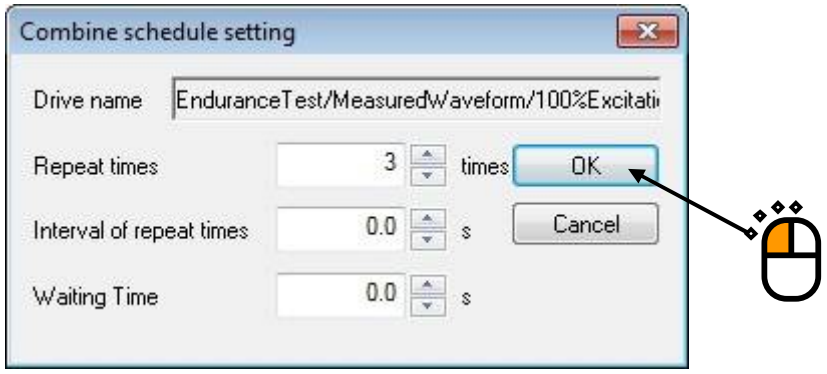
Select No3 drive “EnduranceTest/MeasuredWaveform/100%Excitation” and press “－＞” button.



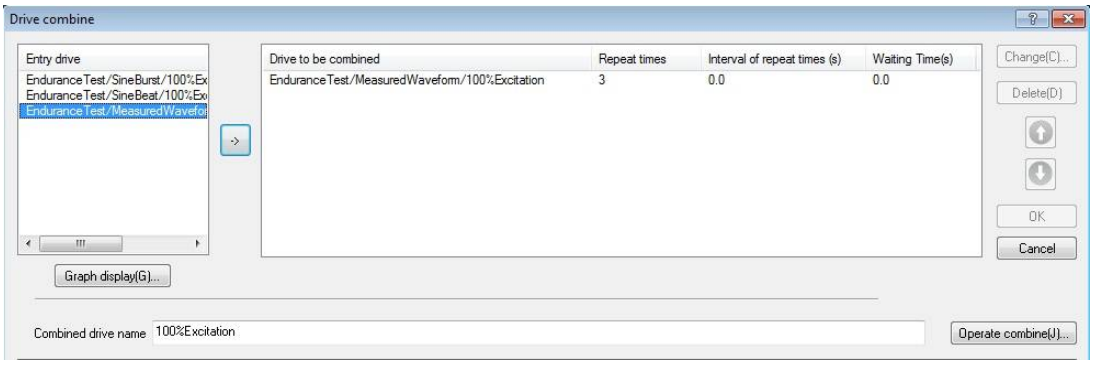
“Combined schedule” screen is displayed.

Operate <Basic operation>1.

Input 3 to “Repeat times” and press OK.

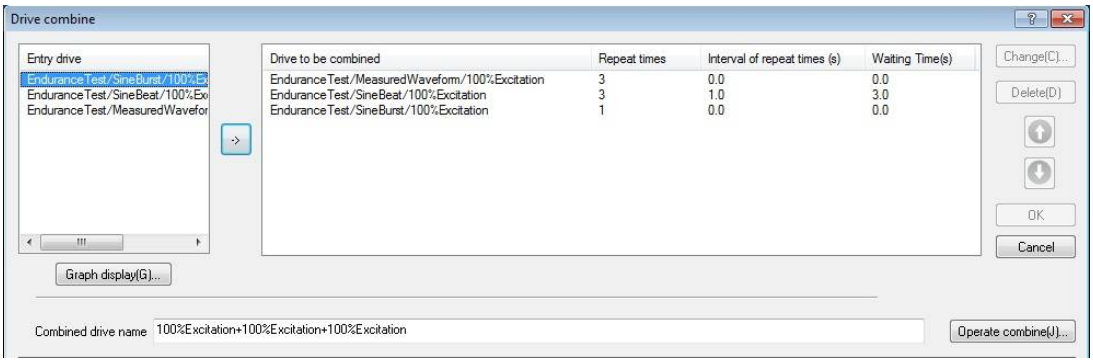


It is added to “Drive to be combined”.



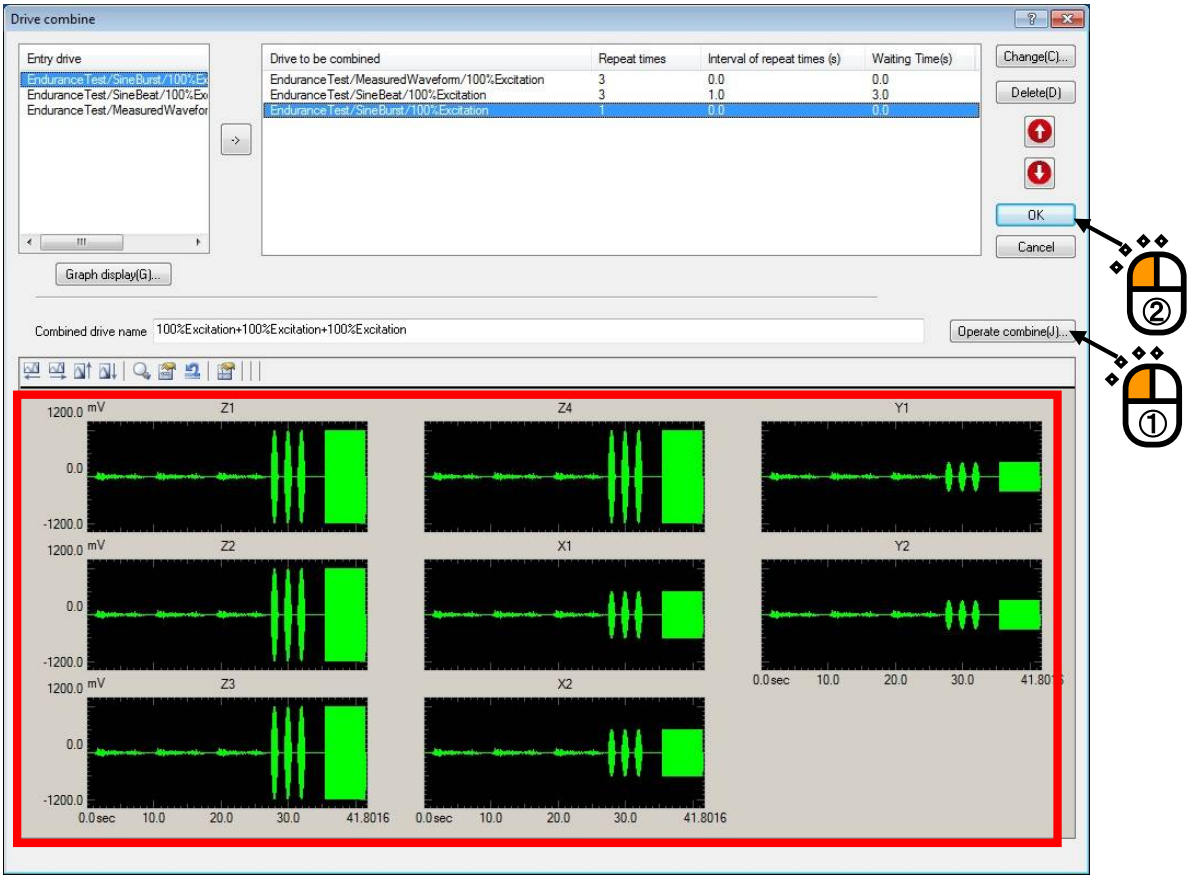
＜Step2＞

In the same way, repeat <Step2> and operate <Basic operation>2 and <Basic operation>3.

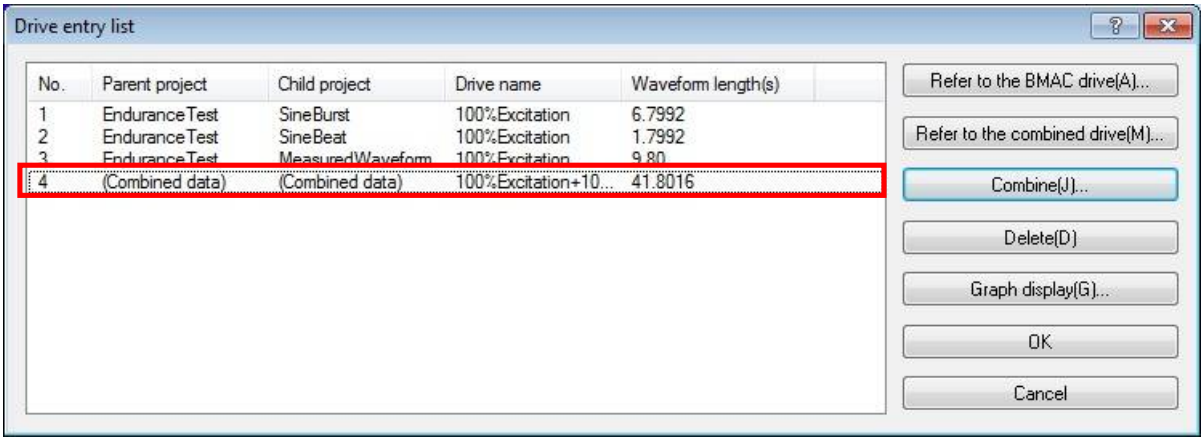


＜Step3＞

Next, when “Operate combine” button is pressed, combine process is operated and the graph of combined drive is displayed in graph display domain. After confirming the graph that intended drive is created, press [OK] button. (<Basic operation>4)



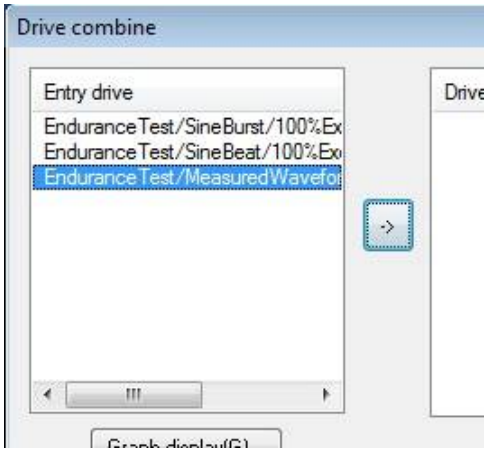
Combined drive is added to the test definition “Drive entry list” screen.



This is the end of <Basic operation>.

4.2.3.1 Entry drive

Drive which is set on “Drive entry list” on the calling screen is displayed.

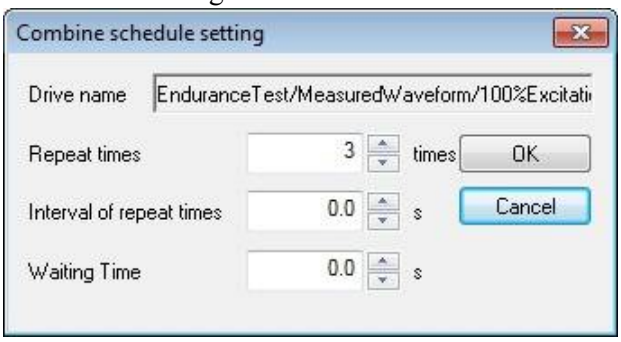


4.2.3.2 Drive to be combined

When drive to be combined is selected from “Entry drive” and [－＞] button is pressed, “Combined schedule setting” screen is displayed.

When “Repeat times, repeat interval and waiting time” is input and settled in the “Combined schedule setting” screen, selected “Entry drive” is added to “Drive to be combined” list.

“Combine schedule setting” screen is shown below.



4.2.3.2.1 Repeat times

Number of times that selected “Entry drive” is repeated to combine is specified.

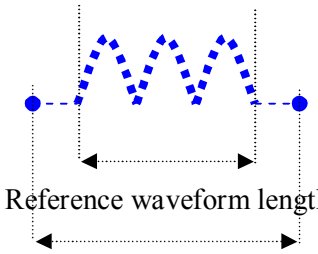
4.2.3.2.2 Repeat interval

When “Repeat times” is set to more than 2 times, number of seconds of repeated drive interval to combine is specified.

To combine drive seamlessly, set 0 second.

For example, there shall be “Drive to be combined : A” as shown below.

Drive to be combined : A



Number of lines L/ Frequency range fmax/ 2 seconds waveform is added to drive waveform backward and forward.

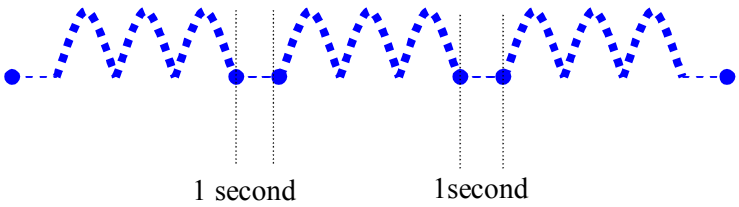
For example, when L=3200 and fmax=400, 4 seconds waveform is added backward and forward. This is not unnecessary waveform but necessary in control theory.

Combine examples are shown below as Example1) and Example2).

Example 1)

Repeat times 3 times

Repeat interval 1 second



Interval of reference waveform length is 1 second.

Example 2)

Repeat times 2 times

Repeat interval 0 second

Interval of reference waveform length is 0 second.

4.2.3.2.3 Waiting time

Number of seconds of zero reference interval after reference waveform length of drive to be combined to combine is specified.

However, when only one drive to be combined is added and when some are set, waiting time of the last drive to be combine is ignored.

For example, “Drive to be combined: A” and “Drive to be combined: B” as shown below shall be set.

Drive to be combined：A

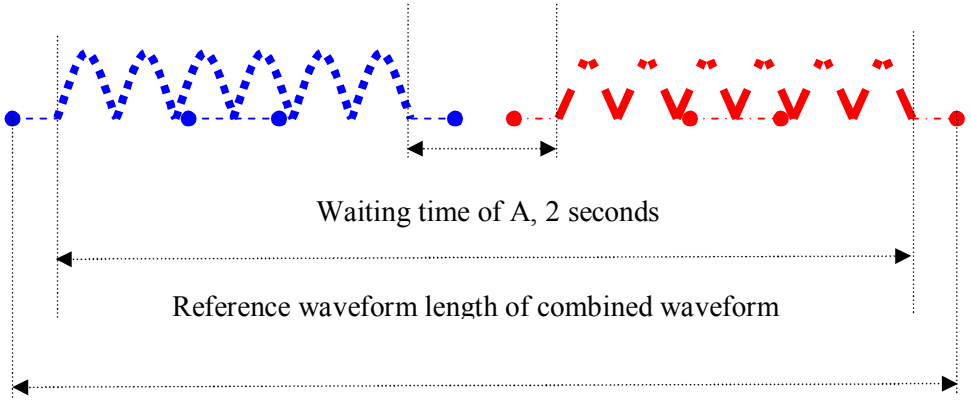
Drive to be combined：B

Combine example is shown below as Example1).

Example 1)

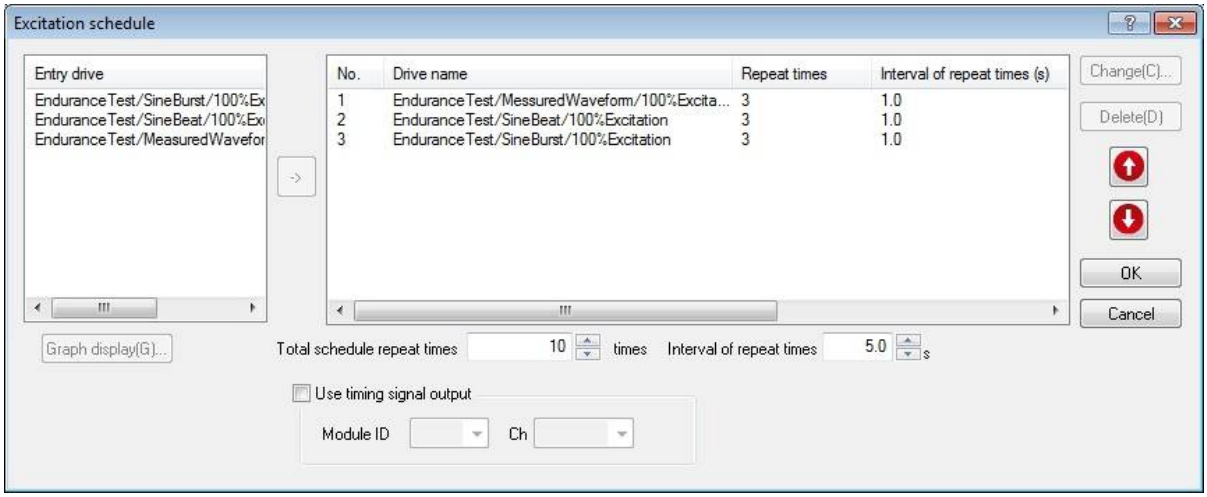
Drive to be combined：A		Drive to be combined：B	
Repeat times	2 times	Repeat times	2 times
Repeat interval	0 second	Repeat interval	0 second
Waiting time	2 seconds	Waiting time	2 seconds

*Waiting time of B, 2 seconds is ignored.



4.3 Excitation Schedule

Scheduling for excitation of drive which is set in “Drive entry” definition.



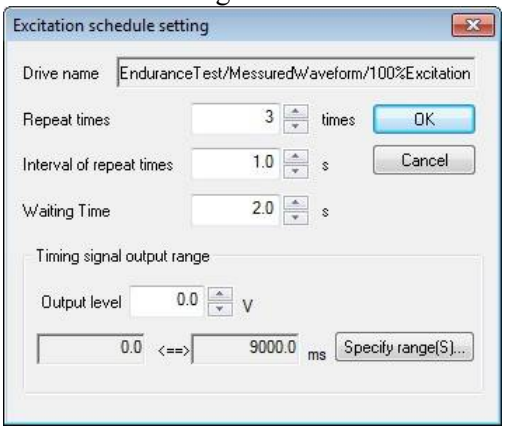
[－＞]	“Excitation schedule setting” screen is displayed. Selected “Entry drive” excitation schedule is set and schedule is added to the scheduling list.
[Correction]	“Excitation schedule setting” screen is displayed and excitation schedule is corrected.
[Delete]	Selected schedule is deleted.
[Up][Down]	The selected order of schedule is corrected. Excitation is operated in order of schedule “No”.
[Display graph]	The Selected “Entry drive” graph is displayed.
[OK]	Excitation scheduling is decided.
[Cancel]	The setting is cancelled.

4.3.1 Excitation schedule setting

When drive to be scheduled is selected from “Entry drive” and [－＞] button is pressed, “Excitation schedule setting” screen is displayed.

At “Excitation schedule setting” screen, “Repeat times, Repeat interval and Waiting time” is input and decided, drive is added to the schedule list.

“Excitation schedule” setting screen is shown as below.



4.3.1.1 Repeat times

Number of times that selected drive is repeated is specified.

4.3.1.2 Repeat interval

When “Repeat times” is set to more than 2 times, number of seconds of repeated drive interval for excitation is specified.

For seamless excitation of drive, set 0 second.

4.3.1.3 Waiting time

Number of seconds of zero reference interval after reference waveform length of drive to be scheduled is specified.

However, when only one drive is added to schedule list and when some are set, waiting time of the last drive is ignored.

4.3.1.4 Output range of timing signal

Output level of timing signal during drive excitation is specified.

Output range of timing signal during drive excitation is specified.

To enable output of timing signal during drive excitation, check “Output timing signal” on “Excitation schedule” screen.

For more information, please refer to “4.3.3 Output timing signal” to be discussed later.

4.3.2 Total schedule repeat times

Total schedule repeat times is specified.

Total schedule means all items which are set on the schedule list.

- Waiting time

  When “Total schedule repeat times” is set to more than 2 times, number of seconds of zero reference interval after total schedule end is specified.

4.3.3 Output timing signal

To output timing signal, check the item of “Output timing signal”.

- Module ID

  Module ID for outputting timing signal is set.

- Ch

  Channel for outputting timing signal is set.

※”Module ID” and “Ch” which are already set with output channel of shaker cannot be set.

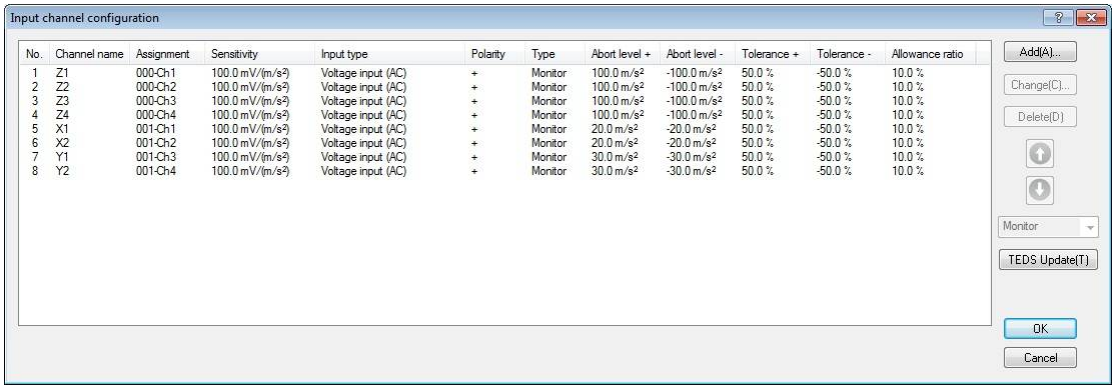
4.4 Input Channel

4.4.1 Outline

Input channel definition is operated.

In this system, input channel can be set as monitor channel.

In input channel definition, setting of abort level and tolerance level are operated.



[Add] A new input channel is added.
"Input channel element" screen is displayed.

[Change] The setting content of selected input channel is changed.

[Delete] The selected input channel is deleted from registration.

[Up][Down] The selected order of input channels is corrected.
The registered order has not much meaning than the order of graph display.

[Not used] The channel is not used.

[Monitor] The channel is used as a monitor channel.

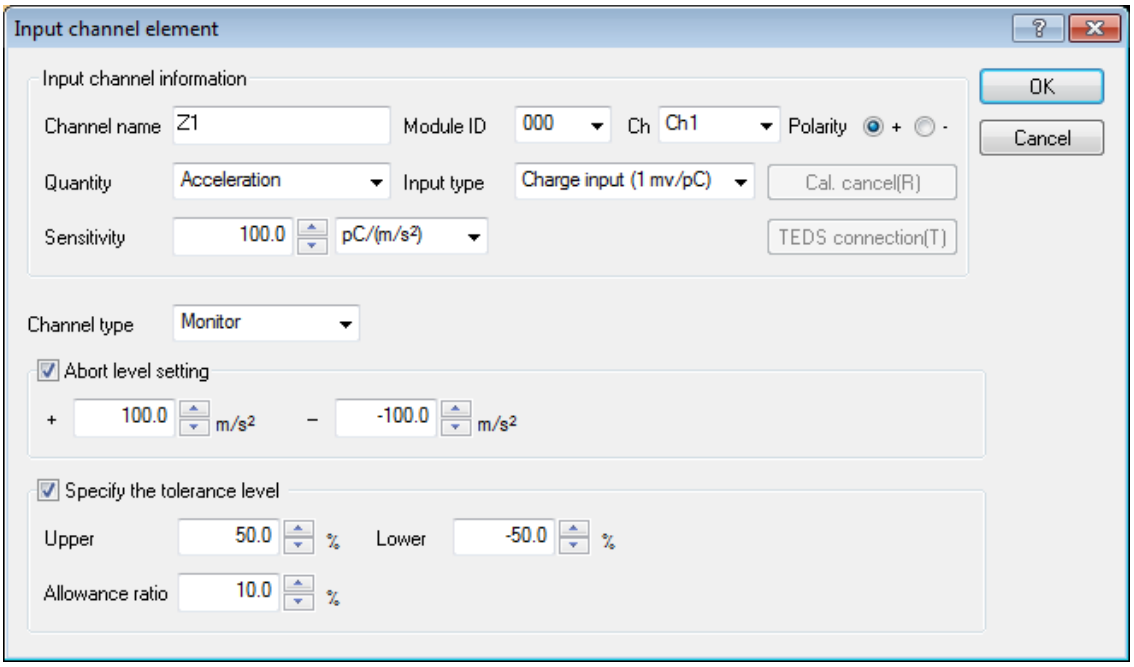
[TEDS Update] The input sensitivity is set from the connected TEDS corresponding IEPE sensor automatically. The function is enabled with the TYPEII hardware.

