

SGEMCS

Users Manual

SGEMCS Ver. 4.0.1



Technology Center

Introduction

This user's manual describes the specifications and operations of SGEMCS.

Please read this manual thoroughly to understand the specifications and fully employ the functions.

Precautions for Use

These precautions must be observed when using this manual and the software introduced herein:

- ◆ Sigma Koki Co., Ltd. retains all rights to this guide and the software introduced in the manual.
- ◆ Unauthorized reproduction or duplication of this manual, whether in whole or in part, is strictly prohibited.
- ◆ Due to improvements or other reasons, the specifications of software and hardware introduced in this manual are subject to change without prior notice.
- ◆ Sigma Koki Co., Ltd. assumes no responsibility for the results obtained when operating the software introduced in this manual.
- ◆ While Sigma Koki Co., Ltd. has thoroughly inspected the contents of this manual and the software introduced herein, unforeseen problems may still arise. Please contact us if there are any concerns.

Applicable Software and hardware

The following software and hardware are referred to in this manual:

- ◆ Software
 - Operating System: Windows 95/98 (SE)/95/Me/2000/XP/Vista
 - Excel 97 or later (must be a version that supports Excel macros)
 - ◆ Hardware
 - Measurement equipment and controller (compatible with RS-232C or GPIB* interface)
 - * GPIB is only supported for interface board/card from National Instruments.
- Stage controller (Stage-Controller, or Driver by Sigma Koki)
- * USB is only supported for stage controller from Sigma Koki.

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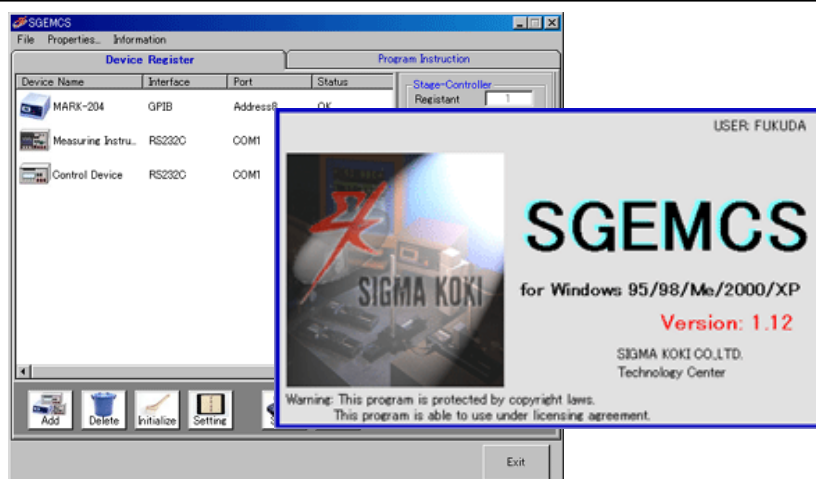
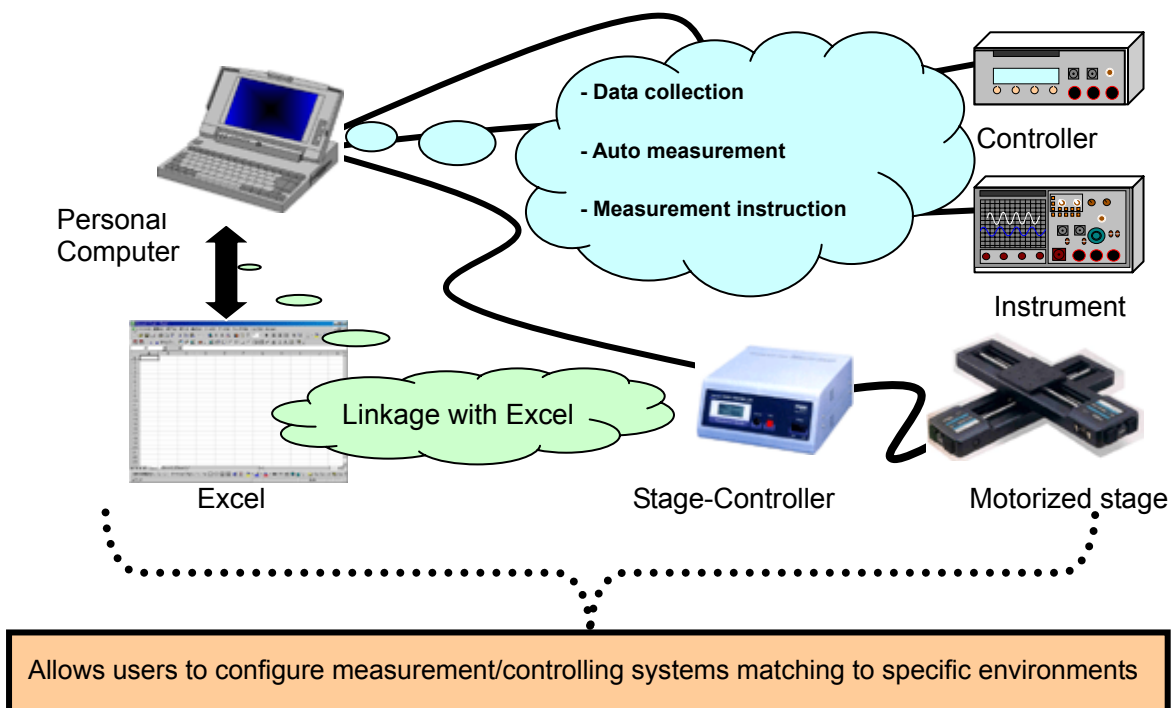
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1. Overview

SGEMCS is an application program which can communicate with devices such as automatic positioning device, measuring instruments or control devices to collect data and conduct measurement.

SGEMCS has high affinity with Microsoft Excel. You can use Excel to edit/save collected or measured data with SGEMCS, or, specify commands on Excel to operate SGEMCS.

With SGEMCS, you can easily configure a measurement/controlling system matching to your environments.



1.1 Main Features

- ◆ Simple auto-measurement with motorized stages, instruments, controllers, etc.
- ◆ Allows multiple connections. Supports RS-232C^{*1}, GPIB^{*2} and USB^{*3} interfaces.
- ◆ SGEMCS facilitates data editing by saving controlling/measurement results as text or Excel formats.
- ◆ Two selectable measurement modes, Program Instruction, in which measurement is designated from SGEMCS, and Excel Instruction, from an Excel file, allow users to choose a variety of measurement settings from the simplest to highly sophisticated measurement matching to purposes and conditions.
- ◆ Program Instruction mode features manual operations, time-series measurement, counter presetting, and other useful measurement functions.
- ◆ In Excel Instruction mode, you can use such convenient features as sequential measurement with multiple Excel files and measurement control with Excel macros.
- ◆ You can save communications and other conditions in SGS files, which allows you to repeat the same process without difficulty.
- ◆ SGEMCS allows you to send/receive commands through interfaces directly with open terminal windows. This enables you to check operational status during command entries.

*1: For RS-232C interface, use COM 1 to 8 ports.

*2: Only National Instruments' card/board can support the GPIB interface.

If you want to use GPIB, be sure to install driver software (supplied with GPIB board/card) in advance.

*3: Only Sigma Koki's stage controller can support USB I/F.

If you want to use USB interface, be sure to install the driver software in advance.

2. Installation

To use SGEMCS, SGEMCS needs to be installed.

The Installation procedure is described below.

To install SGEMCS, follow the steps (1) to (7) described below:

2.1 Installing SGEMCS

(1) Running Setup.exe

Insert the CD-ROM into the CD-ROM drive. The installer runs automatically.

If it does not run automatically, double click Setup.exe in the CD-ROM to start.

(2) Starting Setup Process

On starting Setup.exe, the SGEMCS installation dialog appears.

To continue the installation, click the Next button. To cancel, click the Cancel button.

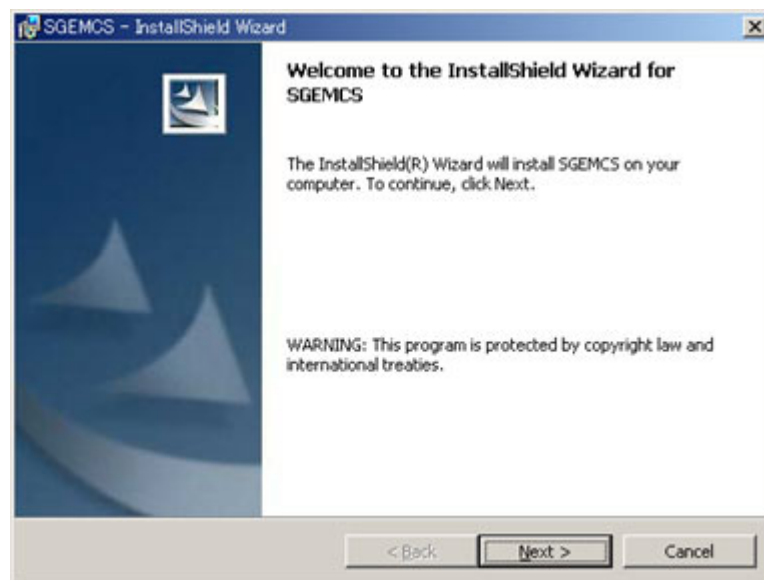
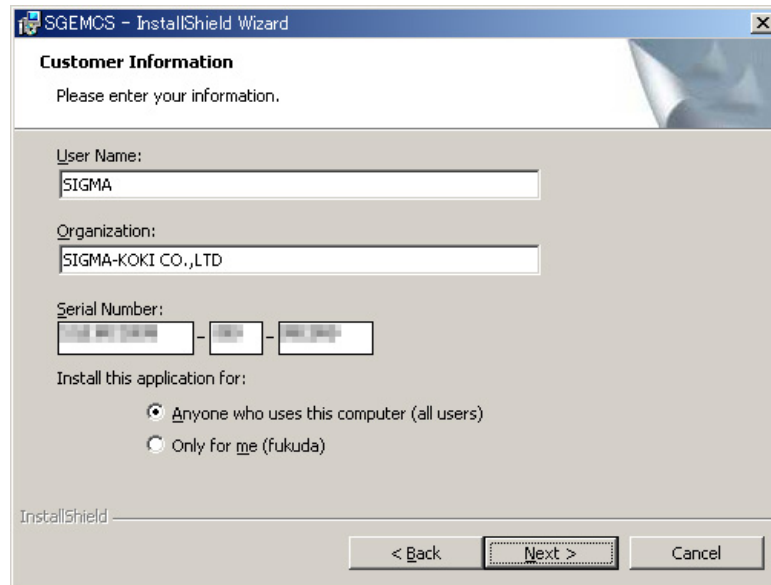


Fig. 2-1 Installation wizard

(3) Setting User Information

Type in your name, organization and the serial number of the product. To continue the setup, click the Next button. To cancel, click the Cancel button.

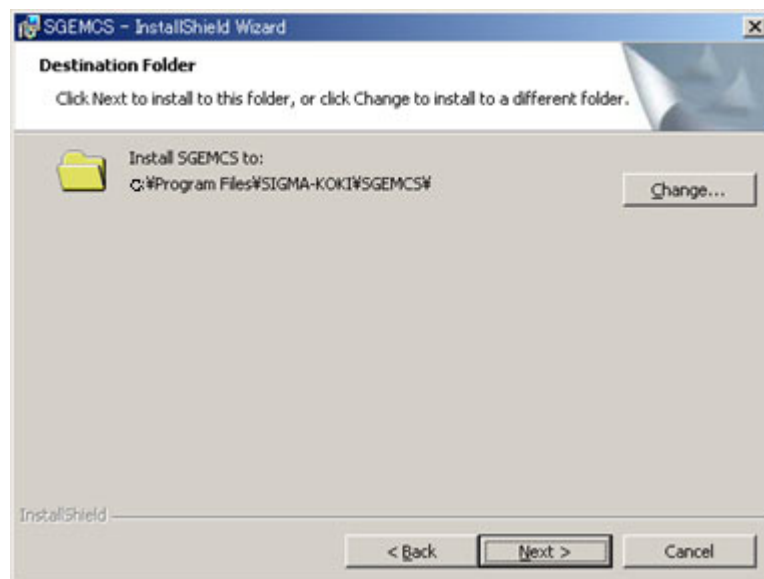


The image shows a Windows-style dialog box titled "SGEMCS - InstallShield Wizard". The main heading is "Customer Information" with the instruction "Please enter your information." Below this, there are three input fields: "User Name:" containing "SIGMA", "Organization:" containing "SIGMA-KOKI CO.,LTD", and "Serial Number:" which is a three-part field with hyphens. Underneath, there's a section "Install this application for:" with two radio button options: "Anyone who uses this computer (all users)" (which is selected) and "Only for me (fukuda)". At the bottom, there are three buttons: "< Back", "Next >" (which is highlighted with a dashed border), and "Cancel". The "InstallShield" logo is visible in the bottom left corner.

Fig. 2-2 Customer Information dialog

(4) Selecting Destination Folder

Select the installation folder. To install to the default folder, click the Next button. To install to a different folder, click the Change button and select a desired destination on the displayed dialog.



The image shows a Windows-style dialog box titled "SGEMCS - InstallShield Wizard". The main heading is "Destination Folder" with the instruction "Click Next to install to this folder, or click Change to install to a different folder." Below this, there's a folder icon and the text "Install SGEMCS to:" followed by the path "C:\Program Files\SIGMA-KOKI\SGEMCS\". To the right of the path is a "Change..." button. At the bottom, there are three buttons: "< Back", "Next >" (which is highlighted with a dashed border), and "Cancel". The "InstallShield" logo is visible in the bottom left corner.

Fig. 2-3 Destination Folder dialog

(5) Selecting Setup Type

Choose a setup type. To continue, click the Next button. To cancel, click the Cancel button. (“Typical” is recommended for normal use).

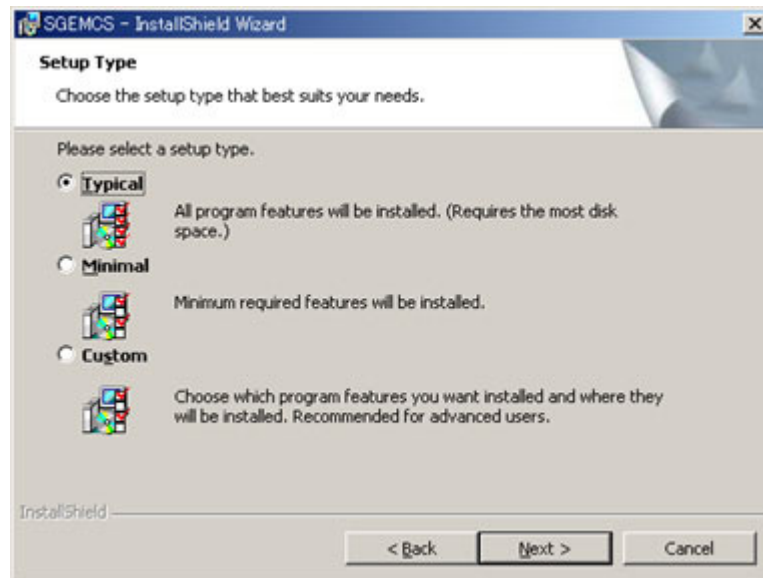


Fig. 2-4 Setup Type dialog

(6) Start Copying Files

Check the summary of installation information. To continue installation, click the Install button. To cancel, click the Cancel button. Clicking the Install button begins the installation of SGEMCS.

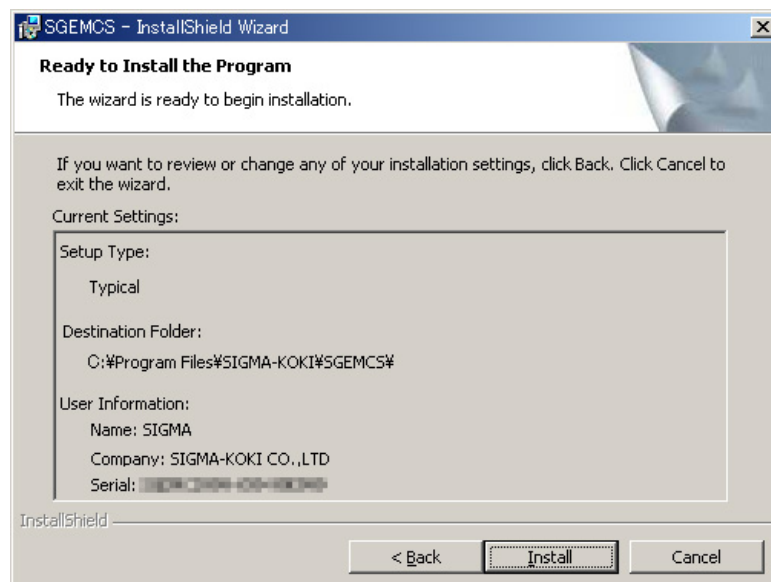


Fig. 2-5 Ready to Install the Program dialog

(7) Completion of Installation

Click the Finish button after the installation is completed.

Now SGEMCS has been installed on your PC successfully!

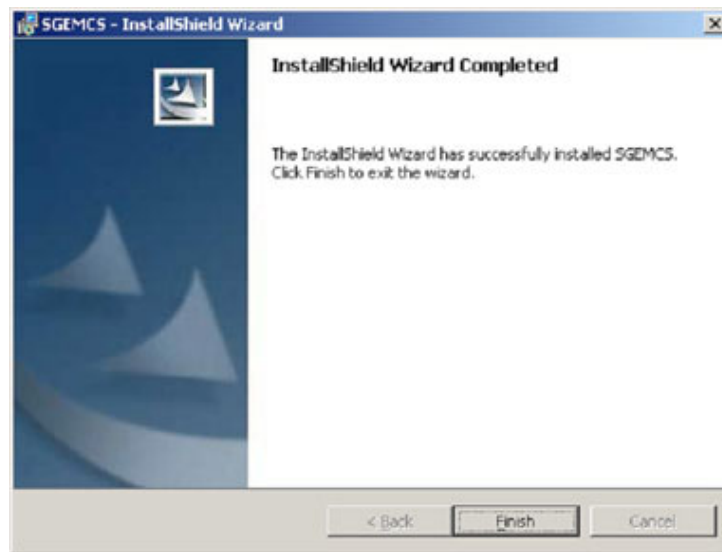


Fig. 2-6 Completion of Installation

2.2 Uninstalling SGEMCS

Select Control Panel and then Add/Remove Programs.

Programs Property dialog appears. Select SGEMCS and click Add/Remove button.



Fig. 2-7 Control Panel

3. Operation

This section describes the operations of SGEMCS.

SGEMCS has three main dialogs; Device Register, Program Instruction and Excel Instruction.

3.1 Device Register Dialog

You can register devices or make settings for them in this dialog.

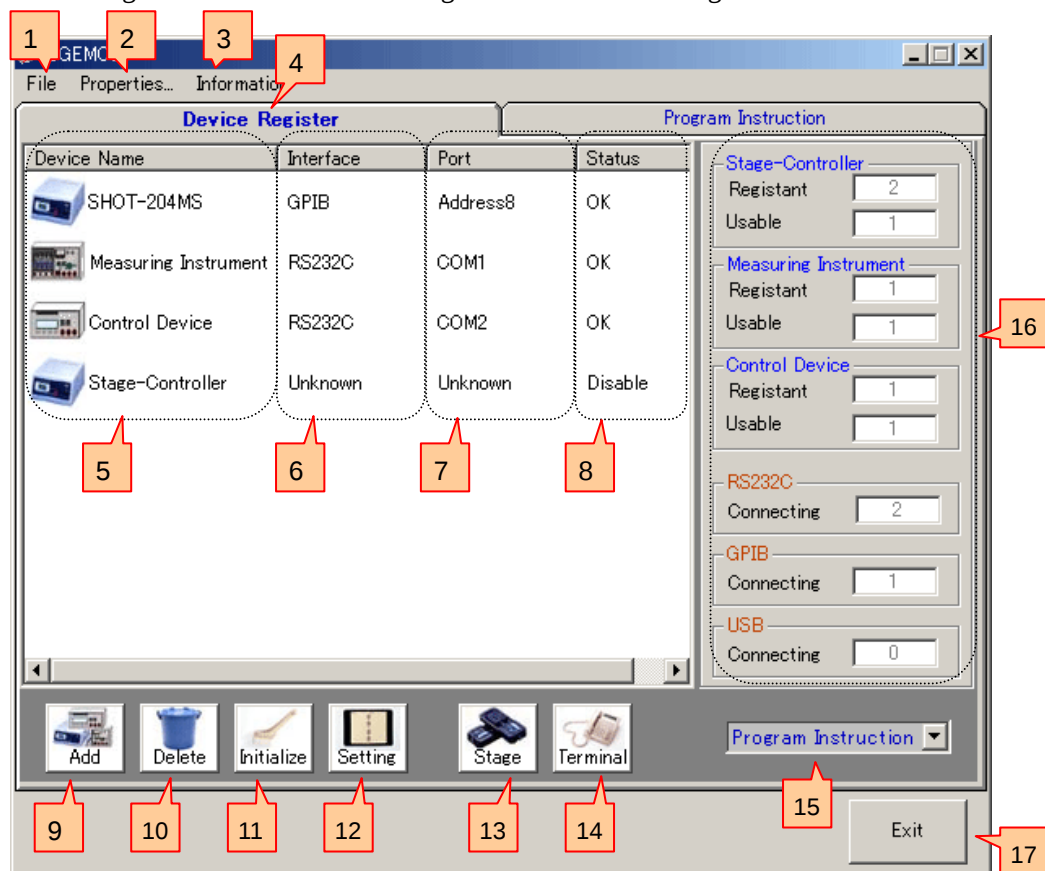


Fig. 3.1 Device Register dialog

1 File Menu

Click File to display the File menu.

A Settings file (with extension SGS) contains conditions and contents set with SGEMCS, and save them. Loading a Settings file can restore the saved environments. Moreover, preservation and restoration of the contents of a setting in a device unit can also be performed.

A "file" menu performs preservation and restoration of a settings file.

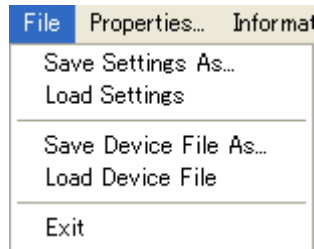


Fig. 3-2 File menu

• “Save / Load Settings” menu

If "Save Settings As" menu is clicked, each conditions and the contents which were set up by "SGEMCS" can be saved as a settings file (an extension is .SGS).

Moreover, if "Load Settings" menu is clicked, a settings file is read and the saved environment can be restored.

