MITSUBISHI ELECTRIC

*Changes for the Better*

# MITSUBISHI CNC

MELSOFT

# Instruction Manual

# NC Analyzer


## MELSOFT
## Integrated FA Software

IB-1501086(ENG)-C

# Introduction

This instruction manual describes how to use NC Analyzer. Incorrect handling may lead to unforeseen accidents, so make sure to read this instruction manual thoroughly before operation to ensure correct usage.
NC Analyzer supports the following NC series.

| Written as in this manual | Appropriate NC |
|---|---|
| M7 series | M70/M70V/M700/M700V series |
| C70 | C70 |
| E70 series | E70 series |

Screens under development are included in this manual. So the screens used in this manual might differ slightly from the actual screens.

# Notes on Reading This Manual

(1) This manual describes as many special operations as possible, but it should be kept in mind that operations not mentioned in this manual cannot be performed.
(2) For the specifications of individual machine tools, refer to the manuals issued by the respective machine tool builders. The "restrictions" and "available functions" described by the machine tool builders have precedence over this manual.

# Precautions for Safety

Always read the specifications issued by the machine tool builder, this manual, related manuals and attached documents before installation, operation, programming, maintenance or inspection to ensure correct use.
Understand this numerical controller, safety items and cautions before using the unit.
This manual ranks the safety precautions into "DANGER", "WARNING" and "CAUTION".

| | |
|---|---|
| ⚠DANGER | **When the user may be subject to imminent fatalities or major injuries if handling is mistaken.** |
| ⚠WARNING | **When the user may be subject to fatalities or major injuries if handling is mistaken.** |
| ⚠CAUTION | **When the user may be subject to injuries or when physical damage may occur if handling is mistaken.** |

Note that even items ranked as " ⚠ CAUTION", may lead to major results depending on the situation. In any case, important information that must always be observed is described.

The following signs indicate prohibition and compulsory.

| | |
|---|---|
| ⃠ | **This sign indicates prohibited behavior (must not do).**<br>**For example,  indicates "Keep fire away".** |
| ● | **This sign indicates a thing that is compulsory (must do).**<br>**For example,  indicates "it must be grounded".** |

The meaning of each pictorial sign is as follows.

| | | | | |
|---|---|---|---|---|
|  <br>CAUTION |  <br>CAUTION<br>rotated object |  <br>CAUTION<br>HOT |  <br>Danger<br>Electric shock risk |  <br>Danger<br>explosive |
|  <br>Prohibited |  <br>Disassembly is prohibited |  <br>KEEP FIRE AWAY |  <br>General instruction |  <br>Earth ground |

⚠DANGER

**Not applicable in this manual.**

⚠WARNING

**Not applicable in this manual.**

**⚠CAUTION**

⚠ **Some screens and functions may differ depending on the NC system (or its version), and some functions may not be possible.**

⚠ **Incorrect parameter settings may cause unforeseen machine operations.**
**To change parameters, fully confirm the meaning of the parameters.**

⚠ **Do not fail to confirm the soft limit movement (over travel) to prevent collision. Be careful of the position of other axes and pay attention when the cutter has already mounted as the collision possibly occurs before the soft limit.**

⚠ **When a large vibration occurs because of increasing the speed loop gain and so on, immediately apply emergency stop to stop the vibration. The machine or servo amplifier could fail if vibration is generated for a long time.**

⚠ **Do not set the notch filters to the frequency where vibration does not occur. The automatic adjustment might not be executed correctly, or the vibration might be caused.**

⚠ **Set the same position loop gain (PGN1, PNG2, SHGC) to all the interpolation axes. (The parameters (PGN1, PGN2, SHGC) are tuned to the minimum setting of adjusted axis assistant.)**

⚠ **Set the same time constant to all the interpolation axes. (The time constant is tuned to the maximum setting of adjusted axis assistant.)**

⚠ **When enabling disturbance observer, lost motion compensation has to be adjusted again.**

⚠ **Restart the NC Analyzer to validate IP address changing.**

# Trademarks

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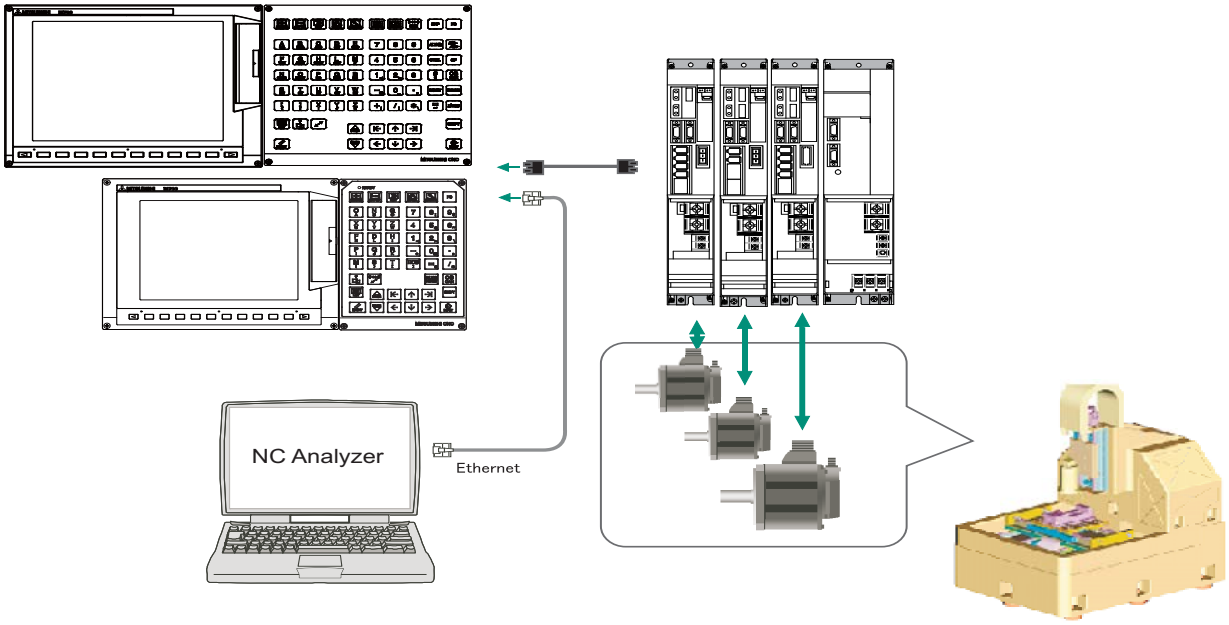
# 1

# Introduction

# 1.1 Outline of NC Analyzer

With NC Analyzer, the attribute of the servo motor system is measured and the bode diagram is output by activating the motor with vibration signals and measuring/analyzing the machine characteristics. And the servo waveform measurement function is supported, too.




**<Function>**

**Waveform measurement function**

| | | |
|---|---|---|
| Frequency response measurement | : | Measures the frequency response (speed command - speed FB) of speed loop for the designated axis. The result will be presented as Bode diagram. |
| Frequency response measurement of machine | : | Measures the frequency response (torque command - speed FB) of machine system for the designated axis. The result will be presented as Bode diagram. |
| Measurement function (with program creation function) | : | Measures the Time-series data measurement, Circular error measurement, Synchronous tapping error measurement, Arbitrary path measurement. |

**Automatic adjustment function**

| | | |
|---|---|---|
| Program creation | : | Creates machining programs for adjustment. |
| Initial notch filter setup | : | Automatically adjusts the notch filter when the initial resonance is large. |
| Velocity loop gain adjustment | : | Automatically adjusts the notch filter and the speed loop gain. |
| Time constant adjustment | : | Automatically adjusts the acceleration/deceleration time constant. |
| Position loop gain adjustment | : | Automatically adjusts the position loop gain. |
| Lostmotion adjustment | : | Automatically adjusts the quadrant protrusion amount of the designated axis. |
| Lostmotion 3 adjustment | : | Automatically adjusts the lost motion type 3 for the quadrant protrusion amount of the designated axis. |

**Environment setup**

| | | |
|---|---|---|
| Communication path setup | : | Sets the path to communicate with NC. The model of connected NC is selected. |
| Parameter setup | : | Saves/changes the servo parameters. |

# 1.2 Applicable Model And Version

The model and the version of the CNC and drive unit which can use this software are as follows.

| NC Analyzer | CNC | | | |
|---|---|---|---|---|
| | M700V/M70V series | E70 series | M700/M70 series | C70 series |
| BND-1201W000-B0 | G4 version or later (Note 1)(Note 2) | - | FB version or later (Note 1)(Note 2) | C4 version or later (Note 1)(Note 2) |
| BND-1201W000-B1 | | J0 version or later (Note 1)(Note 2) | | |
| BND-1201W000-B2 | | | | |

| NC Analyzer | Servo/spindle drive unit | | | |
|---|---|---|---|---|
| | MDS-D/DH series | MDS-D-SVJ3/SPV3 series | MDS-DM series | |
| | | | V3 | SPVx |
| BND-1201W000-B0 | Vx: BND1501W001-B0 or later SP: BND1501W002-B0 or later | SVJ3: BND1501W105-A1 or later SPJ3: BND1501W106-A1 or later | V3: BND-1501W012-B0 or later | SV: BND-1501W016-C0 or later SP: BND-1501W018-A2 or later |
| BND-1201W000-B1 | | | | |
| BND-1201W000-B2 | | | | |

| NC Analyzer | MDS-D2/DH2 series | MDS-DM2 series | MDS-DJ series |
|---|---|---|---|
| BND-1201W000-B0 | - | - | - |
| BND-1201W000-B1 | Vx:BND1501W101-A0 or later SP:BND1501W102-A0 or later | Vx:BND1501W101-A0 or later SP:BND1501W102-A0 or later | Vx:BND-1501W101-A0 or later SP:BND-1501W102-A0 or later |
| BND-1201W000-B2 | | | |

(Note 1) The high-cycle sampling is only supported by M700V series J0 version or later.

(Note 2) The PLC device signal measurement function is only supported by M700V/M70V/E70 series K0 version or later, and C70 series DA version or later. M700/M70 series is not supported.