[OK] Input channel definition is decided.

[Cancel] The setting is cancelled.

4.4.2 Input channel element

Setting of input channel element is operated.



4.4.2.1 Input channel information

For information about input channel, please refer to separate volume “K2/K2Sprint Common Part Instruction Manual 3.4 Input Environment Information”.

4.4.2.2 Input channel type

For information about input channel, please refer to separate volume “K2/K2Sprint Common Part Instruction Manual 3.4 Input Environment Information”.

4.4.2.3 Specify abort level

Upper and lower limit value of abort level is specified.

When response waveform exceeds specified abort level, excitation is aborted.

4.4.2.4 Specify tolerance level

“Upper limit value”, “Lower limit value” and “Allowance ratio” of tolerance level is specified.

Tolerance data is created to observation data by ratio of upper and lower limit value of tolerance level specified in this process.

- Allowance ratio

  Allowance amount of deviance amount from tolerance is specified.

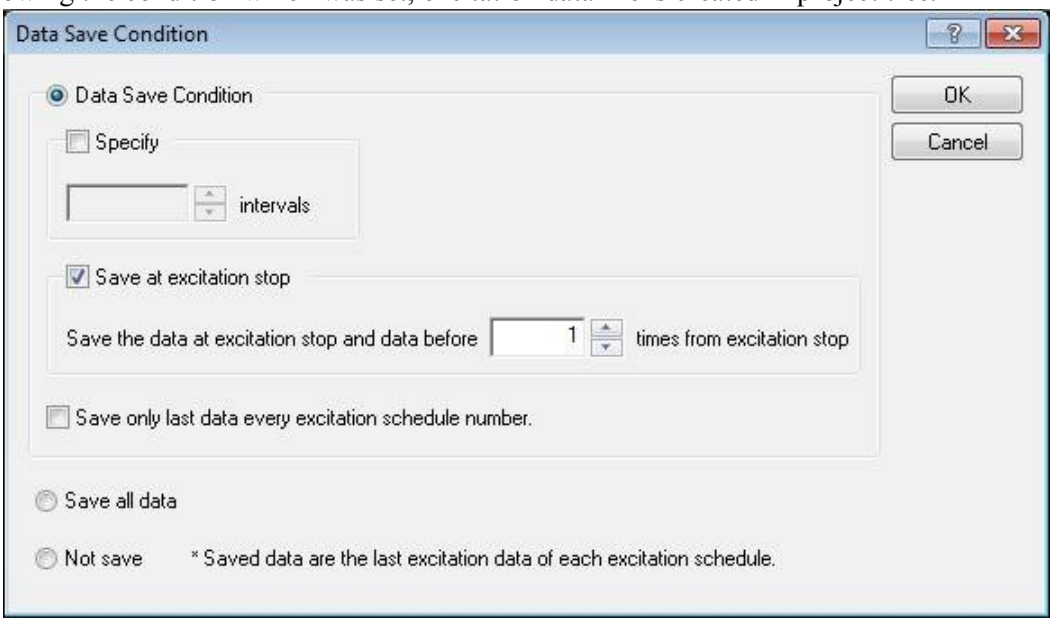
  When amount of deviance is over specified value, the test is aborted.

  Allowance ratio is percentage to reference waveform length.

4.5 Data Save Condition

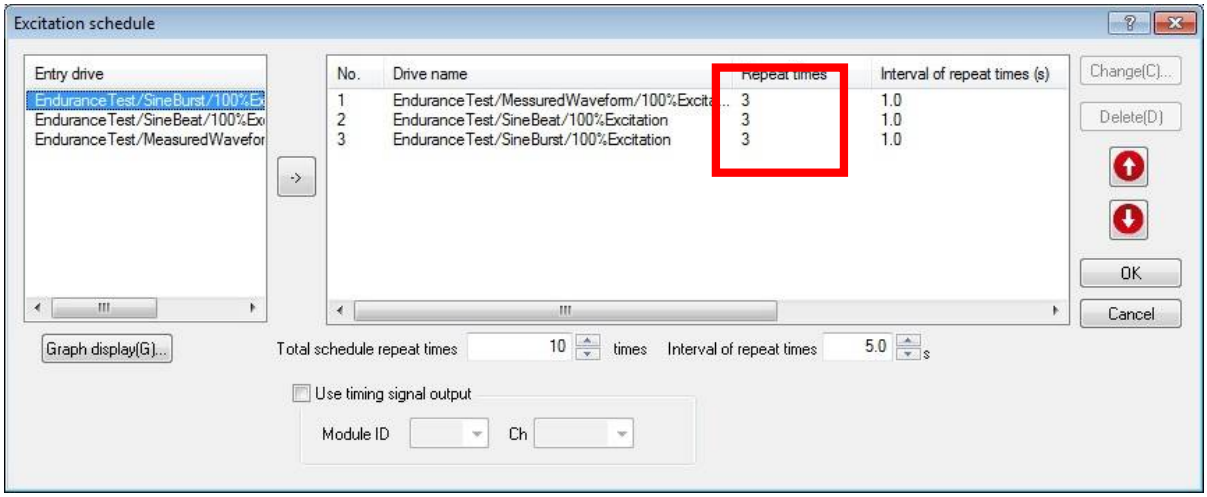
Data save condition is set.

Following the condition which was set, excitation data file is created in project tree.



※about data save unit

Saved data are the last excitation data of each excitation schedule.



4.5.1 Save condition

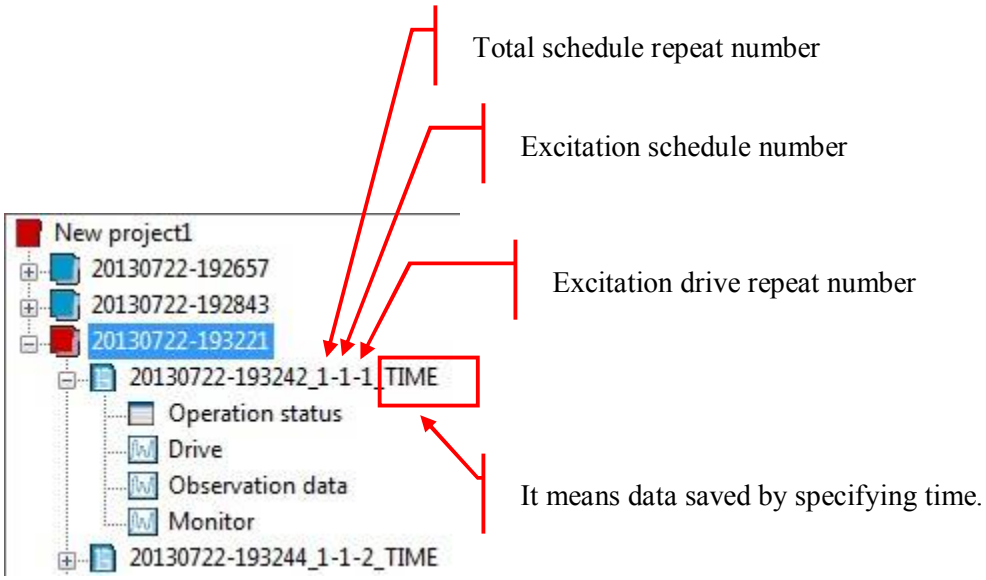
Data save condition is set.

4.5.1.1 Specify time

Data is saved by specifying time.

Data file is saved every specified time from the time excitation starts.

Data saved by “Specify time” is saved in project tree as shown below.

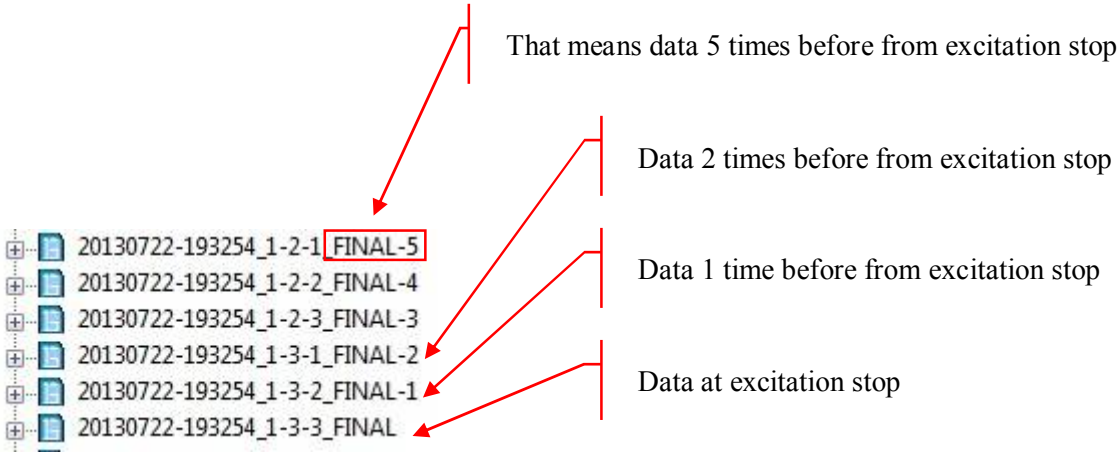


4.5.1.2 Save at excitation stop

Check when data should be saved at excitation stop.

Data at excitation stop and 1～5 times before from excitation stop can be saved.

Data saved by “Save at excitation stop” is saved in project tree as shown below.

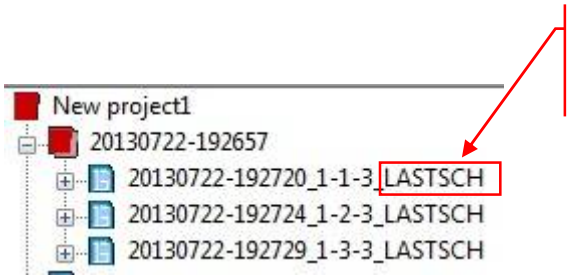


4.5.1.3 Save only the last data of excitation schedule number

Check when only the last data of excitation schedule number is saved.

For example, when repeat times of excitation schedule No.1 drive is set to 3 times, only the third data is saved.

Data saved by “Save only the last data of excitation schedule number” is saved in project control tree shown as below.

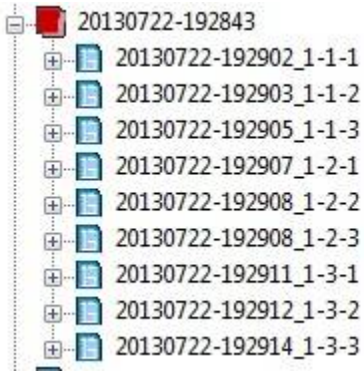


4.5.2 All save

This is selected to save all.

Data is saved at excitation stop.

Data saved by “All save” is saved in project tree shown as below.



4.5.3 Not save

This is selected not to save.

4.6 Continuing excitation Data

At operation end, data as shown below can be loaded into test definition and saved.

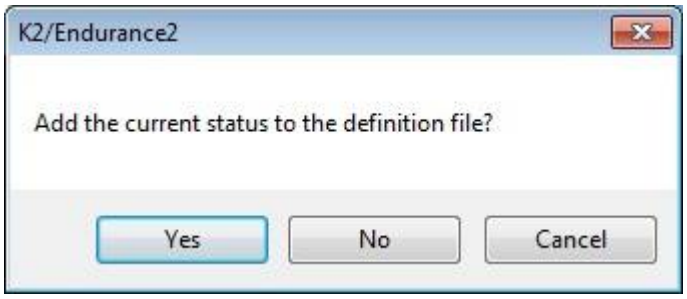
- Observation data
- Total schedule repeat number
- Excitation schedule number
- Excitation drive repeat number
- Elapsed time

These data are called continuing excitation data.

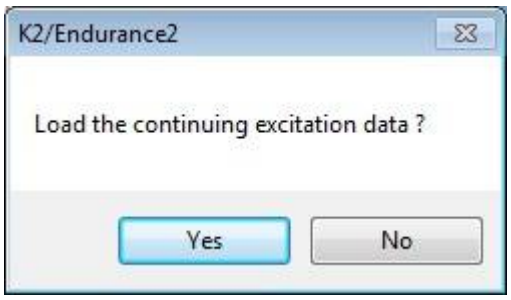
The test can be restarted from the start of excitation drive at the time it was aborted by loading continuing excitation data from test definition at restart of test operation.

The screen below is displayed at operation end of aborted test.

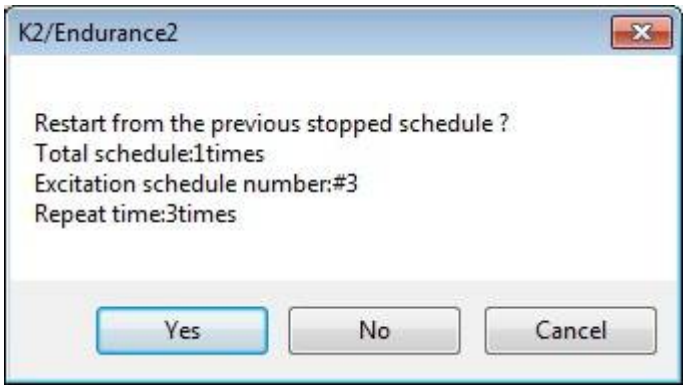
Press “Yes” when continuing excitation data needs to be added to definition file.



Press “Yes” when continuing excitation data needs to be loaded at operation start.



Press “Yes” in the case of restart from previous stopped schedule at excitation start.



Chapter 5 Test Operation

5.1 Difference of excitation type

- Observation data measurement

Reference data of observation tolerance function at operating continuous and step excitation is measured. Reference data are measured in all channels, but actually only data of channels checked in "Specify tolerance level" on input channel definition are used.

Also, regardless of total repeat times and drive repeat times at definition, excitation is operated one by one in order of drive defined in excitation schedule.

- Continuous excitation

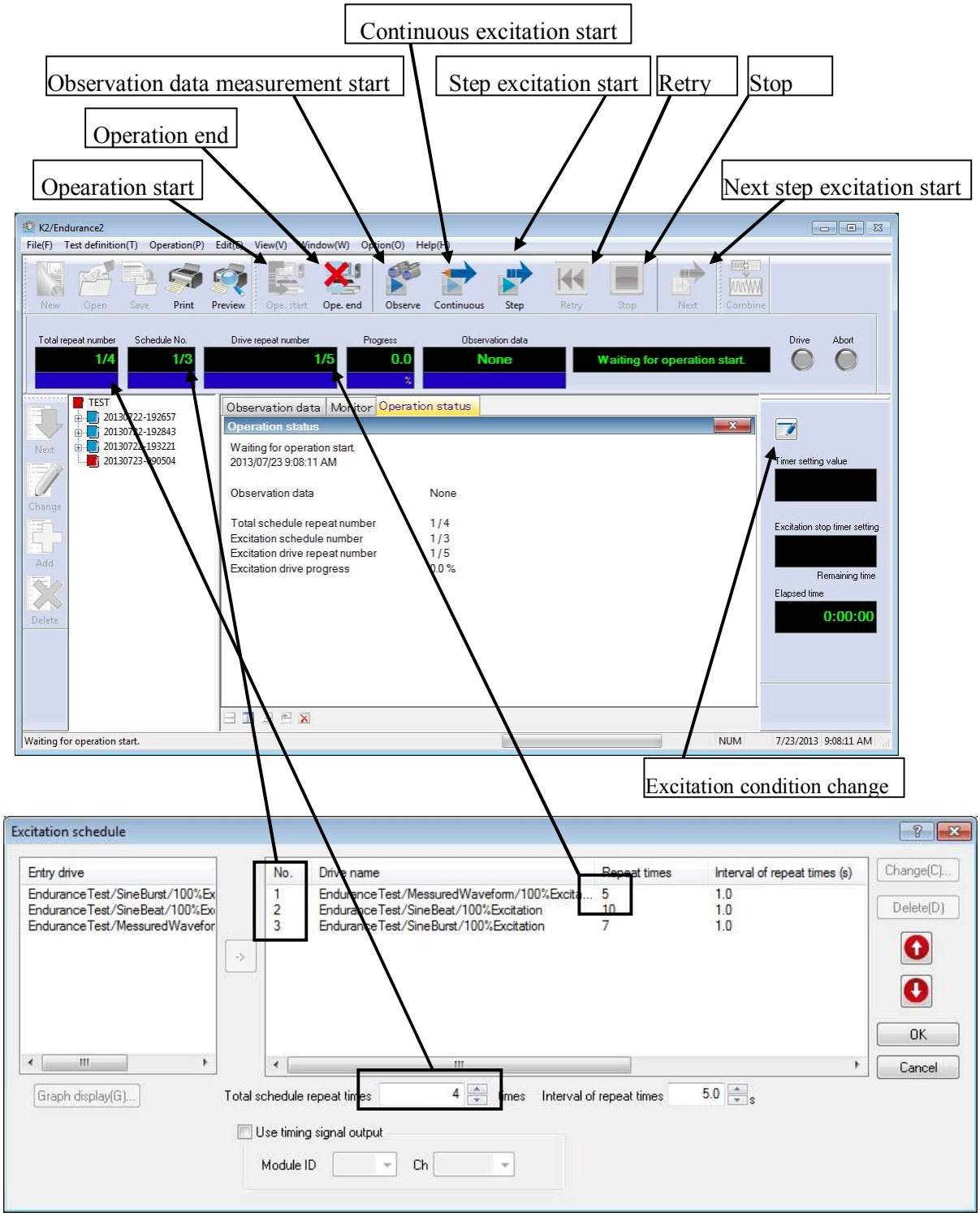
Excitation is operated following excitation schedule. Unless stop by manual or stop by abort or observation tolerance is operated, it does not become excitation stop state until all schedules are completed. Observation tolerance cannot be operated when observation data is not measured.

- Step excitation

In the same way as continuous excitation, when each schedule is completed and go on to next drive, it stops temporally. When next step button is pressed, excitation pause state is reset, and next step excitation is operated. (It does not stop temporally when each drive is repeated.)

5.2 Explanation about operation mode screen

When operation start button is pressed after definition is correctly completed, connection with K2 cabinet is operated. When connection with K2 cabinet is correctly completed, application comes to operation mode. Also, schedule number displayed in operation status panel corresponds to setting of excitation schedule at definition. Observation data measurement start button, continuous excitation start button and step excitation start button can be disabled by operation setting.



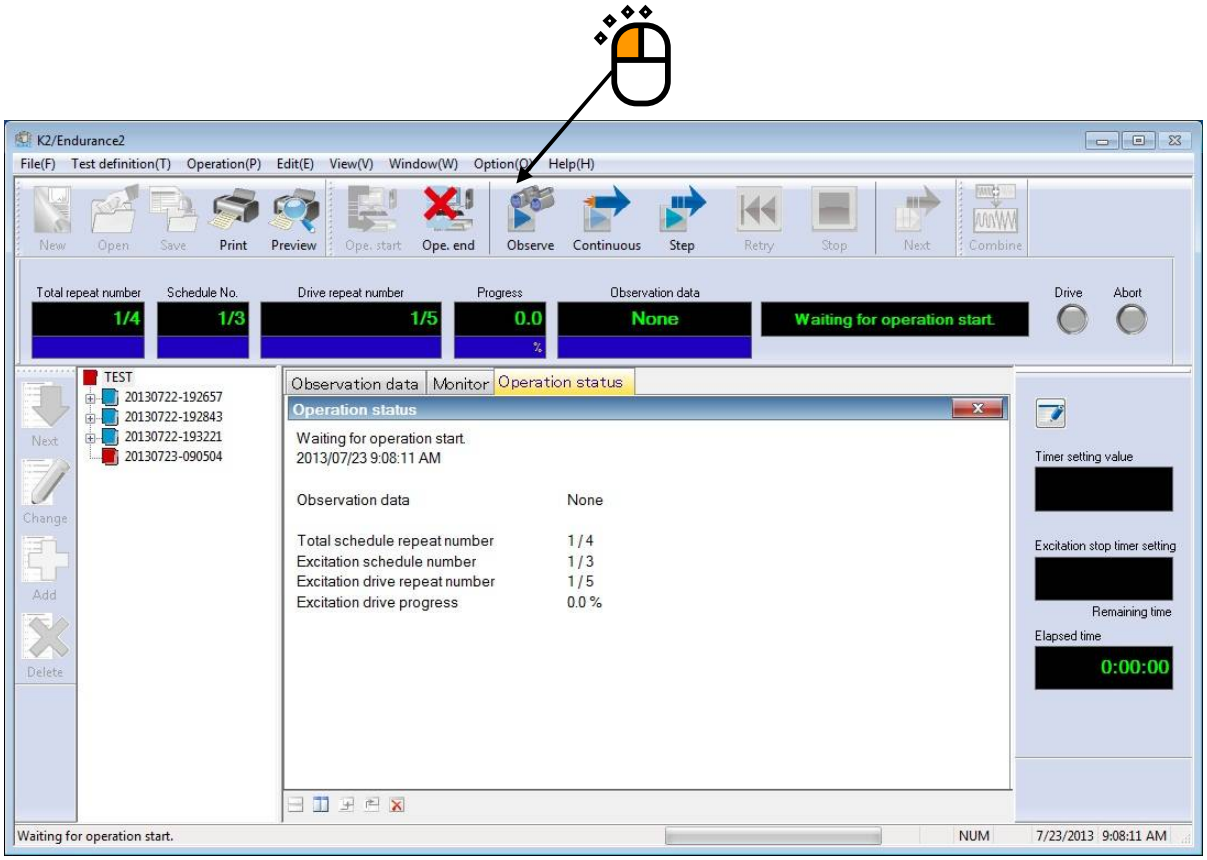
Correspondence of operation mode screen and schedule number

5.3 Observation data measurement

Before operating continuous and step excitation, observation data to monitor channel specified in input channel can be measured in K2/ENDURANCE2. (When observation tolerance is not needed, continuous and step excitation can be operated without measuring observation data.) Method to measure observation data is explained in this section.