• “Save / Load Device File” menu

When the Device Register tab is being displayed, you can click “Save / Load Device File” menu. A setup (the contents of the communication setup, the contents of the setup of operation) of the controller under selection, device in the Device Register tab can be saved as a device file (an extension is .SGV). Moreover, if a device file is read, the saved device of the contents will be added to the Device Register tab.

2

Properties Menu

Clicking the Properties button will display the Properties dialog.

Click on the OK button to affect operations.

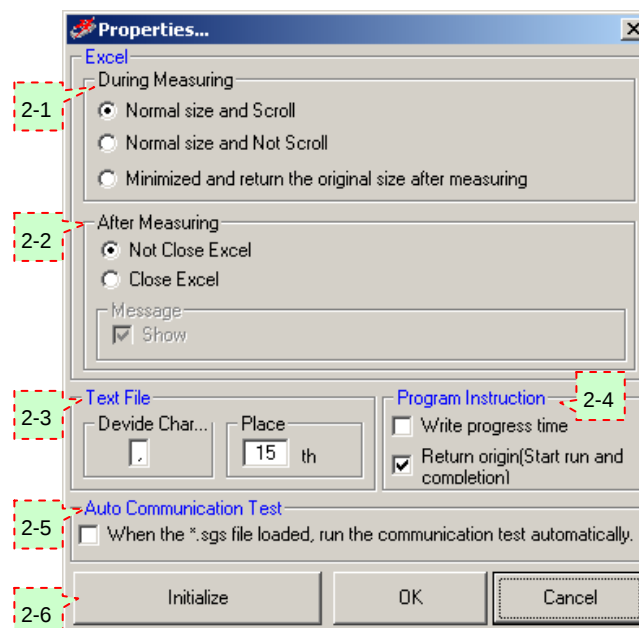


Fig. 3-3 Properties dialog

2-1

During Measurement

Select a desired operation mode to use Excel in measurement.

- ◆ Normal size and Scroll

Excel scrolls the display responding to the update of measurement results.

- ◆ Normal size and Not Scroll

Excel does not scroll the display even measurement results are updated.

- ◆ Minimize and return the original size after measuring

Minimizes Excel and does not display the contents during measurement.

2-2

After Measuring

Select a desired Excel operation mode after measurement.

- ◆ Not Close Excel

Excel will still be open after measurement.

- ◆ Close Excel

Excel will be closed automatically after measurement.

You can choose the display of a confirmation message before closing Excel if you select this mode.

2-3

Text File

Define the text file format.

- ◆ Divide Cha... (Character)

Specify a delimiter.

- ◆ Place

Specify a number of characters in text formats.

Example: 15-characters alignment: ABCDEFG, HIJKLMN, OPQRSTU,

Fill with blanks to add up to 15-character.

2-4

Program Instruction

Make settings in Program Instruction mode.

- ◆ Write progress time

Outputs progress time to measurement result files (Excel/Text).

	A	B
1	Progress time (s)	SHOT-204
2	0	0
3	0.8	1000
4	1.6	2000
5	3.1	0
6	3.9	1000
7	4.7	2000

Note: Progress time varies depending on performance and environments of PC used. So do not expect progress time shows exactly as you calculated. It is merely an approximation.

Fig. 3-4 Progress time

- ◆ Return Origin [Start run and completion]

When the Run Position of a stage controller is set to Prepare or After Measure, specify if the devices are homed.

Device Name	Interface	Port	Run Position	Interval
 SHOT-204MS	RS232C	COM2	Prepare	0
 SHOT-204MS	RS232C	COM2	Measure	0
 Measuring Instrument	RS232C	COM1	Measure	0
 SHOT-204MS	RS232C	COM2	After Mesasure	0

Fig. 3-5 Homing on Start/After Measure

2-5 Auto Communication Test

Enable/disable automatic communication tests with registered devices when loading setting files (.SGS files).

If disabled, manually verify communication with the devices.

2-6 Initialize

To Default the settings in the Properties dialog.

3 Information Menu

Click the Information button to open the Information menu.

You can display Information or About SGEMCS in the Information menu.

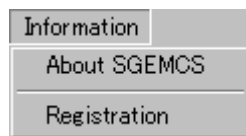


Fig. 3-6 Information menu

4 Display Selection Tabs

Switches Device Register and Properties (Program Instruction and Excel Instruction).

5 Device Name

Displays registered devices (Stage-Controller/Measuring Instrument/Control Device).

Double click to display the setting dialog.

6 Interface

Shows interfaces (RS-232C/GPIB/USB) for registered devices.

Shows "Unknown" if no interface is specified.

7 Port

Displays a connection (COM1 to 8, Address0 to 30 or ID1 to 8) for each registered device.

Shows "Unknown" if no connection is specified.

8 Status

Shows status (connected/error) for registered devices.

Shows "Disable" if a device is not connected.

9 Add button

Click to register additional devices.

Click to show the Add Device dialog. Select a device you want to add on the dialog.



Up to 32 devices are acceptable.

Fig. 3-7 Add Device dialog

◆ Stage ...

Stage-Controller or Intelligent Driver of Sigma Koki.

◆ Measure ...

Measuring Instrument which will return measured results for measurement commands.

◆ Control...

Control device (not reading data) to change temperatures or brightness.

10 Delete button

Click to delete registered devices.

To delete a device, select the device and then click the Delete button.

A device cannot be deleted if currently being used in Program Instruction or Excel Instruction mode.

11 Initialize button

Delete all the registrations and initialize the settings.

You cannot initialize settings if any devices are currently being used in Program Instruction or Excel Instruction mode.

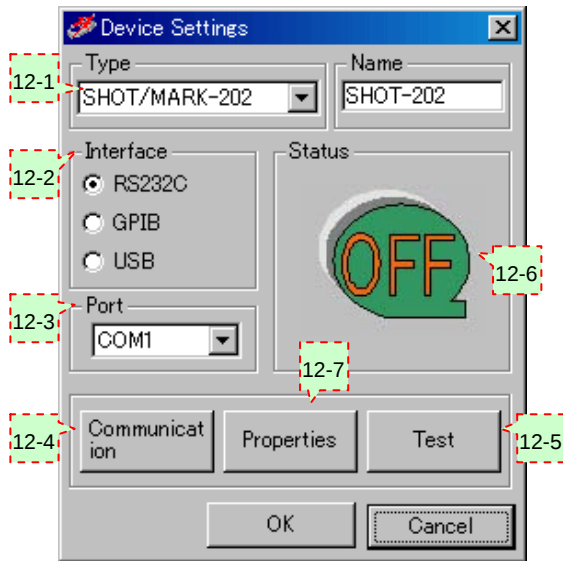
12 Setting button

Click to set a registered device.

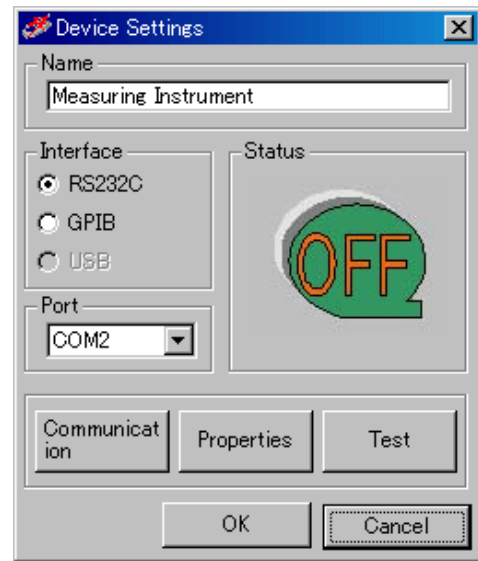
To set a device, select a desired device and then click the Setting button.

The Device Settings dialog will appear.

Click on the OK button to update with the settings.



In the case of a stage-controller



In the case of a measuring Instrument and a control device

Fig 3-8 Device Settings dialog

12-1 Name

Select/Input a model of a device you want to register.

For Stage-Controllers, select a model from the list.

If you want to change the name of a device model, alter it by typing directly in the name box.

For Measuring Instruments or Control Devices, default names are displayed.

To change the name of a model, alter it by typing directly in the box.

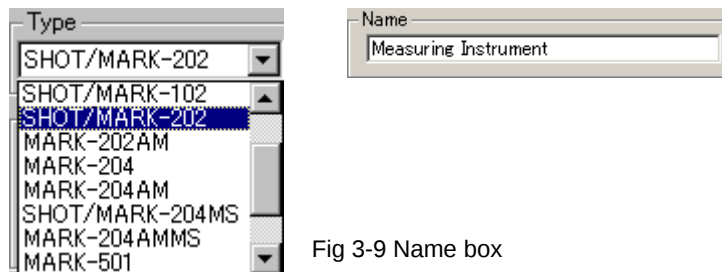


Fig 3-9 Name box

12-2 Interface

Select an interface for the device you want to register.

Selectable interfaces may vary depending on the devices.

- ◆ Stage-Controller: RS-232C, GPIB or USB (dependent on models)
- ◆ Measuring Instrument: RS-232C or GPIB
- ◆ Control Device: RS-232C or GPIB

12-3 Port

Select a connection for the device you want to register.

Selectable connections may vary depending on interfaces for the devices.

- ◆ RS-232C: COM1 to COM8
- ◆ GPIB: Address0 to Address30
- ◆ USB: ID1 to ID8

12-4 Communication button

Click to set communication conditions for a registered device.

Click on the Communication button to display the setting dialog.

The dialog type is dependent on selected interfaces.

- ◆ RS-232C: A communication setting dialog for RS-232C is displayed. The Detail Settings dialog is provided under the normal settings dialog.
Make settings according to a device to be used.

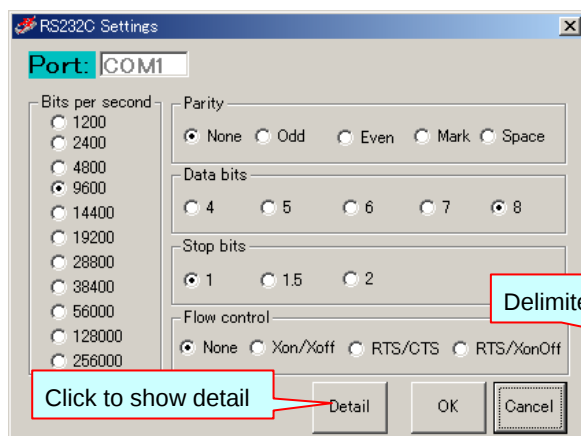


Fig. 3-10 RS232C Settings dialog

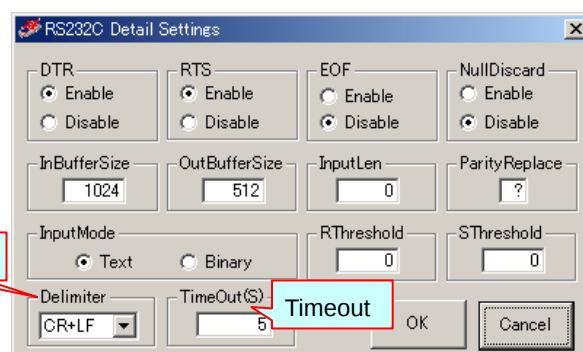


Fig. 3-11 RS232C Detail Settings dialog

In sending, the string specified as Delimiter is added to the end of strings to be sent.

Receive data should in turn include the delimiter at the end.

TimeOut restricts passing time after starting reception. When the preset time specified for TimeOut has passed, receiving process ends.

- ◆ GPIB: When GPIB is selected as the interface, the GPIB Settings dialog is displayed. Make settings according to a device to be used.

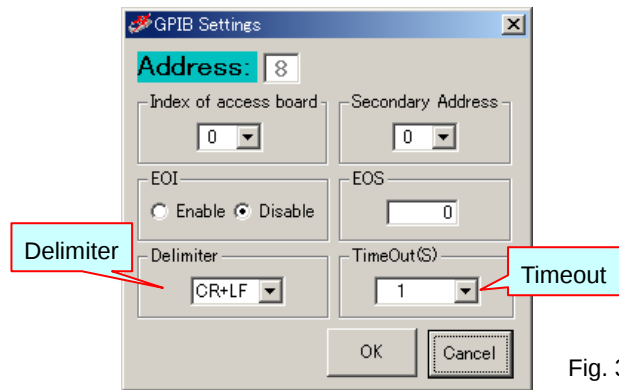


Fig. 3-12 GPIB Settings dialog

In sending, the string specified as Delimiter is added to the end of strings to be sent.

Receive data should in turn include the delimiter at the end.

TimeOut restricts passing time after starting reception. When the preset time specified for TimeOut has passed, receiving process ends.

- * Timeout setting for GPIB affects wait time in the GPIB driver. Therefore, setting longer time in TimeOut freezes SGEMCS until the TimeOut ends, since GPIB has the control during that time span.
- * If you want to use the GPIB Interface, install the driver supplied with GPIB boards or cards by National Instruments, and check the software works properly before the use.

- ◆ USB: For the USB interface, the USB settings dialog is displayed.

* Only Sigma Koki's Stage-Controller can support USB I/F.

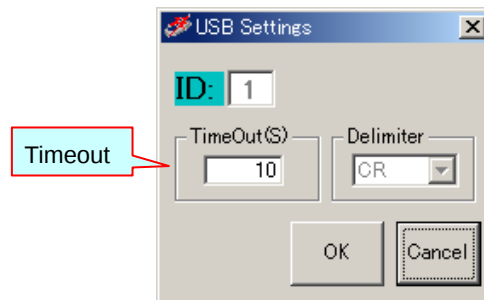


Fig. 3-13 USB Settings dialog

IDs are automatically assigned in the order of connection with Stage-Controllers.

In sending, the string specified as Delimiter is added to the end of strings to be sent.

Receive data should in turn include the delimiter at the end.

Delimiter for the Mark/SHOT series is fixed to "CR," not changeable.

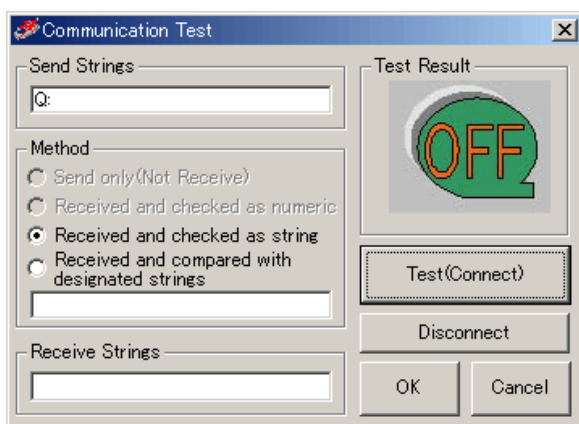
TimeOut restricts passing time after starting reception. When the preset time specified for TimeOut has passed, receiving process ends.

- * When you want to use the USB interface, install the USB driver of Sigma Koki and confirm that it works properly in advance.

12-5 Test Button

Click to test communication with a registered device.

Click on the Test button to display the Communication Test dialog.



Test Results

Fig 3-14 Communication Test dialog

Type in strings to be transferred to the device in the Send Strings box for communication test.

Click the Test (Connect) button to transfer the strings to the specified device, and then the results returned are checked against the sent strings.

The testing mode varies depending on the choice in the Method box:

- ◆ Send only (Not Receive)

Only sends strings, and does not compare receive results (Strings are not received).

- ◆ Received and checked as numeric

Checks if the received results are numeric values.

When the strings include characters other than numeric values, the communication test returns NG.

- ◆ Received and checked as string

Checks if the received results are strings.

Confirms the return of any strings including numeric values.

- ◆ Received and compared with designated strings

Checks if the returned strings match the designated strings.

When they do not match exactly, the communication test returns NG.

Communication test results are indicated in the Test Result display.

When the communication test returns NG, check again the sent/received strings for testing, communication settings, connection status with the devices (cables), etc. Also check installation status of driver software for GPIB or USB.

By conducting a communication test (and if the result is satisfactory), SGEMCS is connected with the device.

Click on the Disconnect button to terminate the communication.

12-6 Status

Displays a communication test result.

12-7 Properties button

Click to specify operational settings for a registered device.

Click on the Properties button to display the setting dialog.

Dialogs shown depend on the types of devices or Stage-Controllers.

(1) Measuring Instrument: For an instrument, the Measuring Instrument Settings dialog is displayed.

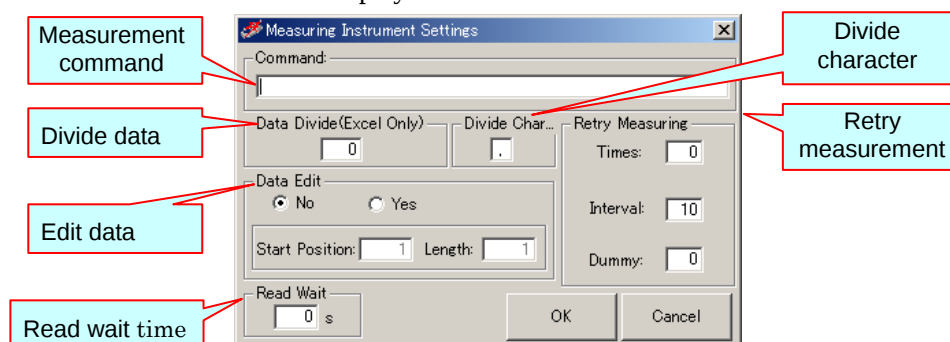


Fig. 3-15 Measurement Instrument Settings dialog

◆ Command

Input a measurement command to send to the instrument.

Instruments must respond to the measurement commands.

(If a device does not respond to a measurement command, SGEMCS cannot recognize it as an instrument).

◆ Divide character

If you want to receive response data from a Measuring Instrument by an Excel file, specify a divide character to divide the data to fill as many number of Excel cells.

- Example: If a response is "X=123,Y=456 Z=789,A=ABC B=DEF" with Divide character set to ",", Dividing number to 3:

	A	B	C
1	X=123	Y=456 Z=789	A=ABC B=DEF

- Example: If a response is "X=123,Y=456 Z=789,A=ABC B=DEF" with Divide character set to " " (space), Dividing number to 3:

	A	B	C
1	X=123, Y=456	Z=789, A=ABC	B=DEF

◆ Data Divide (Excel Only)

If you want to receive response data from a Measuring Instrument by an Excel file, specify a number to divide the data to fill as many number of Excel cells.

Data is divided by the character specified in the "Divide character".

- Example: If a response is "123,456,789" with Divide character set to ",", Dividing number to 0:

	A	B	C
1	123,456,789		

All the data in a cell.

- Example: If a response is "123,456,789" with Divide character set to ",", Dividing number to 2:

	A	B	C
1	123	456	

First two comma-separated strings fill two Excel cells.

Third and after are discarded.

◆ Data Edit

To output a response from a Measuring Instrument, edit the return strings with a start position and length specified.

- Example: If a response is "123, 456, 789" with Start Position set to 2, Length to 2:

	A	B	C
1	23		

You can combine the editing and dividing features.

- Example: If a response is "123, 456, 789" with Start Position and Length set to 2 and 2 in Data Edit, and Data Divide to 2:

	A	B	C
1	23	56	

◆ Retry Measuring

Set retry conditions in communication with Measuring Instruments.

When retry counts are specified in the Times box, communication process is repeated as many times as specified against communication failure before issuing an error.

Interval specifies an interval (in second) between retries.

In the Dummy box, specify the number of dummy communications repeated until reading valid data. This feature is to help receive unstable data.

Assume that Times is set to five, Interval to one, and Dummy to three. The communication is processed as follows:

Error occurs when "Q:" is sent to Measuring Instrument

Repeats 5 times with 1-sec intervals until "Q" TX/RX error has been recovered

Repeats 4 times even after error has been recovered. Discards first 3 RXs, accepts fourth.

◆ Read wait time

Specifies the interval (in second) of sending of the measurement command to a measuring instrument, and a reception start.

- Example: If a measurement command is “ST” and Read wait time is three:

Send “ST” to a measuring instrument



Wait for three seconds



Start to receive response data from a Measuring Instrument

*In the usual measuring instrument, although 0 is set as Read wait time, set up a required value according to device or use environment.

(2) Control Device: For a Control Device, Control Device Settings dialog is displayed.

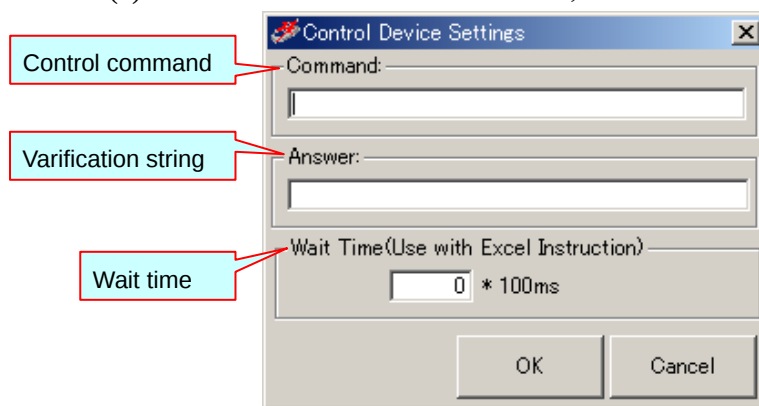


Fig. 3-16 Control Device Settings dialog

◆ Command

Input a control command sent to a Control Device.

◆ Answer

Input strings to be returned from the Control Device.

The Answer field should be specified only when the Control Device can respond to a control command (otherwise, DO NOT input the strings).

If the strings are specified, SGEMCS compares Answer with returned strings. If they do not match, a communication error will occur.

◆ Wait Time (Use with Excel Instruction)

Input wait time, if it is used for controlling purposes in Excel Instruction mode.

Unavailable to Program Instruction mode.

(3) Stage-Controller: For a Stage-Controller, a dialog for the Stage-Controller model is displayed.