**Correspondence function list for each CNC (servo)**

| | | | Function | | M7/E70 series | C70 series |
|---|---|---|---|---|---|---|
| Servo | NC axis | Singular axis | Environment setup | Parameter setup | ○ | ○ |
| | | | Automatic adjustment | Program creation | ○ | ○ |
| | | | | Initial notch filter setup | ○ | ○ |
| | | | | Velocity loop gain adjustment | ○ | ○ |
| | | | | Time constant adjustment | ○ | ○ |
| | | | | Position loop gain adjustment | ○ | ○ |
| | | | | Lostmotion adjustment | ○ | ○ |
| | | | | Lostmotion type 3 adjustment | ○ | ○ |
| | | | Waveform measurement | Frequency response measurement | ○ | ○ |
| | | | | Frequency response measurement of machine | ○ | ○ |
| | | | | Program creation for measurement | ○ | ○ |
| | | | | Time-series data measurement | ○ | ○ |
| | | | | Circular error measurement | ○ | ○ |
| | | | | Synchronous tapping error measurement | ○ | ○ |
| | | | | Arbitrary path measurement | ○ | ○ |
| | | Parallel synchronous control axis (Note 5) | Environment setup | Parameter setup | ○ | ○ |
| | | | Automatic adjustment | Initial notch filter setup | ○ | ○ |
| | | | | Velocity loop gain adjustment | ○ | ○ |
| | | | | Lostmotion type 3 adjustment | ○ | ○ |
| | | | Waveform measurement | Frequency response measurement | ○ (Note 1) | ○ (Note 1) |
| | | | | Frequency response measurement of machine | ○ (Note 1) | ○ (Note 1) |
| | | | | Program creation for measurement | ○ (Note 2) | ○ (Note 2) |
| | | | | Time-series data measurement | ○ | ○ |
| | | | | Circular error measurement | ○ | ○ |
| | | | | Synchronous tapping error measurement | ○ | ○ |
| | | | | Arbitrary path measurement | ○ | ○ |
| | PLC axis | - | Waveform measurement | Time-series data measurement | ○ (Note 3) | ○ (Note 3) |

(Note 1) The graphical display is only a selected axis though a primary axis and a secondary axis are vibrated at the same time when measuring.

(Note 2) Select a primary axis usually when the program for the measurement is created.

(Note 3) On program creation for measurement screen, only the time-series data measurement as a measurement item and the reciprocation acceleration/deceleration as the type can be selected. However, the program for the measurement cannot be created, so search the machining program on NC side.

(Note 4) The value to display waveform for the Time-series data measurement and synchronous tapping error measurement corresponds to the inch system is applied ("#1041 I_inch" is set to "1"). The metric system is fixedly used for displaying the circular error measurement, the arbitrary path and others.

(Note 5) The function of E70 series is restricted by the NC specification.

**Correspondence function list for each CNC (spindle)**

| | | Function | | M7/E70 series | C70 series |
|---|---|---|---|---|---|
| Spindle | Acceleration/deceleration operation | Waveform measurement | Time-series data measurement | ○ | ○ |
| | Orientation | | Time-series data measurement | ○ | ○ |
| | Synchronous tapping | | Time-series data measurement | ○ | ○ |
| | Spindle C axis | | Time-series data measurement | ○ | ○ |
| | Spindle synchronous (Note 3) | | Time-series data measurement | ○ | ○ |

(Note 1) On program creation for measurement screen, only the time-series data measurement as a measurement item and the reciprocation acceleration/deceleration as the type can be selected. However, the program for the measurement cannot be created, so search the machining program on NC side.

(Note 2) The spindle does not correspond to the gear ratio.

(Note 3) The function of E70 series is restricted by the NC specification.

# 1.3 Functions of NC Analyzer and its corresponding CNC

Executable functions differ depending on the NC version and the combination of ATS parameter (#1164 ATS) and the sampling data output parameter (#1224 aux08 bit0).

**Explanatory note for combination pattern of related parameters**

| Abbreviation | Pattern |
|---|---|
| ○ | It does not depend on parameter setting. |
| **ATS** | Executable if ATS parameter is set to "1". |
| **ATS & aux** | Executable if both ATS parameter and the sampling output parameter are set to "1". |
| **ATS=0 & aux** | Executable if ATS parameter is set to "0" and the sampling output parameter is set to "1". |

**List for the detail of each function**

| NC | | M700V/M70V series | | E70 series | M700/M70 series | | C70 series | |
|---|---|---|---|---|---|---|---|---|
| | | G3 or before | G4 or later | G4 or later | FA or before | FB or later | C3 or before | C4 or later |
| Environment setup | Communication path setup | ATS | ○ | ○ | ATS | ○ | ○ | ○ |
| | Parameter setup | ATS | ○ | ○ | ATS | ○ | ○ | ○ |
| Automatic adjustment | Program creation | ATS | ○ | ○ | ATS | ○ | ○ | ○ |
| | Initial notch filter setup | ATS | ATS | ATS | ATS | ATS | ATS | ATS |
| | Velocity loop gain adjustment | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Time constant adjustment | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Position loop gain adjustment | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Lost motion adjustment | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Lost motion type3 adjustment | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| Waveform measurement | Frequency response measurement | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Frequency response measurement of machine | ATS & aux | ATS | ATS | ATS & aux | ATS | ATS | ATS |
| | Time-series data measurement | ATS=0 & aux (Note 1,2,3) | ○ | ○ | ATS=0 & aux (Note 1,2,3) | ○ | ○ (Note 3, 4,5) | ○ (Note 5) |
| | Circular error measurement | ATS & aux | ○ | ○ | ATS & aux | ○ | ○ | ○ |
| | Synchronous tapping error measurement | ATS=0 & aux | ○ | ○ | ATS & aux | ○ | ○ | ○ |
| | Arbitrary path measurement | ATS & aux | ○ | ○ | ATS & aux | ○ | ○ | ○ |

(Note 1) Set "ATS(#1164)=0" when executing the time-series data measurement with software version FA or before for M700V/M70V series and G3 or before for M700/M70 series.
Set "ATS(#1164)=1" when executing functions other than time-series data measurement.
(The function can be executed although NC can be in PR state by changing ATS.)

(Note 2) PLC axis cannot be measured. The control input/output signal cannot be measured.

(Note 3) "Ring buffer" cannot be selected for the process configuration.

(Note 4) The elapsed time/remaining time/progress bar cannot be displayed in "Advance situation" screen.

(Note 5) Operation mode/operation status cannot be displayed in "Advance situation" screen.

# 1.4 About Display Unit

In this manual, (mm) is used for a position and (mm/min) is used for speed, but these units are for the metric system linear axis. Unit is varied depending on the various conditions.

| Unit | Metric system | | Inch system | |
|---|---|---|---|---|
| | Linear axis | Rotary axis (including spindle) | Linear axis | Rotary axis (including spindle) |
| **Position command**<br>**Position feed back**<br>**Model position**<br>**Motor end position FB** | mm | deg | inch | deg |
| **Position droop (Note 1)**<br>**Model error** | um | mdeg | minch | mdeg |
| **Speed command**<br>**Speed feed back (Note 2)** | mm/min | deg/min | inch/min | deg/min |
| **Current command**<br>**Current feedback**<br>**Load meter** | % | % | % | % |

(Note 1) "μ" (micro) is displayed as "u" on the screen.
"mdeg" is 1/100 deg and "minch" is 1/1000 inch.

(Note 2) (r/min) (number of rotations per minute) is also used for speed unit.
The same unit is used regardless of the conditions.

(Note 3) The unit of current feedback is % to the stall current of the motor.

# 2

# Installation and Setup

## 2.1 Operation Environment

NC Analyzer operates in the following personal computer environments.

- Operating system: Windows 8, Windows 7 (SP1 or later), Windows Vista (SP2 or later), Windows XP (SP3 or later) (Note 1,2)
- Language: English / Japanese / Simplified Chinese/ Korean (Note 3)
- RAM: Windows 8/ 2GB or larger, Windows 7/ 1GB or larger, Windows Vista/ 512MB or larger, Windows XP/ 256MB or larger
- Display: SVGA (800 × 600) or better resolution
- Ethernet port
- Peripheral device: CD-ROM drive

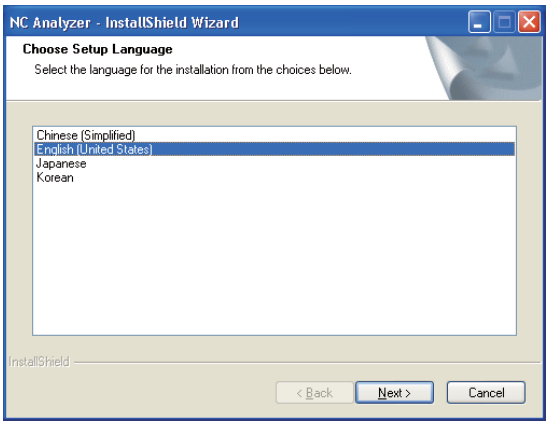
(Note 1) It works with 32-bit or 64-bit version of OS. (WOW64 is used for 64-bit version.)
(Note 2) This tool can be used by all the authorities (such as administrator or guest). However, perform the installation by the administrator authority.
(Note 3) Select at the time of installation. The language can be changed by selecting the language from [Language(&L)] menu and restart NC Analyzer.
(Note 4) For Windows XP, use the same language with NC Analyzer and OS. When they are different, a screen display may be unreadable.

# 2.2 Procedure of the First Installation

(1) Insert NC Analyzer installation CD in computer's CD-ROM drive.

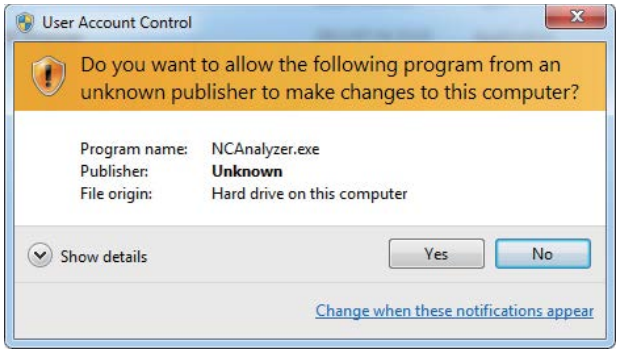
(2) Execute "NCAnalyzer.exe" in the installation CD.