＜Step1＞

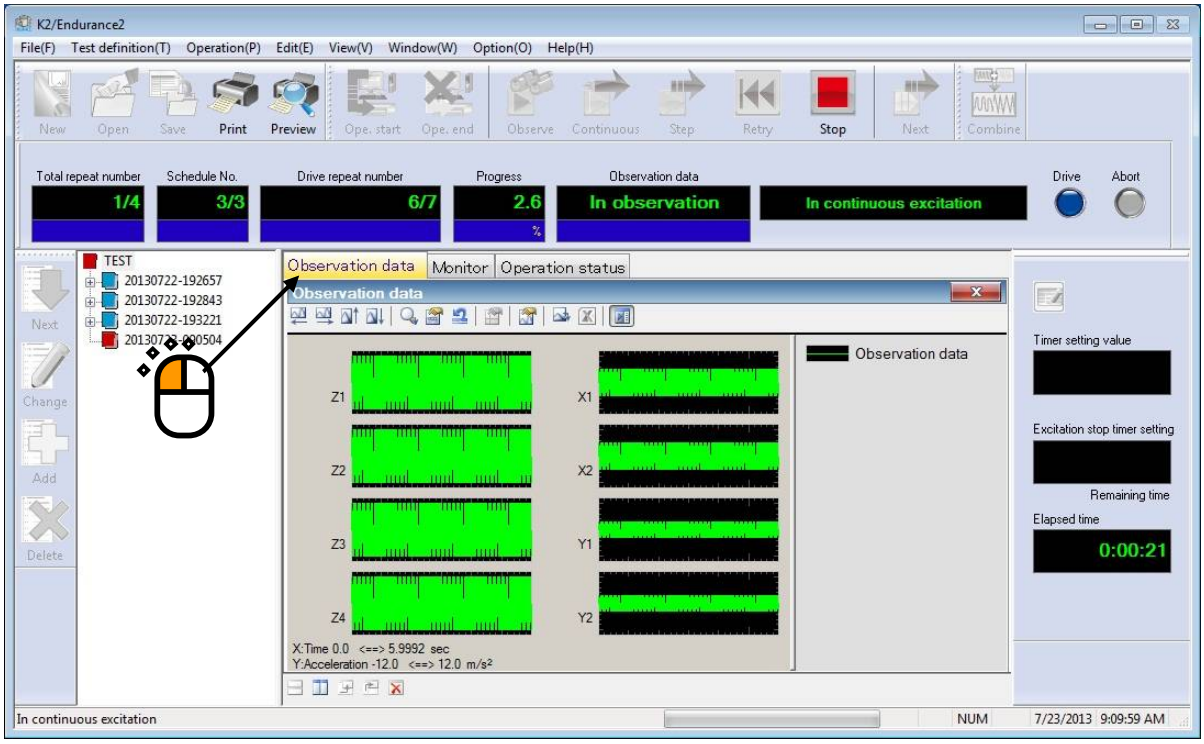
Measurement of observation data is operated by pressing observation data measurement start button. When observation data is already measured, a message that asks whether measured data can be deleted or not appears.



＜Step2＞

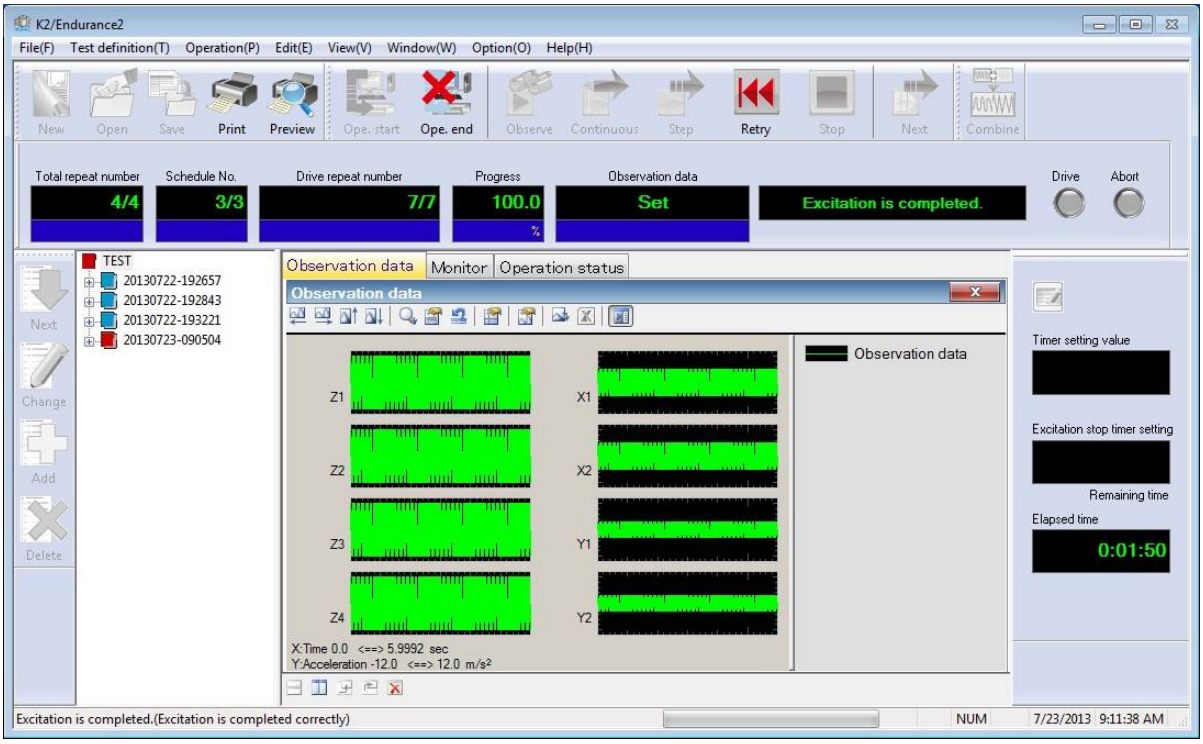
Drive which is set in schedule is output and the response is measured as observation data. Measured channel is measured in all channels regardless of with or without specifying tolerance of monitor definition.

Input waveform progress can be confirmed in observation data graph.



＜Step3＞

When excitation is correctly completed, response observation by observation tolerance can be operated in continuous and step excitation after that. As well, when excitation is stopped before all data are measured, all observation data are deleted.

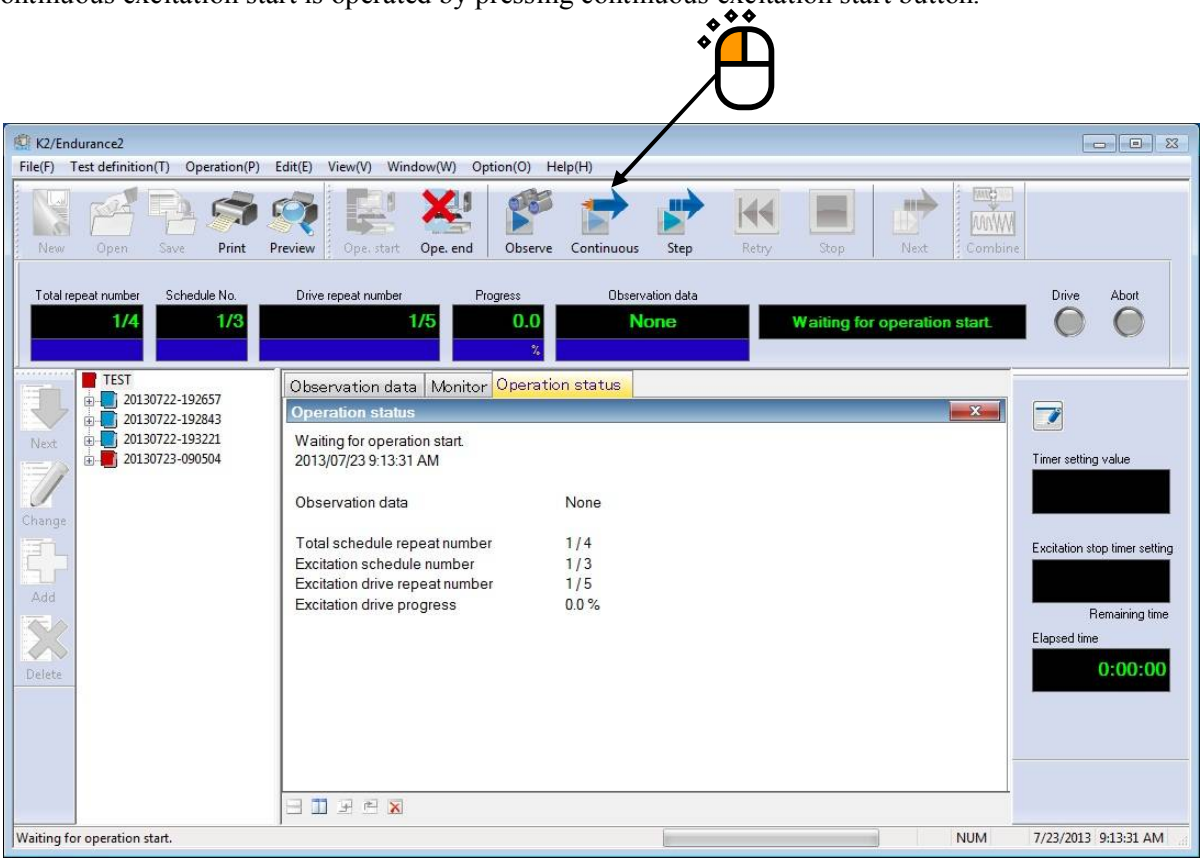


This is the end of loading observation data.

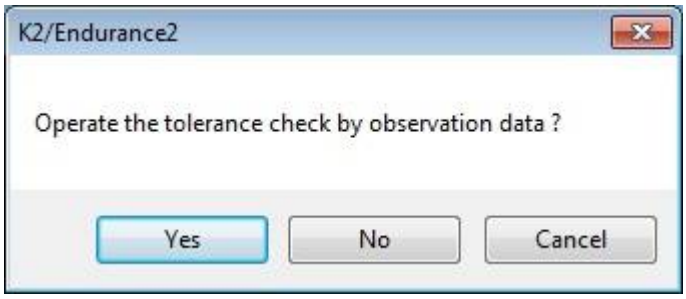
5.4 Continuous excitation start

＜Step1＞

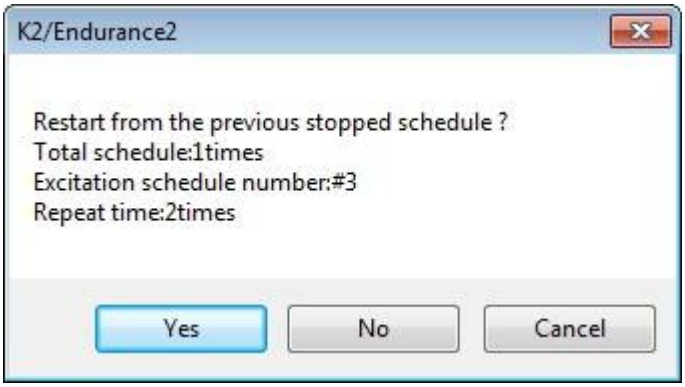
Continuous excitation start is operated by pressing continuous excitation start button.



When observation data is already measured, it is confirmed whether tolerance check is operated or not.



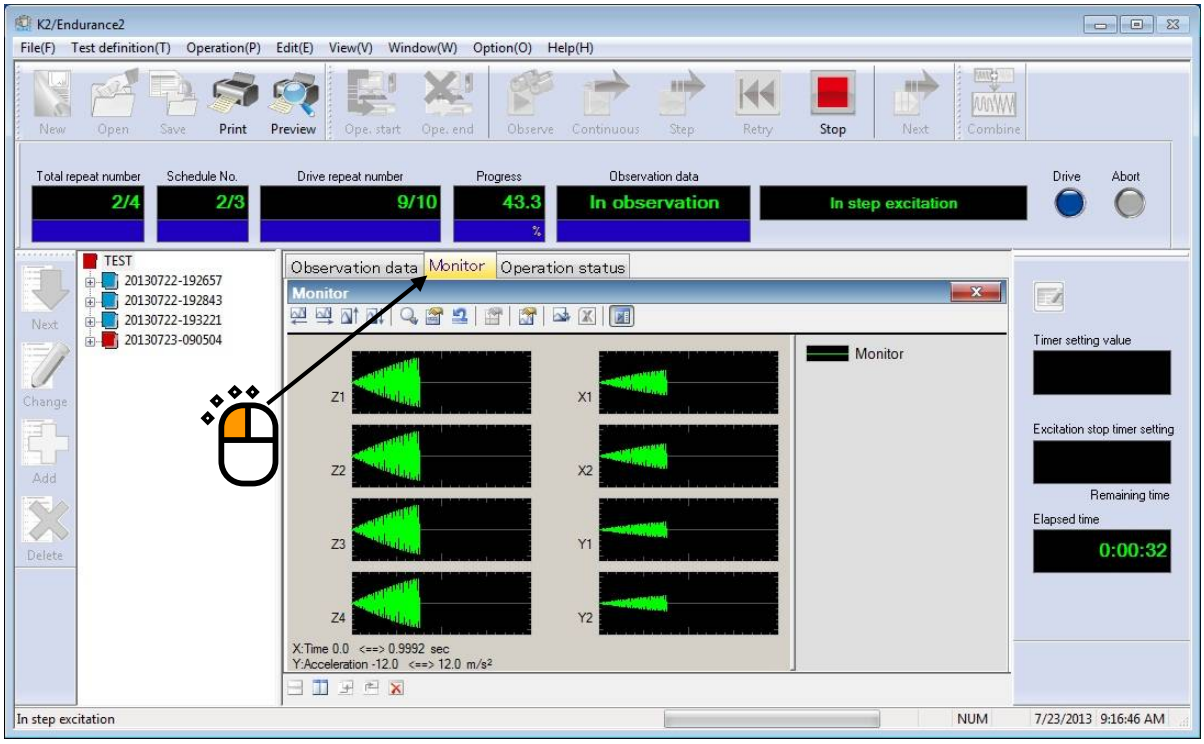
When continuous or step excitation operated previous time is stopped during schedule, it is confirmed whether excitation from the rest of the schedule is operated or not.



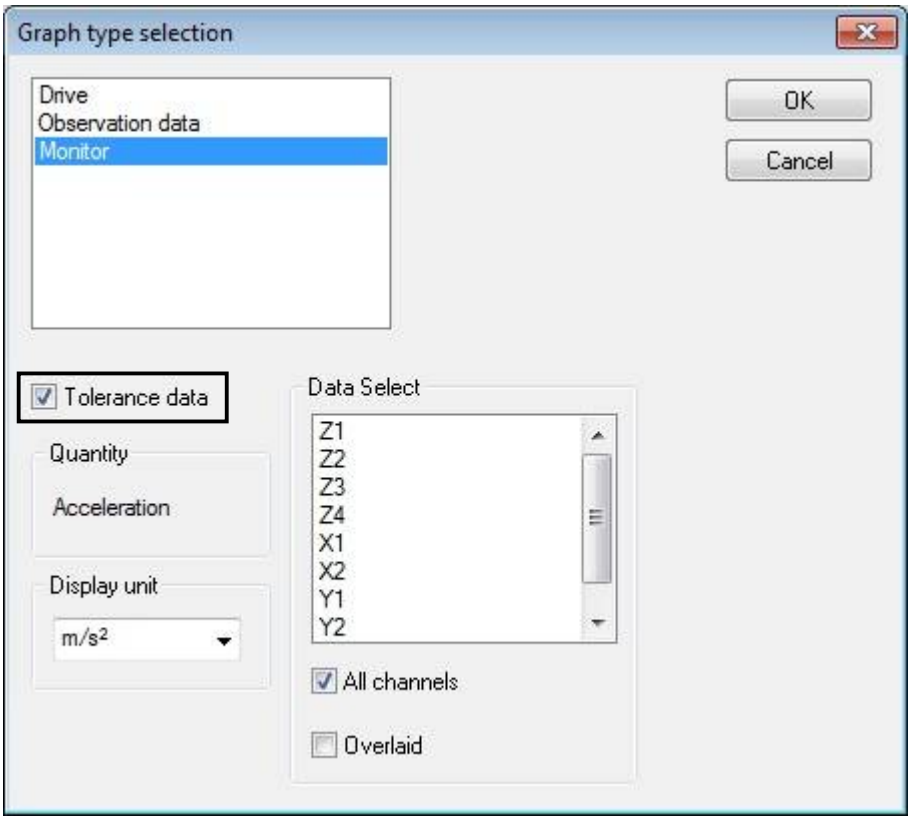
＜Step2＞

Following schedule, drive is output. Unless stop by manual is operated or abort, tolerance error occur, excitation is not stopped until schedule end.

Input waveform progress can be confirmed on monitor graph.



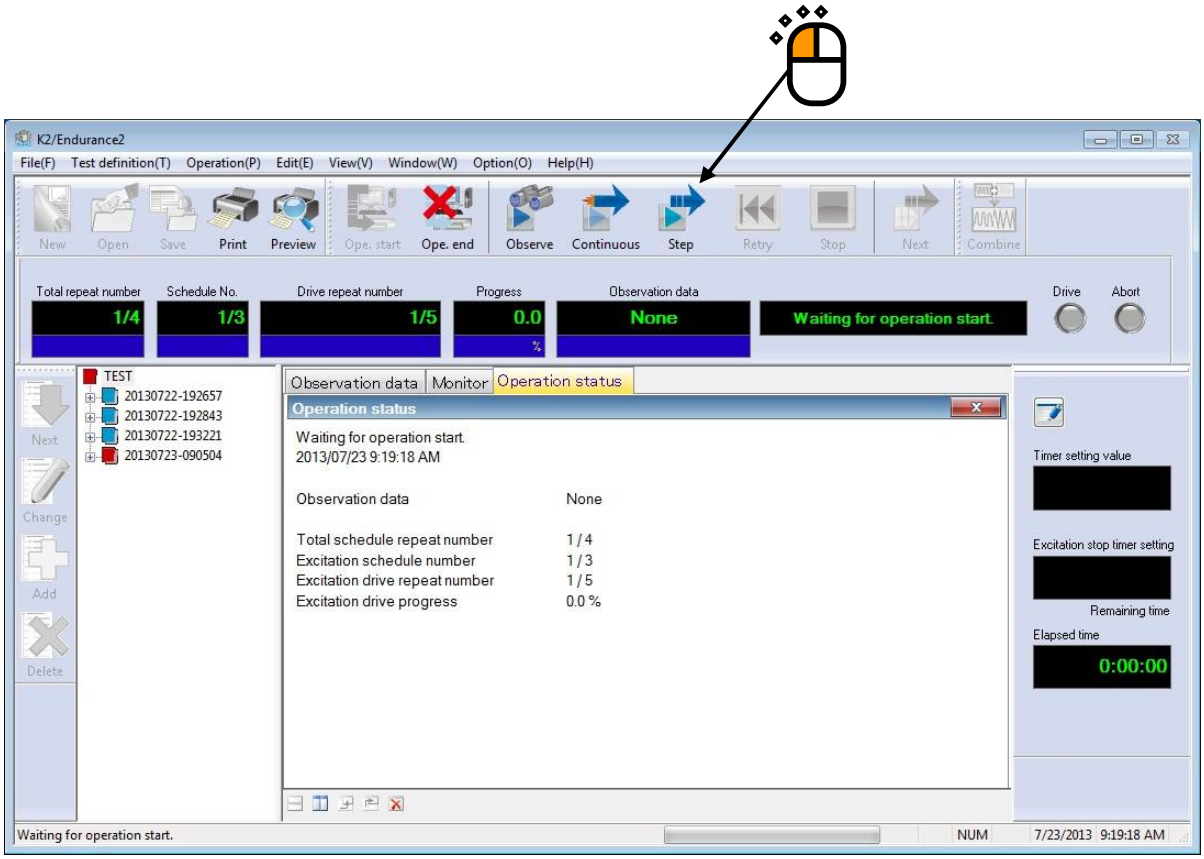
Also, when observation data is already measured and tolerance is set in more than or equal to 1 input channel, tolerance by observation data can be displayed on the monitor graph.



5.5 Step excitation start

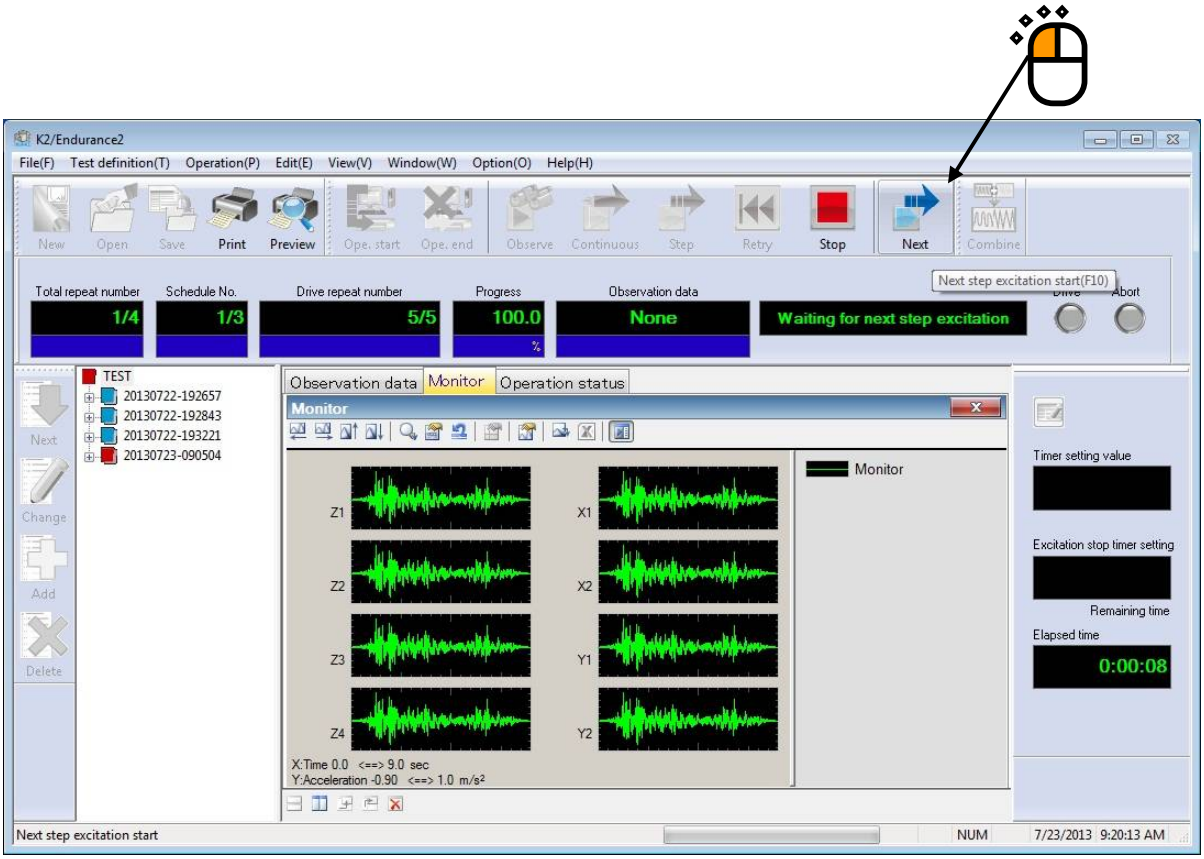
＜Step1＞

Step excitation start is operated by pressing step excitation start button.



＜Step2＞

When drive repeat times on schedule is completed, the state comes to waiting for next step excitation start before excitation of next drive on schedule. When next step button is pressed, excitation of next drive on schedule starts.



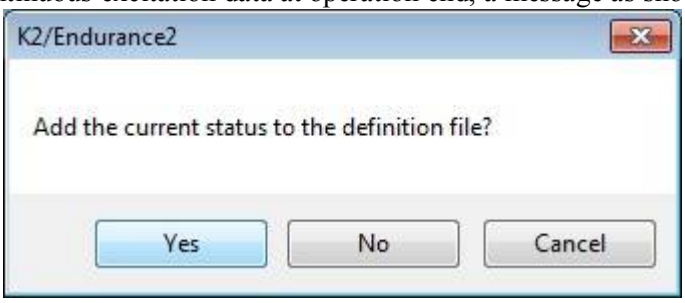
5.6 Continuous excitation data

Observation data and abort information of schedule at operation end is set to definition as added information, so these information can be taken over when operation is started next time.