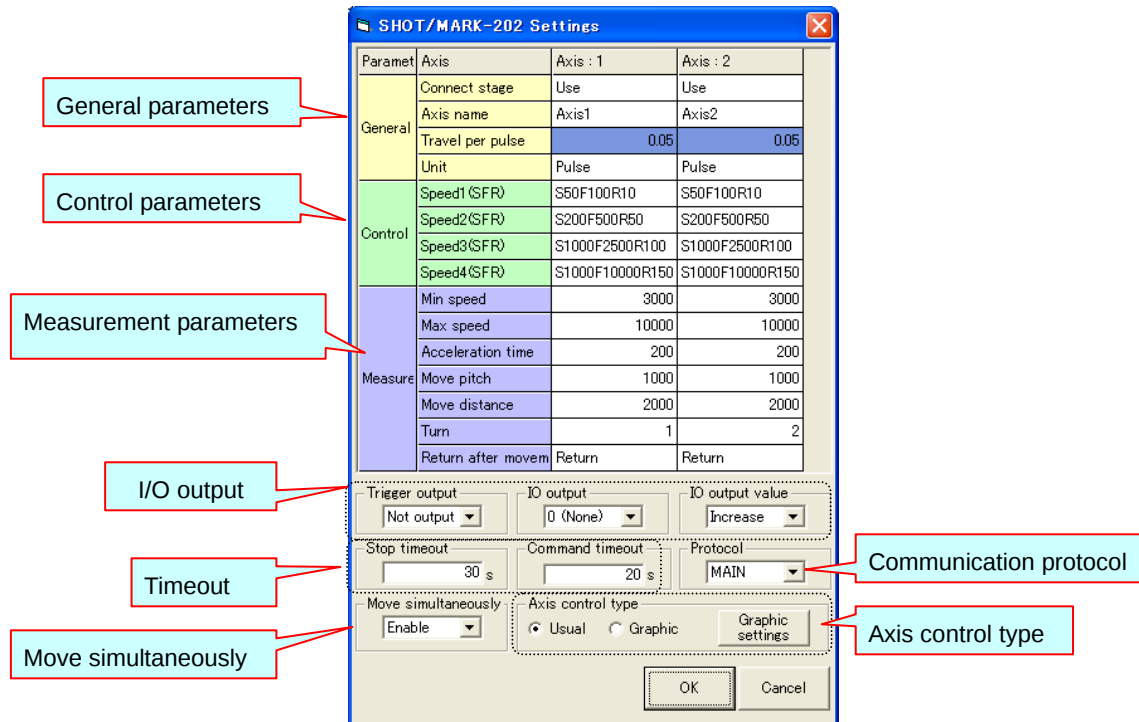


Fig. 3-17 Dialog for Stage-Controller settings

◆ General

Set unique parameters of the Stage-Controller.

Displayed/specified contents vary depending on the models of Stage-Controllers.

Paramet	Axis	Axis : 1
General	Connect stage	Use
	Axis name	Axis1
	Open/Close	Open
	Travel per pulse (micron)	0.05
	Unit	Pulse
	Origin select	Forward

Fig. 3-18 General parameters

Connect stage: Enable/disable an axis.

(Disabled axes are not operated in Program Instruction mode).

Axis name: Give a name to the axis.

Open/Close: Select a control mode (Open/Close).

(Applicable only to models that support closed loop).

Travel per pulse: Specify a moving amount per pulse.

(Set this parameter matching to the stage specifications).

Unit: Specify a unit of moving amounts (pulse/micro m/degree).

Origin select: Specify a direction of the home position.

(Applicable only for a device that can flip the home position).

◆ Control parameters

Set speed parameters used in the control dialog of the Stage-Controller.

You can specify up to four speed modes.

Displayed/specified contents vary depending on the models of Stage-Controllers.

The speed selected here will affect the movement speed in the control dialog.

Control	Speed1(SFR)	S50F100R10
	Speed2(SFR)	S200F500R50
	Speed3(SFR)	S1000F2500R100
	Speed4(SFR)	S1000F10000R150

Fig. 3-19 Control parameters



Fig. 3-20 Speed selection box in control dialog

◆ Measurement parameters

Set measurement parameters used in Program Instruction mode.

Specify a moving speed of a stage in Excel Instruction mode.

Displayed/specified contents vary depending on the models of Stage-Controllers.

Parameter	Axis	Axis : 1
Measure	Min speed	3000
	Max speed	10000
	Acceleration time	200
	Range	
	Move pitch	1000
	Move distance	2000
	Turn	1
	Return after movement	Return

Fig. 3-21 Measurement parameters

Min speed/Max speed Acceleration time/range:

Specify a moving speed of a stage during measurement.

Move pitch:

Specify a moving pitch of a stage during measurement.

In measurement, the stage will move by the pitch.

Move distance:

Specify a moving distance of a stage during measurement.

In measurement, the stage will move to the specified distance.

Turn:

Specify the moving order of a stage during measurement.

In measurement, the stage will move in the specified order.

Return after movement: Select the moving mode of a stage during measurement.

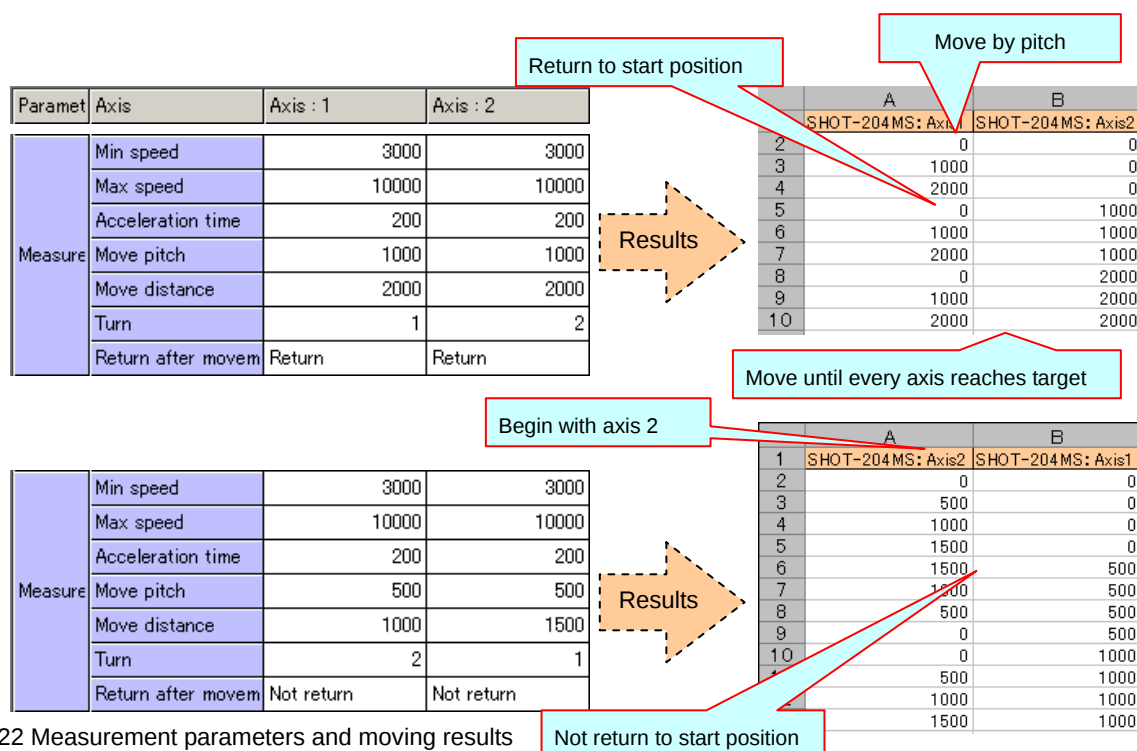


Fig. 3-22 Measurement parameters and moving results

◆ I/O output

Specify I/O signal outputs during measurement in Program Instruction mode.

Available only to Stage-Controllers supporting I/O outputs.

Trigger output Not output ▼	IO output 0 (None) ▼	IO output value Increase ▼
--------------------------------	-------------------------	-------------------------------

Fig. 3-23 Settings in I/O output

Trigger output: If enabled, a trigger signal is output every time a stage makes a pitch move (after the move) during measurement.

I/O output: If NOT DISABLED (not 0), an I/O signal of a specified bit value is output every time a stage makes a pitch move (after the move) during measurement. (Select a bit value from 1 to 15).

I/O output value: If you enabled I/O output, specify the type of bit value output.

For **Fixed**, a specified bit value is output every time a stage makes a pitch move (after the move).

For **Increase**, the value is incremented from 1 to a specified value every time a stage controller makes a pitch move (after the move).

* No signal output at (0, 0) because of the absence of a pitch move.

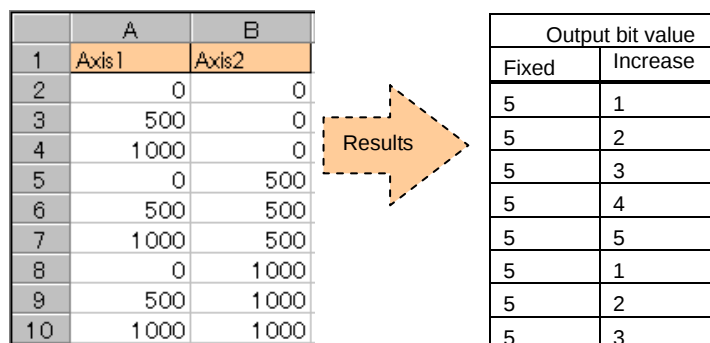


Fig 3-24 Output results of I/O output of 5

◆ Timeout

Specifies communication timeouts during measurement.

Fig. 3-25 Timeout settings

Stop timeout: Specifies maximum allowable time for a stage to stop completely (or, became ready). If a stage fails to stop within this time, an error occurs.

Command timeout: Specifies maximum allowable time from sending a command to a stage to receiving the response. If no response is returned within the specified time, an error occurs.

◆ Protocol

Specifies a communication protocol with the Stage-Controller.

Set a Protocol matching to the communication specifications of the Stage-Controller. (The setting is unnecessary with some Stage-Controller models).

Fig. 3-26 Setting of Communication Protocol

MAIN: Receives a response returned for a command sent to a Stage-Controller.

SUB: Except for some specific commands, SGEMCS does not receive a response returned for a command sent to a Stage-Controller.

◆ Move simultaneously

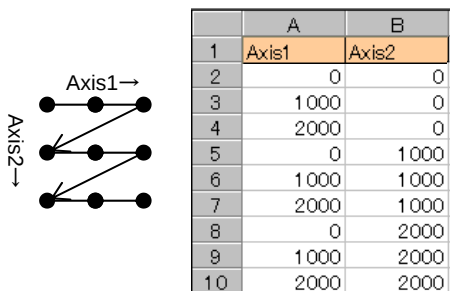
Specify the move method in program instruction measurement.

Enable: Choose, when you perform simultaneous movements of two or more axes.

Disable: Choose, when you move in the shape of a matrix.

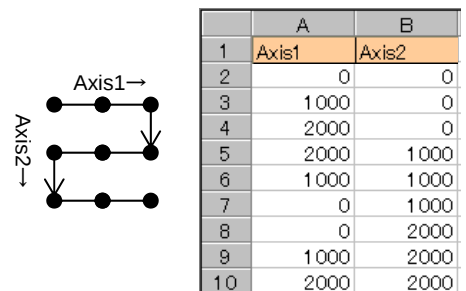
• Matrix-like movement

	Axis : 1	Axis : 2
Move pitch	1000	1000
Move distance	2000	2000
Return after movem	Return	Return



or

	Axis : 1	Axis : 2
Move pitch	1000	1000
Move distance	2000	2000
Return after movem	Not return	Not return



• Simultaneous movement of two or more axes

	Axis : 1	Axis : 2
Move pitch	1000	1000
Move distance	2000	2000

	A	B
1	Axis1	Axis2
2	0	0
3	1000	1000
4	2000	2000
5		

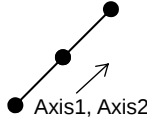


Fig. 3-27 Matrix-like movement and simultaneous movement of two or more axes

◆ Axis control type

Specify the type of an axis control dialog and a setup required in case a graphic type control dialog is used.

Usual: Choose, when you use the usual type dialog.

Graphic: Choose, when you use the graphic type dialog.

Graphic settings button: Click to display the graphic axis control settings dialog.

When you use a graphic type control dialog, set up various required setup on the displayed dialog.

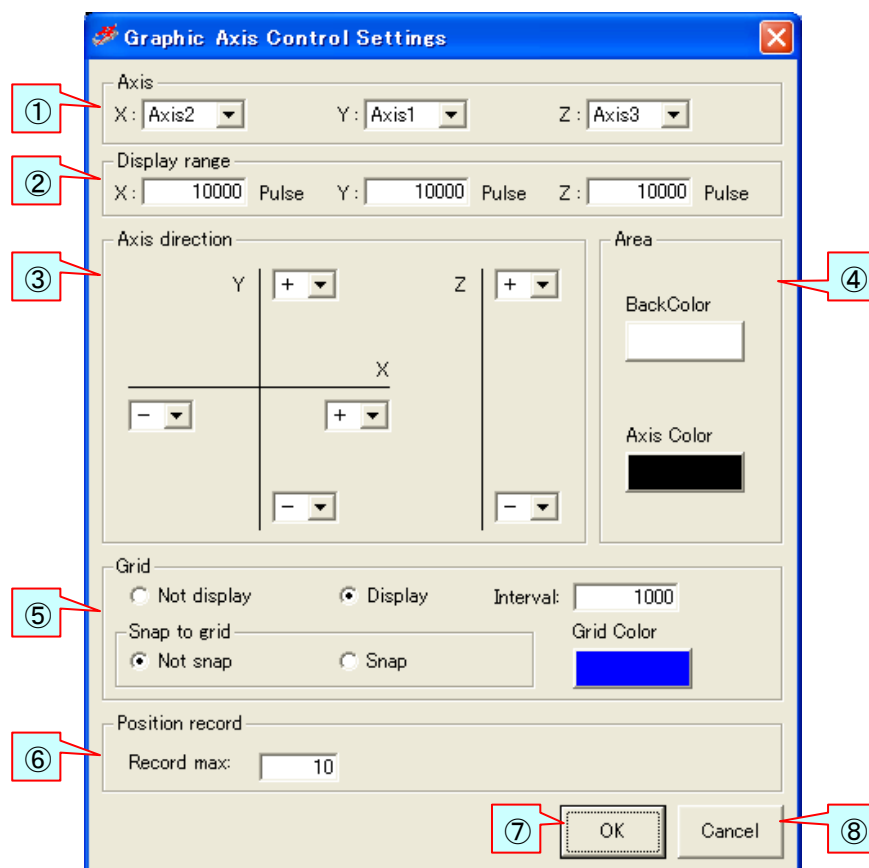


Fig. 3-28 Graphic Axis Control Settings dialog



Axis

Specify the actual axis of a stage assigned to each axis of a graphic control dialog.

Since the axis specified "Use" on the dialog for stage-controller settings is displayed on a list, specify the axis of a stage to assign.

Specify "None", when you do not assign the axis of an axis control dialog.



Display range

Specify the display range of stage operation area.

A unit is a unit specified on the dialog for stage-controller settings.

A value larger than 0 and smaller than 100000000 can be specified.

(It is not the movable range of a stage. When a stage moves out of the display range, the button for moving the display range can be clicked and the display range can be moved to the current position of a stage.)



Axis direction

Specify the direction of each axis of coordinates of stage operation area.

Please specify according to the move direction of an actual stage.



Area

Specify the background color of operation area, and the color of an axis of coordinates.

If you click each button, the setting dialog of a color will be displayed.

Choose a color to specify and click the "OK" button.



Grid

■ Not display ... A grid line is not displayed on operation area.

■ Display A grid line is displayed on operation area.

■ Interval When you display a grid line, specify the interval of a grid line.

You can specify the value from 1/10 of the minimum of the display ranges X, Y, and Z specified by  to the minimum.

■ Not snap to grid ...

When a grid line is displayed, operation area is clicked and a stage movement position is specified, it moves by making a click position into a movement position on a stage.

■ Snap to grid ...

When a grid line is displayed, operation area is clicked and a stage movement position is specified, it moves on a stage by making the position on the nearby grid line of a click position into a movement position.

■ Grid color .. When displaying a grid line, specify the color of a grid line.

If a button is clicked, the setting dialog of a color will be displayed.

Choose a color to specify and click the "OK" button.

⑥ **Position record max**

Specify to how many the movement place coordinates of a stage are recordable.

The table for the number specified here is prepared for a graphic operation dialog.

The values from 10 to 1000 can be specified.

⑦ **“OK” button**

If it clicks, the specified contents will be set up and it will return to the dialog for stage-controller settings.

⑧ **“Cancel” button**

If it clicks, the specified contents will be canceled and it will return to the dialog for stage-controller settings.

13 **Stage button**

Click to operate a stage using a registered Stage-Controller.

To operate a stage, select a Stage-Controller and then click the Stage button. Click to display the Axis Control dialog.

Displayed/specified contents vary depending on the models of Stage-Controllers.

Manual control is available in the same dialog.

There are usually a type and a graphic type of "Axis Control" dialogs.

• Usual type Axis Control dialog

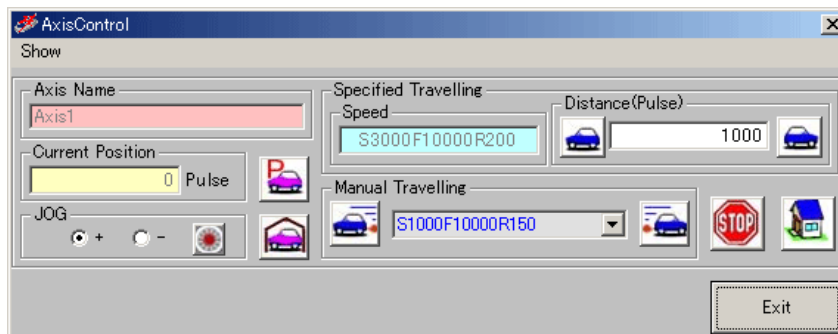
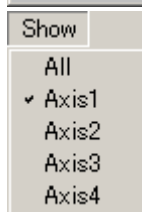


Fig. 3-29 Axis Control dialog



Select an axis to operate in the Show menu.

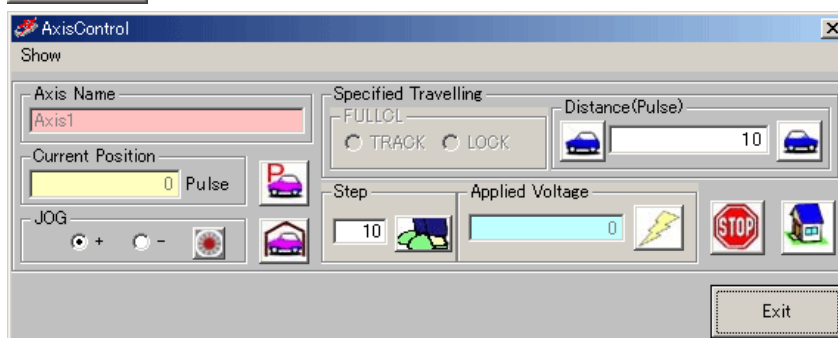
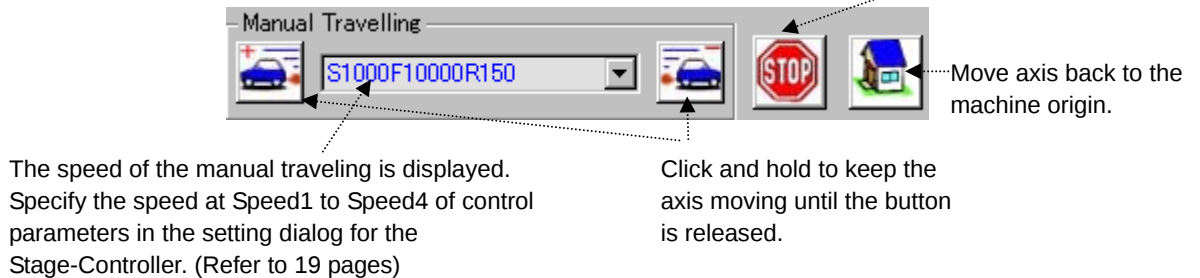
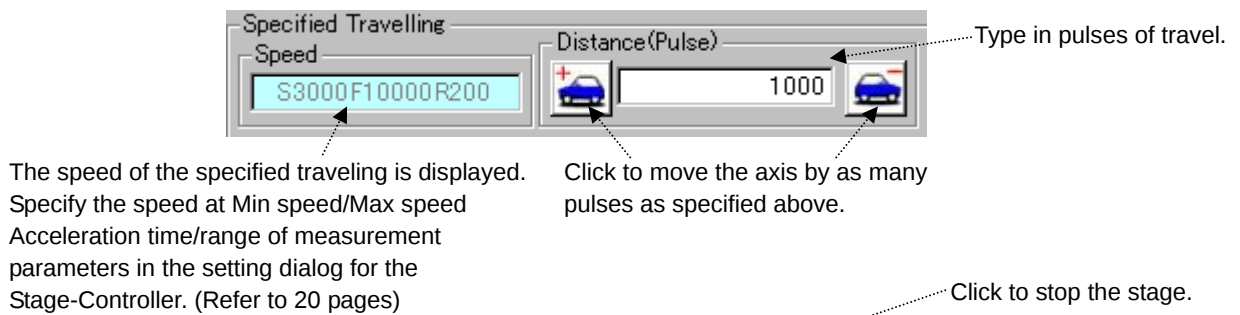
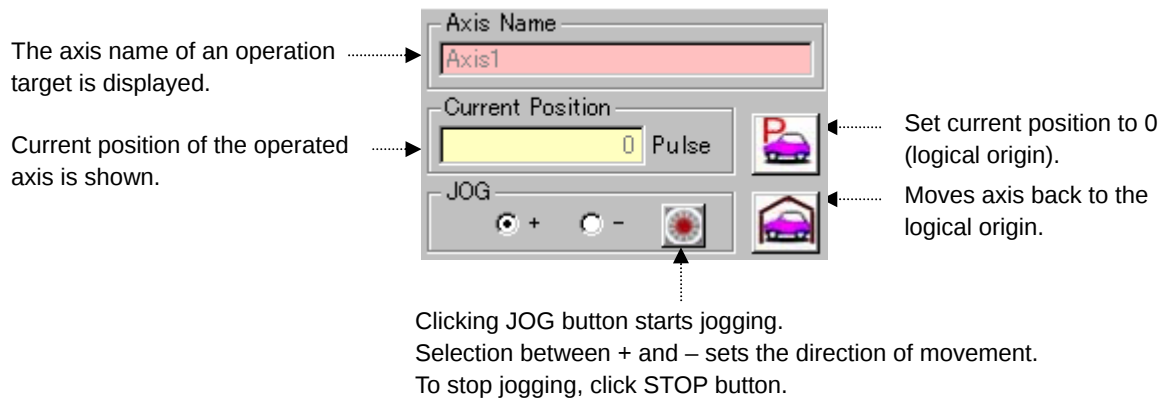


Fig. 3-30 Axis Control dialog for Mark/FINE-503



• Graphic type Axis Control dialog

On a graphic type axis control dialog, the current position of a stage is graphically displayed in stage operation area, the arbitrary points in operation area are clicked, and a movement place can be specified.