After the selection screen for setting language is displayed, select the language to use for installation, and press the "Next" button.

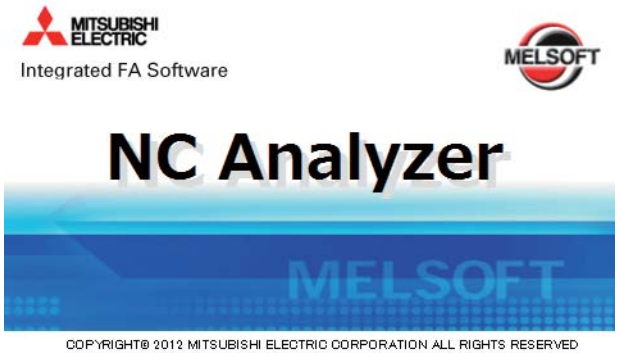



(Note) The installation of NC Analyzer has to be carried out by the authority of the administrator.

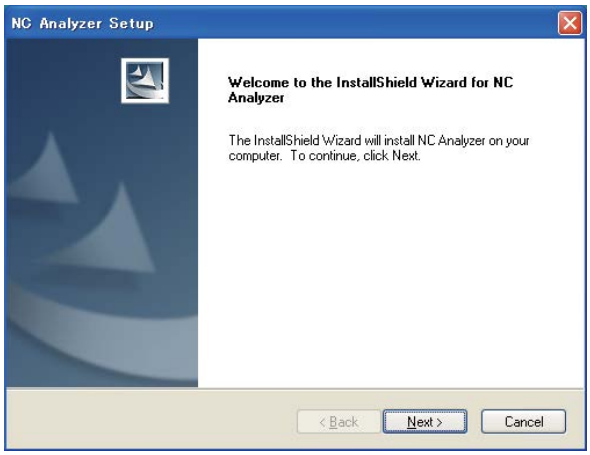
If User Account Control in Windows 7 or Windows Vista is enabled, the confirmation dialog box as below pops up. Then, select "Allow (A)" to start the installation.



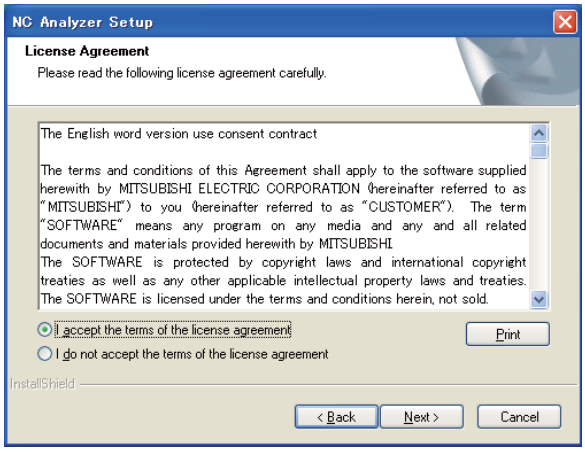

(3) Splash screen is displayed. Then the installer is started.



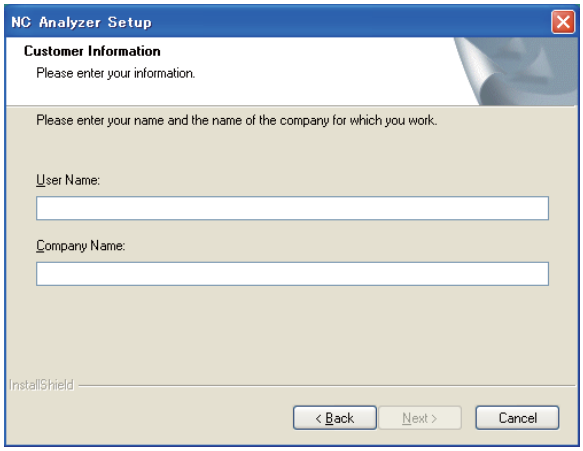
(4) The setup screen is displayed.
Press the "Next" button.



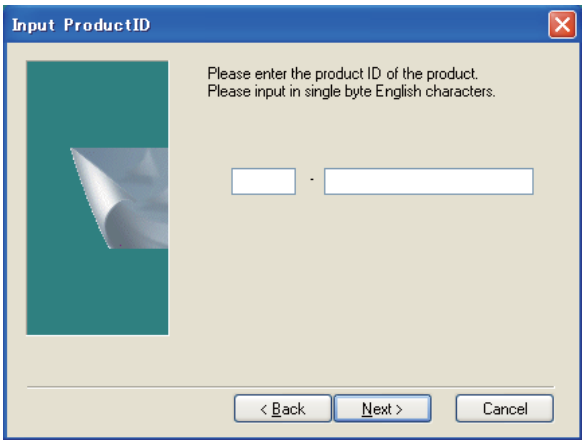

(5) The software license agreement is displayed.
Read the software license agreement carefully, and press the "Yes" button.
If "No" is selected (when you do not agree this agreement), the installation of NC Analyzer is discontinued.



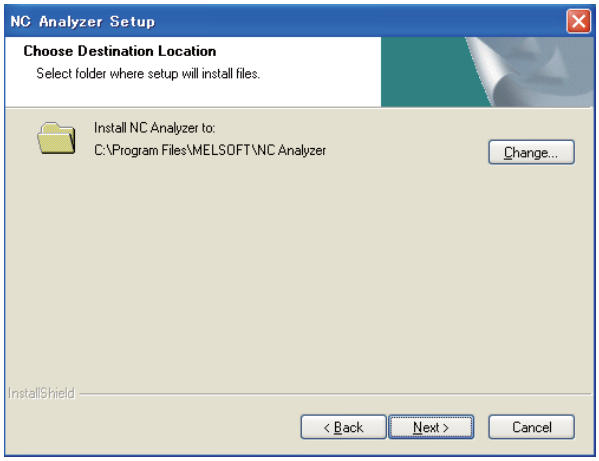

(6) When the installation is correctly completed, the complete screen is displayed.
When "Finish" button is pressed, the installation completes.



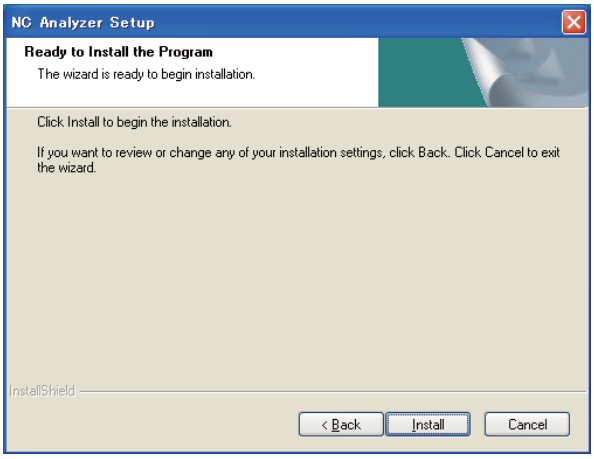
(7) Input the product ID on the Input Product ID screen and press the "Next" button.



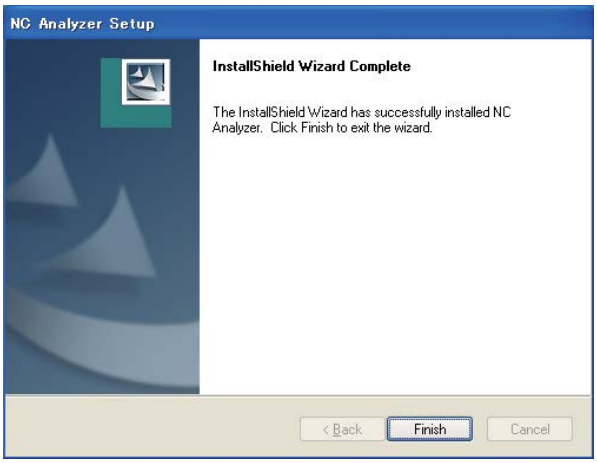

(8) The "Choose Designation Location" screen is displayed. Press "Change" and select the installation destination when changing the installation destination. Press the "Next" button after the installation destination settings.




(9) The "Ready to Install the Program" screen is displayed.
Press "Browse" and select the folder to store NC data file when changing the folder.
Press the "Next" button after the settings.



(10) When the installation is correctly completed, the complete screen is displayed.
When "Finish" button is pressed, the installation completes.




## 2.3 Installation Procedure When Upgrading

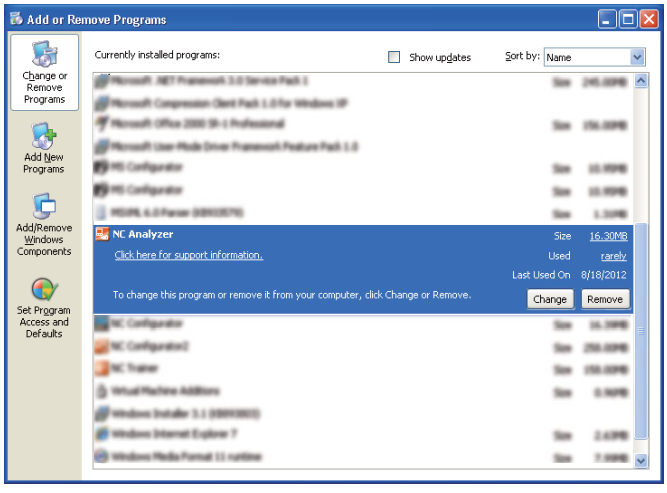
When the old version has already been installed, install the new version after uninstalling the old version.