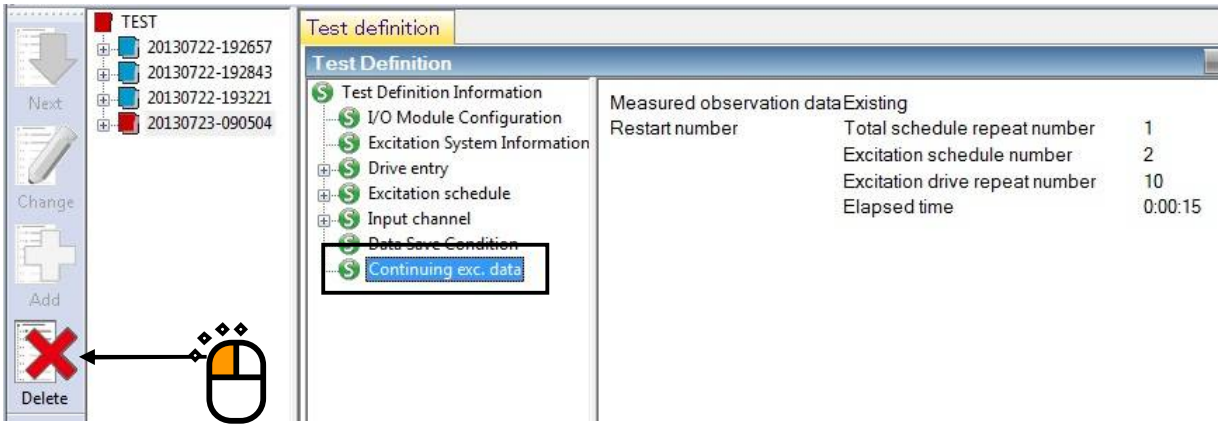
Information below can be taken over.

- Observation data
- Schedule number and elapsed time (Except the case that total repeat number, schedule number and drive repeat number are all first time)

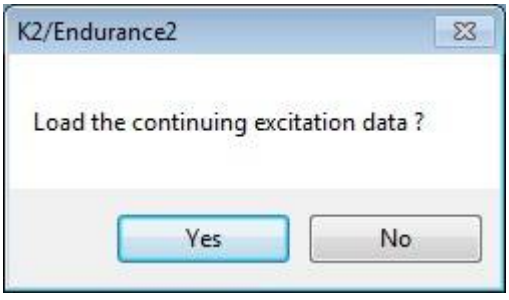
When there is continuous excitation data at operation end, a message as shown below is displayed.



Continuous excitation data added to definition is added to the bottom of definition tree. As well, other definition items cannot be changed in the state that continuous excitation data is added. After deleting continuous excitation data by pressing definition delete button, select definition item to be edited.



When definition to which continuous excitation data is added is operated, a message box shown as below is displayed and it is selected whether continuous excitation information is used or not.



5.7 Elapsed time and stop timer

Confirming of elapsed time and setting of stop timer can be operated in continuous and step excitation. Setting of stop time interval is operated by pressing excitation condition change button. As well, elapsed time is taken over with schedule number at restart from schedule abort.

Excitation stop timer is made up of three display items.

- Timer setting value

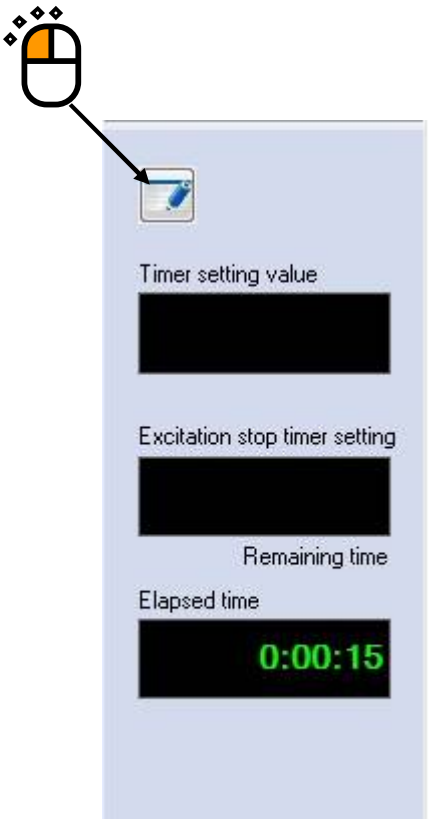
Setting time is displayed at setting of stop time interval. Stop time instant is displayed at setting of stop time instant.

- Excitation stop timer

The remaining time before stop is displayed at setting of stop time interval.

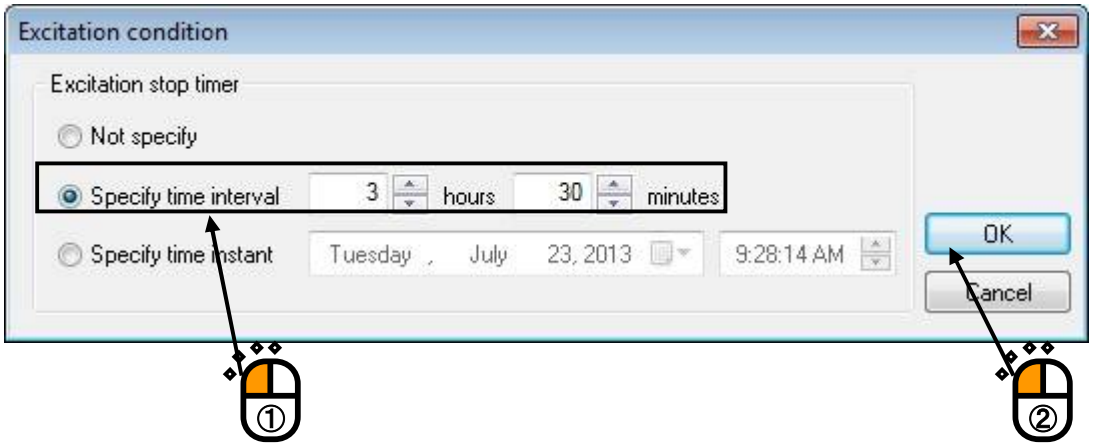
- Elapsed time

Elapsed time is displayed regardless of set or not set of stop timer.



5.7.1 Setting of stop time interval

When excitation condition change button is pressed, excitation condition setting dialogue is opened. Select “specify time interval” and input stop time interval.

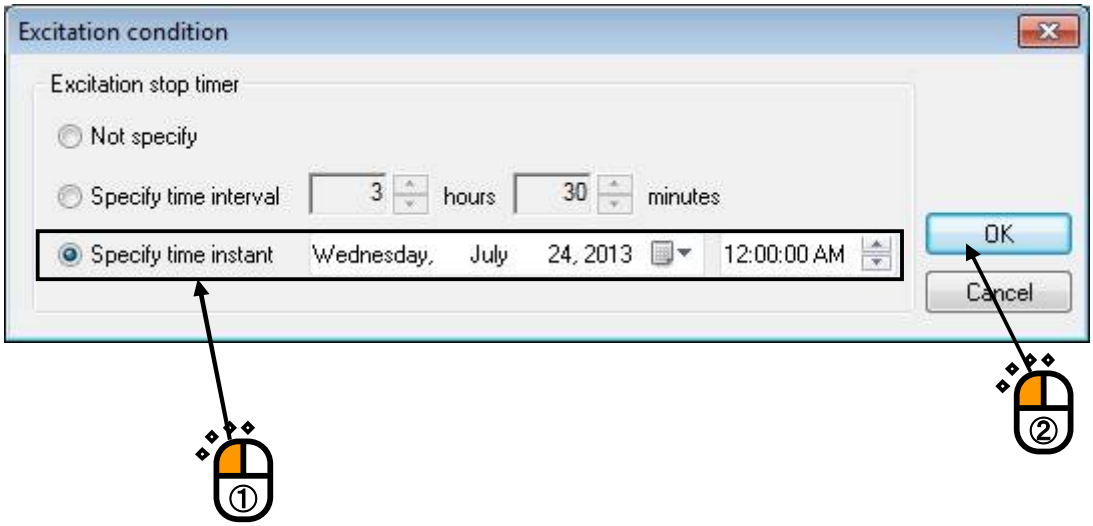


When excitation is started after stop time interval is set, elapsed time is counted up and excitation stop timer is counted down at the same time.

When elapsed time is over setting value of stop time interval timer at taking over schedule number, excitation cannot be operated. Reset stop timer or operate excitation from the start of schedule.

5.7.2 Setting of stop time instant

When excitation condition change button is pressed, excitation condition setting dialogue is opened. Select “specify time instant” and input date and time to stop.



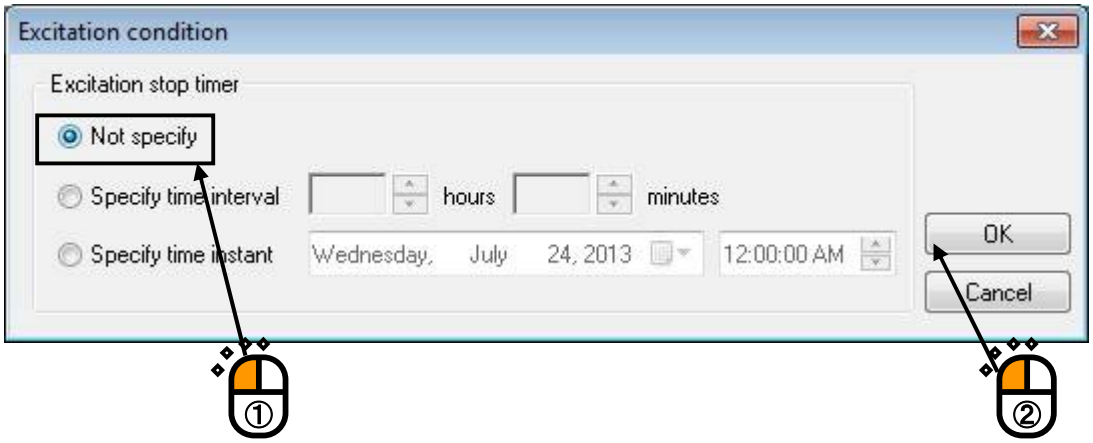
When excitation is started after stop time instant is set, elapsed time is counted up. Excitation stop timer is not displayed.

When current date and time is over stop time instant, excitation cannot be operated. Reset stop timer.

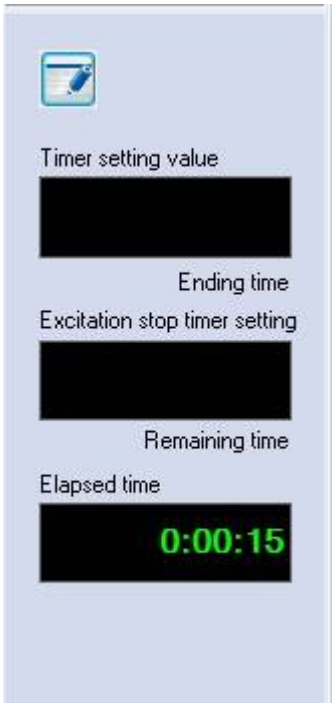
5.7.3 No setting of stop timer

When excitation condition change button is pressed, excitation condition setting dialogue is opened.

Select “not specify”.



When excitation is started, only elapsed time is counted up.



Chapter 6 Drive Combine

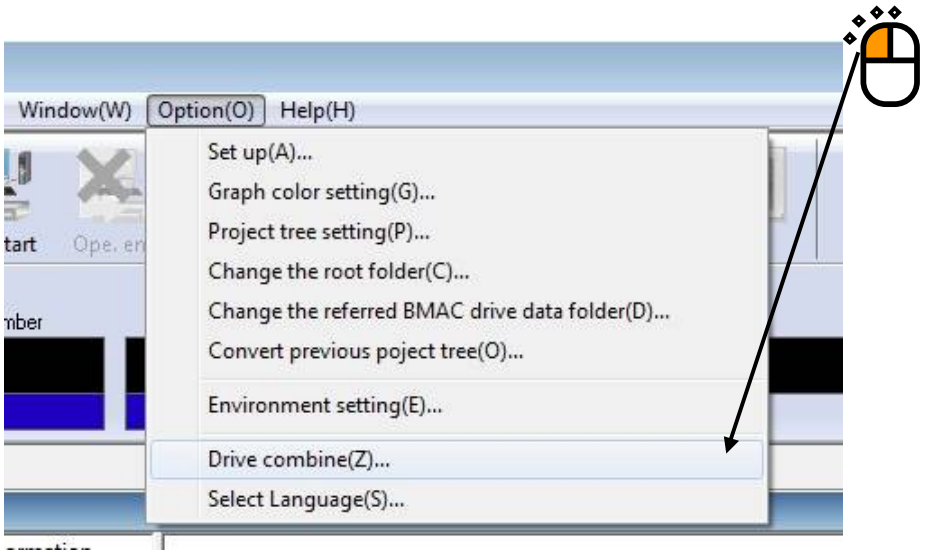
6.1 Outline

New drive waveform data is created by combining some BMAC drives. At combining, conditions such as repeat times and repeat interval can be set.

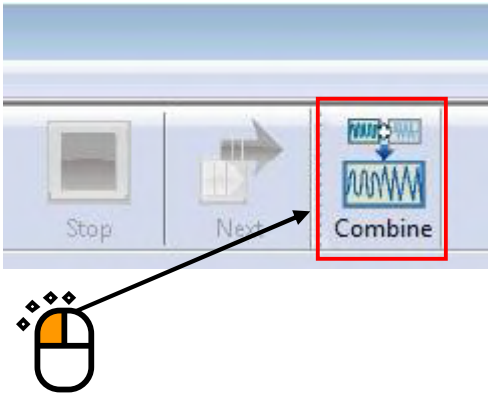
6.2 Combined Drive List

This section describes combined drive list.

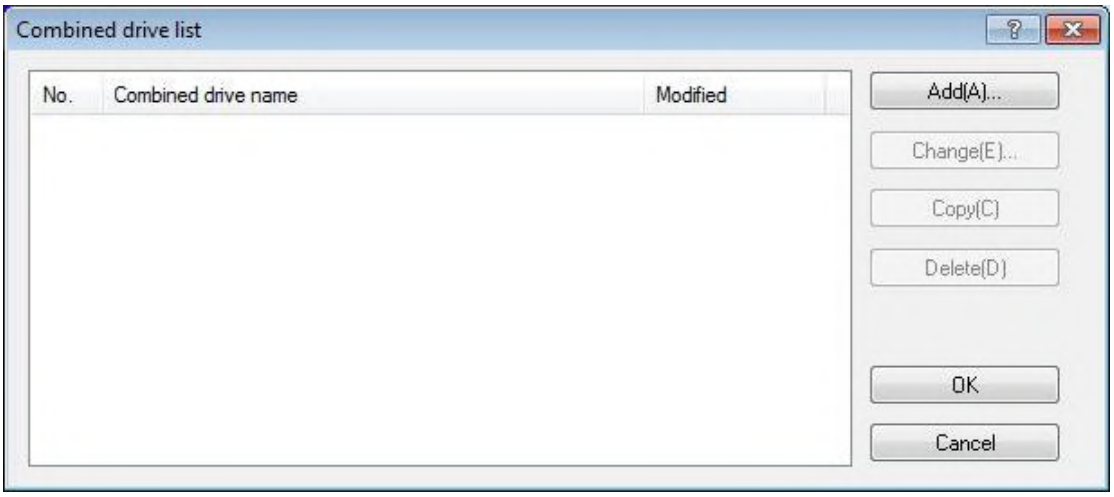
To display screen of combined drive list, select “Option” > “Combine drive” on the menu.



Or, click “Drive Combine” button on the option tool bar.



Screen shown as below is displayed.

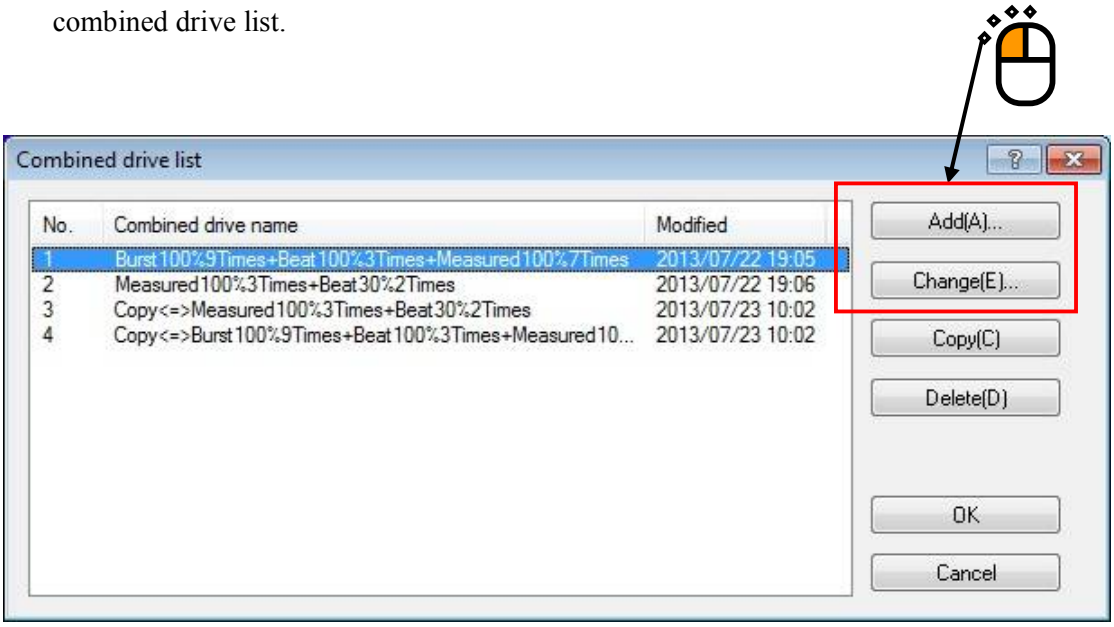


[Add]	New combined drive is added.
[Change]	The setting content of selected combined drive is changed.
[Copy]	Copy of the selected combined drive is created.
[Delete]	The selected combined drive is deleted from combined drive list.
[OK]	Combined drive list which was set is decided and saved in a file.
[Cancel]	Combined drive list which was set is cancelled.

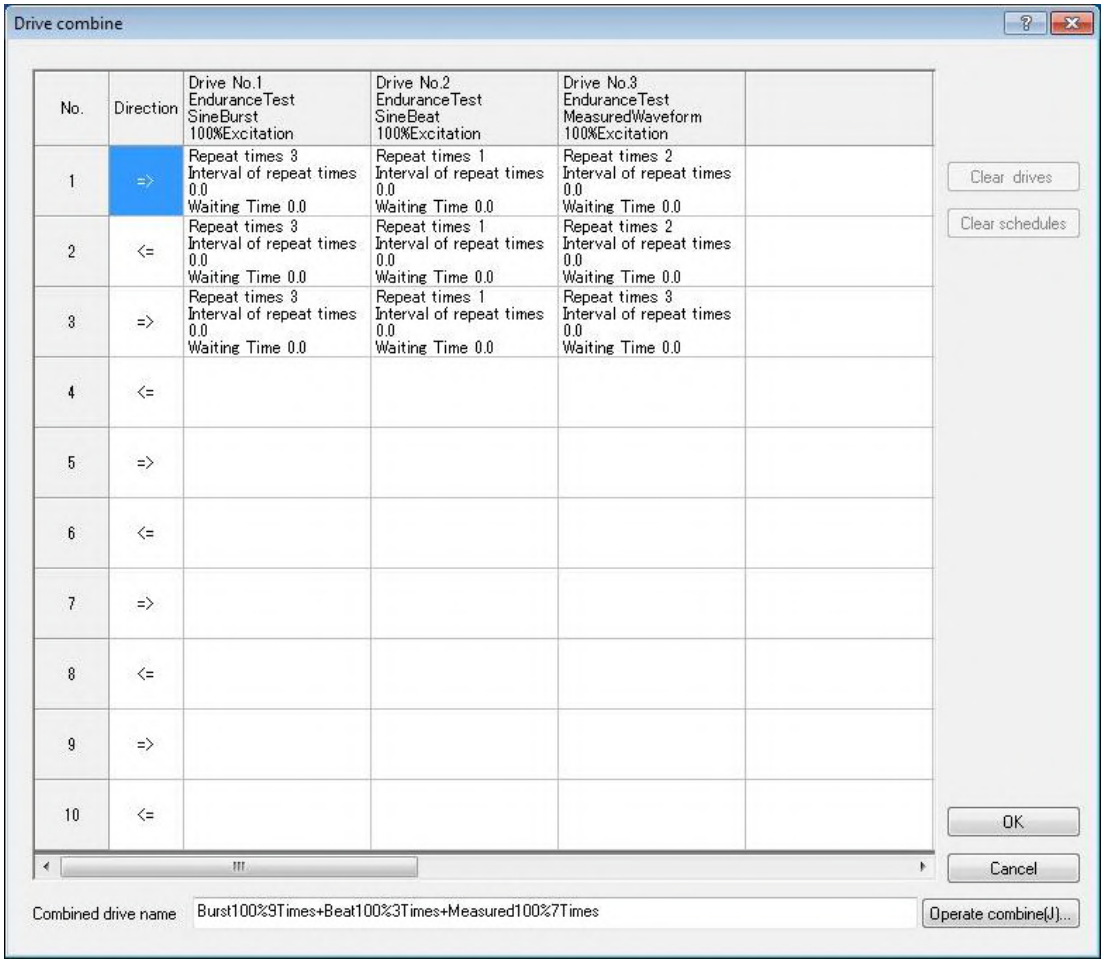
6.2.1 Drive combine

This section describes drive combine.

To display the screen of drive combine, click “Add” button and “Change” button on the screen of combined drive list.



Screen shown as below is displayed.



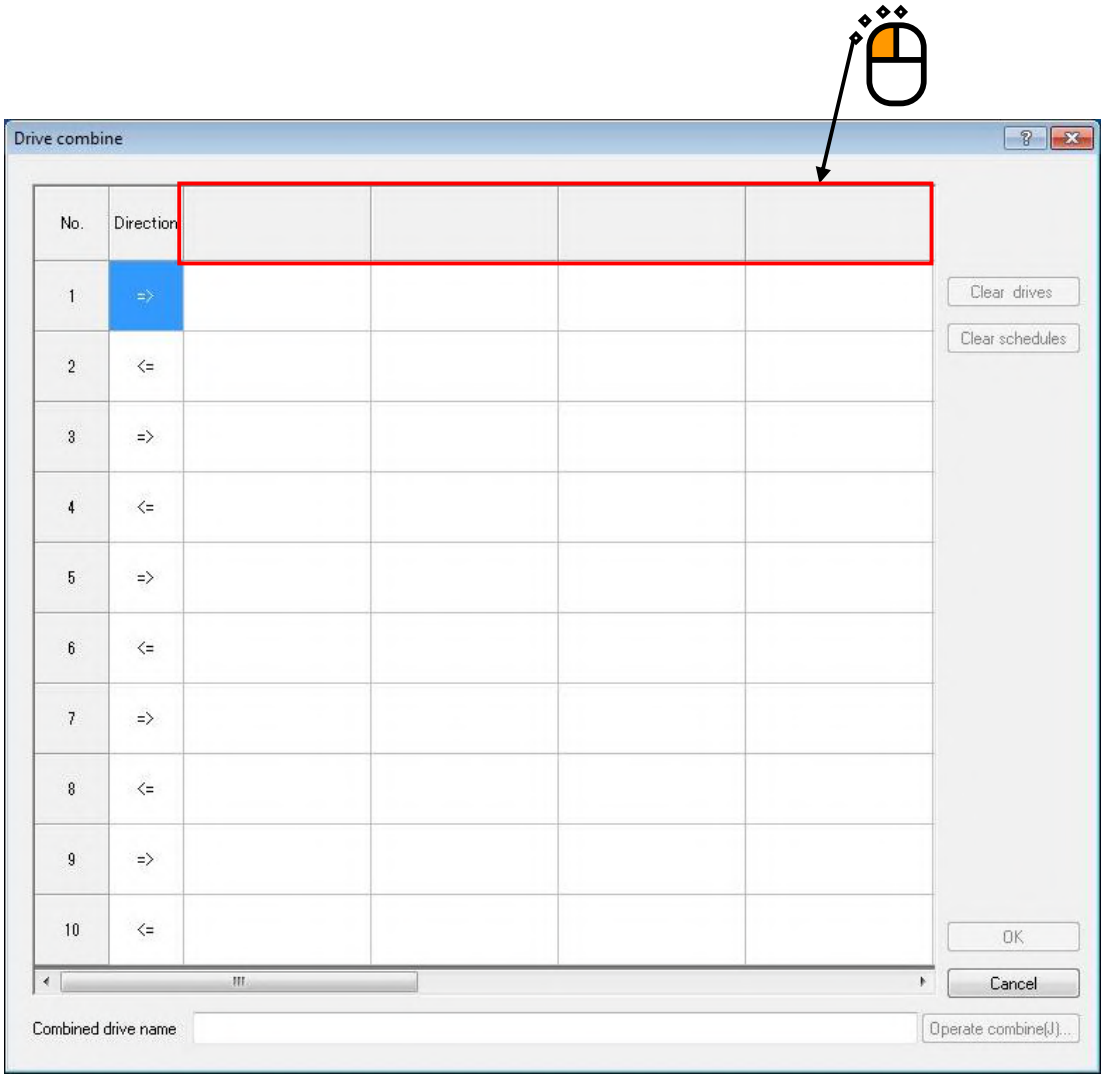
6.2.1.1 Drive add

This section describes drive add.