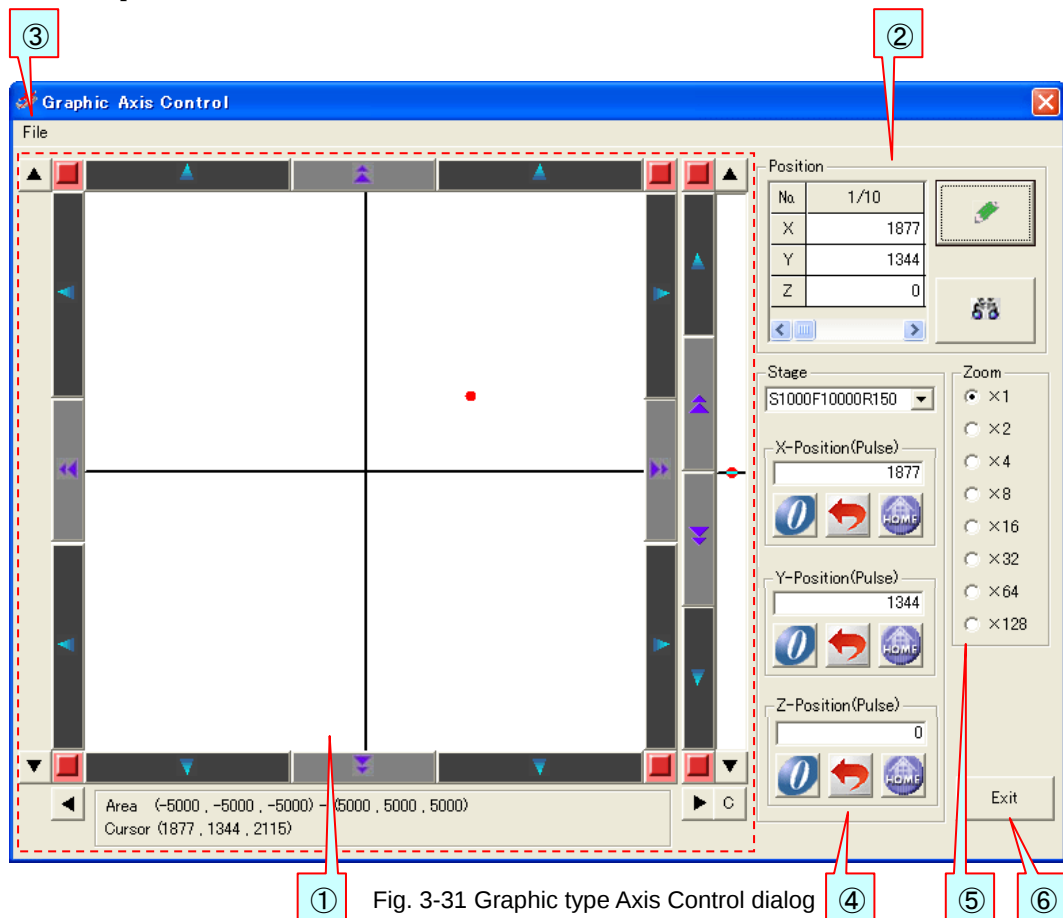


Fig. 3-31 Graphic type Axis Control dialog

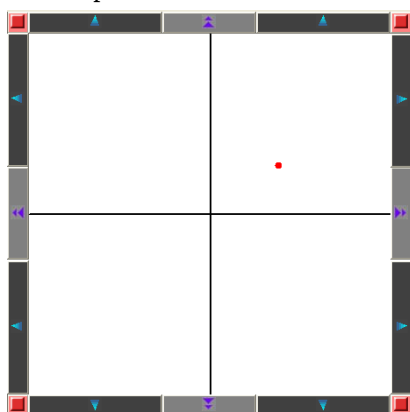
① Stage operation area

The current position of a stage is displayed by ●.

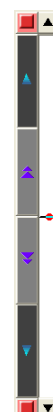
If the inside of operation area is clicked, the position will be displayed by ● and a stage will be moved to the position.

(The color of ● which shows a position changes in the background color of operation area.)

Moreover, the button of the circumference of operation area can be clicked and it can move on the stage of each axis. The button for moving the display range can be clicked and the range which operation area shows can be changed.

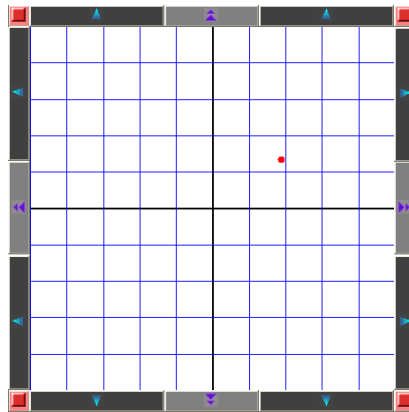


Stage operation area for X-axis and Y-axis.



Stage operation area for Z-axis.

When it sets up for displaying a grid line, a grid line is displayed as shown in the following figure.



■ **JOG button**



JOG operation will be started if it clicks. Click a stop button, when you stop JOG operation.

■ **Manual move button**



While clicking, it moves on a stage.

■ **Stop button**



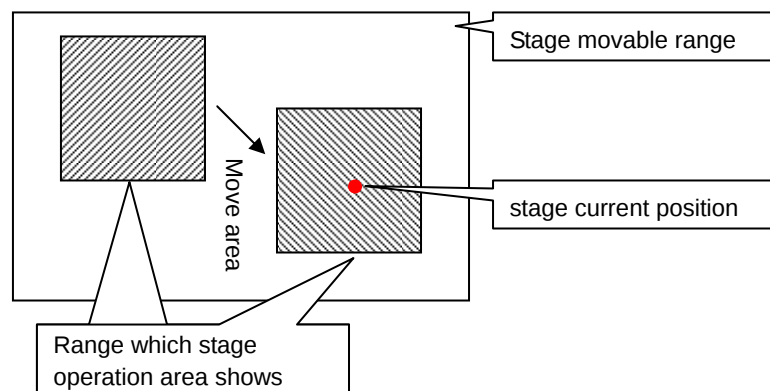
A stage will be stopped if it clicks.

■ **Button for moving the display range**



If it clicks, the range which stage operation area shows will be moved.

When the stage current position is outside operation area, the display range can be changed with this button and the stage current position can be displayed.



■ **Button which displays the origin in the center**



If it clicks, the origin will be displayed in the center of operation area.

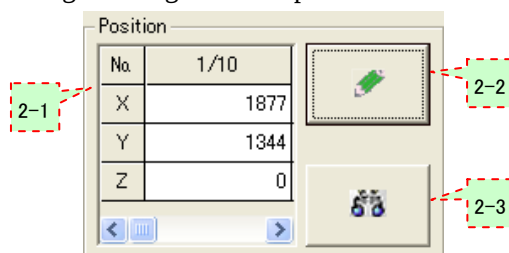
■ **The display of the display range and the cursor position**

The display range of operation area and the position of a mouse cursor are displayed.

Area (-5000 , -5000 , -5000) - (5000 , 5000 , 5000)
Cursor (1877 , 1344 , 2115)

② Position record

It is used, when recording the stage current position on a table and moving a stage to the recorded position.



2-1 Table

It displays the recorded stage position.

Moreover, you can click the cell of a table and can also do the direct entry of the stage position.

The columns of a table is prepared in the number of the position record maximum numbers specified on the graphic axis control settings dialog.

You move a scroll bar and can display other columns.

2-2 Record button

If it clicks, the stage current position will be recorded on a table at a column present on display.

2-3 Move button

If it clicks, a stage will be moved to the position of the column of a table present on display.

③ "File" menu

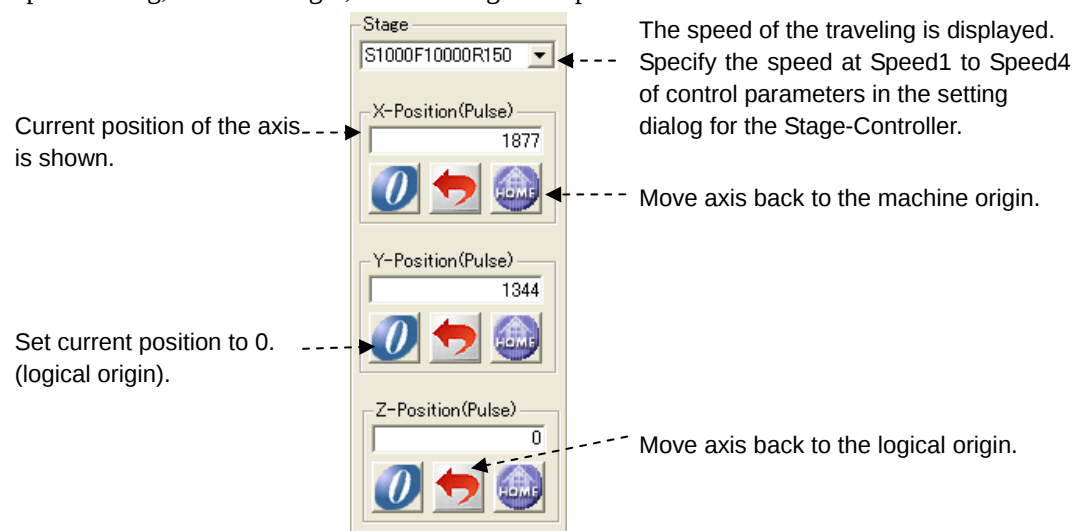
If it clicks, the "File" menu will be displayed.

The contents of the table which recorded the position can be saved with the "File" menu. And the saved file can be read and it can restore to a table.



④ Stage control

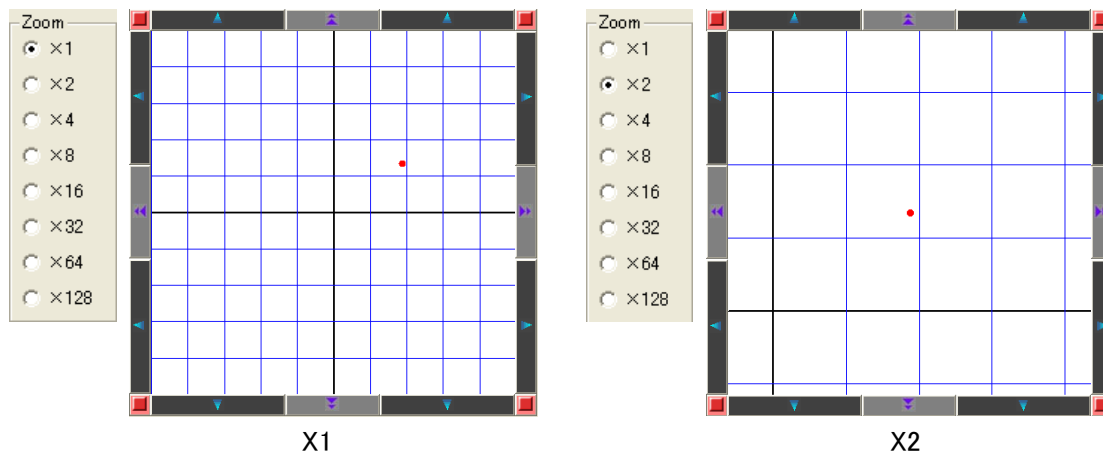
Speed setting, return to origin, etc. of a stage are operated.



⑤ Zoom

Operation area is zoomed in.

If "x1" is chosen, it will return to a standard.



⑥ "Exit" button

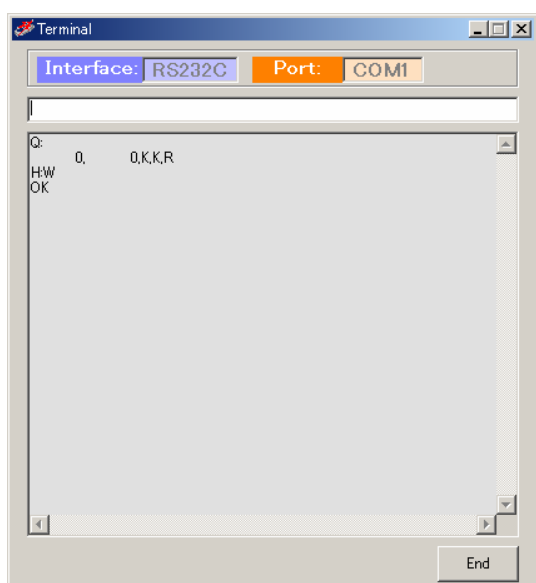
If it clicks, a graphic axis control dialog will be closed and it will return to a main window.

14 Terminal button

Click to open the Terminal dialog to communicate with a registered device.

In the Terminal dialog, you can communicate with a registered (set) device by directly inputting commands.

To start the Terminal dialog, select a device and then click the Terminal button. The dialog is displayed.



Input strings and press the Enter key to send the strings to the destination device.

Received strings from the device are displayed in the dialog.

If a destination device is not connected, communication by the Terminal feature is not available.

A timeout does not suspend communication.

Click End to finish

Fig. 3-32 Terminal dialog

15 Measurement mode selection box

Specify a measurement mode with this box.

If you change the measurement mode, the mode tab changes accordingly.



Fig 3-33 Measurement mode selection box and mode tabs

- ◆ Program Instruction: Select to run in Program Instruction mode.
- ◆ Excel Instruction: Select to run in Excel Instruction mode

16 Connection status display

Shows connection status of registered devices.

Device type information and interface information are available.

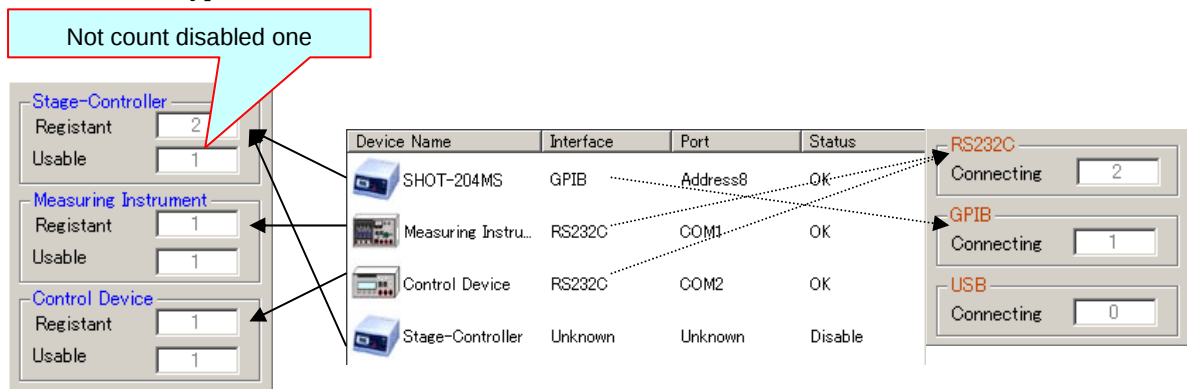


Fig. 3-34 Connection status display

17 Exit button

Click to exit SGEMCS.

This button can function identically as the exit button in the File menu.

3.2 Program Instruction Dialog

The dialog to register devices or set conditions for operations in Program Instruction mode.

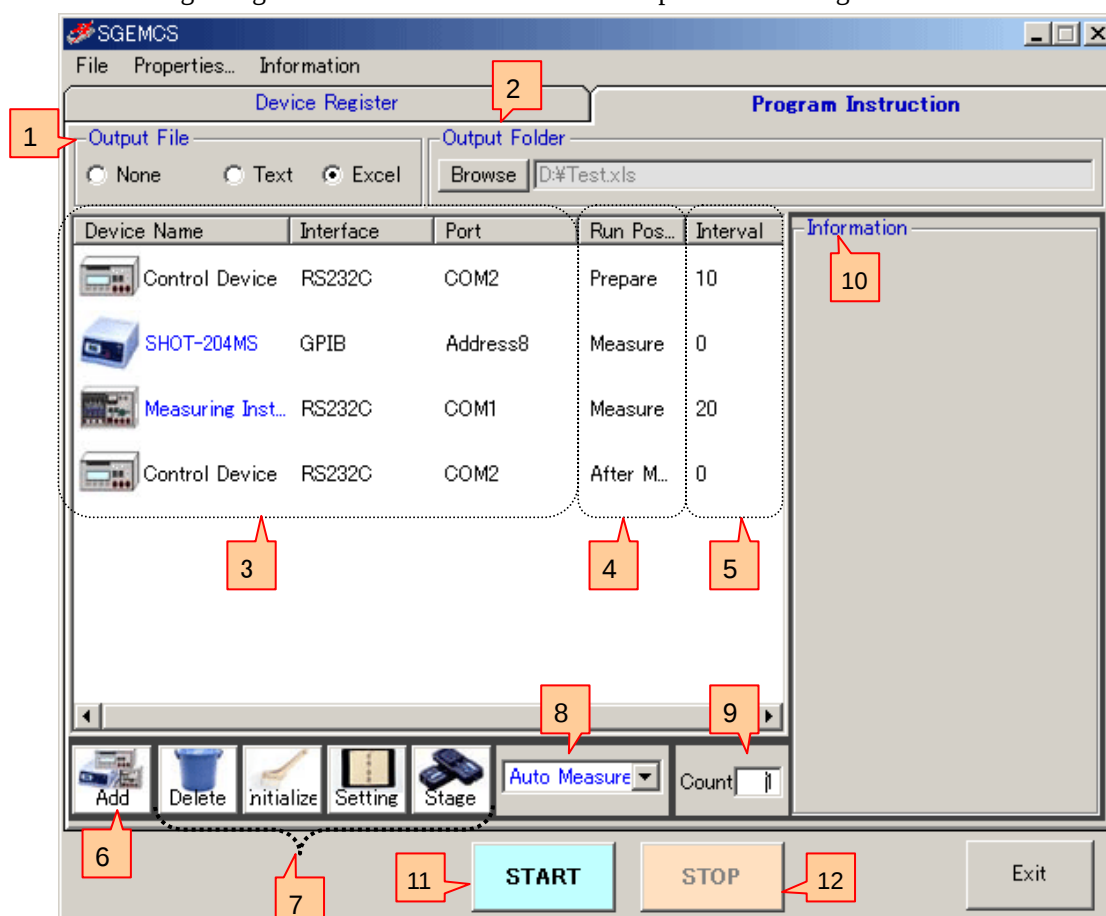


Fig. 3-35 Program Instruction dialog

1 Output File

Select a format to save results.

- ◆ None

Does not output measurement results.

- ◆ Text

Saves measurement results to text files.

- ◆ Excel

Save measurement results to Excel files.

2

Select Output Folder

Specify a destination to save measurement results.

Click Browse to show a file list. Select a file for saving the results.

If not specified, a new file is created to save the results.

If you selected text format for saving, a new file named SGdata.txt is created under the current directory.

For Excel, it is named Book*.xls.

(The Excel program decides file names and destinations).

3

Registered Device List Display

Devices used in Program Instruction mode are displayed in the order of operations.

4

Run Position

Shows the run position (operation timing) for each device in Program Instruction mode.

◆ Prepare

Devices operated only at the start of measurement. (Not operated in measurement).

◆ Measure

Devices operated during measurement.

◆ After Measurement

Devices operated only after measurement finishes. (Not operated in measurement).

5

Interval

Shows an interval (in 100 ms) from the end of operations in a device to starting of the next device.

6

Add button

Click to register additional devices in Program Instruction mode.

Click to show the Add Device dialog. Select a device you want to add.

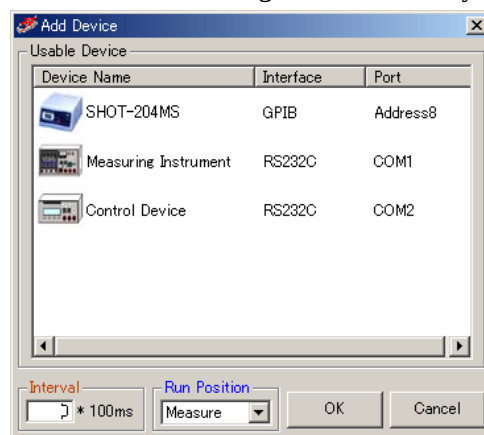


Fig. 3-36 Add Device dialog

In the Add Device dialog, only devices registered and able to communicate are displayed.
(Devices without communication settings are not displayed).

You can specify Interval and Run Position for adding devices.

If you choose Run Position, selection in Run Position must precede the device selection.

7 Delete, Setting, Initialize and Stage buttons

Click to delete, set, initialize or control a device.

Select a device for a desired process, and then click one of the buttons.

(Device specification is not necessary for initialization).

8 Measurement mode selection box

Select a measurement mode in Program Instruction mode.



Fig. 3-37 Measurement mode selection box

- ◆ Auto Measure: Select to perform auto-measurement.
- ◆ Auto Measure-M: Select to perform auto-measurement-Multi.
- ◆ Manual Measure: Select to perform manual measurement.

9 Count

Specify a count to repeat measurement in Program Instruction mode.

Set a count from 1 to 999.

10 Information display

Displays setting status of registered devices.

Select a device to show information on the device.

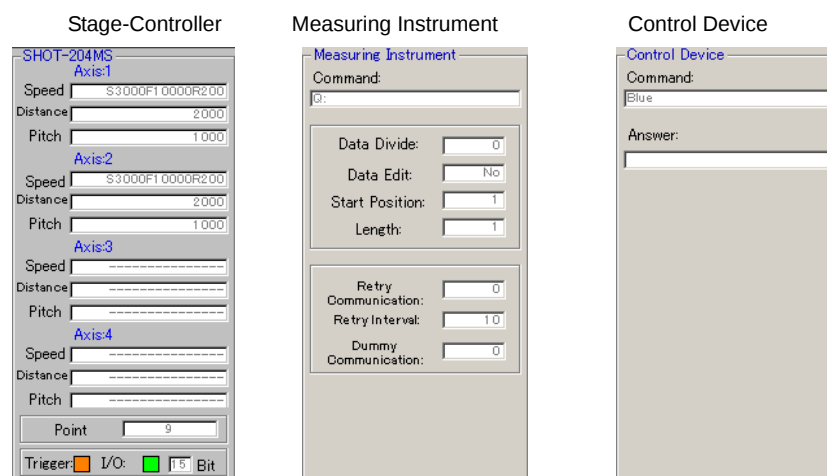


Fig. 3-38 Information displays

11 START Button

Click to start measurement.

* If an error occurs during operations, terminate communication in the setting dialog and check the conditions such as connection status. Then test communication status to confirm that SGEMCS is communicating with the device successfully.

* If an output file (Text/Excel) is operated during measurement, an error may occur. Don't operate a file during measurement.

12 STOP Button

Click to stop measurement.

Clicking STOP will abort measurement.

(Measurement did not stop immediately. It will stop when a step of processes are completed).