## 2.4 Procedure of Uninstalling

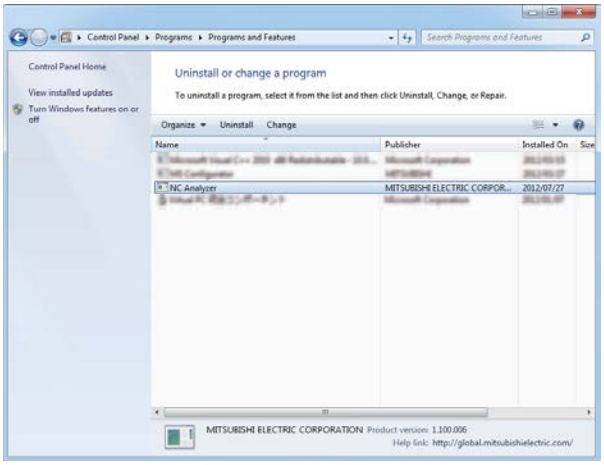
To uninstall NC Analyzer, execute from Control Panel or double-click the NCAnalyzer.exe.

### 2.4.1 Procedure of Uninstalling by the Control Panel

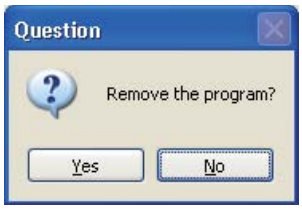
(1) For Windows XP, select the [Start] - [Control Panel] - [Add or Remove Programs].
The "Add or Remove Programs" screen is displayed.
Select the NC Analyzer from the list, and press the "Remove".



For Windows Vista or Windows 7, Select the [Start] - [Control Panel] - [Uninstall a program].
The "Uninstall or change a program" screen is displayed.
Select the NC Analyzer from the list, and press the "Uninstall".

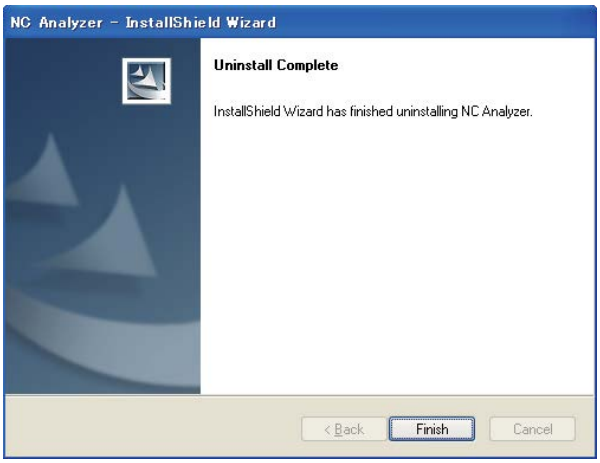



(2) The "Confirm Uninstall" screen is displayed.
When the "OK" is pressed, the uninstallation starts.
(When the "Cancel" is pressed, return to the Control Panel screen.)




(Note) After starting the uninstallation, it cannot be canceled.

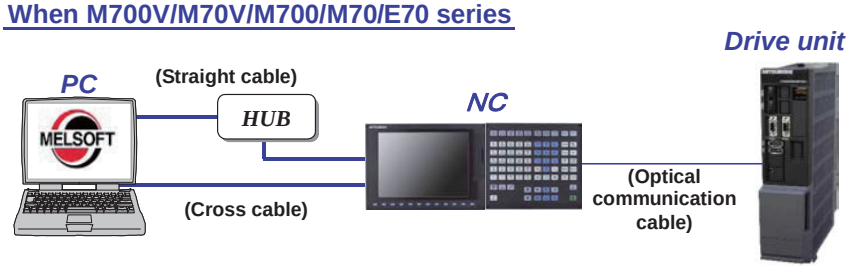
(3) When the uninstallation is finished, the complete screen is displayed.
When "Finish" button is pressed, the uninstallation completes.



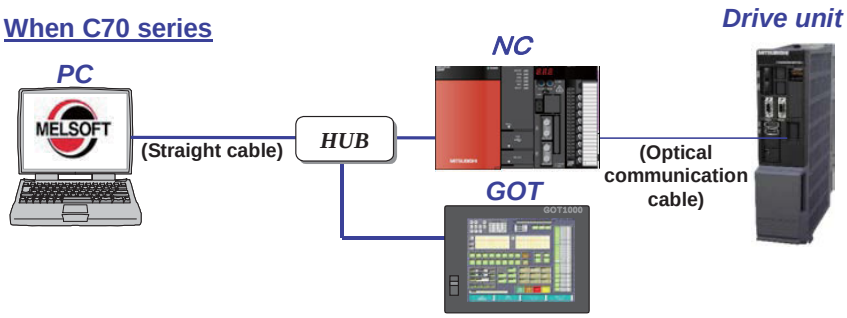
## 2.5 Connection Diagram

The connection diagrams with the M700V/M70V/M700/M70/E70 series and C70 series are shown below.

**When M700V/M70V/M700/M70/E70 series**




**When C70 series**



# 3

# How to Use

# 3.1 Preparation (Connect with NC)

Prepare the followings before using NC Analyzer.

## 3.1.1 Preparation for PC

| Item | Details |
|---|---|
| Cross cable | Personal computer is connected to NC with LAN cable. |
| NC Analyzer | Install the NC Analyzer. |
| IP address setting | Set IP address of personal computer to the same network address as the IP address of NC which is set to "#1926 Global IP address".<br>(Example)<br>NC IP address: 192.168.200.5<br>Personal computer IP address: 192.168.200.7<br>Same group |

## 3.1.2 Parameter Setting

Correctly set the following NC parameters before starting the adjustment.
Turn OFF the CNC power after setting parameters with (PR) mark. These parameters will be enabled when the CNC power is turned ON again.

**Base specifications parameter**

### 【#1164(PR)】 ATS Automatic tuning function

Set this parameter to "1" (Enable).
0: Disable
1: Enable

(Note 1) For the relationship between parameter settings and each functions, refer to "1.3 Functions of NC Analyzer and its corresponding CNC".

(Note2) With M700V/M70V/E70 series, this parameter setting becomes valid after turning the power ON again. With C70 series, after this parameter is set, this function is instantly enabled.

### 【#1224】 aux08

#### bit0: Sampling data output

Set this parameter to "1" (Enable).
0: Disable
1: Enable

(Note) For the relationship between parameter settings and each functions, refer to "1.3 Functions of NC Analyzer and its corresponding CNC".

### 【#1267(PR)】 ext03

#### bit0: High-speed high-accuracy control G code type

Set this parameter to "0" (Conventional format).
0: Conventional format (G61.1)
1: MITSUBISHI special format (G08P1)

### 【#1926(PR)】 Global IP address IP address

Set the IP address of the PC to be connected to the same group as this parameters' setting value.

### 3.1.3 Other Preparations/Precautions

(1) Coordinate system offset

NC Analyzer creates programs created on the workpiece coordinate system. When the adjustment is executed, set the coordinate system offset in consideration of it.

(Note) Always restore the coordinate system offset after NC Analyzer completes.

(2) Operation mode of NC

Select the "memory mode" of NC when using NC Analyzer.

When NC Analyzer is valid ("#1164" is "1"), normal memory operation cannot be used.

Set "#1164" to "0" when using normal memory operation.

(3) Parameter related to high-accuracy control

The "before interpolation" and "after interpolation" must be selected in position loop gain adjustment. Thus, pay attention when setting NC parameters related to high-accuracy control below.

(Example) When "#1205 G0bdcc" is set to "1", the adjustment is always "G0 before interpolation".

(4) Motor vibration and soft limit

When "Vibration signal setup", "Frequency response measurement", "Frequency response measurement of machine" or "Velocity loop gain adjustment" is executed, a minute vibration is added to the motor. Do not execute close to the soft limit as this may cause dangerous consequences. (Provide space of at least 10mm or more.)

(5) Vibration signal setup

If a large resonance exists, the adjustment is not executed properly. In that case, reduce the speed loop gain until the resonance become small, and execute the vibration signal setup.

(6) Velocity loop gain adjustment

The upper limit of notch filter adjustment is around 2000Hz. Before executing this adjustment, set the parameter below and validate the speed feedback filter.

Set "#2217 SV017/bit3 vfb Speed feedback filter" to "1" (Start (2250Hz)).

(7) Time constant adjustment

This function can be used only when the acceleration/deceleration mode is "soft acceleration/deceleration". Set the following parameters.

Set "#2003 smgst/bit0-7 (Rapid traverse acceleration/deceleration type and Cutting feed acceleration/deceleration type)" to "FF (soft acceleration/deceleration)".

Also set "#1219 aux03/bit7 (Time constant setting changeover for soft acceleration/deceleration)" to "1 (valid)".

When the target time constant has margin for the maximum output torque of the motor, the machine may vibrate. In that case, adjust the upper limit value of the motor current.

(8) Position loop gain adjustment

The default upper limit of the position loop gain adjustment with automatic adjustment is "47(SHG)".

(9) Lost motion adjustment

In this function, a compensation amount is simply determined by measuring the friction with a low speed feed.

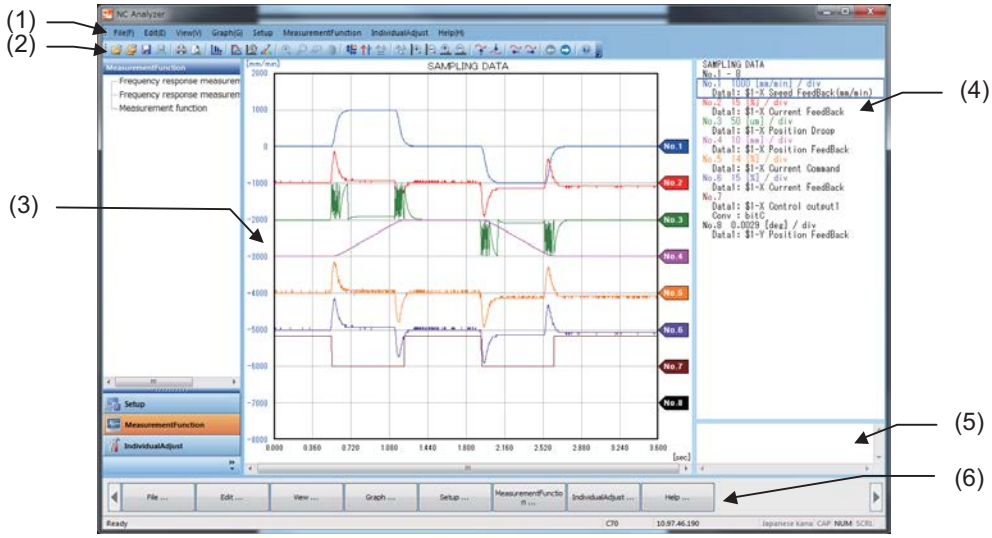
(10) Measurement functions

When [Model] is [Lathe] and [G code system] is 2, 4 or 6, check the parameter below before sending a machining program.