＜Operation procedure＞

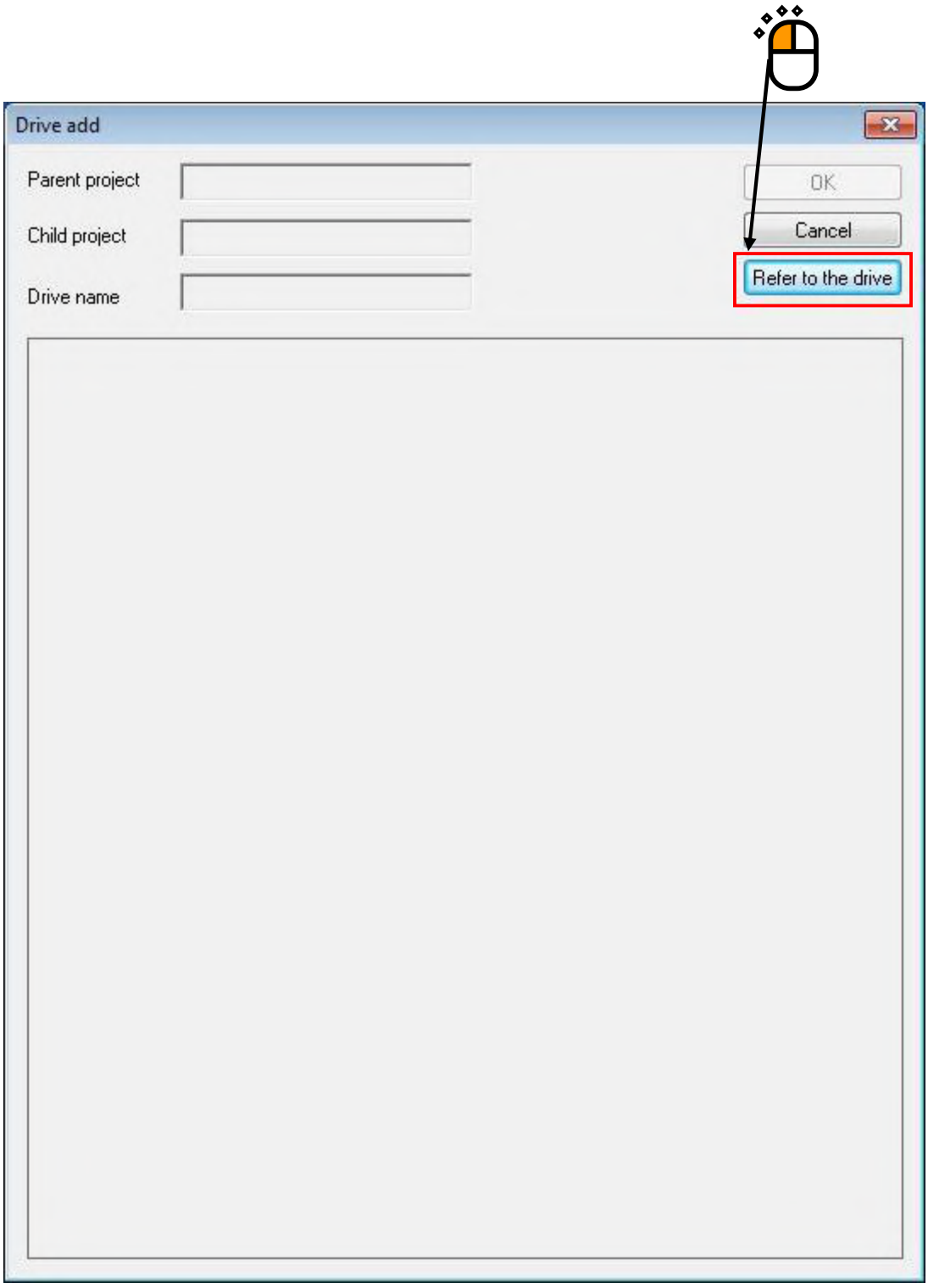
＜Step1＞

Double-click a cell on the column to be added grid control drive.



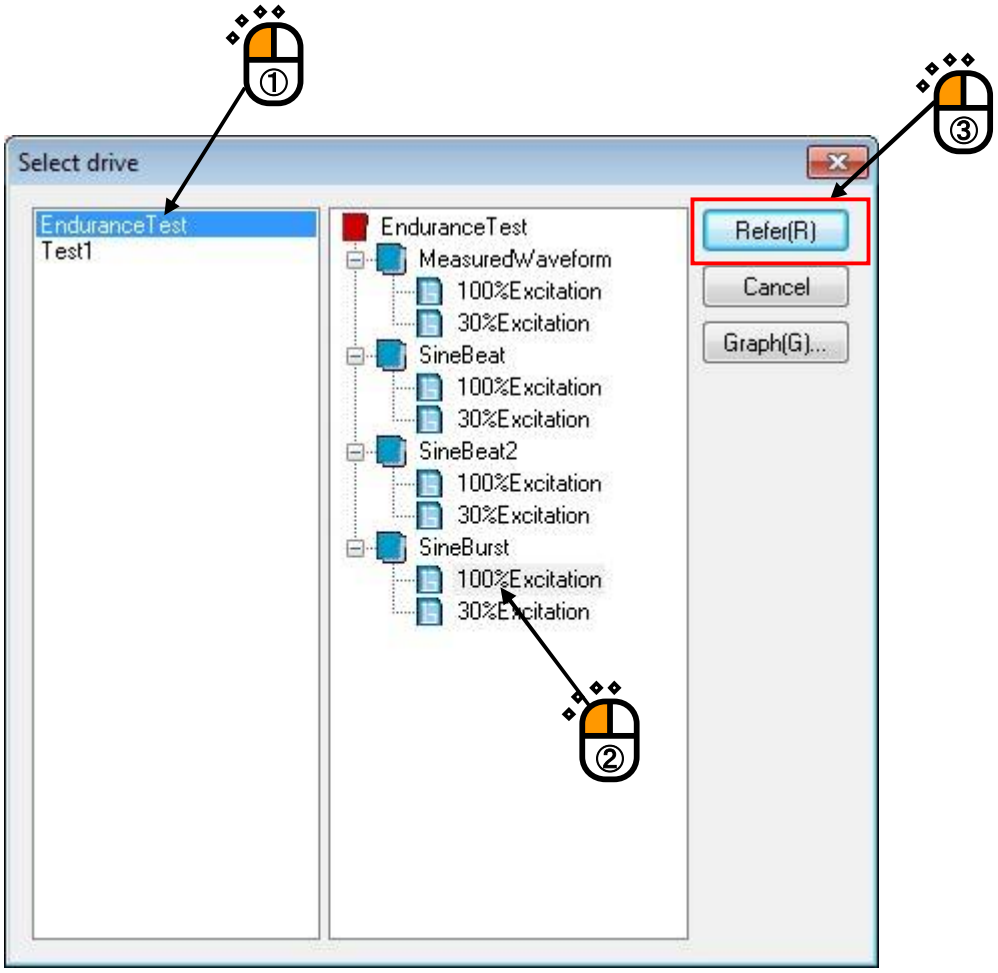
＜Step2＞

As add drive screen is displayed, click “Refer to drive” button.



＜Step3＞

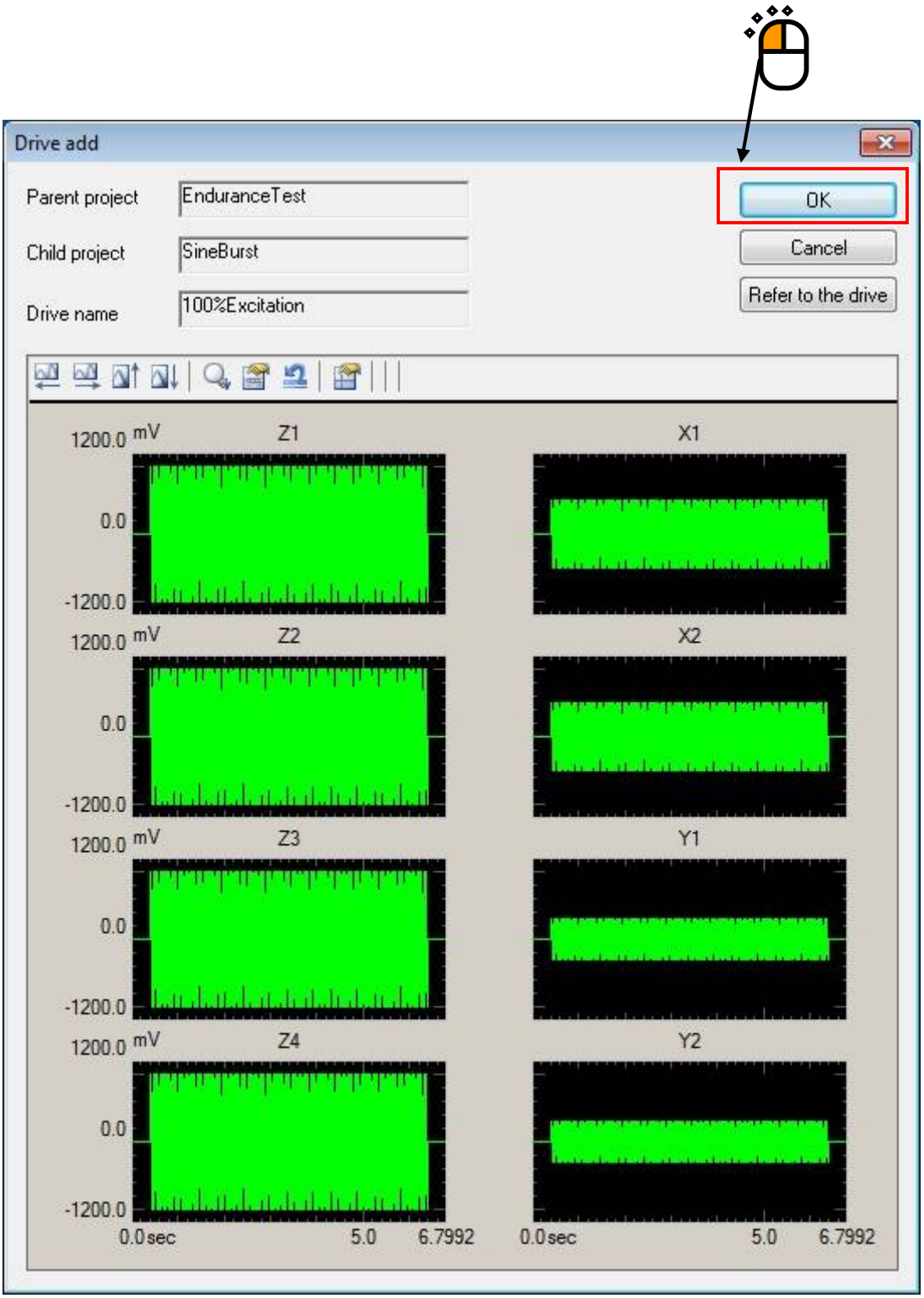
As select drive screen is displayed, select BMAC drive to be added and click “Refer” button.



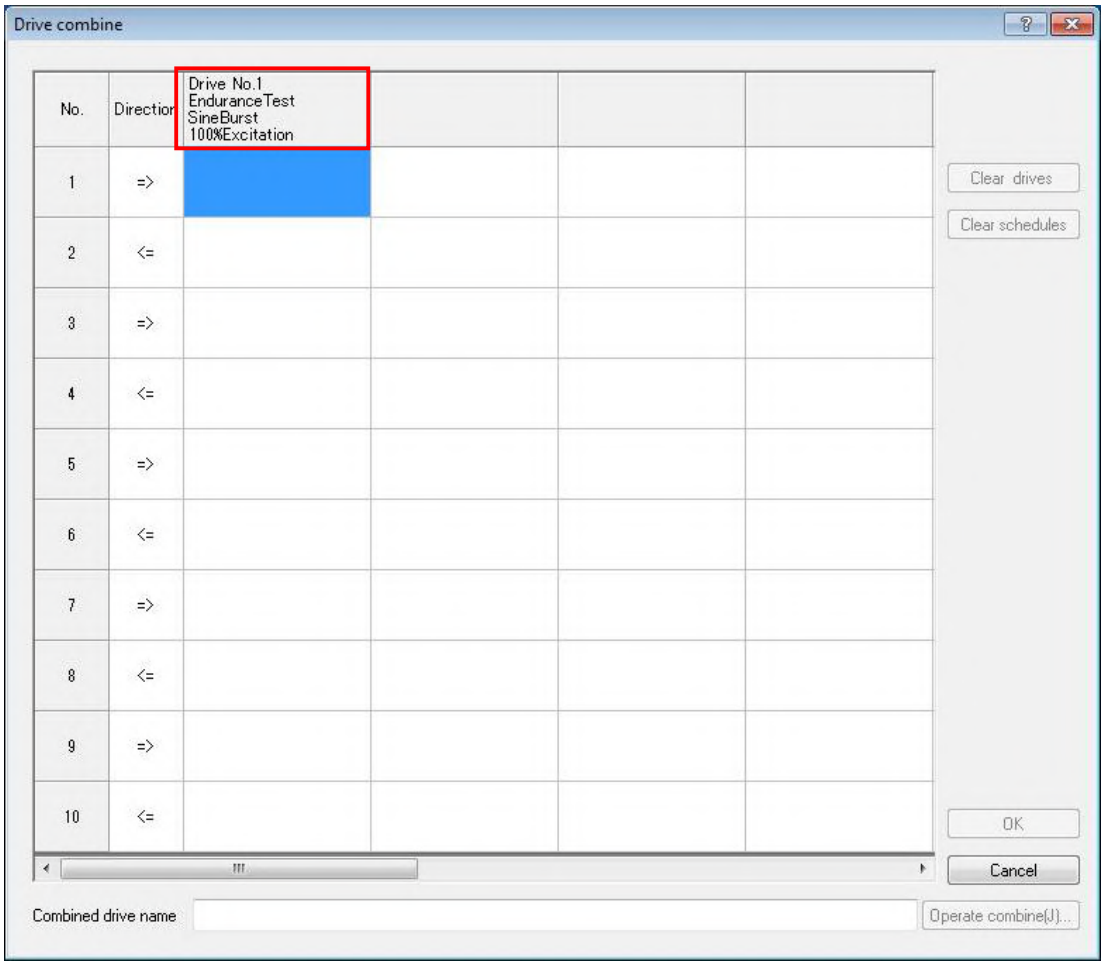
＜Step4＞

"Parent project","Child project", and "Drive name" of BMAC drive selected on add drive screen and drive waveform graph is displayed.

If the selected BMAC drive is OK, click "OK" button.



When drive is added, “Parent project”,”Child project”, “Drive name” is displayed on the cell double-clicked on the drive combine screen.



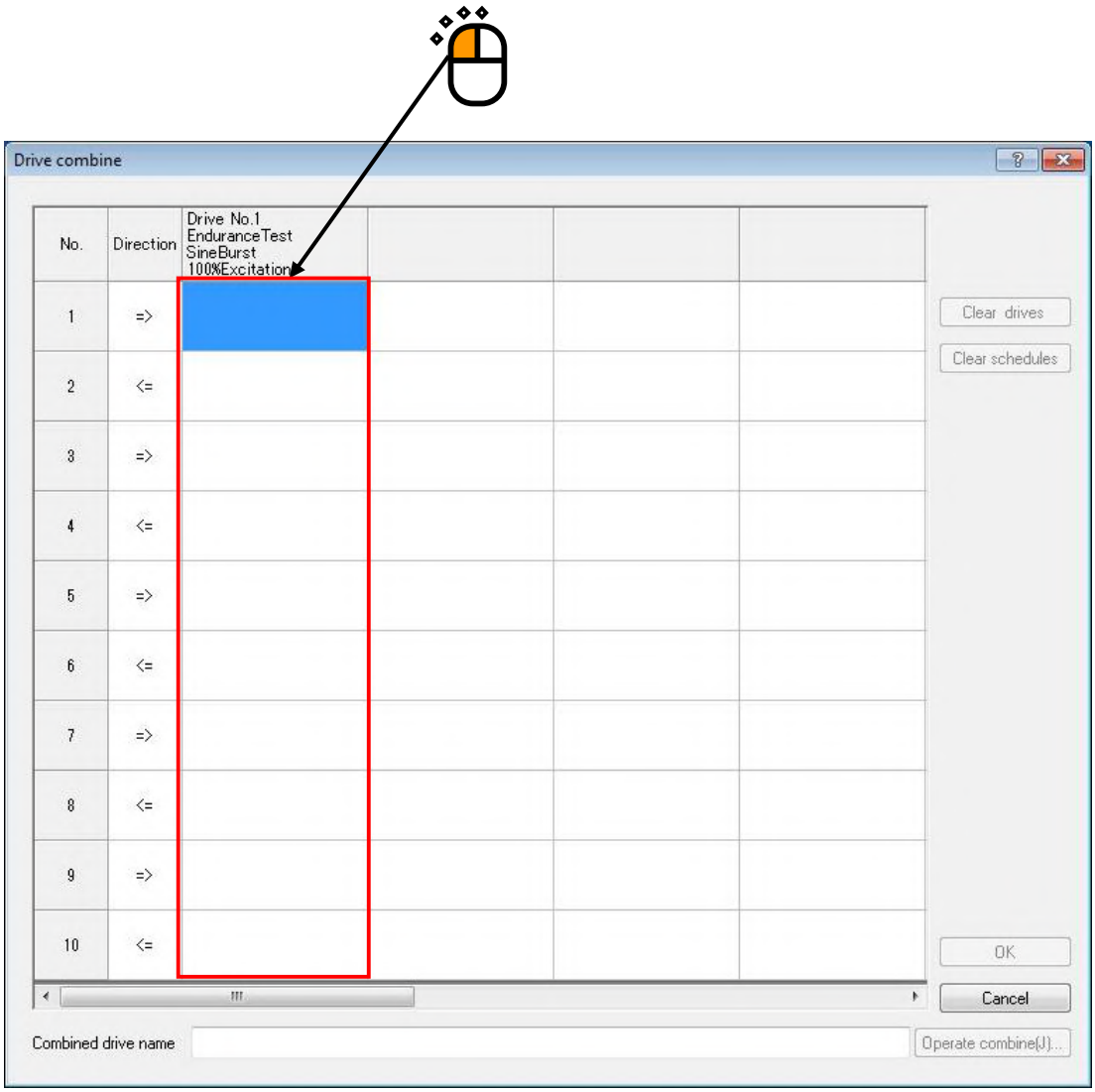
6.2.1.2 Combine schedule setting

This section describes combine schedule setting.

＜Operation procedure＞

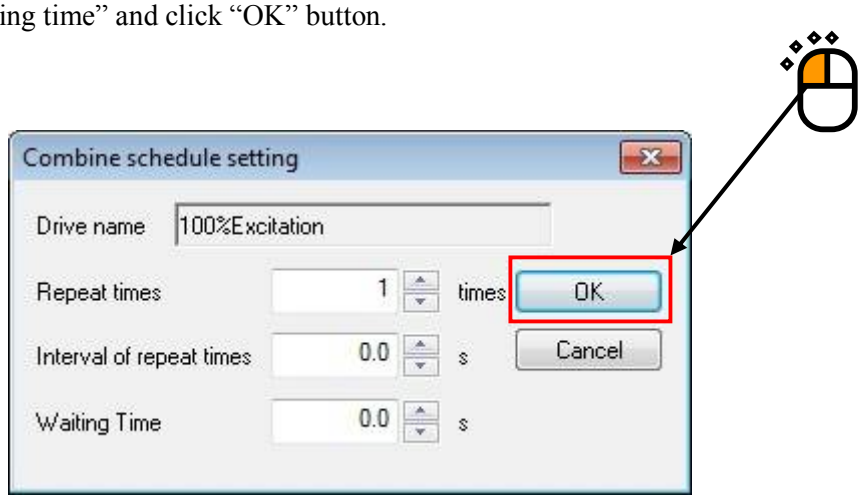
＜Step1＞

Double-click a cell to be operated combine schedule setting on the column that drive was added in grid control.



＜Step2＞

As combine schedule setting screen is displayed, set “Repeat times”, “Repeat interval” and “Waiting time” and click “OK” button.



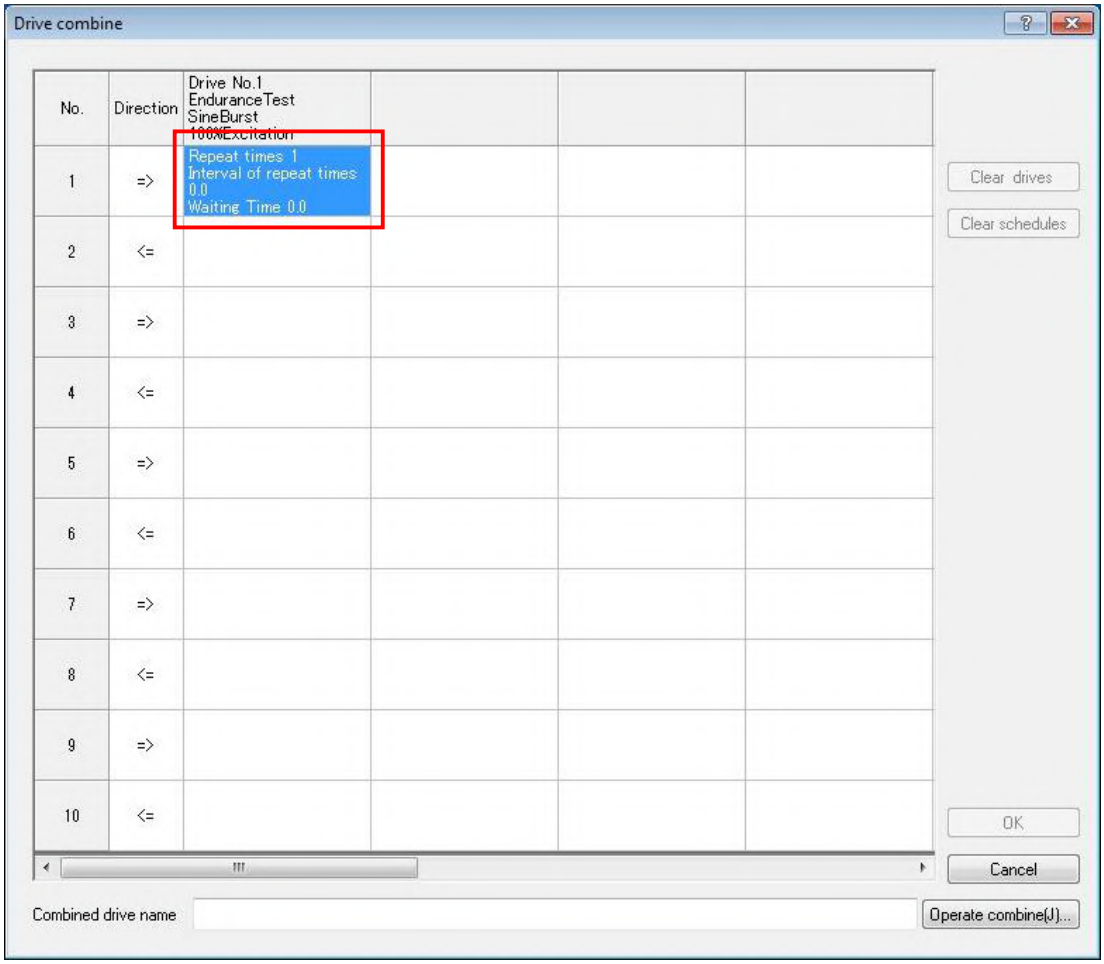
“Repeat times” Number of times that drive waveform is repeated at combine operation is set.