3.3 Excel Instruction Dialog

Register devices or set conditions for operations in Excel Instruction mode.

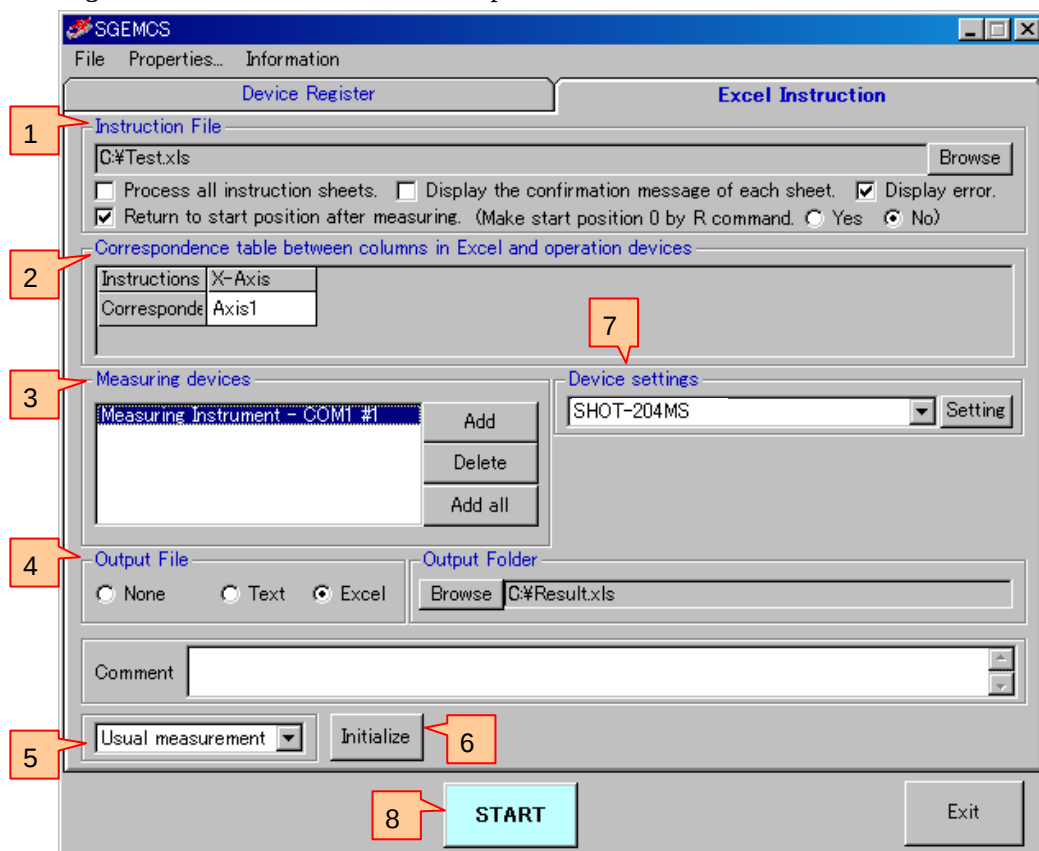


Fig. 3-39 Excel Instruction dialog

1 Instruction File

Specify an instruction file used in Excel Instruction mode.

Click Browse to show the file list display. Select an instruction file in the list.

◆ Process All Instruction Sheets

If an instruction file (book) contains two or more sheets of which the names begins with “Instruction,” all applicable sheets will be selected for processing.

If not selected, only the first Instruction sheet is to be processed.

◆ Display the confirmation message of each sheet

When “Process All Instruction Sheets (a name starts in Instruction)” is chosen, set up whether a confirmation message is displayed before the measurement start of the sheet after the 2nd sheet.

A measurement will be in a stop state during the display of a confirmation message. Select, if a confirmation message is displayed. When not selected, a confirmation message does not display and a measurement of the following sheet is started continuously.

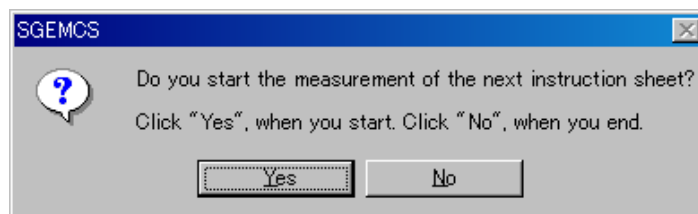


Fig. 3-40 Confirmation message

Buttons of a confirmation message

◆ Yes : Start a measurement of the following sheet.

◆ No : Stop a measurement.

◆ Display error

Select to display an error message and to halt a measurement, when an error occurs during a measurement.

If not selected, an error message does not display but continues a measurement even if an error occurs.

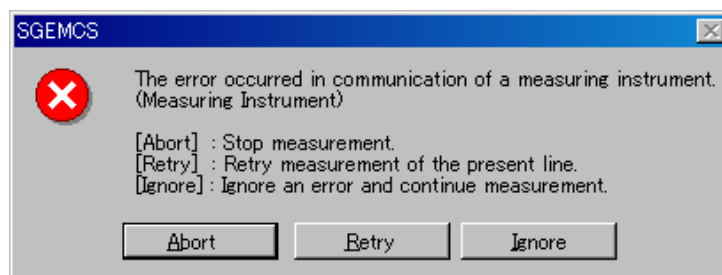


Fig. 3-41 Error message

Buttons of an error message

- ◆ **Abort** : A measurement is interrupted and it returns to an "Excel instruction" dialog.
- ◆ **Retry** : A measurement of the line of an instruction file which was being performed now is retried.
- ◆ **Ignore** : An error is disregarded and a measurement is continued.

◆ Return to start position after measuring

Select to return a stage to measurement start position after measurement.

If not selected, a stage will stay at the place where the measurement finishes.

* The measurement start position to which a stage returns after measurement is a location computed from the origin at the time of measurement termination (criteria origin).

If it moves to a machine origin or a logical origin is set up during a measurement, since a home position is changed, with the time of measurement initiation, a stage may return to a different location from a actual measurement starting position.

◆ Make start position 0 by R command

Yes : When the R command (logic starting point setup) is executed during a measurement, the measurement start coordinates of the axis are changed into 0. After a measurement end, a stage returns to the origin (criteria origin).

No : Even if it executes the R command (logic starting point setup) during a measurement, the measurement start coordinates of the axis are not changed. After a measurement end, a stage returns to a measurement starting position (position computed from the criteria origin).

* 'Make start position 0 by R command' can be set up only when 'Return to start position after measuring' is chosen.

Example 1 : When YES is chosen by Make start position 0 by R command

	The contents of an Excel instruction sheet	A motion of a stage	The coordinate value displayed on a controller	The coordinate value on the basis of the origin at the time of a measurement start
①		The coordinates at the time of a measurement start are set to 500.	500	500
②	1000	It moves to 1000.	1000	1000
③	R	It is set as the logic origin. <u>*Measurement start coordinates are changed into 0.</u>	0	1000
④	2000	It moves to 2000	2000	3000
⑤		A measurement is ended and <u>it moves to the measurement start coordinates 0.</u>	0	1000

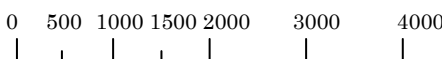
The coordinate value on the basis of the origin at the time of a measurement start

A motion of a stage

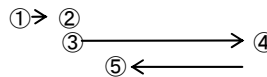
Example 2 : When NO is chosen by Make start position 0 by R command

	The contents of an Excel instruction sheet	A motion of a stage	The coordinate value displayed on a controller	The coordinate value on the basis of the origin at the time of a measurement start
①		The coordinates at the time of a measurement start are set to 500.	500	500
②	1000	It moves to 1000.	1000	1000
③	R	It is set as the logic origin. * <u>Measurement start coordinates are with 500 without being changed.</u>	0	1000
④	2000	It moves to 2000	2000	3000
⑤		A measurement is ended and <u>it moves to the measurement start coordinates 500.</u>	500	1500

The coordinate value on the basis of the origin at the time of a measurement start



A motion of a stage



2 Correspondence table between columns in Excel and operation devices

The table to relate an instruction column in the Excel instruction file and the device to be operated.

Shows titles in the Excel instruction file (except rightmost columns) as Instruction columns.

Select related devices to columns.

Shows titles				Titles			
Instructions	X-Axis	Y-Axis	Control	A	B	C	D
Correspondence	Axis1	Axis2	Control Dev	X-Axis	Y-Axis	Control	Measure
				0	0	RED	*
	100	1000	RED				
	200	1500	GREEN				*
	300	2000	GREEN				
	400	2500	BLUE				*
	500	3000	BLUE				

Rightmost column for measurement

Fig. 3-42 Relate Excel Instruction column and device

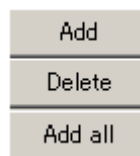
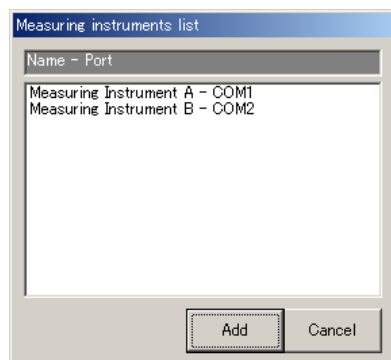
3 Measuring Devices

Select measuring instruments used in Excel Instruction mode.

Click on the Add button to show the list of available instruments. Select instruments in the list.

Click “Add all” to add all the instruments in the list.

Select an instrument and click the Delete button to delete an instrument.



* If you selected two or more instruments, measurement results are displayed at rightmost column in the output file in the order of selection.

Fig. 3-43 Measuring Instruments list

4 Output File

Select a format to save results.

- ◆ None

Does not output measurement results.

- ◆ Text

Saves measurement results to text files.

- ◆ Excel

Save measurement results to Excel files.

5 Select Output File

Specify a destination to which measurement results are saved in Excel Instruction mode.

Click Browse to show a file list. Select a file for saving the results.

If the destination is an Excel file, a new Excel book is created and the results are saved there when the output file name is “New Book” in the list.

Comments written in the Comment box are written to the destination file as the comments.

* Output of the measurement data to an Excel file

- ◆ Usual measurement

The line (a measurement cell is space or W (numeric value)) indicating measuring by an instruction file is displayed on an output Excel file.

When an error occurs with a measuring instrument, space is displayed on a measurement result cell.

- ◆ Step measurement

All lines of an instruction file are displayed on an output Excel file.

When an error occurs with a measuring instrument, space is displayed on a measurement result cell.

6 Measurement mode selection box

Select a measurement mode in Excel Instruction mode.

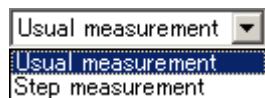


Fig. 3-44 Measurement mode selection box

- ◆ Usual measurement Select to run in usual measurement mode.
- ◆ Step measurement Select to run in step measurement mode.

7 Initialize Button

Click to clear the settings.

8 Device settings

Set/change operational conditions of a device.

Select a device of which conditions you want to set/change, and then click the Setting button to display the Device Settings dialog.

9 START Button

Click to begin measurement.

* If an error occurs during operations, terminate communication in the setting dialog and check the conditions such as connection status. Then test communication status to confirm that SGEMCS is communicating with the device successfully.

* If an output file (Text/Excel) or Excel instruction file is operated during measurement, an error may occur. Don't operate a file during measurement.

4. Functions

This section is dedicated to describe various functions which SGEMCS can offer. SGEMCS supports Program Instruction and Excel Instruction measuring modes.

◆ Program Instruction

Run measurement by using the Program Instruction dialog.

There are two modes in the Program Instruction.

- Auto measure : Normal measurement
- Auto measure-Multi : The measurement which two or more controllers are interlocked and controls them

◆ Excel Instruction

Run measurement by following descriptions in an Excel instruction sheet.

4.1 Measurement in Program Instruction Mode

In Program Instruction mode, automatic or manual measurement is available by operating/setting in relating dialogs.

Device Name	Interface	Port	Run Pos...	Interval
 Control Device	GPIB	Address8	Prepare	10
 SHOT-204MS	RS232C	COM2	Measure	0
 Measuring Inst...	RS232C	COM1	Measure	20
 Control Device	GPIB	Address8	After M...	0

Fig 4.1 Program Instruction dialog

To begin measurement in Program Instruction mode, first register all the applicable devices to enable them.

For the details of device registrations, see “3 Operation.”

In Program Instruction mode, devices registered in the Program Instruction dialog are operated sequentially in the order of registration, following the settings for the devices.

Note that processing is affected by the settings in the Run Position column and the order of registration. Therefore, when you register devices in the Program Instruction dialog, consider what to be processed with the devices.

Also note that each registered device operates as specified in the settings, so also consider target processes in making settings for a device.

◆ Parameters affecting operations in Program Instruction mode

The following parameters can affect operations in Program Instruction mode.

(1) Run Position

Select one of Prepare, Measure and After Measure in the Run Position list when you register/change the settings of a device in Program Instruction mode.

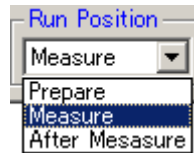
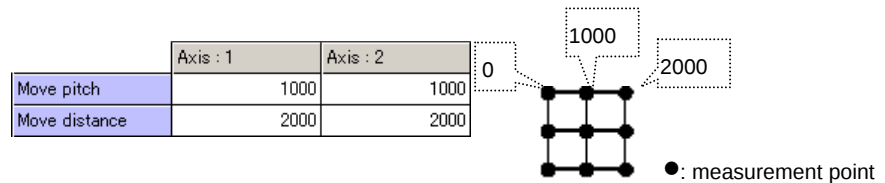


Fig. 4-2 Run Position list

Prepare: Operates a registered device only once before measurement in the order of registration.
 Typical purpose of “Prepare” is to initialize a device before measurement.
 The operation results are not saved to a file (in text or Excel format).
 If the device is a Stage-Controller, each applicable axis is moved by a pitch.
 If the device is Measuring Instrument, the measurement command is performed once.
 If the device is a Control Device, the control command is performed once.

Measure: Perform measurement processes with the registered device.
 Measuring as many times as specified.
 The results can be saved to a file (in text or Excel format).
 If a Stage-Controller is registered, measurement count is calculated as follows:
 Let (moving distance/pitch + 1) be multiplied by itself as many times as the number of axes.



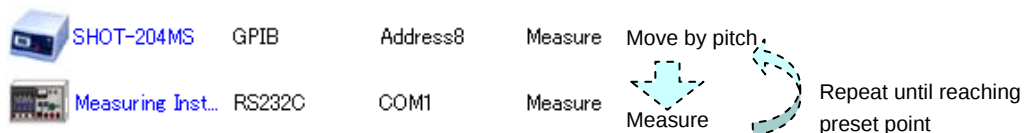
$$\text{Measurement count: } (2000/1000 + 1) \times (2000/1000 + 1) = 9 \text{ (times)}$$

Fig. 4-3 Measurement count

If a Measuring Instrument is registered, the measurement command is executed in each measurement point.

If a Control Device is registered, the control command is executed in each measurement point.

* If no Stage-Controllers are registered, measurement/control is performed only once.



After Measure: Controls registered devices once in the order of registration after the measurement.
 Typical purpose of “After Measure” is to set devices after measurement.
 The operation results are not saved to a file (in text or Excel format).
 The contents of device operation are the same as in the Prepare mode.

(2) Execution Order of Devices

In Program Instruction mode, devices are run sequentially in the order of registration.

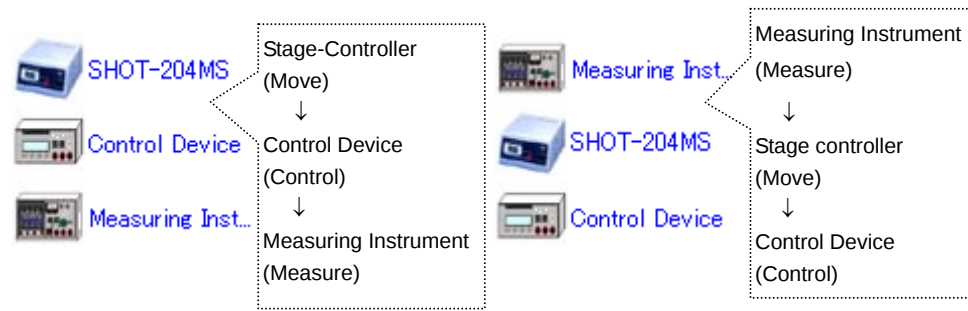


Fig. 4-4 Execution order of devices

(3) Interval

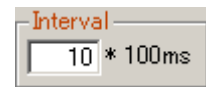
In Program Instruction mode, you can set intervals between the runs of sequentially operated devices.

If an interval is specified, a device starts to run after the previous device has finished and the specified interval has elapsed.

Set intervals in 100 ms.

* Actual time spans of intervals are not an exact time you specified. It may vary depending on environments of PC, etc.

Device Name	Interface	Port	Run Pos...	Interval
SHOT-204MS	GPIB	Address8	Measure	0
Control Device	RS232C	COM2	Measure	10
Measuring Inst...	RS232C	COM1	Measure	20



Operation flow: SHOT-204MS operates => No wait => Control Device operate => Wait 1-sec => Measuring Instrument operates => Wait 2-sec

Fig. 4-5 Setting Intervals

(4) Set operations

In Program Instruction mode, specify operations of each registered device in the Device Settings dialog.

The settings determine the controlling features like communication commands.

For the details of the settings, see the descriptions of the Device Settings button in “3.

Operation.”

Settings for Stage-Controller operations are described below:

◆ Stage Speed

Speed parameters specify the moving speeds of each axis of a stage.

	Axis : 1	Axis : 2
Min speed	3000	3000
Max speed	10000	10000
Acceleration time	200	200

Fig. 4-6 Speed parameters

◆ Moving Pitch and Distance

Operations of a stage of each axis are decided by moving pitches and distances.

	Axis : 1	Axis : 2
Move pitch	1000	1000
Move distance	3000	1500

Fig. 4-7 Movement parameters

A stage moves along rows and columns in a matrix. The moving amount and range are dependent on values specified in Move pitch and Move distance boxes.

The matrix is 2-D with two axes (X and Y) or 3-D with three axes (X, Y and Z).

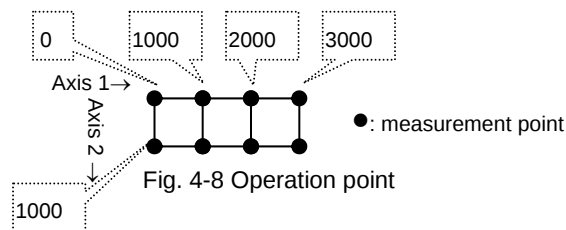
A measurement count with a stage is calculated as follows:

Let (moving distance/pitch + 1) be multiplied by itself as many times as the number of axes.

For figure 4-7, the number of times the stage operated (moving point) equals to the measurement count calculated as follows:

$$\text{Measurement count: } (3000/1000 + 1) \times (1500/1000 + 1) = 8 \text{ times (points)}$$

* A reminder in a division is rounded down.



◆ Moving Order of Stages

Specify the order of stage movement if you use two or more stages.

	Axis : 1	Axis : 2	Axis : 3	Axis : 4
Turn	1	2	3	4
Operate Axis 1, then Axis 2, Axis 3, Axis 4				
Turn	3	1	4	2

Operate Axis 2, then Axis 4, Axis 1, Axis 2

Fig. 4-9 Moving order

◆ Operations After Stage Movement

Specifies operation method of a stage for the moving range decided by the moving pitch and distance.

If a return after movement is chosen ("Return" is selected), a stage will return to the start position after moving a preset distance, and then repeat the move to the positions incremented by the pitch.

If disabled ("Not return" is selected), a stage will not return to the start position after moving a preset distance. It will continue move to decremented (or, incremented) positions by the pitch.

* If selecting "Return," a stage will return to the starting position after every movement has finished. If selecting "Not return," a stage will not return.

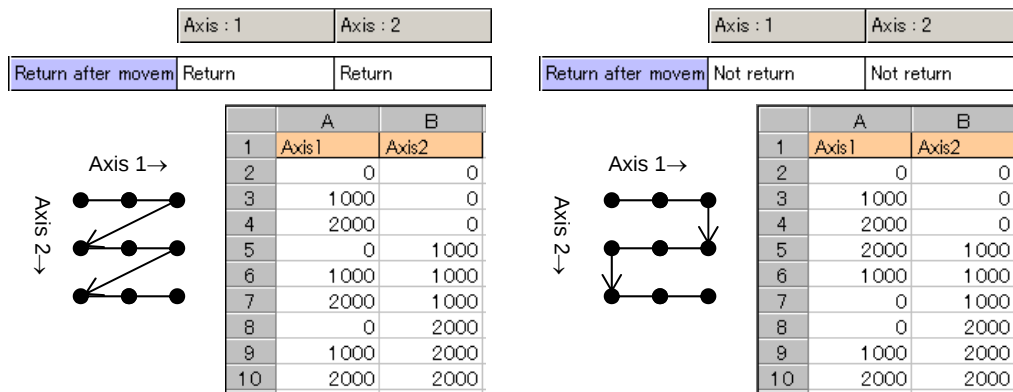
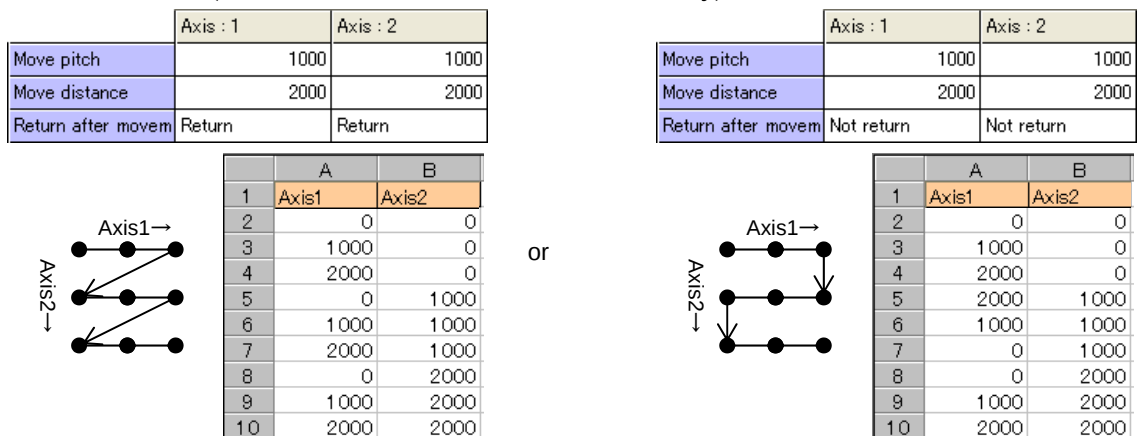


Fig. 4-10 Operations: Return/Not return after movement

◆ Move simultaneously

Specify whether two or more axes are simultaneously moved for whether it moves in the shape of a matrix in the moving range of the stage determined by a move pitch and distance.