When "#1037(PR) cmdtyp (Command type)" is "3", "5", or "7", "#1076 Abslnc ABS/INC address (for L system only)" is set to "1".

## 3.1.4 Starting NC Analyzer

### Configuration of main screen




| Display item | | Details |
|---|---|---|
| (1) | Menu | This executes the Windows general operations, analysis of data displayed in the graph, NC Analyzer settings, etc. |
| (2) | Tool bar | The function of some menus can be executed by pressing the icon of the toolbar. |
| (3) | Graph area | This displays a graph of the data measured by NC Analyzer. |
| (4) | Text area | This displays the analysis of the data measured by NC Analyzer. |
| (5) | Memo area | The user can arbitrarily input text. |
| (6) | Function bar | This reproduces the layered structure of the menu, and the function of the menu can be executed with a function key. |
| (7) | Navigation window | This executes the Setup, IndivisualAdjust and Measurement Function menus. |

### Graph display mode

| Name | Measurement item | Details |
|---|---|---|
| XY mode | Circular error measurement | Two channels of position command or position feedback data will be indicated by a roundness graph. |
| | Arbitrary path measurement | Two channels of position command or position feedback data will be indicated as a path on a plane. |
| Time mode | Time-series data measurement | Eight channels of waveforms (command and feedbacks of position, current, and speed) will be displayed on top of each others. |
| | Sync. tapping error measurement | Waveforms of spindle and servo axis (error pulse and servo and spindle speed) when measuring the synchronous tapping will be indicated with time on the horizontal axis and value on the vertical axis. |

The XY mode is established at the startup.
The time mode will be entered when the time-series data measurement graph is opened.
Likewise, the XY mode will be entered when Circular error measurement/Arbitrary path measurement graph is opened.

(Note1) All the ATS files stored in the MS Configurator Ver. A4 or older will open in the XY mode.
The ATS files saved in the Time mode cannot be opened by the MS Configurator Ver. A4 or older.

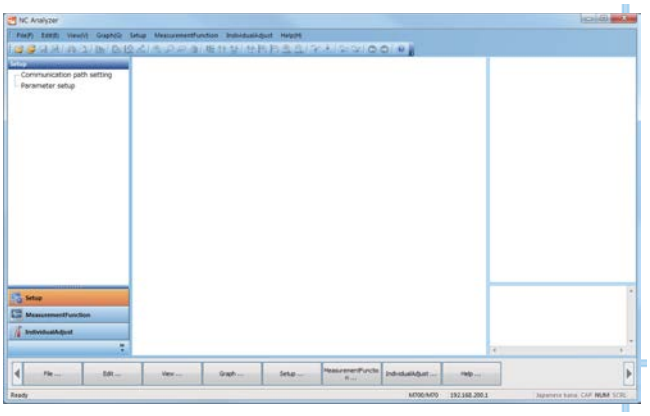
**Operation method**

(1) Set the base specification parameter "#1164 ATS" to "1".

(2) Set the NC operation mode to the memory mode.

(3) Release the emergency stop.

(4) Start the NC Analyzer.
The main screen is displayed.



### 3.1.5 Menu Items

Items available on the menu, the toolbar, and the function bar and by right-clicking the mouse in the graph area are listed below.

**File**

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Open | Open the waveform file.<br>Open the window to select a file (ATS format) to be opened. | ○ | ○ | ○ | ○ | ○ | |
| Read data | Add a waveform to the graph.<br>Open the window to select a file (CSV format) to be opened. | × | ○ | × | × | × | |
| Open multiple files | Open the multiple waveform files and display simultaneously.<br>Open the window to select a file (ATS format) to be opened. | ○ | ○ | ○ | ○ | ○ | |
| Save as | Save the graph.<br>Open the window to specify a directory file to save the graph. | × | ○ | ○ (Note 1) | ○ (Note 2) | ○ (Note 2) | |
| Save | Overwrite and save the currently displayed graph. | × | × | ○ (Note 1) | ○ (Note 2) | ○ (Note 2) | "Save as" is executed right after a measurement. |
| Save data between cursors | Save the data between cursors in the graph.<br>Open the window to specify a directory file to save the data. | × | × | ○ (Note 1) | × | × | Enabled only when cursors are displayed. |
| Save bitmap | Save the bitmap.<br>Save the contents of graph area, text area, and memory area in the bitmap file or PNG file (Ver. A3 or later).<br>Open the window to specify a directory file to save the graph. | × | ○ | ○ | ○ | ○ | |
| Print | Execute printing.<br>When connected to a printer, print the contents of graph area, text area, and memory area.<br>Display the print window. | × | ○ | ○ | ○ | ○ | |
| Print preview | Display the print image. | × | ○ | ○ | ○ | ○ | |
| Printer setting | Provide printer settings. | ○ | ○ | ○ | ○ | ○ | |
| Close application | Close the NC Analyzer. | ○ | ○ | ○ | ○ | ○ | |

(Note 1) When multiple files are open, this item is grayed out and cannot be saved.

(Note 2) The data is saved as time-series data if it is saved in FFT display.

**Edit**

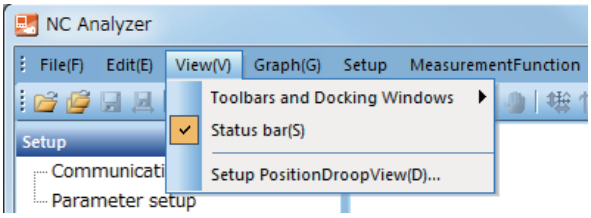
| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Copy image on clipboard | Copy the graph area on the clip board. | × | ○ | ○ | ○ | ○ | |
| Copy text on clipboard | Copy all the contents of text area and memory area on the clip board. | × | ○ | ○ | ○ | ○ | |

### View

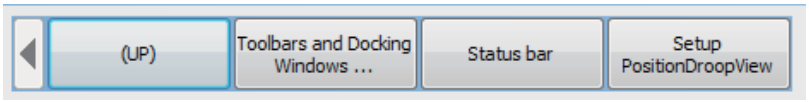
| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Toolbars and Docking Windows | | ○ | ○ | ○ | ○ | ○ | |
| Standard | Set to show/hide the tool bar. | ○ | ○ | ○ | ○ | ○ | |
| Function bar | Set to show/hide the function bar. | ○ | ○ | ○ | ○ | ○ | |
| Navigation window | Set to show/hide the navigation window. | ○ | ○ | ○ | ○ | ○ | |
| Customize | Provide custom settings of bars or menus. | ○ | ○ | ○ | ○ | ○ | |
| Status bar | Set to show/hide the status bar. | ○ | ○ | ○ | ○ | ○ | |
| Setup PositionDroopView | Specify whether to enable the loopback function and the loop-back amount for measuring a position droop graph. | ○ | ○ | ○ (Note1) | ○ | ○ | |

(Note1) "Setup PositionDroopView" is valid for the time constant adjustment and the position loop gain adjustment.
Time-series data graph will not be affected.

Select [View]-[Setup PositionDroopView] on the menu bar.




The same items, [View]-[Setup PositionDroopView] are also on the function bar.




Setting up the Position Droop View
Set how to display the positioning droop waveform when adjusting the position loop gain and time constant.
Loop-back display will be applied to the Y axis direction only. The waveform will be displayed as shown below.

(1) Waveform loop-back display

| Item | State | |
|---|---|---|
| Y axis display format | 1.000 to 9999.999 | Without index display |
| | 0.999 or less and 10000.000 or more | With index display |
| Y-axis maximum value | Same as the specified loop-back width. (The scale value must be rounded up to the closest whole number)<br>Ex. 50.4 -> When the maximum loop-back width is 50.4, the Y-axis maximum value will be 51. | |
| Y-axis minimum value | Same as the specified loop-back width with a minus sign. (The scale value must be rounded up to the closest whole number)<br>Ex. 50.4 -> When the maximum loop-back width is -50.4, the Y-axis minimum value will be -51. | |
| Waveform | Loop-back display.<br>If the maximum or the minimum value of the Y axis is smaller than the specified loop-back width, the loop-back display will not be applied. | |

(2) Waveform no loop-back display

| Item | State |
|---|---|
| Y axis | ■ When there is a 0 value or 0 cross<br>- 0 line will be displayed at the center.<br>- After multiplying the maximum value or the minimum value whichever the absolute value is larger, by 1.05, the upper two digits will be treated as the significant figures and the rest will be<br>■ Other than above<br>(1) Positive value<br>- Maximum value ->After multiplying the maximum value by 1.05, the third figure is rounded up and the upper two digits will be treated as the significant figures.<br>- Minimum value ->After multiplying the minimum value by 0.95, the upper two digits will be treated as the significant figures and the rest will be rounded off.<br>(2)Negative value<br>- Maximum value ->After multiplying the maximum value by 0.95, the third figure is rounded up and the upper two digits will be treated as the significant figures.<br>- Minimum value ->After multiplying the minimum value by 10.5, the upper two digits will be treated as the significant figures and the rest will be rounded off. |
| Waveform | No loop-back display |