“Repeat interval” Interval that BMAC drive waveform is repeated is set by seconds.

“Waiting time” Waiting time until next BMAC drive is combined is set by seconds.

＜Step3＞

When combine schedule is set, “Repeat times”, “Repeat interval” and “Waiting time” is displayed on the cell double-clicked on the drive combine screen. However, when “Repeat times” is “0 time”, it is same as it is not set, so it is not displayed.



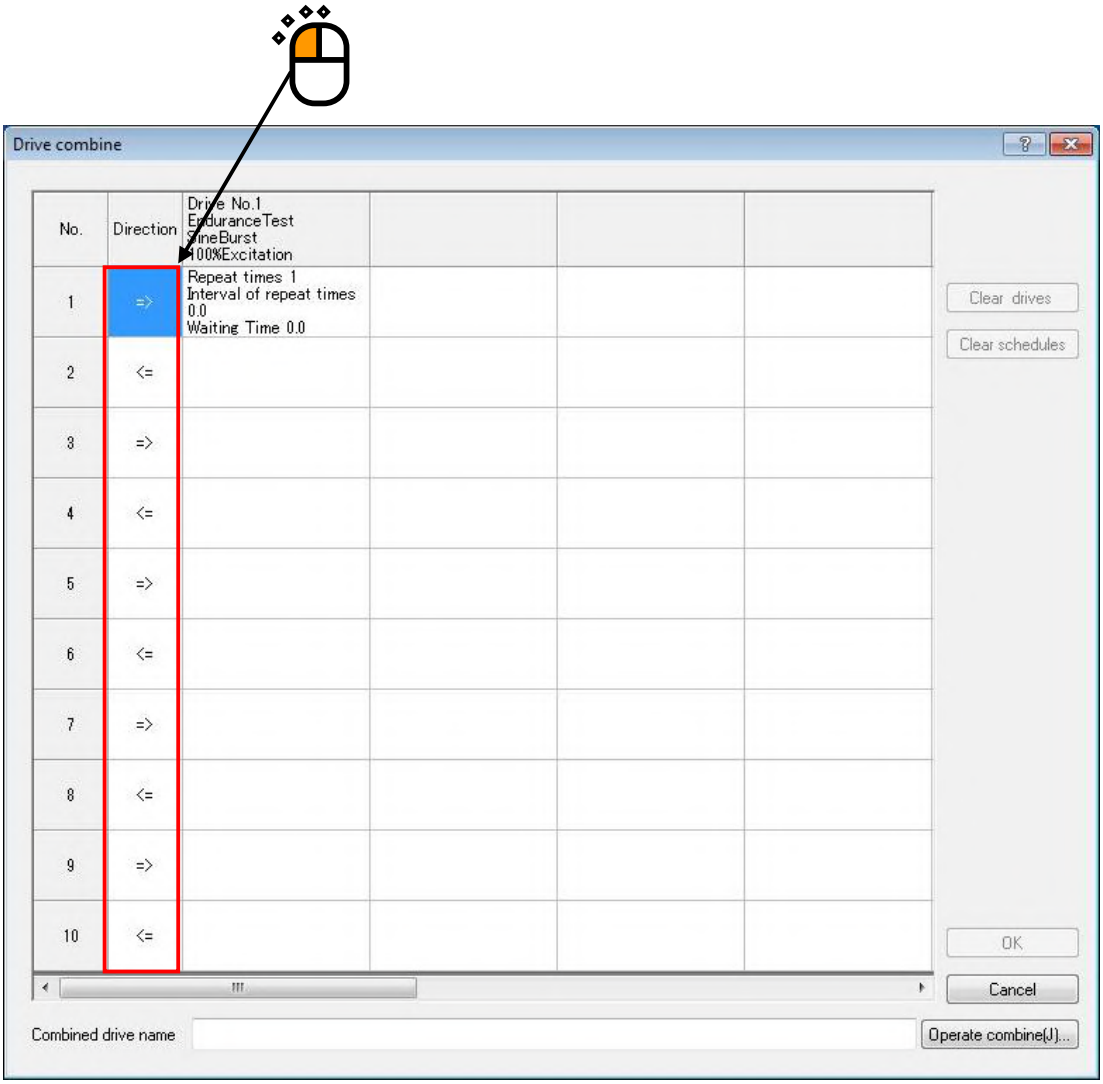
6.2.1.3 Direction setting

This section describes combine direction setting.

＜Operation procedure＞

＜Step1＞

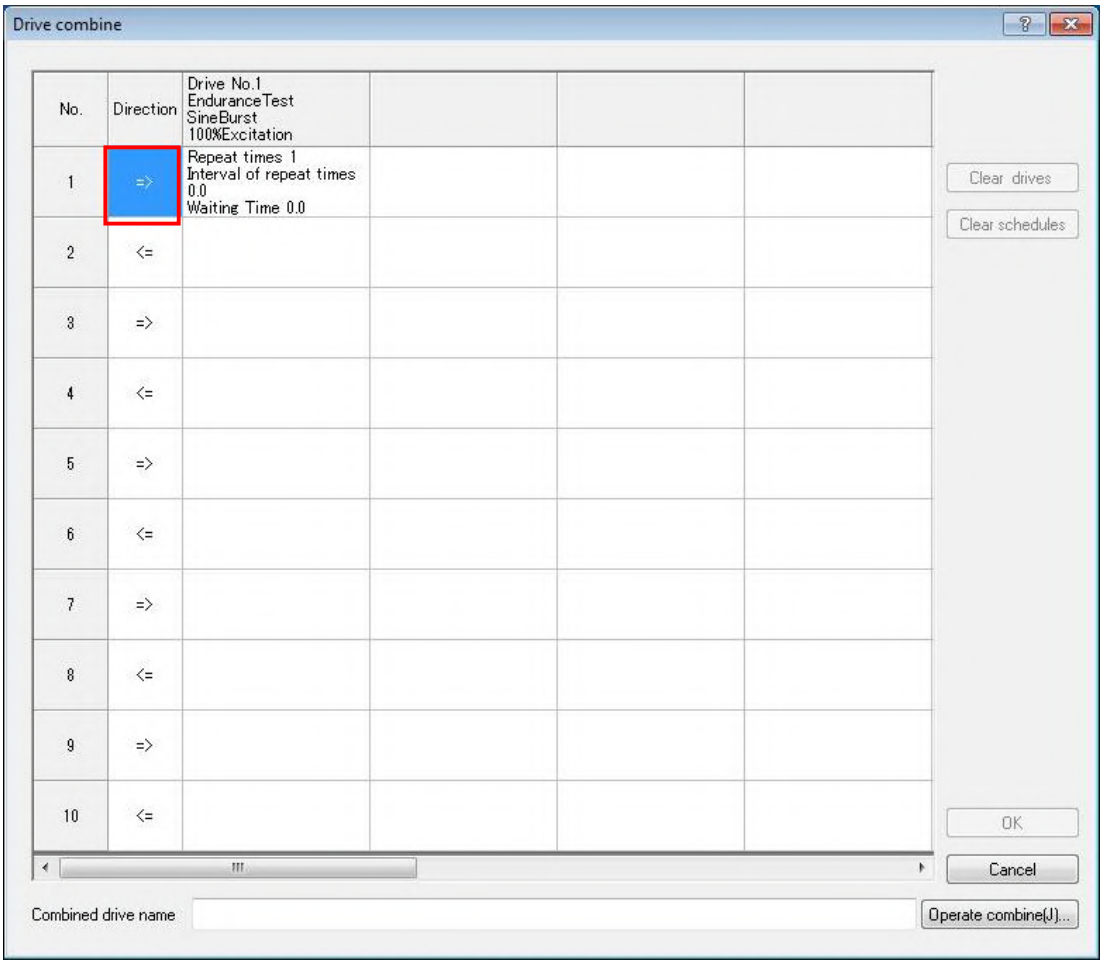
Double-click a cell on the row to be operated direction setting in grid control.



＜Step2＞

As direction setting screen is displayed, select right "→" or left "←" and then click "OK" button.

When direction is set, selected direction arrow is displayed on the cell double-clicked on the drive combine screen.



6.2.1.4 Clear drives

This section describes clearing drives.

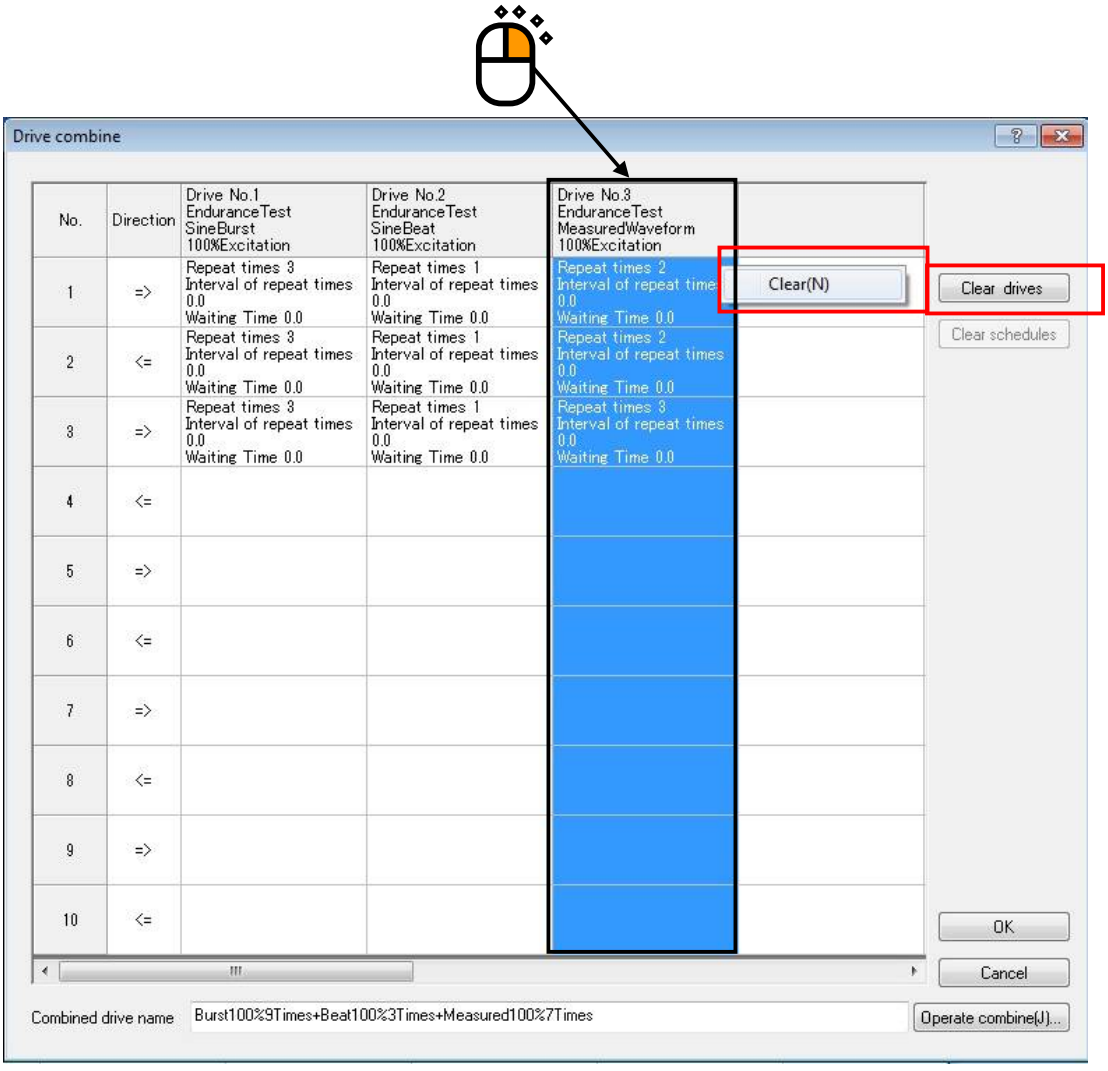
＜Operation procedure＞

＜Step1＞

When a column to be cleared is selected in grid control, “Clear drives” button becomes effective.

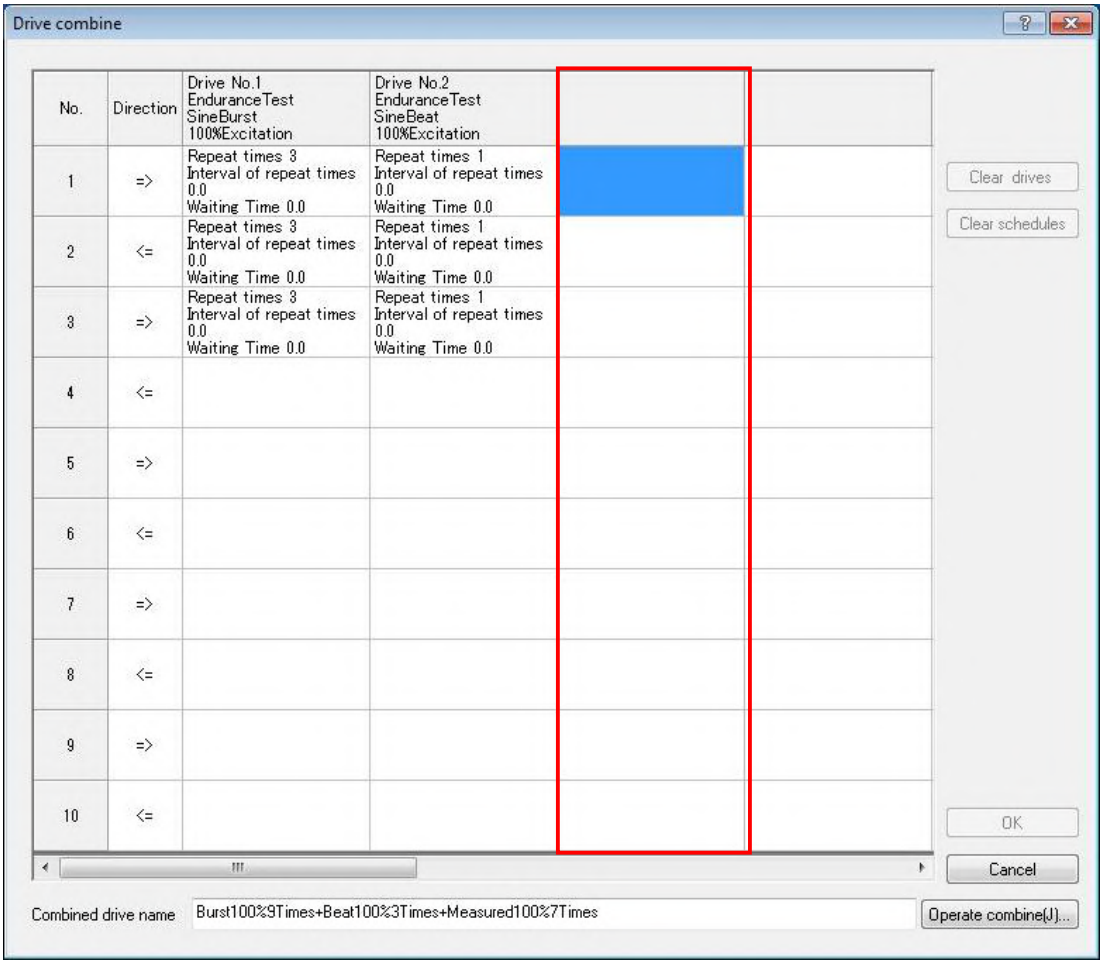
Or, when the right mouse button is clicked in the state that the column to be cleared is selected, pop-up menu “Clear” is displayed.

More than one columns also can be selected.



＜Step2＞

When “Clear drives” button or pop-up menu “Clear” is clicked, setting of selected column is cleared.



6.2.1.5 Clear schedules

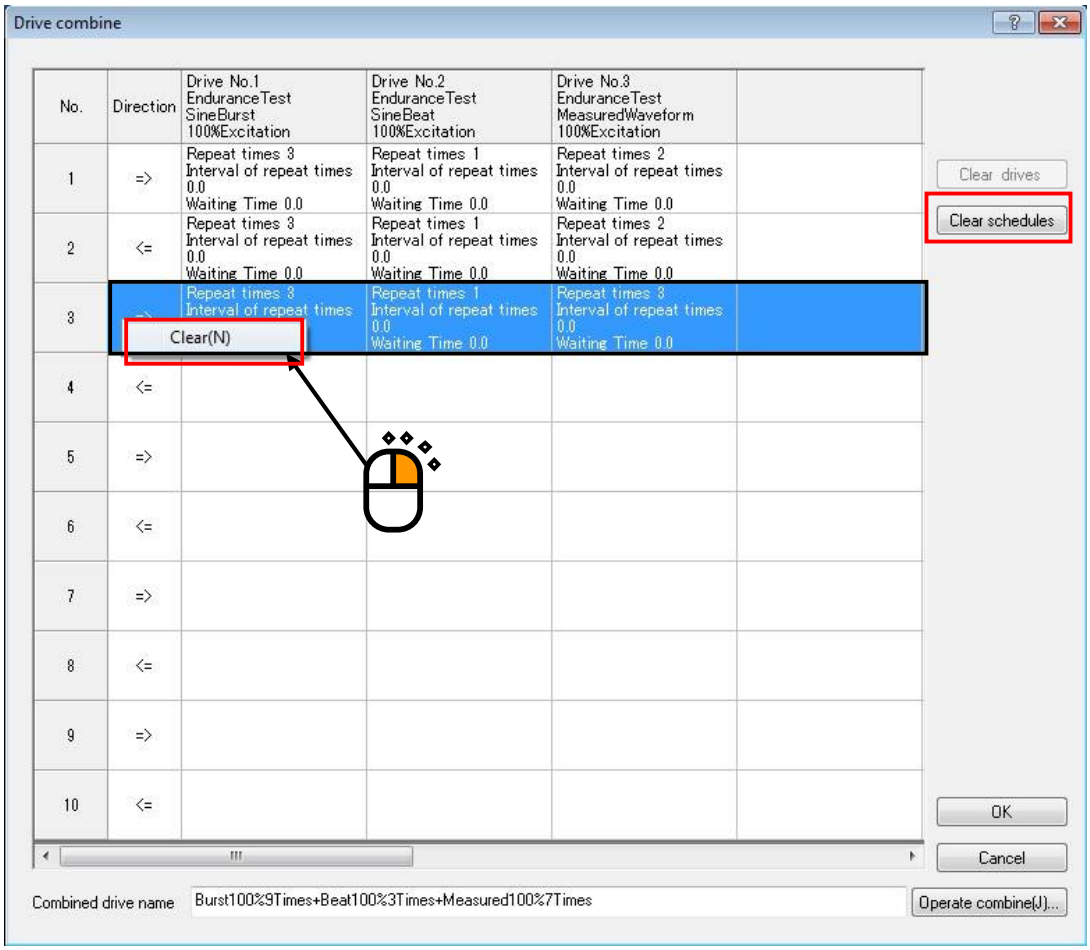
This section describes clearing schedule.

＜Operation procedure＞

＜Step1＞

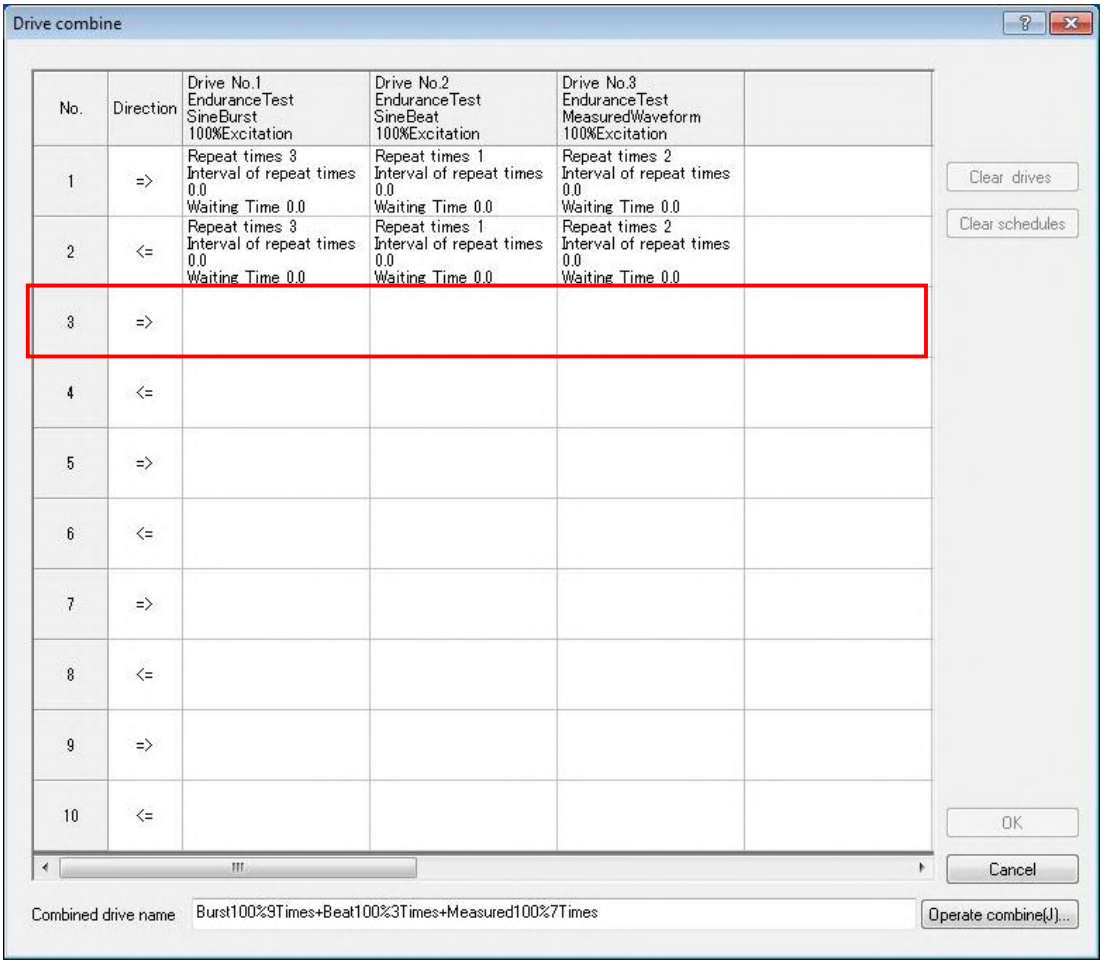
When a row to be cleared is selected in grid control, “Clear schedules” button becomes effective. Or, when the right mouse button is clicked in the state that the row to be cleared is selected, pop-up menu “Clear” is displayed.