• Matrix-like movement (Choose “Disable” in Move simultaneously)



• Simultaneous movement of two or more axes

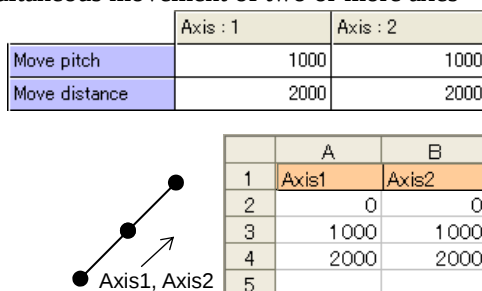


Fig. 4-11 Matrix-like movement and simultaneous movement of two or more axes

- ※ Simultaneous movements of two or more axes move by all the axis simultaneous move command of a controller.

Example: In movement with two axes, when a move pitch is the same and movement speed is the same, it moves in the shape of 1 straight line. However when the move pitch of both axes is different, or when movement speed differs, movement of an actual stage does not become 1 straight line-like.

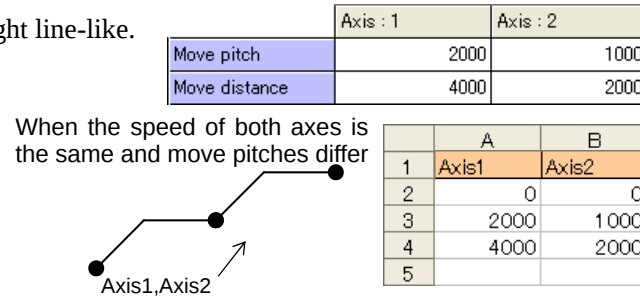


Fig. 4-12 Simultaneous movement of two or more axes

- ※ By an OMEC series controller, when the groups of the axis which moves differ, one axis moves at a time. All axes simultaneous movement is not performed.

4.2 Measurement Example in Program Instruction Mode

Measurement in Program Instruction mode is described with examples as follows:

◆ Automatic Measurement by Specifying Range and Pitch

Devices used: Stage-Controller SHOT-204MS, two motorized stages (X- and Y-axis) and Measuring Instrument.

Measurement: Measure at moving points (measurement points) by moving X and Y stages by the specified distance.

Conditions: Use COM1 (RS-232C) for SHOT-204MS, COM2 (RS-232C) for Measuring Instrument

The X-axis of the stage moves in 100-pulse until it reaches 300-pulse.

The Y-axis of the stages move in 200-pulse until it reaches 400-pulse.

The measurement command for a Measuring Instrument is “M.” If “M” is transmitted, the instrument will return measurement results.

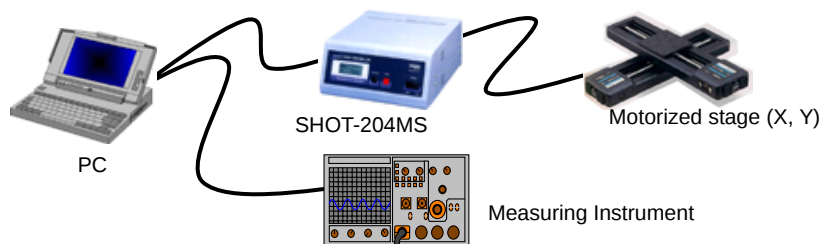


Fig 4-13 Devices for measurement

(1) Register Devices

Add the Stage-Controller and Measuring Instrument in the Device Register dialog.

(See “3.1 Device Register Dialog” for the details of the registration).

Device Name	Interface	Port	Status
 Stage-Controller	Unknown	Unknown	Disable
 Measuring Instru...	Unknown	Unknown	Disable

Fig. 4-14 Adding device

(2) Set Conditions for Devices

Enable the added devices by setting communication and operation conditions, and verify the communication with the devices. (See “3.1 Device Register Dialog” for the details of the settings).

Set SHOT-204MS

Select SHOT-204MS

Select RS-232C

Select COM1

Set communication conditions

Verify communication

Axis	Axis : 3	Axis : 4
Connect stage	Not use	Not use

Disable axis-3 and axis-4

	Axis : 1	Axis : 2
Move pitch	100	200
Move distance	300	400

Set pitch and distance for axis-1 and axis-2

Fig. 4-15 Settings for SHOT-204MS

Set Measuring Instrument

Select RS-232C

Select COM2

Set communication conditions

Input measurement command "M"

Verify communication

Command "M" and Send Strings "M" are examples. Actually follow the specification of the measuring instrument used.

Fig. 4-16 Settings for Measuring Instrument

When the settings finish, check if the device is connected in the Device Register dialog.

Device Name	Interface	Port	Status
SHOT-204MS	RS232C	COM1	OK
Measuring Instru...	RS232C	COM2	OK

Check communication status

Fig. 4-17 Device status

(3) Register Devices in Program Instruction Dialog

In the Program Instruction dialog, add SHOT-204MS and Measuring Instrument in this order.

(See “3.2 Program Instruction Dialog” for the details of the registration).

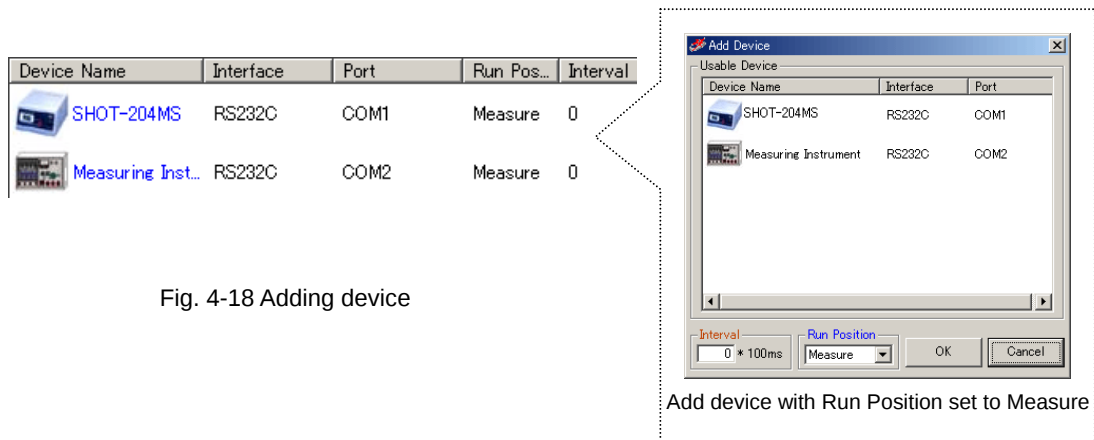


Fig. 4-18 Adding device

(4) Set Measurement Conditions

Specify the destination to save the results, select Auto Measure mode, and set the count to one.

(See “3.2 Program Instruction Dialog” for the details of the settings).

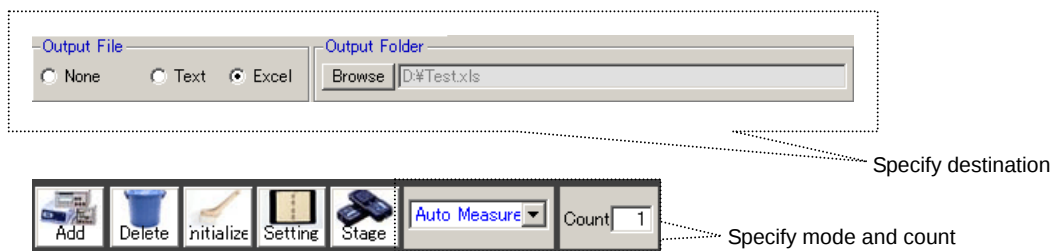


Fig. 4-19 Setting measurement conditions

(5) Start Measurement

Click on the START button to start measurement.

During measurement, click on the STOP button to suspend the measurement.



Fig. 4-20 START and STOP buttons

If measurement finishes, a completion message is displayed.

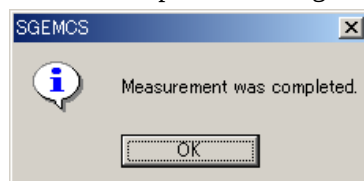


Fig 4-21 Completion message

(6) Result Output

The measurement results are output to the specified destination.

	A	B	C
1	SHOT-204MS: Axis1	SHOT-204MS: Axis2	Measuring Inst
2	0	0	0.287
3	100	0	1.829
4	200	0	2.491
5	300	0	3.089
6	0	200	4.275
7	100	200	5.692
8	200	200	6.481
9	300	200	7.902
10	0	400	8.963
11	100	400	9.472
12	200	400	10.583
13	300	400	11.892

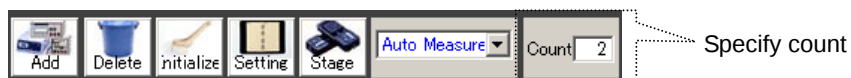
Move pitch	100	200
Move distance	300	400

Fig. 4-22 Measurement results

◆ Specify Count to Repeat Measurement

You can repeat measurement by specifying the count.

If you set the count to two while other conditions are set to the same as in “Automatic Measurement by Specifying Range and Pitch,” the same measurement runs twice successively.



	A	B	C
1	SHOT-204MS: Axis1	SHOT-204MS: Axis2	Measuring Inst
2	0	0	0.287
3	100	0	1.829
4	200	0	2.491
5	300	0	3.089
6	0	200	4.275
7	100	200	5.692
8	200	200	6.481
9	300	200	7.902
10	0	400	8.963
11	100	400	9.472
12	200	400	10.583
13	300	400	11.892
14	0	0	0.653
15	100	0	1.005
16	200	0	2.341
17	300	0	3.852
18	0	200	4.297
19	100	200	5.023
20	200	200	6.374
21	300	200	7.854
22	0	400	8.987
23	100	400	9.015
24	200	400	10.465
25	300	400	11.925

Fig. 4-23 Run by count

◆ Set Start/End Stage Positions (Set Offsets)

For a stage, you can specify a start/end position before/after measurement.

Operation definitions: The X-axis of the stage starts measurement at 150-pulse point, and to be positioned at the 200-pulse point when the measurement finishes.

The Y-axis of the stage begins measurement at 200-pulse point, and to be positioned at 100-pulse point when the measurement finishes.

* Except the above, run under the same conditions as in “Automatic Measurement by Specifying Range and Pitch.”

(1) Add Devices

Select the Device Register tab. Add Stage-Controllers for the start and finish. Specify the same conditions as for the Stage-Controller used for measurement (rename both new devices for identification), and add both devices in the Program Instruction dialog with Run Position set to Prepare and After Measure for each. (See “3.1 Device Register Dialog” and “3.2 Program Instruction Dialog” for the details of the registrations).

* If you register a controller and used it for the both purposes, the movement of the controller becomes unpredictable. Be sure to add a controller for each purpose.

Device Name	Interface	Port	Run Posit...	Interval
 SHOT-204MS Prepare	RS232C	COM2	Prepare	0
 SHOT-204MS	RS232C	COM2	Measure	0
 Measuring Instrument	RS232C	COM1	Measure	0
 SHOT-204MS After Measure	RS232C	COM2	After Mes...	0

Fig. 4-24 Add devices for Prepare and After Measure

(2) Set Conditions

Set moving pitches matching to the conditions, and select “Return origin” in the Properties dialog.

		Axis : 1	Axis : 2	
 SHOT-204MS Prepare	Move pitch	150	200	Measurement start position
 SHOT-204MS	Move pitch	100	200	Measurement pitch and distance
	Move distance	300	400	
 SHOT-204MS After Measure	Move pitch	200	100	Position after measurement

Program Instruction

☐ Write progress time

☒ Return origin(Start run and completion)

Select

Fig. 4-25 Settings of Prepare and After Measure

(3) Operation and Measurement Result

The stages move in accordance with the settings and outputs measurement results.

* Devices for which Run Position is set to Prepare or After Measure are not subject to measurement.

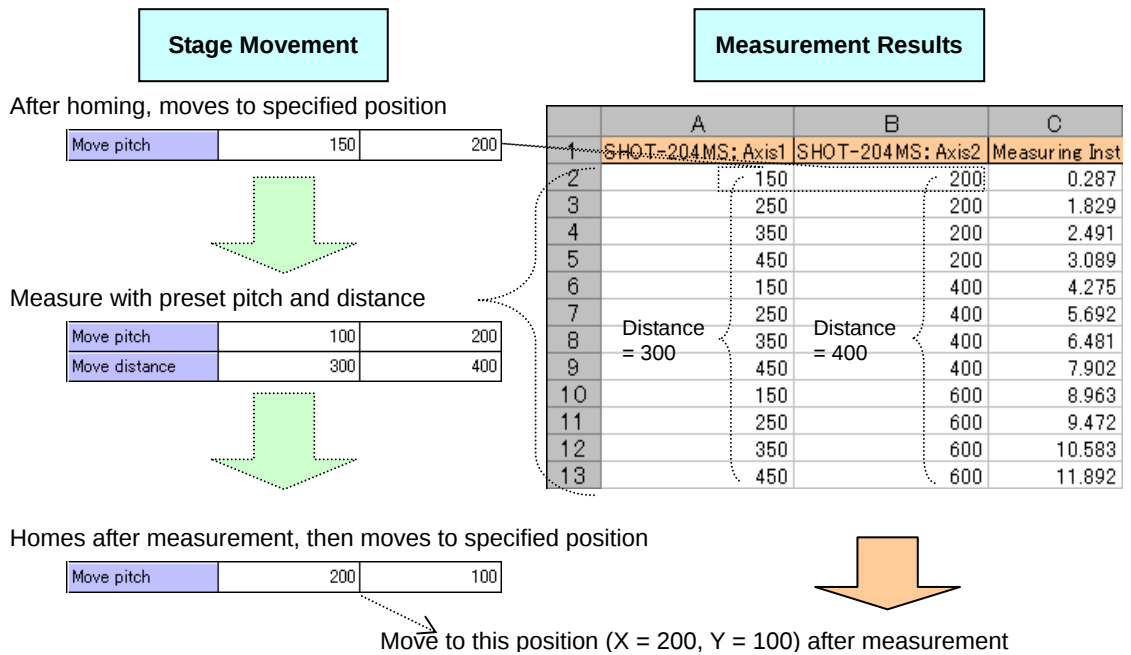


Fig. 4-26 Stage operation and measurement result

◆ I/O Signal Output in Measurement

A stage controller featuring I/O signal output can send out I/O and trigger signals during measurement.

If you set trigger output and I/O output with other conditions set as in “Automatic Measurement by Specifying Range and Pitch,” each signal is output every time a stage makes a move (after the move).

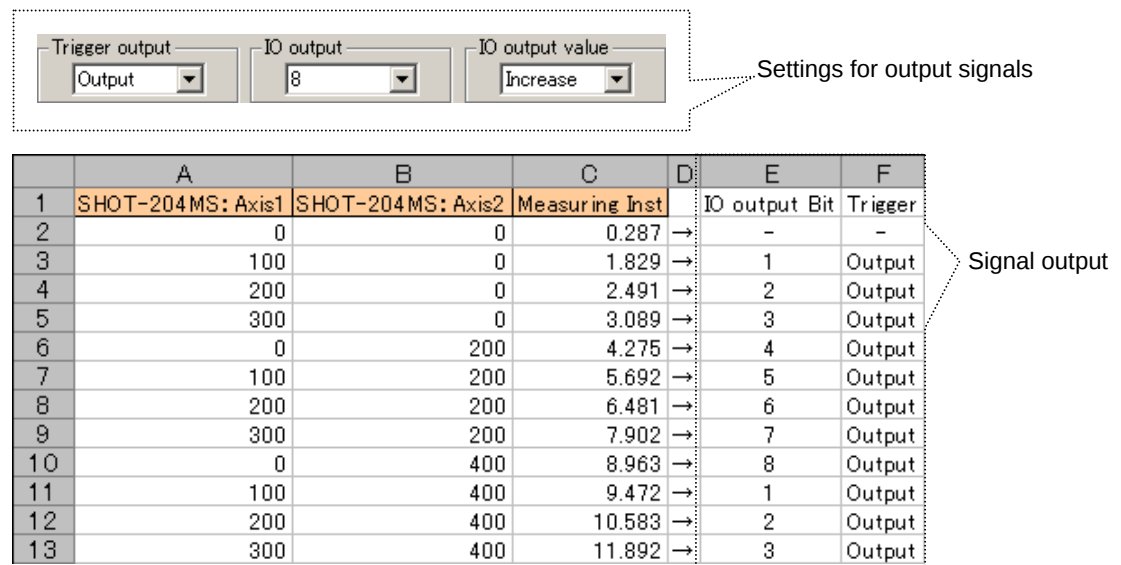


Fig. 4-27 Setting and output result of I/O and trigger signal (1)

- * Results of such output signals shown in Fig. 4-25 or 4-26 are NOT output to the destinations (text or Excel files).
- * The signal is not output for the first point (X = 0, Y = 0) since it is output after a stage move.
- * Set signal logics (voltage levels) or pulse width of trigger signals on the Stage-Controller.
- * For I/O signal, 0-bit is output immediately before a stage move, and a specified bit value immediately after the move.
- * An I/O signal output is held until the next output.

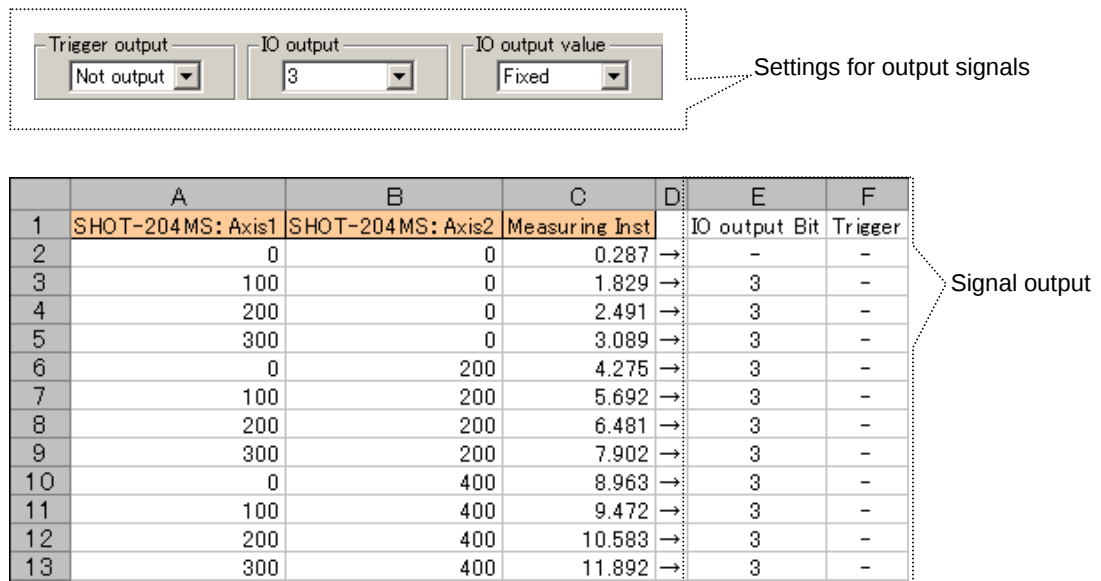


Fig. 4-28 Setting and output result of I/O and trigger signal (2)

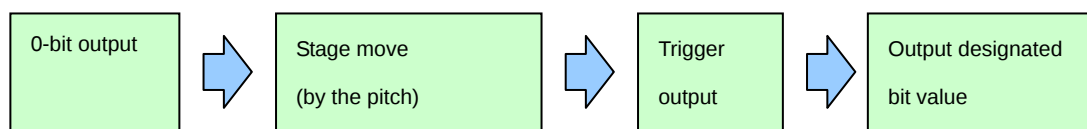


Fig. 4-29 Output flow of I/O and Trigger signals

◆ Auto measure and Auto measure-Multi

There are two kinds of automatic measurement of a program instruction measurement, Auto measure and Auto measure-Multi.

When using one controller for a measurement, a difference is not in both. However, when two or more controllers are used for a measurement, the methods of moving of stages differ.

Devices used : Stage-Controller SHOT-202 (X-axis) --- one motorized stage (X-axis) is connected.
Stage-Controller SHOT-202 (Y-axis) --- one motorized stage (Y-axis) is connected.
Measuring Instrument.

Measurement : Measure at moving points (measurement points) by moving X and Y stages by the specified distance.

Conditions : Use COM1 (RS-232C) for SHOT-202 (X-axis), COM2 (RS-232C) for SHOT-202 (Y-axis), Address1 (GPIB) for Measuring Instrument.

The X-axis of the stage moves in 100-pulse until it reaches 300-pulse.

The Y-axis of the stage moves in 200-pulse until it reaches 400-pulse.

The measurement command for a Measuring Instrument is "M." If "M" is transmitted, the instrument will return measurement results.

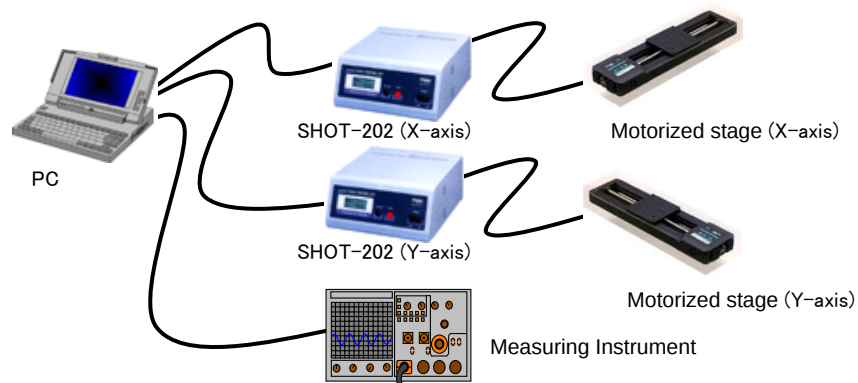


Fig. 4-30 Devices for measurement

(1) Register Devices

Add the Stage-Controller and Measuring Instrument in the Device Register dialog. And add SHOT-202 (X-axis), SHOT-202 (Y-axis) and Measuring Instrument in this order in the Program Instruction dialog.

(See "3.1 Device Register Dialog" and "3.2 Program Instruction Dialog" for the details of the registration).