**Graph**

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Drawing setting | Set the graph drawing method. Position can be converted into speed or acceleration. And the difference between data can be viewed. | × | × | ○ | ○ | ○ | |
| Axis setting | Set the maximum/minimum XY axis value and etc. | × | ○ | ○ | ○ | ○ | |
| Setup graph | Set the plot color of displayed graph and etc. | × | ○ | ○ | ○ | ○ | |
| Graph layout setting | Set the number of graph to display. | × | ○ | × | × | × | |
| RemoveGraph | Delete the graph in a specified graph area. | × | ○ | × | × | × | |
| RemovePlot | Delete the graph plot. | × | ○ | × | × | × | |
| Zoom | Enlarge/reduce the graph. | × | ○ | × | ○ | ○ | |
| Search | Read the values of points on a specified graph and reflect it in the text area. | × | ○ | × | ○ | ○ | |
| Plural Search | Read the values in the 1st line of the graph displayed on the screen and reflect it in the text area. | × | ○ | × | × | × | Enabled only when more than one graph are displayed in the far left line of the graph area. |
| Drag | Drag the graph in a specified graph area. | × | ○ | × | ○ | ○ | |
| Execute AutoScaling | Perform auto scaling to the whole graph to make it easy-to-read. | × | × | ○ | ○ | ○ | |
| ShowCursor | Change to show or hide the cursor. | × | × | ○ | × | × | |
| Move Cursors together | Change whether to move the two cursors together or separately. | × | × | ○ | × | × | Enabled only when cursors are displayed. |
| Show data between cursors | Enlarge (reduce) the data between cursors. | × | × | ○ | × | × | Enabled only when cursors are displayed. |
| Measure again | Start to measure again. | × | × | ○ | ○ | ○ | |
| Enlarge/Reduce in the vertical direction | Enlarge/Reduce the selected waveform in the vertical direction. | × | × | ○ | ○ | × | |
| Enlarge/Reduce in the horizontal direction | Enlarge/Reduce the selected waveform in the horizontal direction. | × | × | ○ | ○ | × | |
| Move the base line upward/downward | Move the selected waveform in vertical direction by 1Div. | × | × | ○ | ○ | × | |
| Change the display No. to the previous page/next page | Change the display No. of the waveform. | × | × | ○ | ○ | ○ | Disabled when No.1 to 8 are displayed. Disabled when No.25 to 32 are displayed. |

### Setup

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Communication path setup | Displays "Communication path setup" screen. | ○ | ○ | ○ | ○ | ○ | |
| Parameter setup | Displays "Parameter setup" screen. | ○ | ○ | ○ | ○ | ○ | |

### Language

Japanese, English, Korean, or Chinese (simplified) can be selected.
It is required to restart NC Analyzer after selecting the language.

### Measurement Function

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Frequency response measurement | Starts "Frequency response measurement" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Frequency response measurement of Machine | Starts "Frequency response measurement of Machine" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Measurement function | Starts "Measurement function" Wizard. | ○ | ○ | ○ | ○ | ○ | |

### Indivisual Adjust

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Program creation | Starts "Creation of the machining program for adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Initial NotchFilter Setting | Displays "Initial notch filter setting" screen. | ○ | ○ | ○ | ○ | ○ | |
| Velocity loop gain adjustment | Starts "Velocity loop gain adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Time constant adjustment | Starts "Time constant adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Position loop gain adjustment | Starts "Position loop gain adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| Lostmotion adjustment | Starts "Lostmotion adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |
| LostmotionTYPE3 adjustment | Starts "Lostmotion type 3 adjustment" Wizard. | ○ | ○ | ○ | ○ | ○ | |

### Help

| Item | Function | Validity | | | | | Other conditions |
|---|---|---|---|---|---|---|---|
| | | No wave form | XY mode | Time mode | FFT mode | Arc / Arbitrary / Arbitrary error mode | |
| Version information | Displays this NC Analyzer’ s version information. | ○ | ○ | ○ | ○ | ○ | |

### 3.1.6 Close the Application

NC Analyzer is closed.

**Operation method**

(1) Select the [File] - [Close application] from the menu.
This function can be selected from the function bar [File] - [Close application] also.
(2) NC Analyzer is closed.

# 3.2 Environment Setup

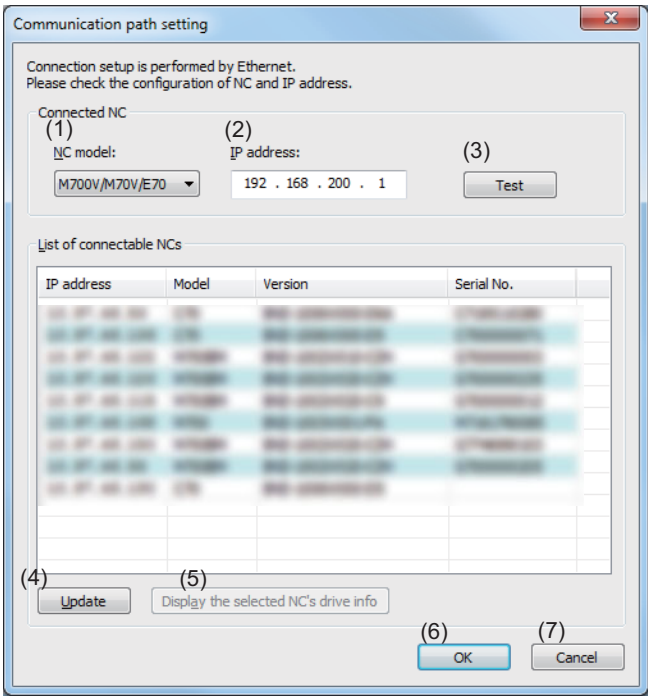
With this function, the system environment is set. The environment setup must always be set first.

## 3.2.1 Communication Path Setup

With this function, the communication path is selected, and the communication setup is executed.

**Operation method**

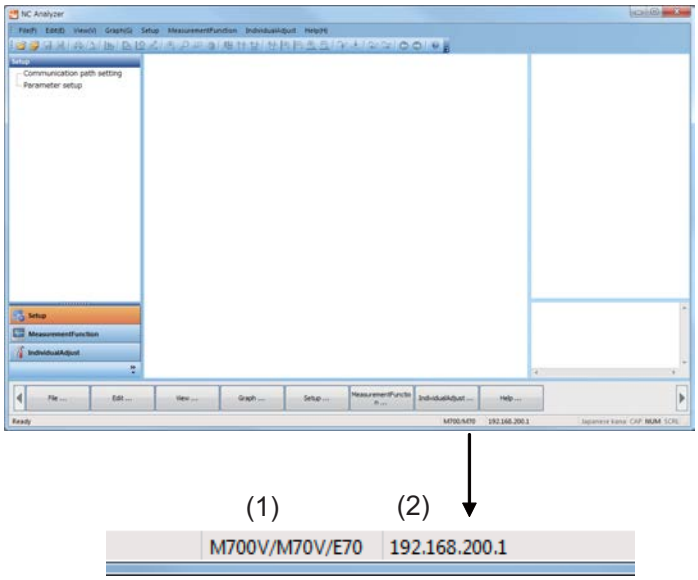
(1) Select "Setup" - "Communication path setting".
(This function can be selected from the function bar also.)
The "Communication path setting" screen is displayed.




| Display item | Details | Initial value | Setting range |
|---|---|---|---|
| (1) NC model | Select the model of connected NC.<br>Restores the previous settings at the activation of the screen.<br>Displays the initial value at the initial activation of the tool. | M700/M70/E70 | 1.M700/M70/E70<br>2.C70 |
| (2) IP address | Set the IP address of connected NC.<br>Restores the previous settings at the activation of the screen.<br>Displays the initial value at the initial activation of the tool. | 192.168.200.1 | 0.0.0.0 to<br>255.255.255.255 |
| (3) Test | Performs a communication test for the NC of NC model and IP address which are set in the "Connected NC" and displays the result in a dialog.<br>When succeeding in communication, the message "It succeeded in communication." will appear.<br>When not being able to communicate, the message "E002 It was not able to communicate." will appear. | - | - |
| (4) Update | Searches connectable NCs again and updates the "List of connectable NCs" display. | - | - |
| (5) Display the selected NC's drive info | Displays the NC's drive version selected in the "List of connectable NCs" on another dialog.<br>When NC is not selected in the "List of connectable NCs", this button will be disabled.<br>When not being able to communicate, the message "E002 It was not able to communicate." will appear. | - | - |
| (6) OK | Closes the screen after saving the current setting. | - | - |
| (7) Cancel | Closes the screen without saving the setting. | - | - |

<Display of the connection target information on the status bar>

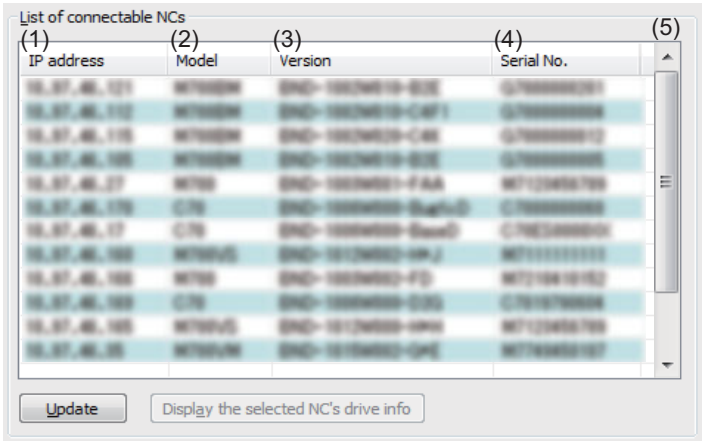
The current connection target setting information is displayed in the status bar of the tool. The previous connection target setting information is displayed at the activation of the tool. The display of the status bar is updated by the newly set connection target setting information when closing the "Communication path setting" screen with "OK" button.




| Display item | Details |
|---|---|
| (1) NC model | Displays the NC model which is currently set to the connection target. |
| (2) IP address | Displays the NC's IP address which is currently set to the connection target. |

<List of connectable NCs>

Searches online NCs at the activation of the screen and lists them. Only the NCs that belong to the same network as the local PC will be displayed.




| Display item | Details |
|---|---|
| (1) IP address | Displays the NC's IP address. |
| (2) Model | Displays NC model. |
| (3) Version | Displays NC version. |
| (4) Serial No. | Displays NC's Serial No. |
| (5) Vertical scroll bar | The vertical scroll bar will be displayed if the NC list is too long to fit in the screen. |

<Sort of NC list>

The item in the list can be sorted by clicking the header section of NC list.
The order of sort (ascending or descending) is switched for every one click.