More than one rows also can be selected.



＜Step2＞

When “Clear schedules” button or pop-up menu “Clear” is clicked, setting of selected row is cleared.



6.2.1.6 Clear cells

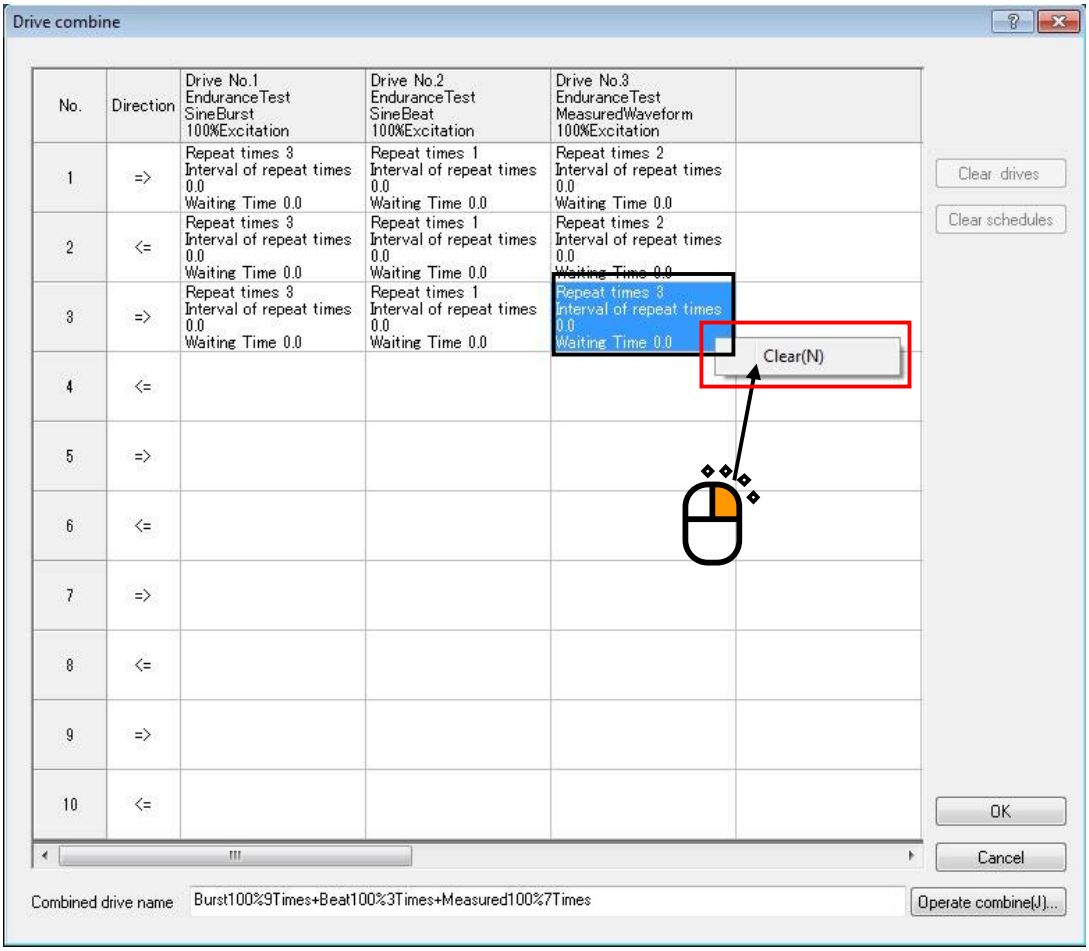
This section describes clearing cells.

＜Operation procedure＞

＜Step1＞

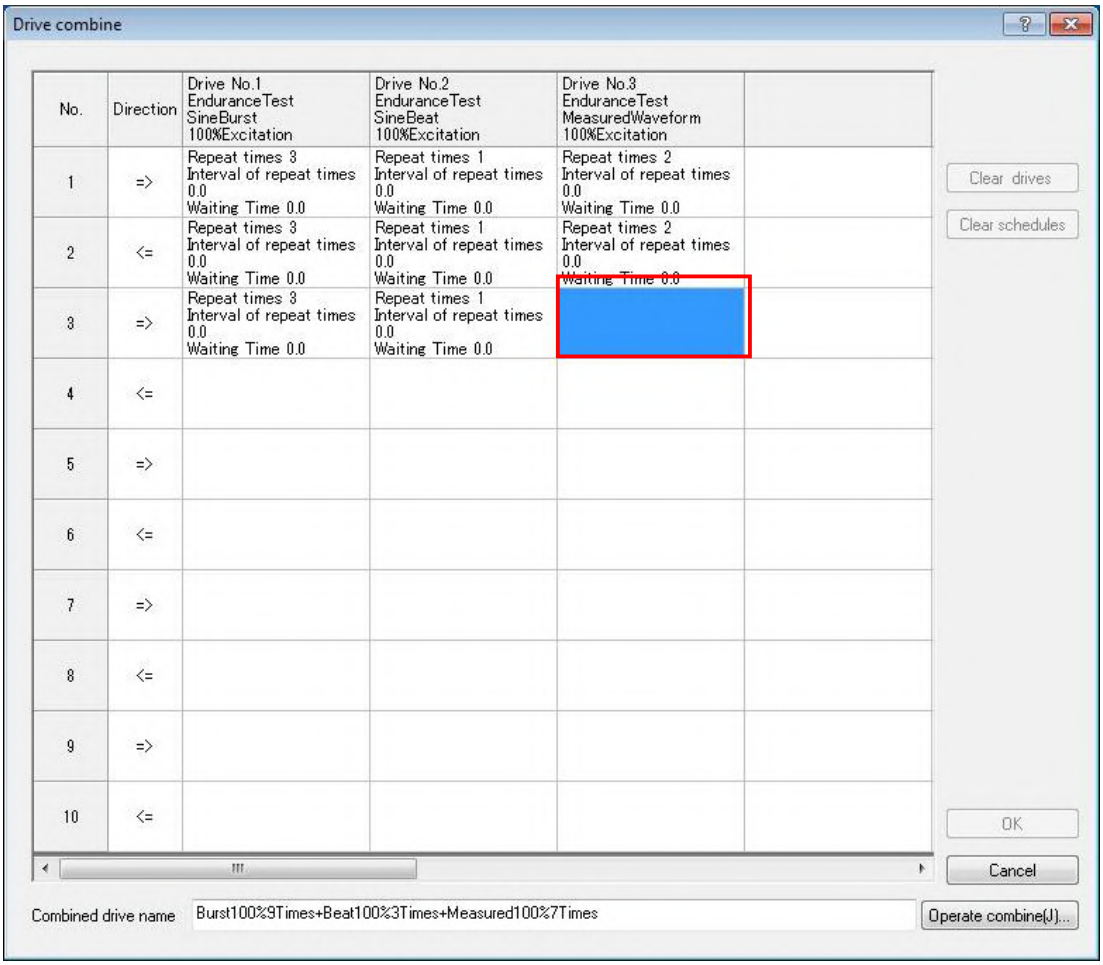
When the right mouse button is clicked in the state that the cell to be cleared is selected in grid control, pop-up menu “Clear” is displayed.

More than one cells also can be selected.

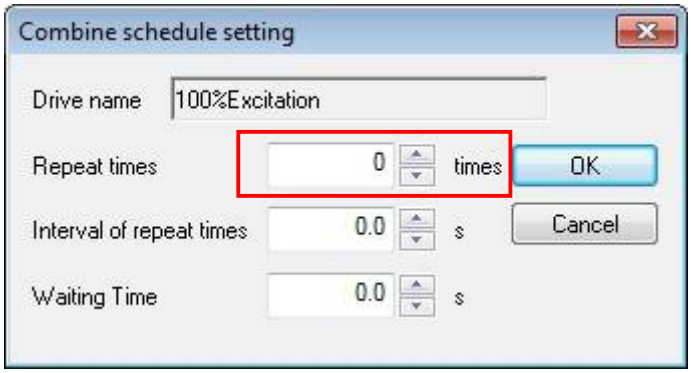


＜Step2＞

When pop-up menu “Clear” is clicked, setting of selected cell is cleared.



Or, that can be cleared when a cell to be cleared is double-clicked to display combine drive select screen, and “Repeat times” is set to “0 times” on that screen.



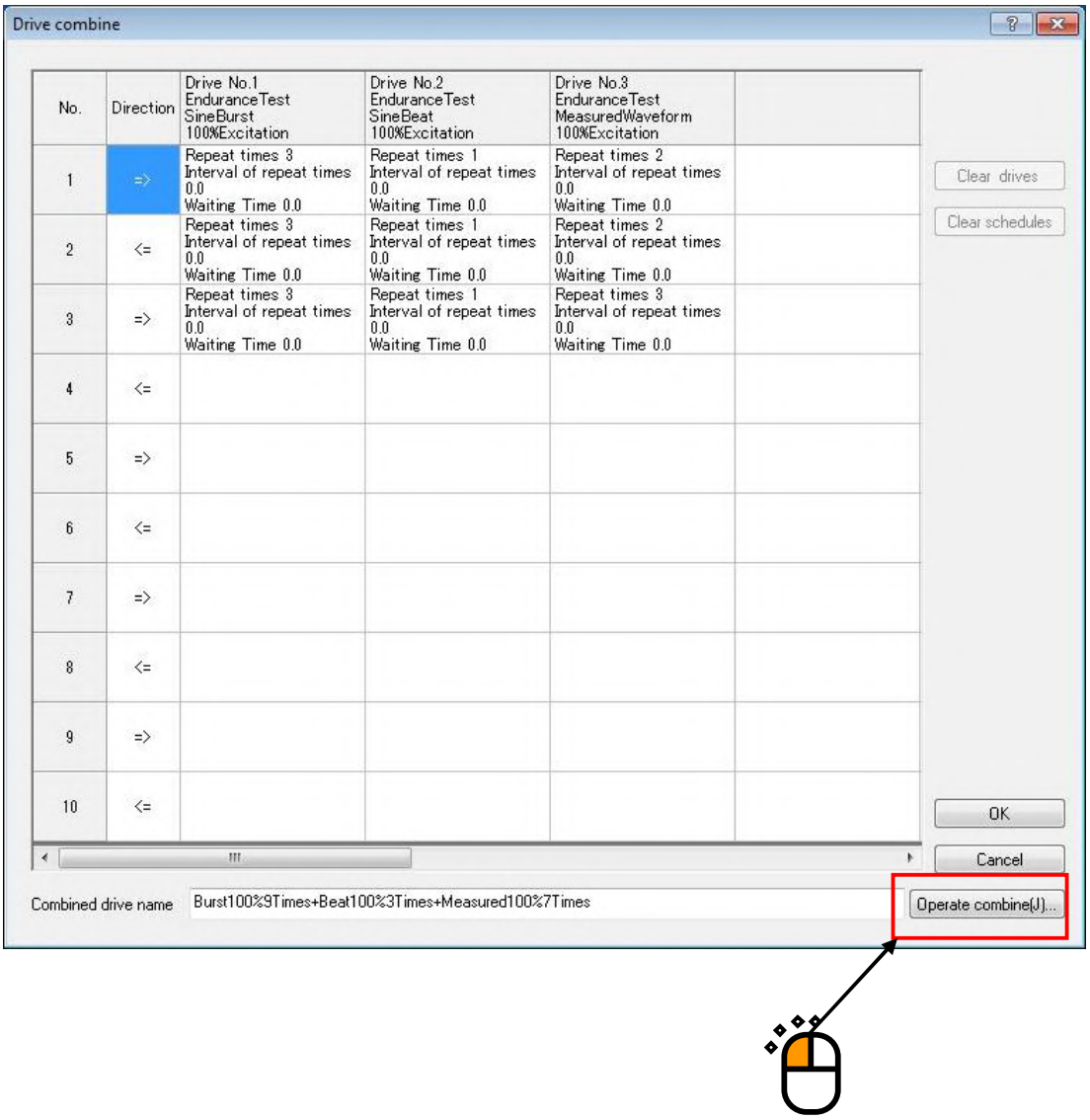
6.2.1.7 Operate Combine

This section describes operating combine.

＜Operation procedure＞

＜Step1＞

When more than one combine schedule setting is operated on the drive combine screen, “Operate combine” button becomes effective. Click “Operate combine” button.



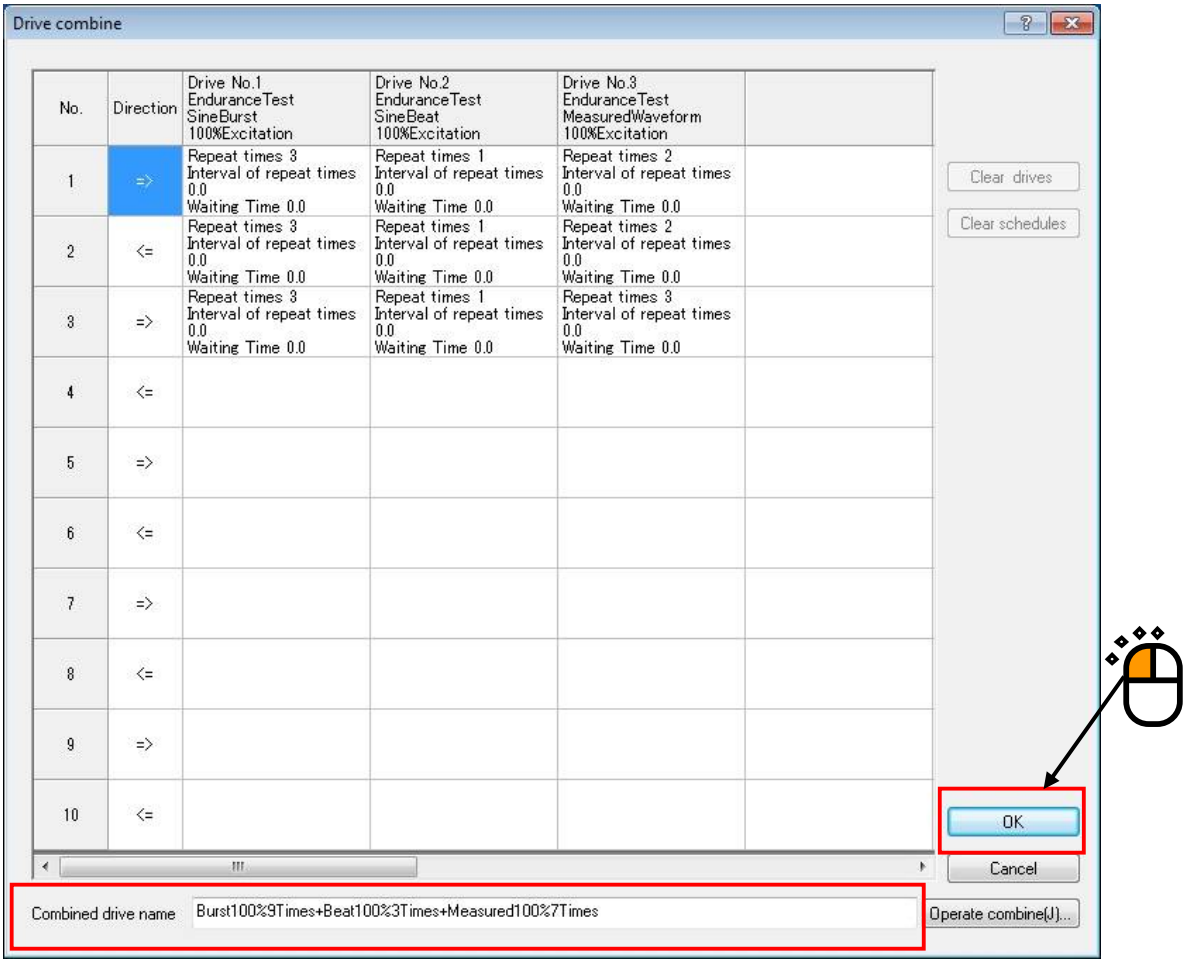
＜Step2＞

When combined drive generation is operated, generated drive waveform is displayed by graph in the dialogue.

Click “Close” button to close the dialogue.

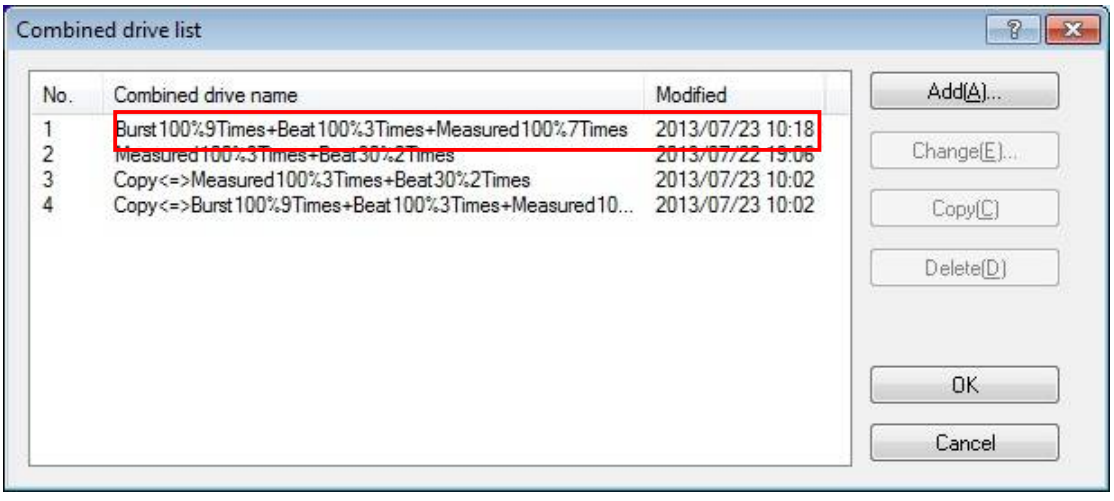
6.2.1.8 Combined drive name

Intrinsic “Combined drive name” is set for generated combined drive. Input combined drive name in “Combined drive name” edit box on the drive combine screen.



When combined drive name is input and combine operation is being operated, “OK” button becomes effective.

After clicking “OK” button and finishing drive combine screen, the name is reflected in combine drive list screen.

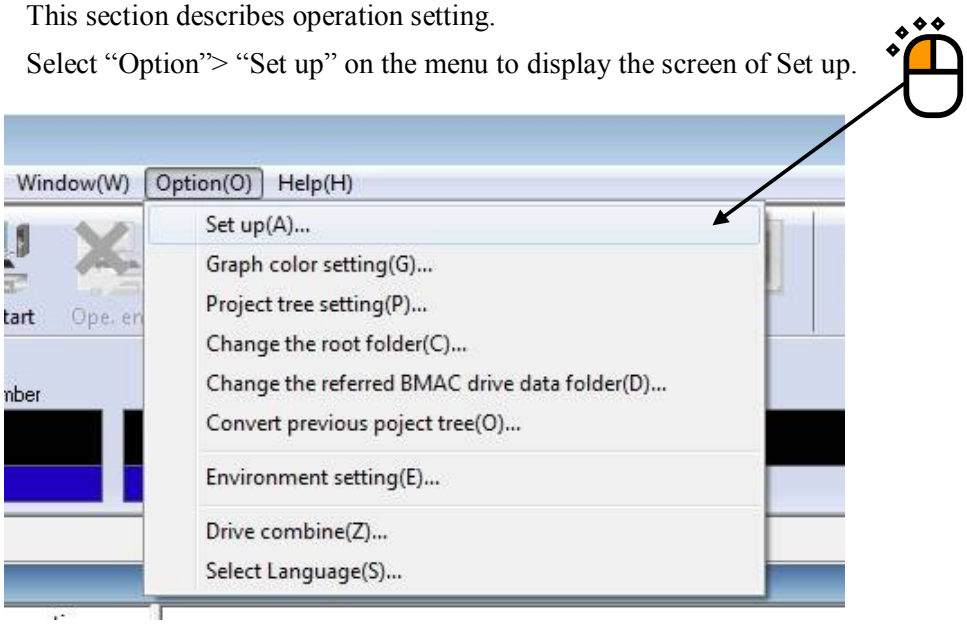


Chapter 7　Supplement related to Operation

7.1 Set up

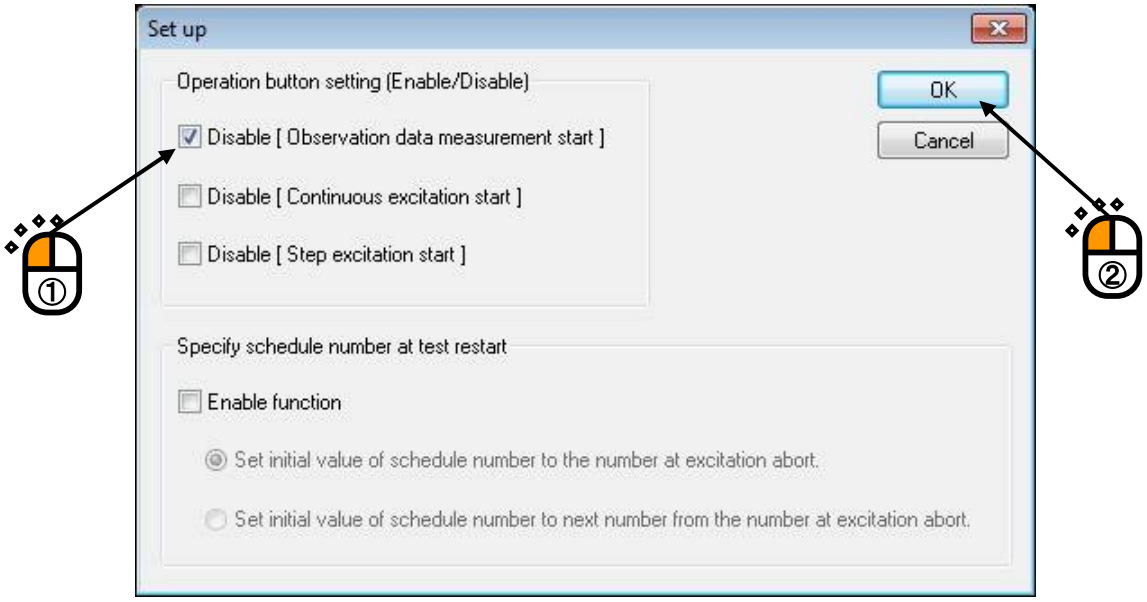
This section describes operation setting.

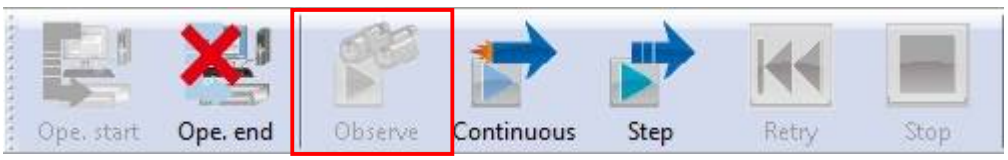
Select “Option”> “Set up” on the menu to display the screen of Set up.