Device Name	Interface	Port	Run Pos...	Interval
 SHOT-202(X-axis)	RS232C	COM1	Measure	0
 SHOT-202(Y-axis)	RS232C	COM2	Measure	0
 Measuring Instrument	GPIB	Address1	Measure	0

Fig. 4-31 Adding device

(2) Set Conditions

Set moving pitches and distance matching to the conditions in the Properties dialog.

Axis	Axis : 1	Axis : 2	Axis	Axis : 1	Axis : 2
Connect stage	Use	Not use	Connect stage	Use	Not use
Axis name	X-axis	Axis2	Axis name	Y-axis	Axis2
Move pitch	100	1000	Move pitch	200	1000
Move distance	300	2000	Move distance	400	2000

Setting of SHOT-202 (X-axis).

Setting of SHOT-202 (Y-axis).

Fig. 4-32 Move parameters

(3) Operation and Measurement Result

◆ Auto measure

The stage X-axis and the stage Y-axis do not carry out the action which interlocked. It does not become the two dimension matrix of X and Y.

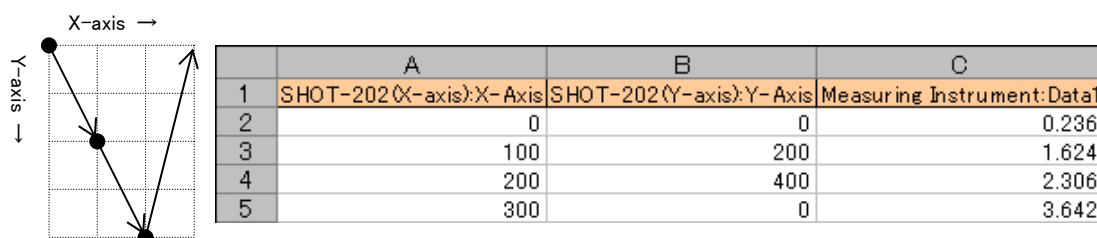


Fig. 4-33 Measurement result

◆ Auto measure-Multi

The stage X-axis and the stage Y-axis carry out the action which interlocked. It become the two dimension matrix of X and Y.

It operates the same with two sets, the stage X-axis and the stage Y-axis, having been connected to one controller.

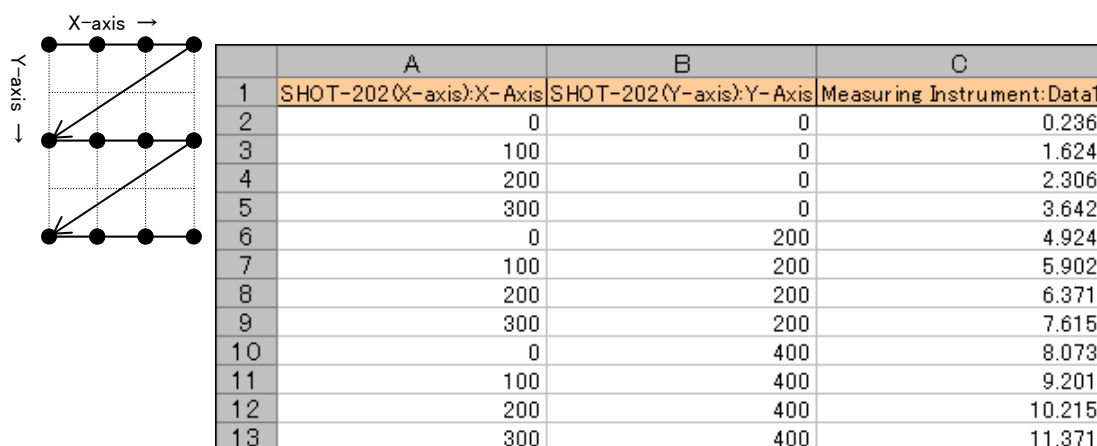


Fig. 4-34 Measurement result

◆ Manual Measurement

In Program Instruction mode, manual measurement is available as well as the automatic. Typically, use manual mode to measure and check on a step-by-step basis.

(1) Operation Settings

Select Manual Measurement mode with operation conditions set to the same as in “Automatic Measurement by Specifying Range and Pitch.”

(See “3.1 Device Register Dialog” and “3.2 Program Instruction Dialog” for the details of the settings).

Device Name	Interface	Port	Run Position	Interval
 SHOT-204MS	RS232C	COM1	Measure	0
 Measuring Instrument	RS232C	COM2	Measure	0

Fig. 4-35 Adding device



Fig 4-36 Select measurement mode

Select Manual Measurement

(2) Start Up Axis Control Dialog

Select the registered SHOT-204MS in the Program Instruction dialog, and then click the Stage button to display the Axis Control dialog.

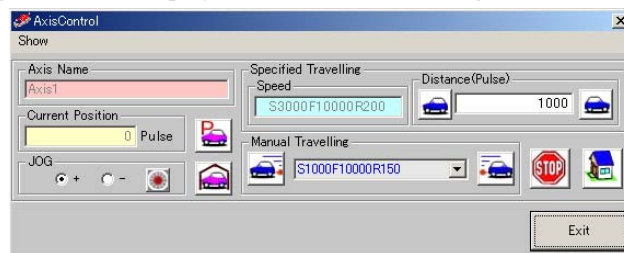


Fig. 4-37 Axis Control dialog

(3) Stage Operation and Measurement

Move the stage to a desired measurement point in the control dialog, and click the START button. Measurement begins on the instant.

Measured data and the current stage position are output to the destination.

In the Axis Control dialog, you can repeat measurement by operating the stage and clicking the START button at desired positions until clicking the STOP button.

- * In manual measurement mode, you CANNOT operate a Stage-Controller registered in the Program Instruction dialog by clicking Start (You can operate Stage-Controllers only in the Axis Control dialog).
- * Manual measurement continues until the STOP button is clicked.
- * Be sure to click the STOP button to exit the manual measurement mode.
- * Do not access the destination files (text or Excel) while manual measurement continues, or an error will be generated.



Fig. 4-38 START and STOP buttons

◆ Time Series Measurement

Performs measurement with specified measuring time (intervals).

* An actual time span in time series measurement is not an exact time you specified. It may vary depending on PC environments, etc.

* Finish continuous operations within 24 hours from the start. When exceeding the limit, the timer will reset.

Devices: Two Measuring Instruments

Measurement: Measure every time a specified time has elapsed.

Conditions: Use COM1 (RS-232C) for Measuring Instrument A, COM2 (RS-232C) for Instrument B.

Measure with Instrument A, then wait for one second to begin measurement with Instrument B.

Wait two seconds after measuring with B. Repeat the procedure ten times.

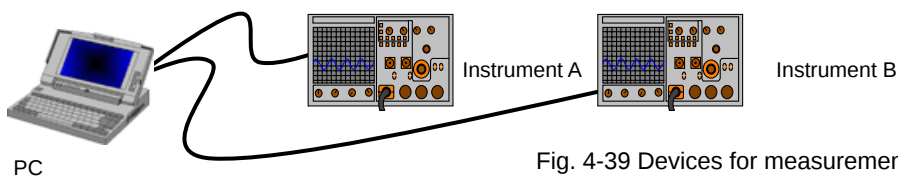


Fig. 4-39 Devices for measurement

(1) Device Registration and Operation Setting

Add Instruments A and B, and then set measurement conditions.

(See “3.1 Device Register Dialog” and “3.2 Program Instruction Dialog” for the details of the registration and settings).

Specify intervals for each device.

Device Name	Interface	Port	Run Position	Interval
Measuring Instrument A	RS232C	COM1	Measure	10
Measuring Instrument B	RS232C	COM2	Measure	20

Specify

Fig. 4-40 Specify intervals

Select “Write progress time” in the Properties menu. Set measurement mode to Automatic Measurement and the count to ten.



Fig. 4-41 Set Write progress time, Auto measurement, and count

(2) Operation and Measurement Result

Measurement is performed with preset intervals according to the settings, and the results are

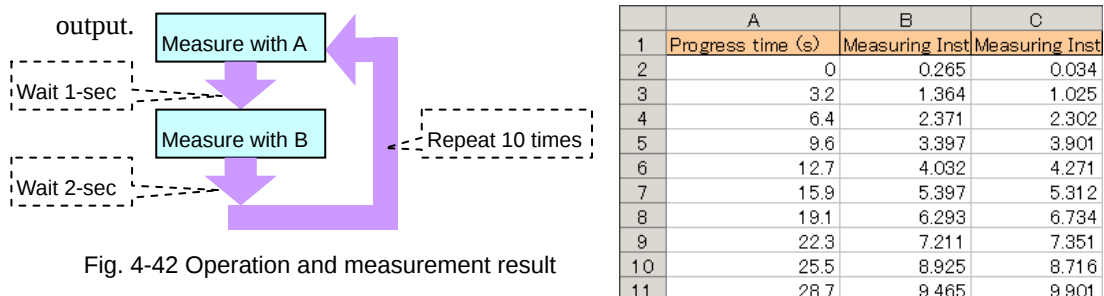


Fig. 4-42 Operation and measurement result

4.3 Measurement in Excel Instruction Mode

In Excel Instruction mode, you can run automatic/manual measurement. Stage positions and operations of a Control Device are designated by an Excel instruction file.

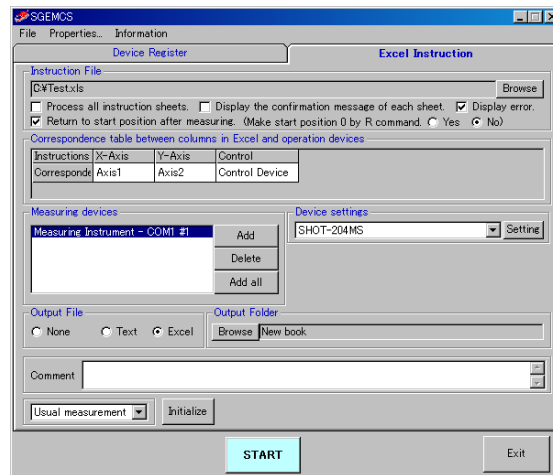


Fig 4-43 Excel Instruction dialog

To begin measurement in Excel Instruction mode, first register all the applicable devices to enable them.

For the details of device registrations, see “3. Operation.”

The move speed of the stage of each axis at the time of a measurement is set up with "the measurement parameters" of the setting dialog of a controller.

(See “3 Operation” for the details of the settings of the speed).

◆ Usual Measurement and Step Measurement

In Excel Instruction mode, two measurement modes are available:

Usual Measurement: Auto-measurement by following the contents of instruction files.

Supports sequential running of two or more instruction sheets.

Step Measurement: Manually run the contents in an instruction sheet on a row-by-row basis.

SGEMCS can run only one (the first) instruction sheet in step mode.

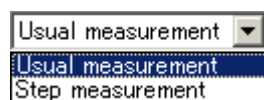


Fig. 4-44 Measurement mode selection box

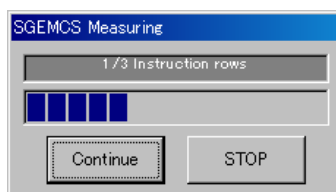
◆ Instruction File

You need to create an instruction file in advance in order to designate operations.

Create an instruction file by following the rules below:

- The first row is a title row. Fill in the axis name of the stage to be used, a control device name, a measuring instrument name, etc. Be sure to enter.

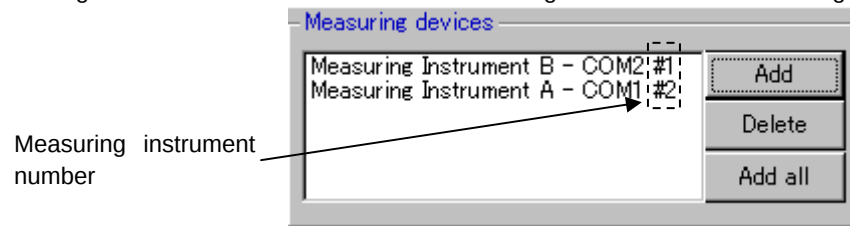
- A title row is filled in from column A one by one to the right in order of operation of a stage or a control device. Assign the last column to measurement. Always assign only one column to measurement even if you use two or more measuring instruments. Blank out a column at the right of a measurement column.
 - * Do not insert a blank column on the way in a title row. The column on the right of a blank column is disregarded.
 - * See figure 4-43. Column D is the blank column, and column C, at the left, is the measurement column. SGEMCS recognizes the entries in further left columns (A and B) as coordinate values or control commands.
 - * In figure 4-43, cells on the first row are assigned to X-axis, Y-axis and measurement. Enter any of characters, symbols or numeric values, but be sure to begin with the first row.
- Fill in the control commands to a stage or a control device from the 2nd row.
- The measurement process goes down from the 2nd row. A blank cell on column A finishes the process.
- Coordinate designation commands for stages must be numeric values or H, R, RH, STOP in single-byte upper case.
 - H : Return the axis to home position.
 - R : Designate the position as the origin in logical coordinate system, and assign the coordinate (0).
 - RH : Move to the logical origin.
 - STOP : Stop Excel instruction measurement. The following dialog is displayed during a stop.
 - Click on the Continue button to continue the measurement. (Measurement is continued from the right-hand cell of the cell which specified STOP.)
 - Click on the STOP button to stop the measurement. (Measurement did not stop immediately. It will stop when a step of processes are completed).



- The moving coordinate values for stages shall be absolute values.
 - * The values should be distances from the origin, not relative positions from the current position.
- SGEMCS does not transmit the same coordinates already encountered in the previous row to the stages.
- SGEMCS does not transmit the same commands already encountered in the previous row to the control devices.
- Fill in assignment of the measuring instrument number and wait time in a measurement column.

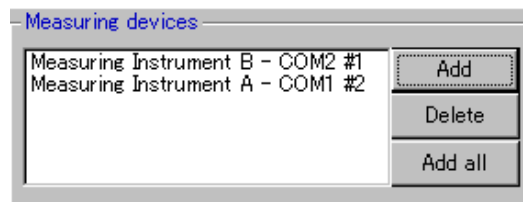
- “#” followed by a numeric value (like #1) in a measurement column will specify the measuring instrument number. Use single byte characters to write “#” and the numeric values.

* A measuring instrument number is determined according to the turn of a "Measuring devices" list.



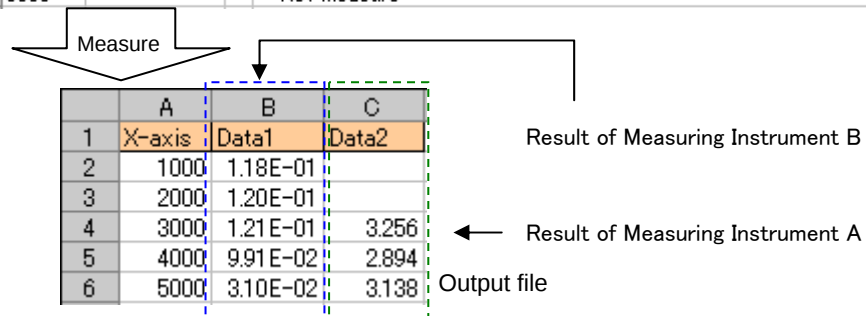
- “W” followed by a numeric value (like W10) in a measurement column will specify wait time. Use single byte characters to write “W” and the numeric values.
A wait time can be specified in the range for 1 - 3600 seconds.
- You can specify combining a measuring instrument number and wait time in a measurement column.
- If you enter contents other than “W” followed by a numeric value or “#” followed by a numeric value in a cell on a measurement column, SGEMCS can move stages, or operate control devices, but cannot designate measurement.
- When a measurement column is blank, or when only assignment of wait time is filled in, SGEMCS measures in order of a list using all the measuring instruments of a "Measuring devices" list.

Example of measurement column assignment : "Measuring devices" list is the following



Instruction file

	A	B	C	D
1	X-axis	Measurement		
2	1000	#1		←Measure with Measuring Instrument B
3	2000	W5#1		←Wait for 5 seconds and measure with Measuring Instrument B
4	3000	#1W5#2		←Measure with Measuring Instrument B and wait for 5 seconds and measure with Measuring Instrument A
5	4000			←Measure with Measuring Instrument B and measure with Measuring Instrument A
6	5000	W5		←Wait for 5 seconds and measure with Measuring Instrument B and measure with Measuring Instrument A
7	6000	*		←Not measure



- A sheet name of an instruction sheet must begin with “**Instruction**” in single byte characters. After it, no restraints are imposed on the names.
Valid naming examples: Instruction test, Instruction-01, InstructionSample.
- SGEMCS can sequentially run auto-measurement for two or more instruction sheets. In such cases, you must specify the same stages and control devices for all sheets.
Example: If you write X-axis in column A and measurement in column B in the Instruction01 sheet, and write X-axis in column A, Y-axis in column B and measurement in column C, the difference breaks the formatting rules.

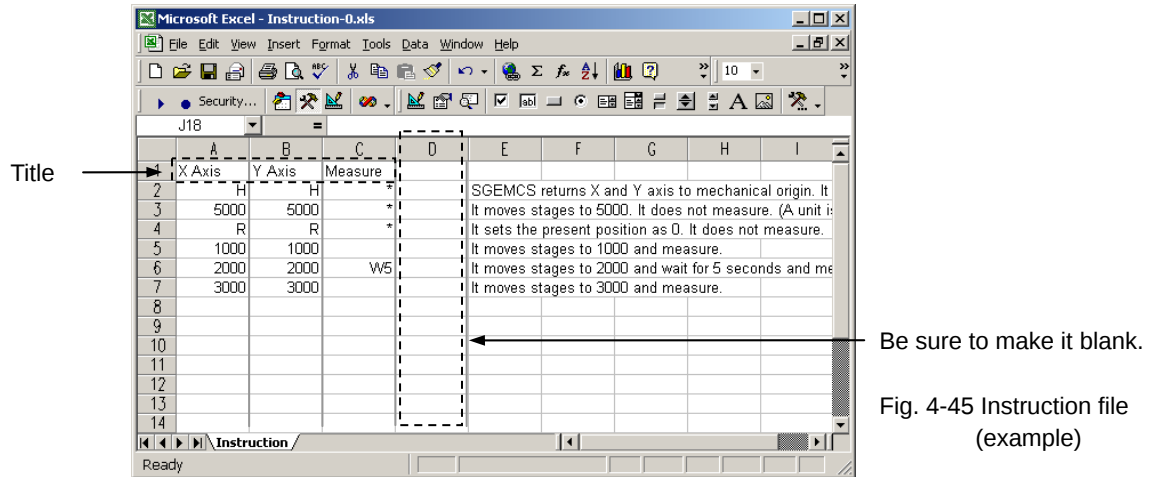


Fig. 4-45 Instruction file (example)

4.4 Measurement Example in Excel Instruction Mode

The following descriptions are dedicated to measurement examples in Excel Instruction mode.

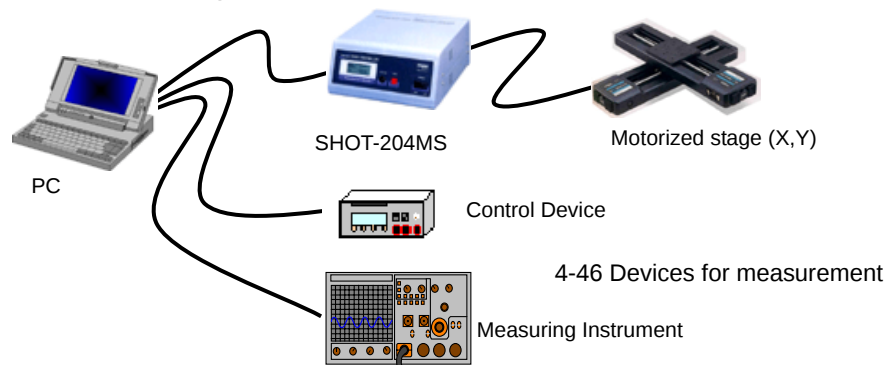
◆ Usual Measurement

Devices: A Stage-Controller SHOT-204MS, two motorized stages (X and Y-axis), a Control Device and Measuring Instrument

Measurement: Move X and Y-stage in specified amounts. Send a control command to the Control Device, then conduct measurement at each moving points (measurement points).

Conditions: Assign COM1 (RS-232C) to SHOT-204MS, Address1 (GPIB) to the Control Device, and COM2 (RS-232C) to the Measuring Instrument.

The Control Device begins to operate on receiving a control command from PC. The device does not send any verification strings. When the device received the command from PC, it waits one second before the measurement. The measurement command for a Measuring Instrument is "M." If transmitting "M," the instrument will return measurement results.



(1) Register Devices

Add the Stage-Controllers, Control Device and Measuring Instrument in the Device Register dialog (See "3.1 Device Register Dialog" for the details of the registration).

Device Name	Interface	Port	Status
 Stage-Controller	Unknown	Unknown	Disable
 Control Device	Unknown	Unknown	Disable
 Measuring Instru...	Unknown	Unknown	Disable

Fig. 4-47 Adding device

(2) Set Conditions for Devices

Enable the added devices by setting communication and operation conditions, and verify the communication with the devices. (See “3.1 Device Register Dialog” for the details of the settings).