<Automatically set the selected NC to the connection target>

Select the NC which is displayed in the NC list to automatically set the machine type and IP address of the selected NC on "Connected NC".

(2) Press the [Test] button on the communication path setting screen.
The communication test between NC Analyzer and NC is executed, and then the result is displayed.
When the result is normal, the message "It succeeded in communication." is displayed. When the result is abnormal, the message "E002 It was not able to communicate." is displayed.
Confirm the communication test results, and close the communication test dialog by pressing the "OK" button.
When the result is abnormal, display the Ethernet communication screen, confirm the NC model and IP address set with procedure (3), and start NC Analyzer.exe again.

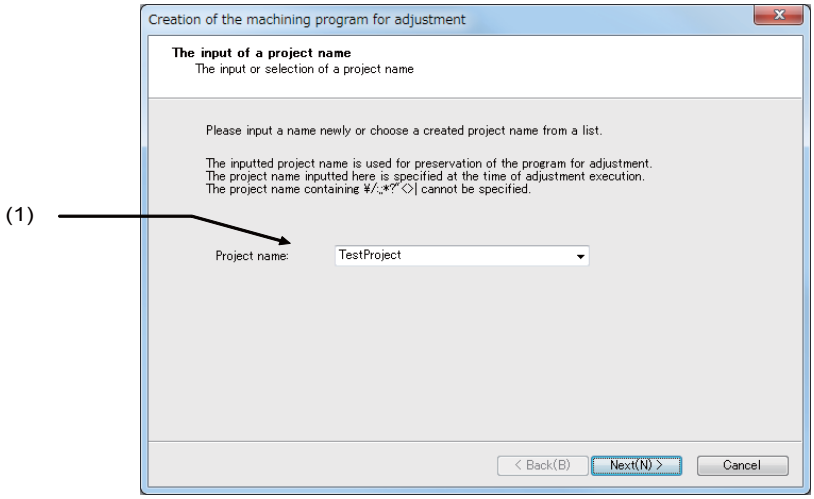
(3) Press the [Display the selected NC's drive info] button on the communication path setting screen, and confirm whether the versions such as NC, servo unit, etc. are versions for NC Analyzer.
The servo axis to which "-" (hyphen) is displayed in the version is an unconnected axis. Therefore, do not use the servo axis with "-" for the adjustment and the measurement


(4) Close the communication path setting by pressing the "OK" button when setting value is saved or by pressing the "Cancel" button when setting value is not saved.

## 3.2.2 Program Creation

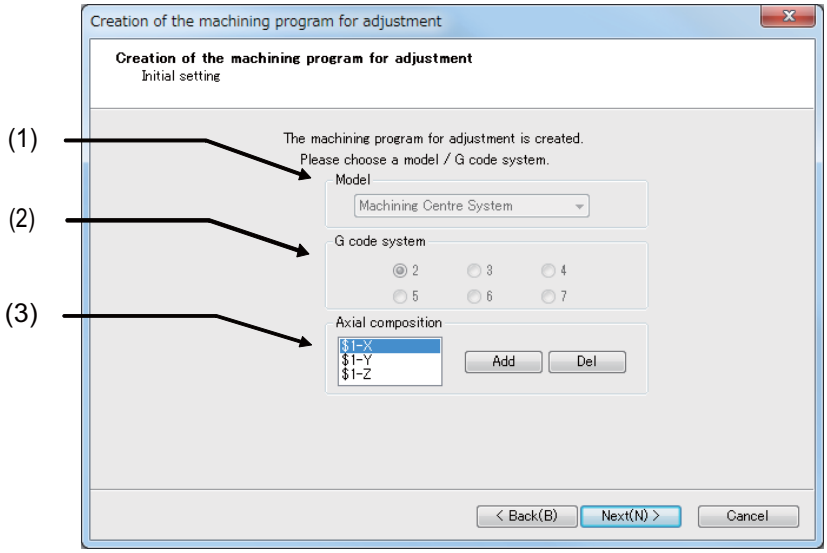
With this function, the machining program used for each adjustment is created.

**Configuration of The input of a project name screen**



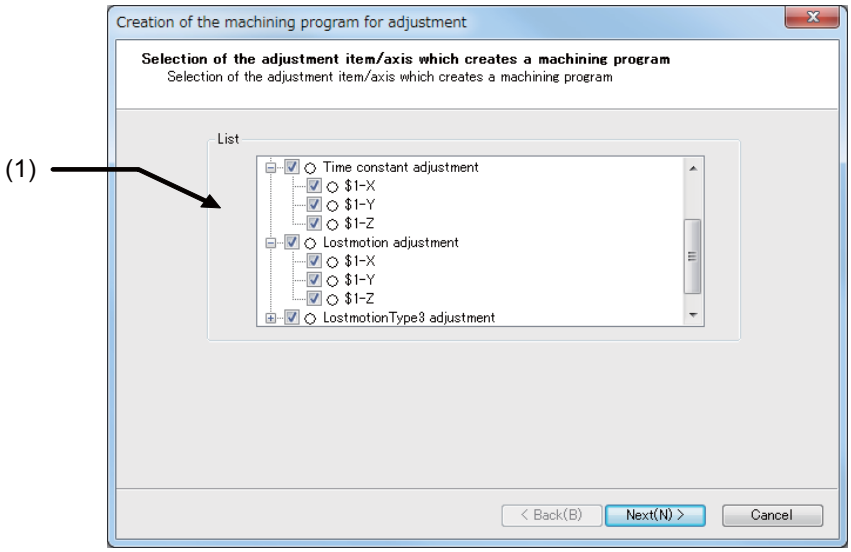

| Display item | | Details |
|---|---|---|
| (1) | Project | When uncreated name is input, the project is newly created.<br>When selecting or inputting a created project name, the project is changed.<br>The characters can be input except the following:\ / : , ; * ? " < > \| |

### Configuration of Creation of the machining program for adjustment screen



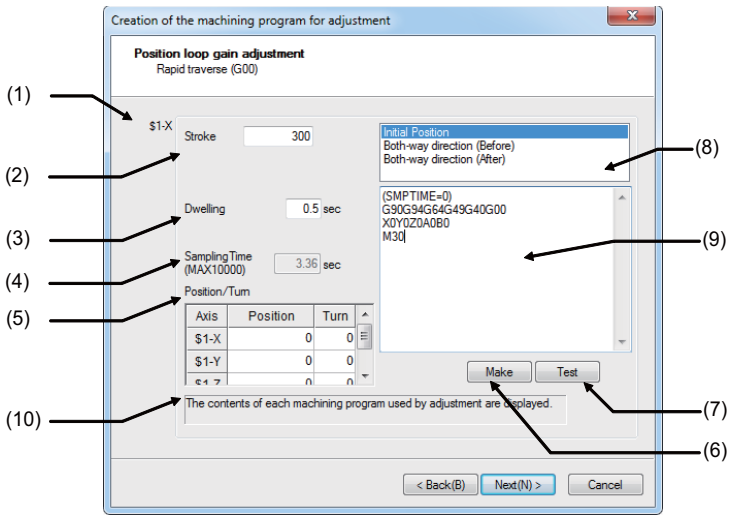

| Display item | | Details |
|---|---|---|
| (1) | Model | This selects "Lathe" or "Machining". |
| (2) | G code system | This selects the G code system. The setting is valid when "Lathe" is selected. |
| (3) | Axial composition | This displays axis configuration. When NC is connected, the axis configuration is obtained from NC. When NC is not connected, the "Add" and "Del" buttons are valid. |

### Configuration of Creation of the machining program for adjustment screen




| Display item | | | Details |
|---|---|---|---|
| (1) | List | | This displays adjustment items and target axes.<br>Position loop gain adjustment<br>Time constant adjustment<br>Lost motion adjustment<br>Lost motion type 3 adjustment |
| | | ☐ ☑ | When the checkbox is ON, a machining program is created. |
| | | ○ | This indicates a machining program for adjustment has not been created. |
| | | ● | This indicates a machining program for adjustment has been created. When the checkbox ( ☐ ) for this item is ON ( ☑ ), the program is over written. |

### Configuration of Position loop gain adjustment screen (Rapid traverse)

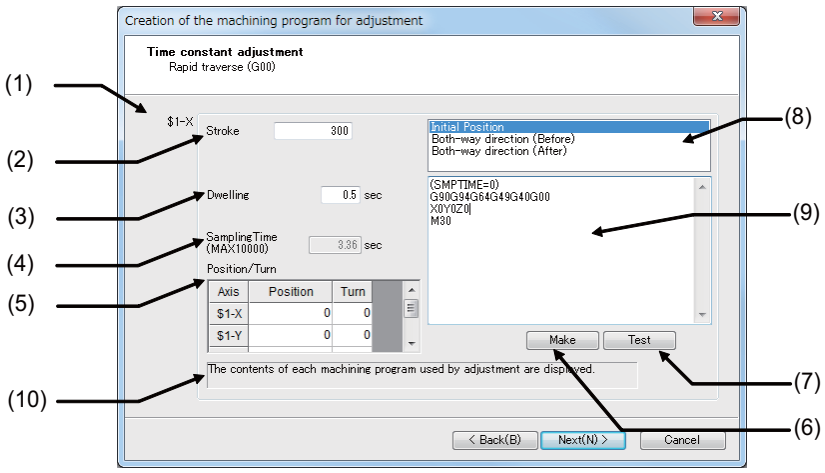



| Display item | | Details | Default | |
|---|---|---|---|---|
| (1) | Axis name | This displays the target part system and axis name. | - | |
| (2) | Stroke | This sets a stroke (mm). | 300 | |
| (3) | Dwelling | This sets a dwell time (s). | 0.5 | |
| (4) | Sampling Time | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (5) | Position/Turn | This sets each axis' starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | 0 |
| | | | Turn | 0 |
| (6) | Make | This creates the machining programs (two or more) based on the input data. | | |
| (7) | Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (8) | Machining program list | This displays the creating machining program list. | | |
| (9) | Machining program display | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (10) | Hint | This displays a hint for the input item where the cursor is put. | | |

(Note 1) When axes of multiple part systems are selected and the [Make] button is pressed, reference value movement program is created for each part system No.