7.1.1 Disable [Observation data measurement start]

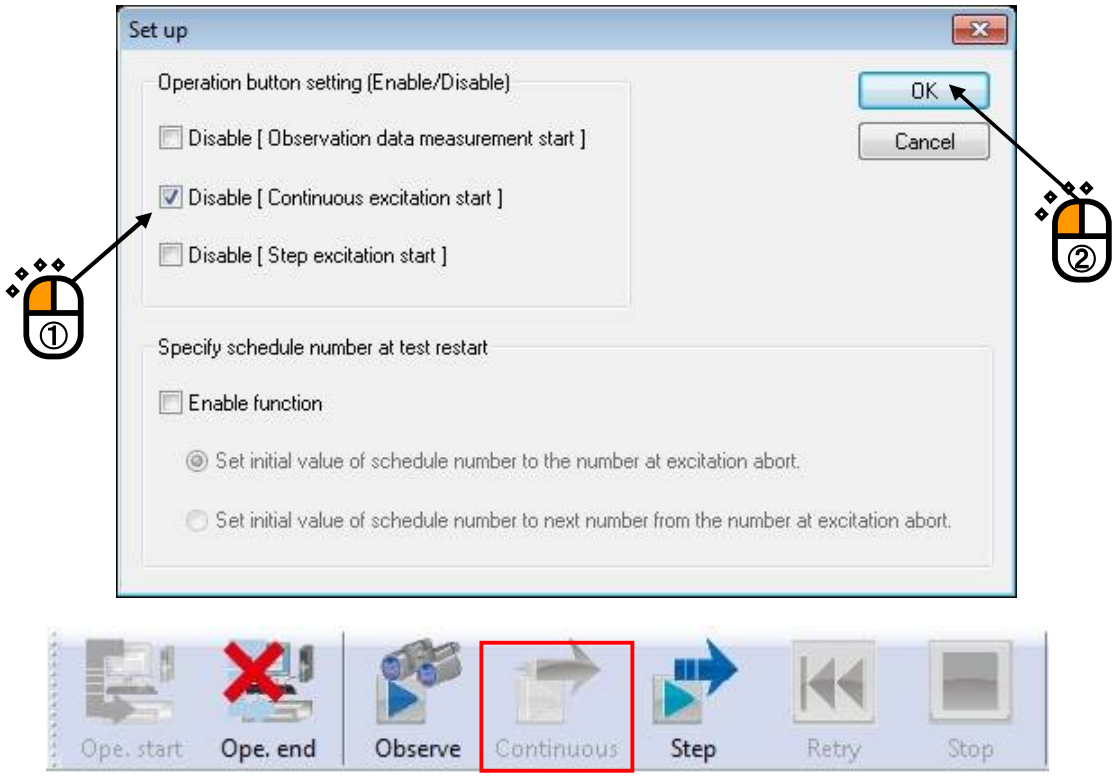
After checking “Disable [Observation data measurement start]” and pressing “OK” button, [Observation data measurement start] button remains in the invalid state even if the state comes to waiting for excitation start.





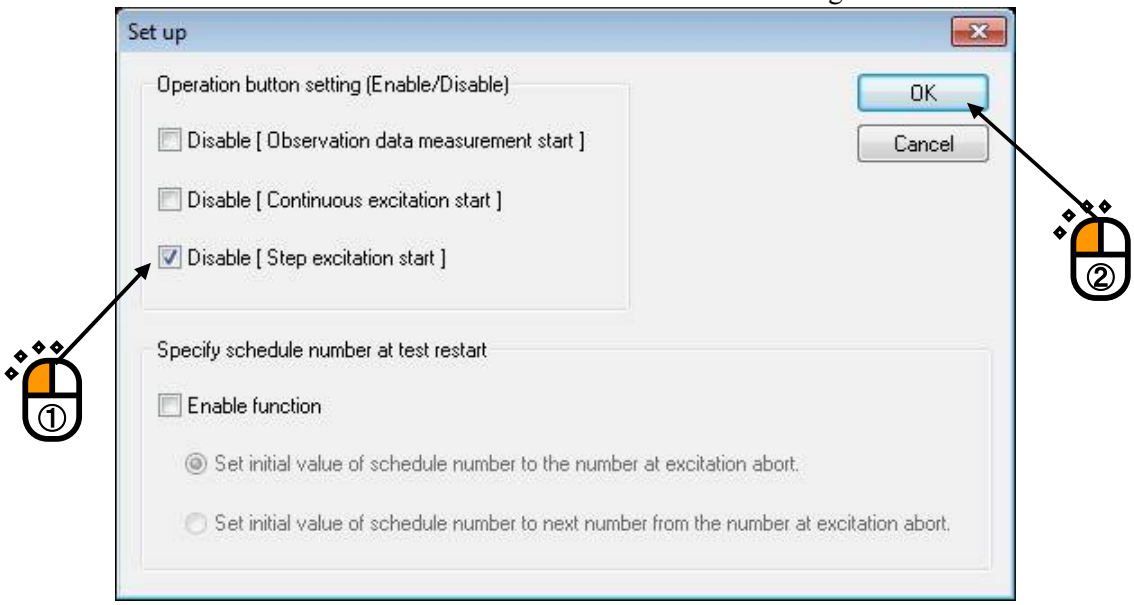
7.1.2 Disable [Continuous excitation start]

After checking “Disable [Continuous excitation start]” and pressing “OK” button, [Continuous excitation start] button remains in the invalid state even if the state comes to waiting for excitation start.



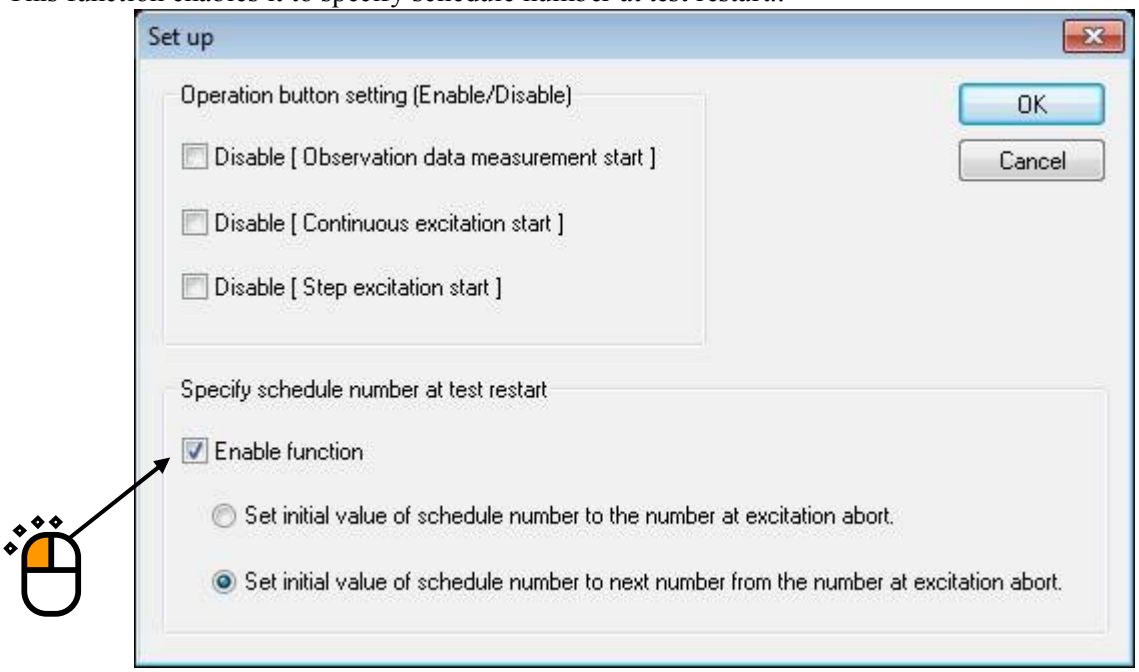
7.1.3 Disable [Step excitation start]

After checking “Disable [Step excitation start]” and pressing “OK” button, [Step excitation start] button remains in the invalid state even if the state comes to waiting for excitation start.

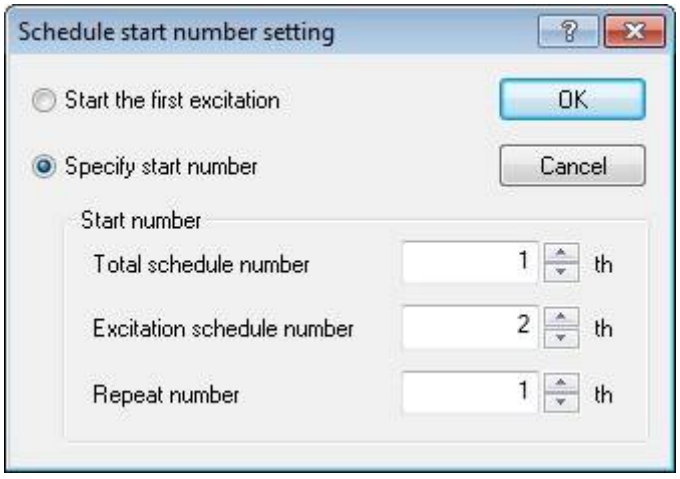


7.1.4 Specify schedule number at test restart

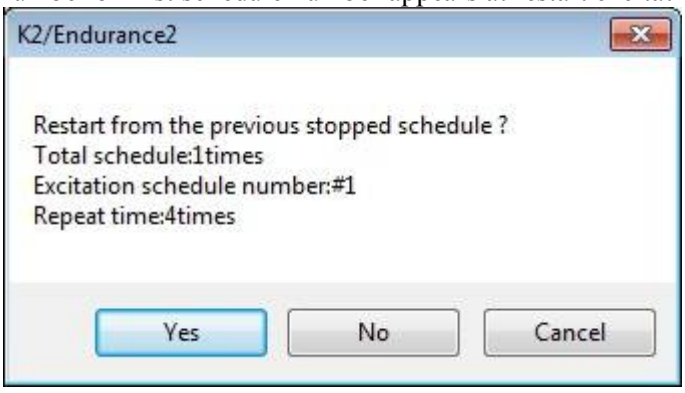
This function enables it to specify schedule number at test restart..



After checking “Enable function” and pressing “OK” button, the dialogue for setting the schedule start number appears at step excitation start or continuous excitation. Initial setting of start number is set according as Set-up setting..



When this function is disabled, the dialogue for selecting whether to start from the stopped schedule number or first schedule number appears at restart excitation.

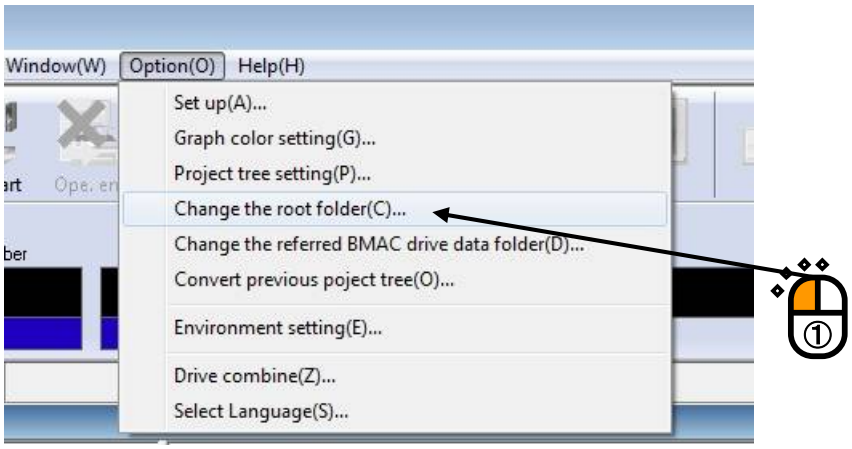


7.2 Change the Root Folder

This section describes root folder change.

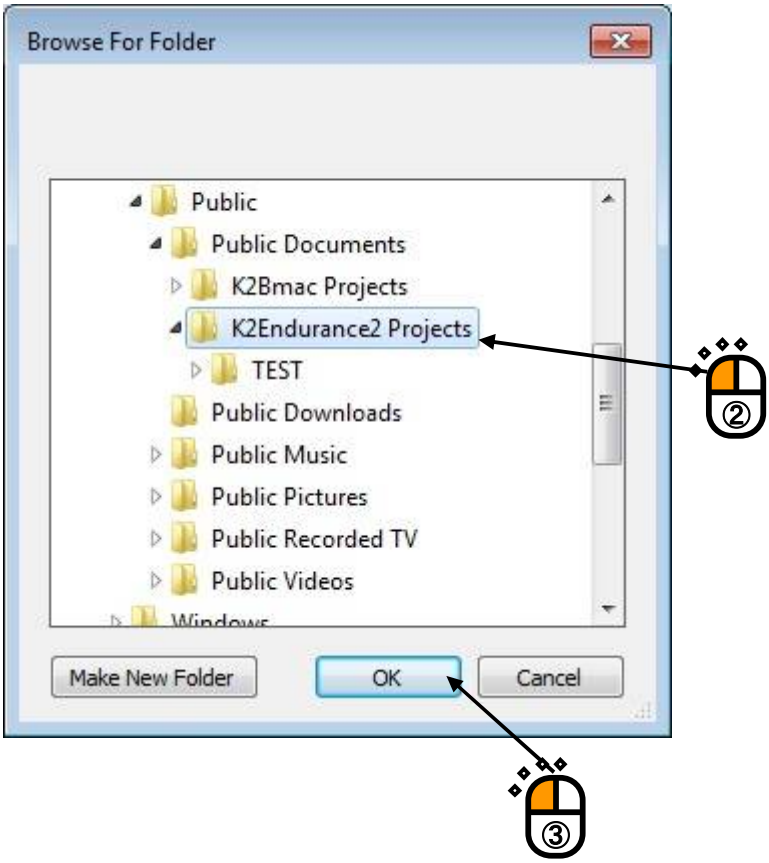
The place of folder in which parent project is created can be changed.Create folder to be specified beforehand by Windows Explorer etc. Operation procedure is described below.

Select “Root folder change” from Option on the menu.



As reference screen of folder is displayed, select folder to be specified to the destination to save of parent project, and press “OK” button.

Now, setting is finished. The specified place will be Endurance2 working folder.

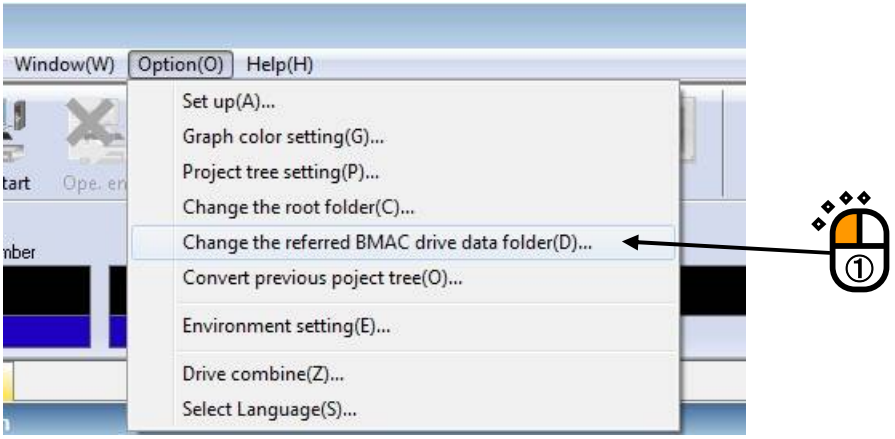


7.3 Change the referred BMAC drive data folder

This section describes change of the referred BMAC drive data folder.

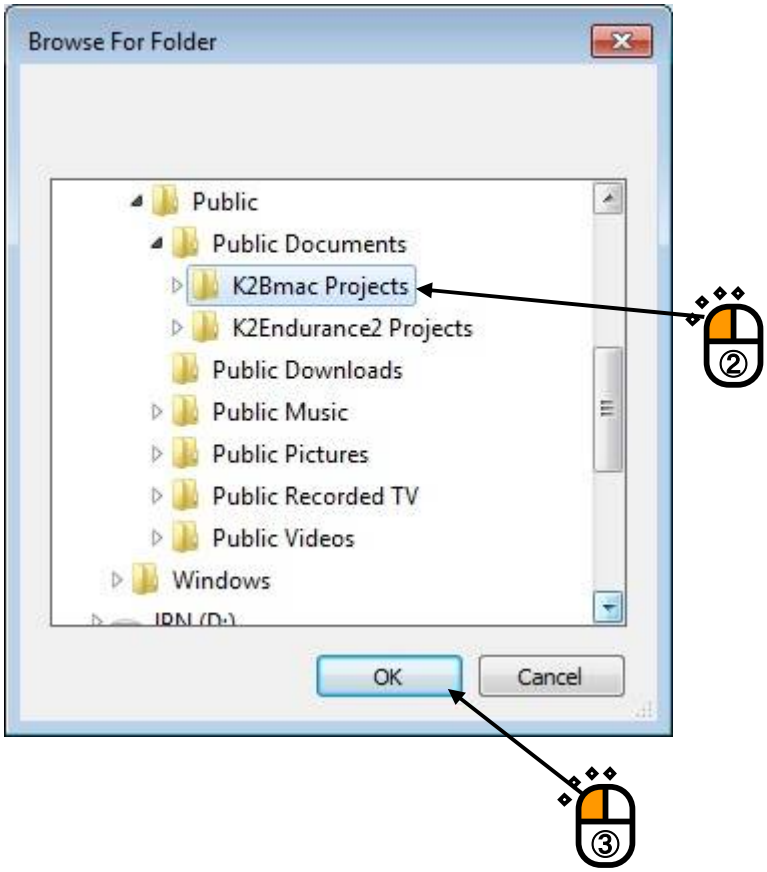
The place of the referred BMAC drive data folder can be changed. Operation procedure is described below.

Select “Change the referred BMAC drive data folder” from Option on the menu.



As reference screen of folder is displayed, select folder to be specified to the referred BMAC drive data folder and press “OK” button.

Now, setting is finished. The specified place will be folder to be referred BMAC drive in drive entry or drive combine.



7.4 Contact I/O signal Setting

There is no description about contact I/O signal setting of K2/ENDURANCE2 in K2 common part Instruction manual.

The contact I/O signal setting of K2/ENDURANCE2 is as follows.

Input Part

Name	Indication
NOTUSE	The specified terminal is not used.
RMTENB	This item is for setting of an allowance of remote control for a contact state before the initial measurement. Valid : one time only before the initial measurement Default : Remote control is always allowed.
SYSRDY	This item is for setting of Excitation system to be available to operate. Valid : in all the state of test operation mode Default : Excitation system is always available to operate.
Excitation start	Not available
STOP	This item is for stopping of excitation. Valid : in the state of executing the operation Default : no order
PAUSE	Not available
DCAN	Not available
UP	Not available
DOWN	Not available
TRIG	Not available
NEXT	Not available
RETRY	Not available
NXLOOP	Not available
EXIT	Not available
XFRRNW	Not available
AUXIN 1～16	Not available

Name	Indication
Emergency stop	This item is for operating of emergency stop. The mute function of D/A converter decreases the drive output in hardware.

Output Part

Name	Indication
HOLDOFF	The specified terminal is not used.
HOLDON	The system is in Test Operation mode.
WSTART	The system is in the state of waiting for excitation start.
WTRIG	Not available
WNEXT	This system is in the state of waiting for proceeding to the next step (each process divided at the point of a waiting state for the operator's order is called 'step').
INMEAS	Not available
INOPE	The system is in test operation or in data acquisition. (Including the state in pause.)
SIGOUT	The system is outputting the drive signal.
INPAUSE	Not available
EXC0DB	Not available
TIMEUP	Not available
FINISHED	The system is in the state of excitation completion except for in observation data measurement. (Including abort)
ABORTED	The excitation is stopped by abort function.
ALARM	Not available
CHKERR	The excitation is stopped according to the result of Tolerance check as 'NG'.
AUXOUT 1～16	Not available

7.5 Converting the previous project tree

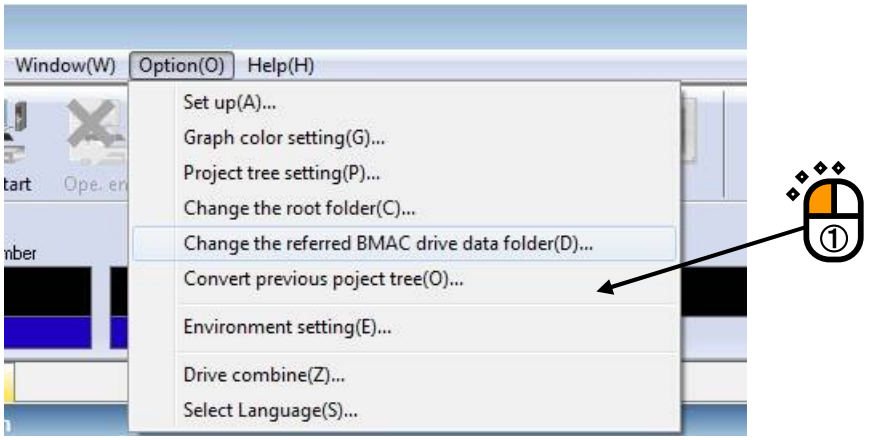
Projects created by the BMAC of which versions are older than Ver10.0.0.0 are described as the previous project trees hereinafter.

To use the previous project tree for BMAC Ver10.0.0.0 or later versions, the project format should be converted to that for Ver10.0.0 or later versions.

This function is to convert and back up previous project trees.

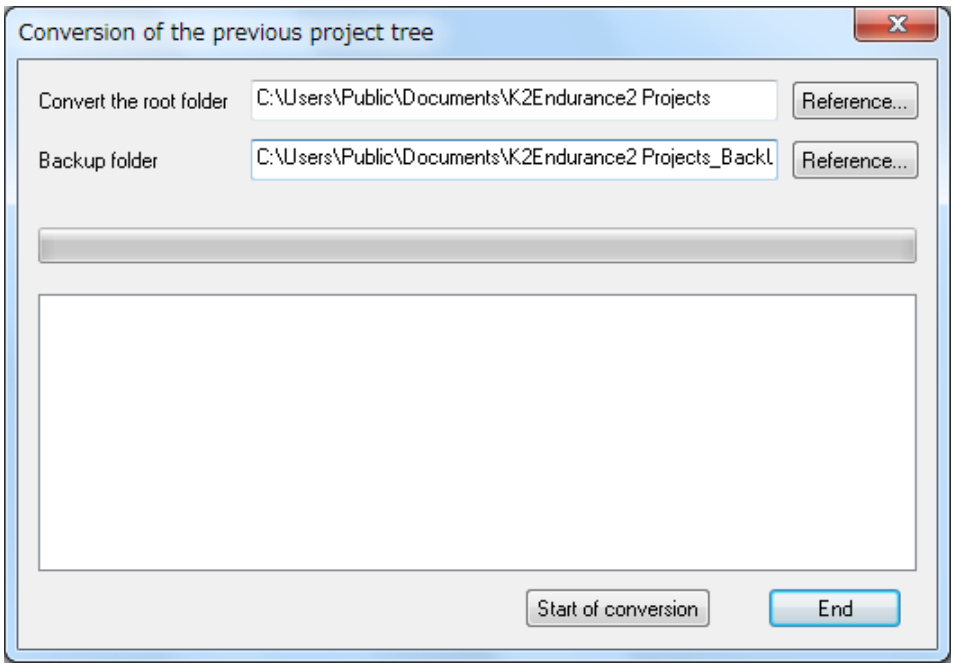
Take the procedure below:

Select ‘Convert previous project tree’ from the menu options.



Since the dialog box below opens, select the previous project tree to be converted, and set to the ‘Convert the root folder’.And select the destination folder to back up, and set to the ‘Backup folder’. Press the ‘Start of conversion’ button to copy the previous project tree in the ‘Backup folder’ and convert the format.

Then the project tree in the ‘Convert the root folder’ is converted to the format for Ver10.0.0.0 and later versions and overwritten.



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