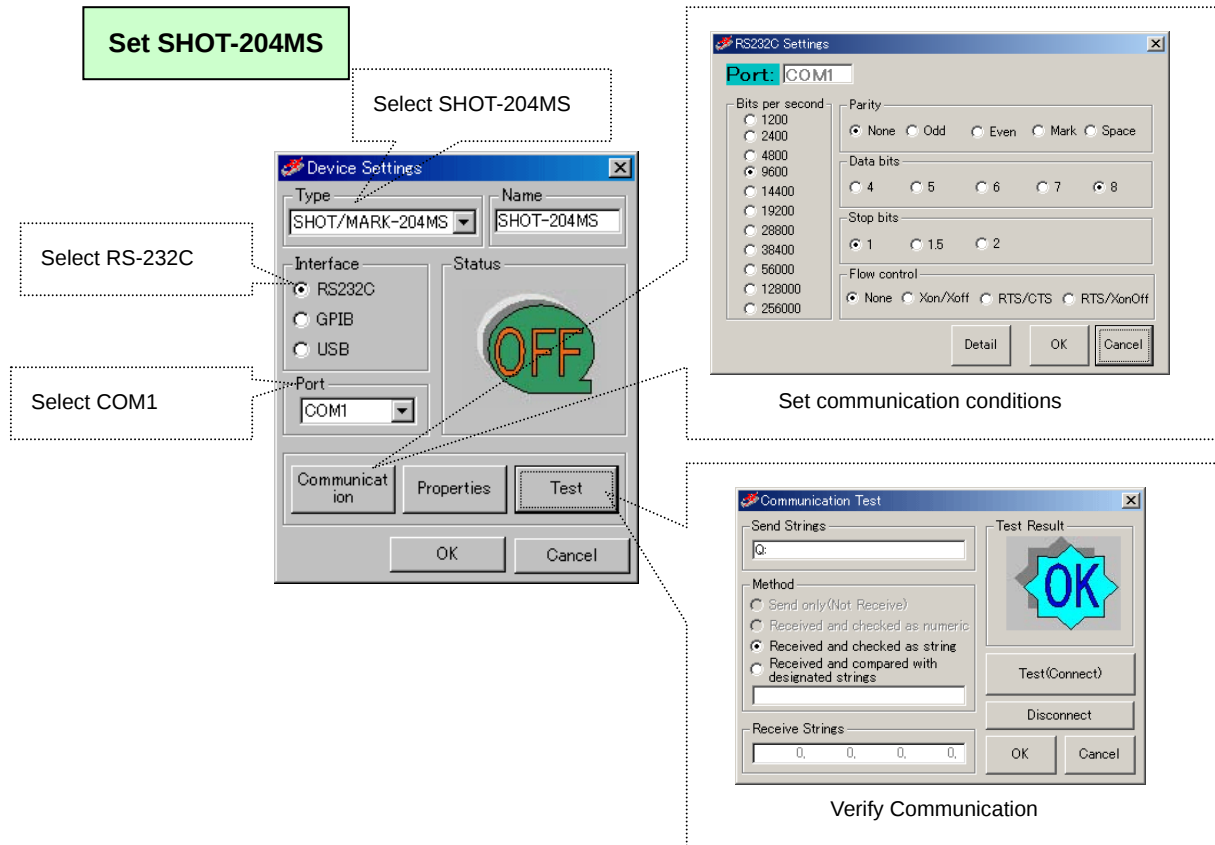


Fig. 4-48 Settings for SHOT-204MS

Set Control Device

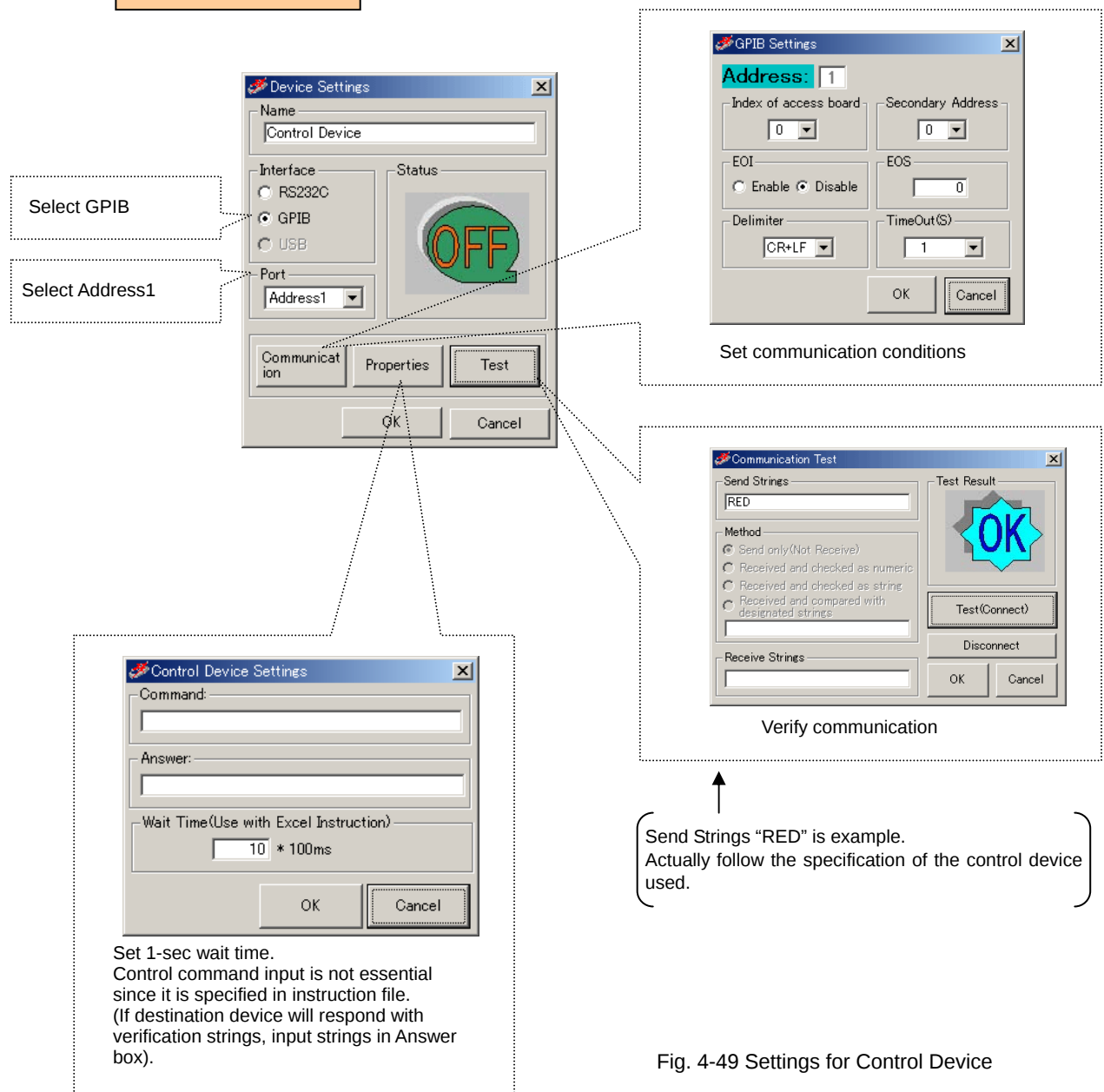


Fig. 4-49 Settings for Control Device

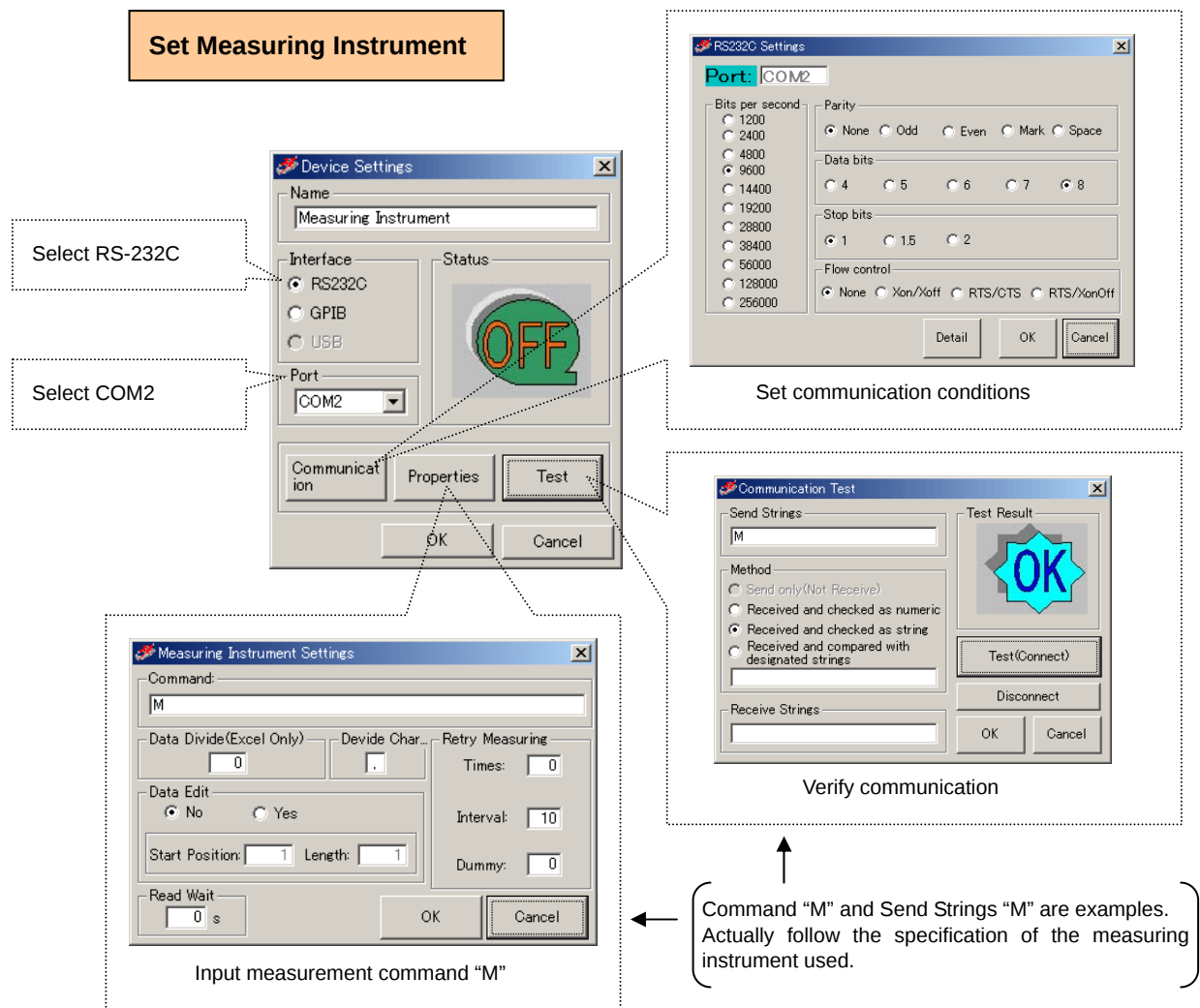


Fig. 4-50 Settings for Measuring Instrument

When the settings finish, check if the device is connected in the Device Register dialog.

Device Name	Interface	Port	Status
SHOT-204MS	RS232C	COM1	OK
Control Device	GPIB	Address1	OK
Measuring Instru...	RS232C	COM2	OK

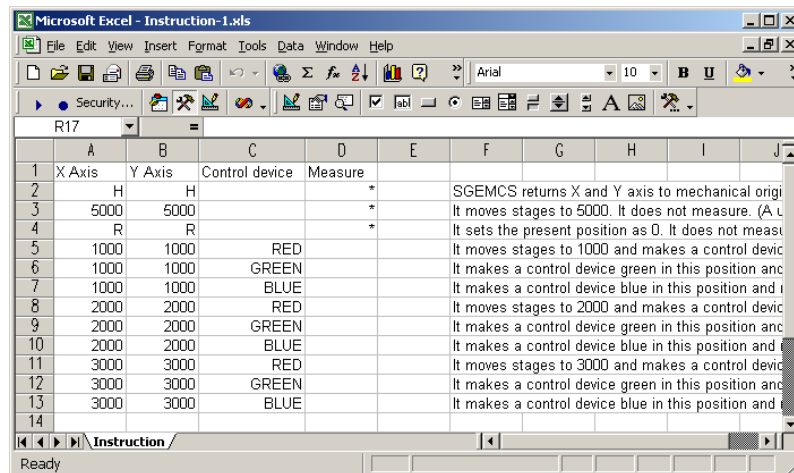
Check status

Fig. 4-51 Device status

(3) Create Instruction Files

Create an instruction file as described in figure 4-52.

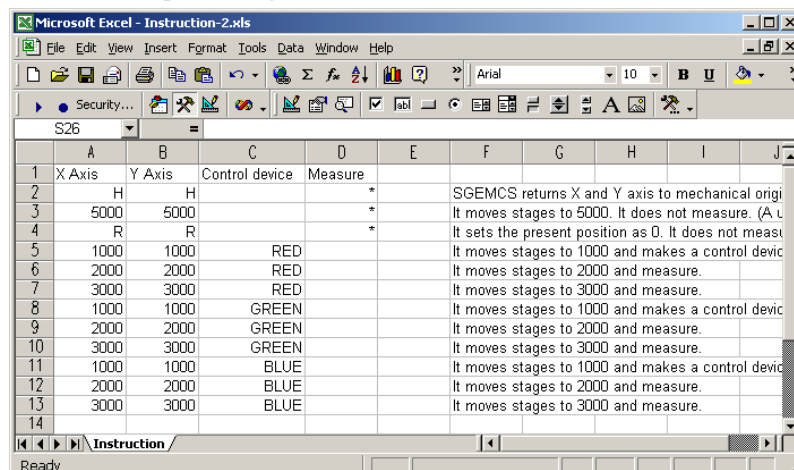
This instruction file is to send a control command (RED, GREEN or BLUE) to a control device at every measuring position.



	A	B	C	D	E	F	G	H	I	J
	X Axis	Y Axis	Control device	Measure						
1	H	H		*		SGEMCS returns X and Y axis to mechanical origin.				
2	5000	5000		*		It moves stages to 5000. It does not measure. (A.U.)				
3	R	R		*		It sets the present position as 0. It does not measure.				
4	1000	1000	RED			It moves stages to 1000 and makes a control device red.				
5	1000	1000	GREEN			It makes a control device green in this position and measure.				
6	1000	1000	BLUE			It makes a control device blue in this position and measure.				
7	2000	2000	RED			It moves stages to 2000 and makes a control device red.				
8	2000	2000	GREEN			It makes a control device green in this position and measure.				
9	2000	2000	BLUE			It makes a control device blue in this position and measure.				
10	3000	3000	RED			It moves stages to 3000 and makes a control device red.				
11	3000	3000	GREEN			It makes a control device green in this position and measure.				
12	3000	3000	BLUE			It makes a control device blue in this position and measure.				
13										
14										

Fig. 4-52 Instruction file-1.xls

If you want to fix the control command in order to give priority to stage movement, create an instruction file exemplified in figure 4-53.



	A	B	C	D	E	F	G	H	I	J
	X Axis	Y Axis	Control device	Measure						
1	H	H		*		SGEMCS returns X and Y axis to mechanical origin.				
2	5000	5000		*		It moves stages to 5000. It does not measure. (A.U.)				
3	R	R		*		It sets the present position as 0. It does not measure.				
4	1000	1000	RED			It moves stages to 1000 and makes a control device red.				
5	2000	2000	RED			It moves stages to 2000 and measure.				
6	3000	3000	RED			It moves stages to 3000 and measure.				
7	1000	1000	GREEN			It moves stages to 1000 and makes a control device green.				
8	2000	2000	GREEN			It moves stages to 2000 and measure.				
9	3000	3000	GREEN			It moves stages to 3000 and measure.				
10	1000	1000	BLUE			It moves stages to 1000 and makes a control device blue.				
11	2000	2000	BLUE			It moves stages to 2000 and measure.				
12	3000	3000	BLUE			It moves stages to 3000 and measure.				
13										
14										

Fig. 4-53 Instruction file-2.xls

(4) Settings in Excel Instruction Dialog

Set the Excel Instruction dialog as shown in figure 4-54.

(See “3.3 Excel Instruction Dialog” for the details of the settings).

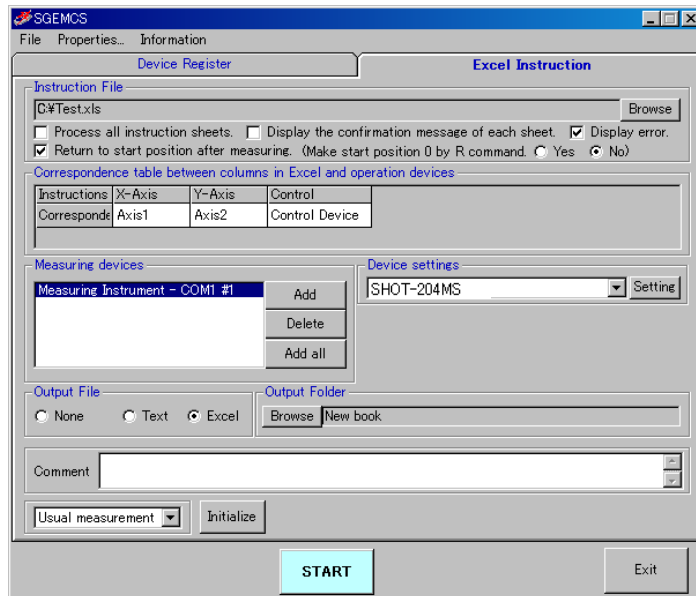


Fig. 4-54 Excel Instruction dialog

(5) Start Measurement

Click on the START button to start measurement.

During measurement, click on the Pause button on the progress display to halt the measurement. Click on the Continue button to continue the measurement. Click on the STOP button to stop the measurement. (Measurement did not stop immediately. It will stop when a step of processes are completed).

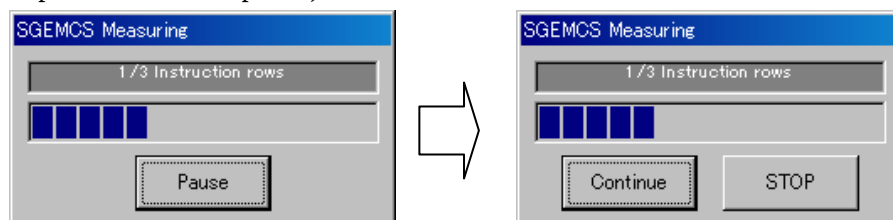


Fig. 4-55 Measurement progress display

(6) Result Output

The measurement results are output to the destination.

	A	B	C	D	E	F	G	H	I
	Axis1	Axis2	Control Device	Data1					
1	1000	1000	RED	1.539					
2	1000	1000	GREEN	1.602					
3	1000	1000	BLUE	1.598					
4	2000	2000	RED	2.486					
5	2000	2000	GREEN	2.506					
6	2000	2000	BLUE	2.534					
7	3000	3000	RED	3.251					
8	3000	3000	GREEN	3.302					
9	3000	3000	BLUE	3.283					
10									
11									

Fig. 4-56 Measurement results

◆ Step Measurement

In step measurement mode, manually run the contents in an instruction file on a row-by-row basis.

As a step control, SGEMCS can send control characters to specified control devices every time measurement defined in a row has finished.

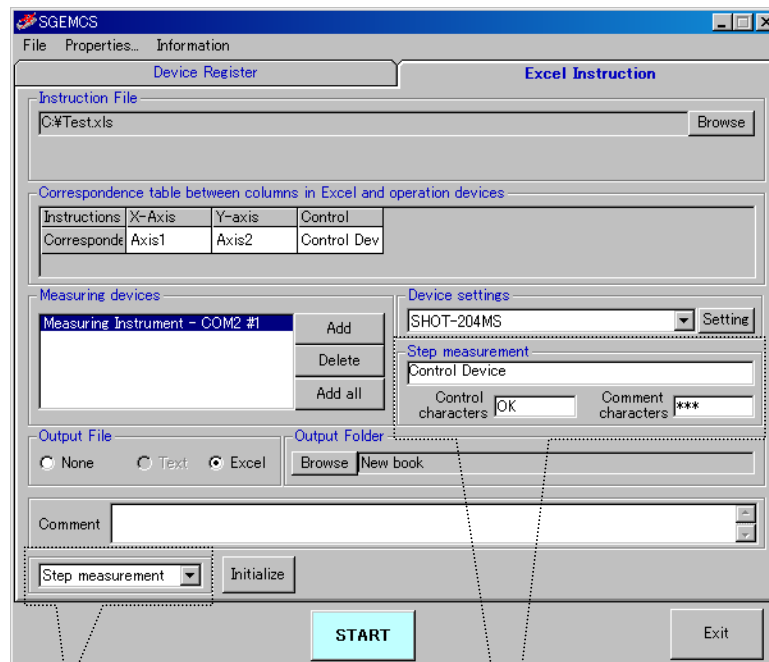
* When there are two or more instruction sheets, only a measurement of the first sheet is performed.

(1) Register devices, (2) set conditions for devices and (3) create instruction files as described for the Usual Measurement mode above.

(4) Settings in Excel Instruction Dialog

Set the Excel Instruction dialog as shown in figure 4-57.

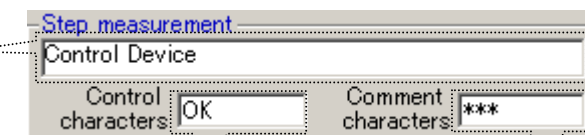
(See “3.3 Excel Instruction Dialog” for the details of the settings).



Select step mode in measurement mode selection box

Displayed if selecting Step measurement

Specify destination device if SGEMCS sends control characters, as step control, to Control Device every time measurement defined in a one row finishes



Specify characters to send to Control Device for step control

Specify characters to write to mark column in destination file every time measurement in a row finishes

Fig. 4-57 Excel Instruction dialog (step measurement)

(5) Start Measurement

Click START to show the Step measurement dialog.

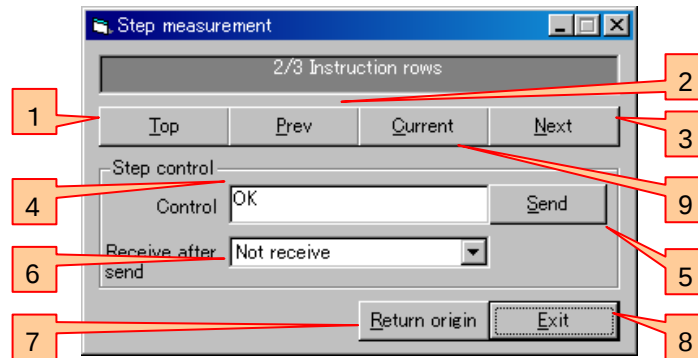


Fig. 4-58 Stem measurement dialog

- 1 Click TOP to run as described in the first row of an instruction file.
- 2 Click "Prev" to run the previous row.
- 3 Click Next to run the next row (run the first row immediately after starting measurement).
- 4 Displays the control characters specified in the Excel Instruction dialog (Fig. 4-50). Or, you can change the characters in this box.
- 5 If you select a control device to which the control characters are sent, click Send to transmit the characters to the device. In addition, comment strings described in Fig. 4-50 are displayed in the mark column of the destination file.
- 6 Select the reception of a response from the step control device after sending the control characters. Note that SGEMCS does not check received characters.
- 7 Click to return to the measurement start coordinates.
- 8 Click to terminate measurement.
- 9 Click to rerun the current line. The measurement result of the current line is overwritten.

(6) Result Output

The measurement results are output to the specified destination.

	A	B	C	D	E	F
	Axis1	Axis2	Control Device	Data1	Mark	
1	1000	1000	RED	1.539	OK	
2	1000	1000	GREEN	1.602	***	
3	1000	1000	BLUE	1.598	***	
4	2000	2000	RED	2.486	OK	
5	2000	2000	GREEN	2.506	***	
6	2000	2000	BLUE	2.534	***	
7	3000	3000	RED	3.251	OK	
8	3000	3000	GREEN	3.302	OK	
9	3000	3000	BLUE	3.283	OK	
10						
11						

Fig. 4-59 Measurement results