(Note 2) Begin a new line for G code of simultaneous movement command along the way so that the number of the simultaneous command axes of the machining program does not exceed the number of the simultaneous control axes of NC.

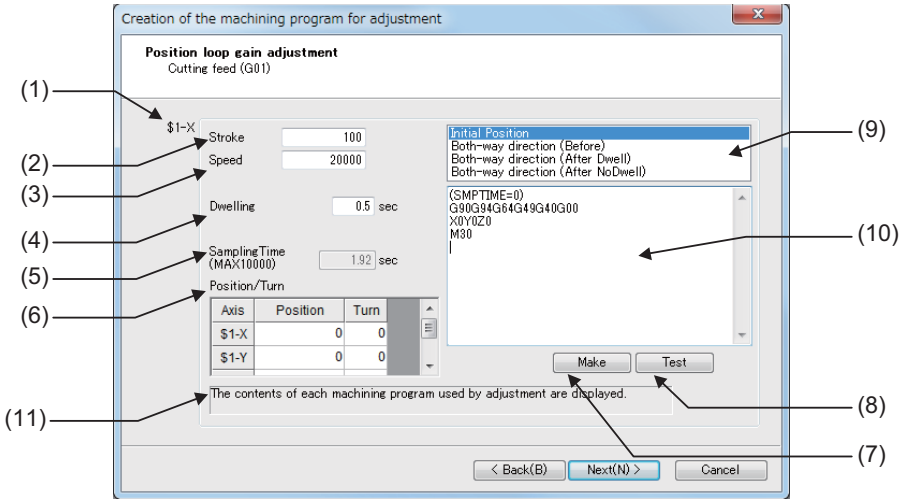
**Configuration of Time constant adjustment screen (Rapid traverse)**




| Display item | | Details | Default | |
|---|---|---|---|---|
| (1) | Axis name | This displays the target part system and axis name. | - | |
| (2) | Stroke | This sets a stroke (mm). | 300 | |
| (3) | Dwelling | This sets a dwell time (s). | 0.5 | |
| (4) | Sampling Time | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (5) | Position/Turn | This sets each axis starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | (Note) |
| | | | Turn | (Note) |
| (6) | Make | This creates the machining programs (two ore more) based on the input data. | | |
| (7) | Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (8) | Machining program list | This displays the creating machining program list. | | |
| (9) | Machining program display | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (10) | Hint | This displays a hint for the input item where the cursor is put. | | |

(Note) When the position loop gain adjustment (rapid traverse) has been executed, the set amount there is the initial amount here.
When the position loop gain adjustment (rapid traverse) has not been executed, the initial amount is "0".

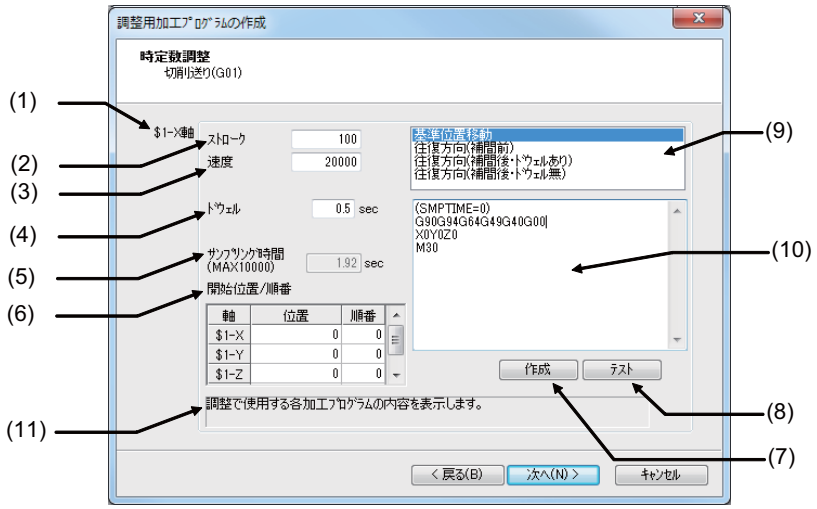
### Configuration of Position loop gain adjustment screen (Cutting feed)




| Display item | | | Details | Default | |
|---|---|---|---|---|---|
| (1) | Axis name | | This displays the target part system and axis name. | - | |
| (2) | Stroke | | This sets a stroke (mm). | 100 | |
| (3) | Speed | | This sets a cutting feedrate (mm/min). | Clamp value of NC | |
| (4) | Dwelling | Effect | This sets a dwell validity. It is valid when the checkbox is ON. | OFF | |
| | | Input | This sets a dwell time (s). | 0.5 | |
| (5) | Sampling Time | | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (6) | Position/Turn | | This sets each axis starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | (Note) |
| | | | | Turn | (Note) |
| (7) | Make | | This creates the machining programs (two or more) based on the input data. | | |
| (8) | Test | | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (9) | Machining program list | | This displays the creating machining program list. | | |
| (10) | Machining program display | | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (11) | Hint | | This displays a hint for the input item where the cursor is put. | | |

(Note) When the position loop gain adjustment (rapid traverse) or time constant adjustment (rapid traverse) has been executed, the set amount there is the initial amount here. When neither is executed, the initial amount is "0".

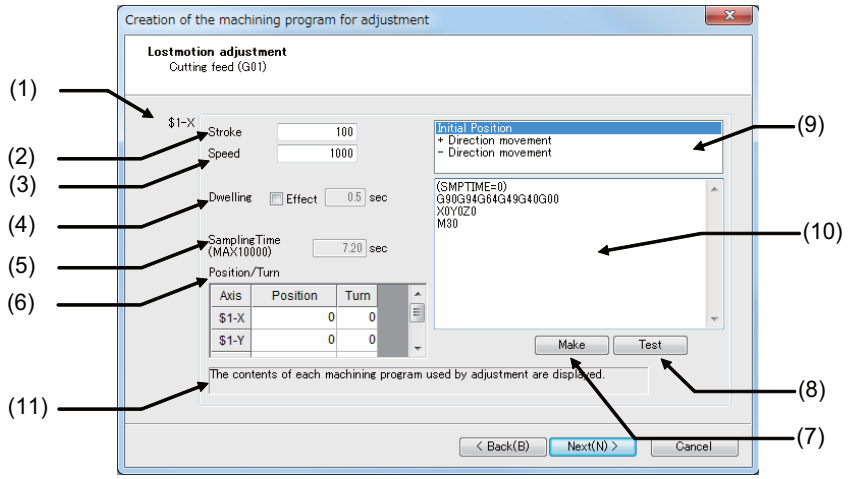
**Configuration of Time constant adjustment screen (Cutting feed)**




| Display item | | | Details | Default | |
|---|---|---|---|---|---|
| (1) | Axis name | | This displays the target part system and axis name. | - | |
| (2) | Stroke | | This sets a stroke (mm). | 100 | |
| (3) | Speed | | This sets a cutting feedrate (mm/min). | Clamp value of NC | |
| (4) | Dwelling | Effect | This sets a dwell validity. It is valid when the checkbox is ON. | OFF | |
| | | Input | This sets a dwell time (s). | 0.5 | |
| (5) | Sampling Time | | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (6) | Position/Turn | | This sets each axis starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | (Note) |
| | | | | Turn | (Note) |
| (7) | Make | | This creates the machining programs (two or more) based on the input data. | | |
| (8) | Test | | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (9) | Machining program list | | This displays the creating machining program list. | | |
| (10) | Machining program display | | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (11) | Hint | | This displays a hint for the input item where the cursor is put. | | |

(Note) When the position loop gain adjustment (rapid traverse/cutting feedrate) or time constant adjustment (rapid traverse) has been executed, the set amount there is the initial amount here. When neither is executed, the initial amount is "0".

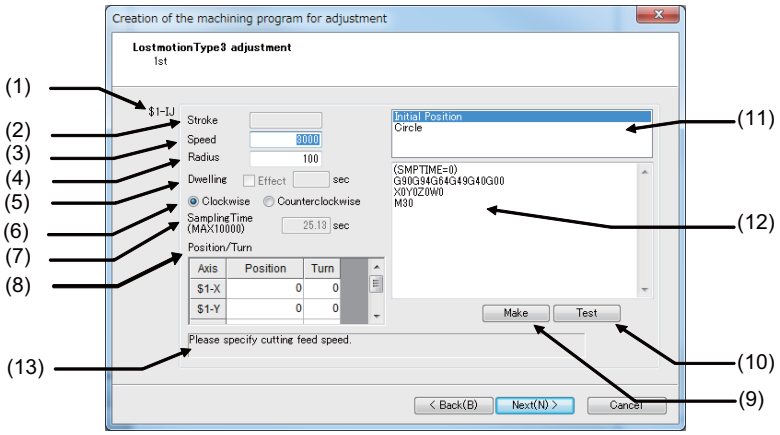
### Configuration of Lostmotion adjustment screen




| Display item | | | Details | Default | |
|---|---|---|---|---|---|
| (1) | Axis name | | This displays the target part system and axis name. | - | |
| (2) | Stroke | | This sets a stroke (mm). | 100 | |
| (3) | Speed | | This sets a cutting feedrate (mm/min). | 1000 | |
| (4) | Dwelling | Effect | This sets a dwell validity. It is valid when the checkbox is ON. | OFF | |
| | | Input | This sets a dwell time (s). | 0.5 | |
| (5) | Sampling Time | | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (6) | Position/Turn | | This sets each axis starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | (Note) |
| | | | | Turn | (Note) |
| (7) | Make | | This creates the machining programs (two or more) based on the input data. | | |
| (8) | Test | | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (9) | Machining program list | | This displays the creating machining program list. | | |
| (10) | Machining program display | | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (11) | Hint | | This displays a hint for the input item where the cursor is put. | | |

(Note) When the position loop gain adjustment (rapid traverse/cutting feedrate) or time constant adjustment (rapid traverse/cutting feedrate) has been executed, the set amount there is the initial amount here. When neither is executed, the initial amount is "0".

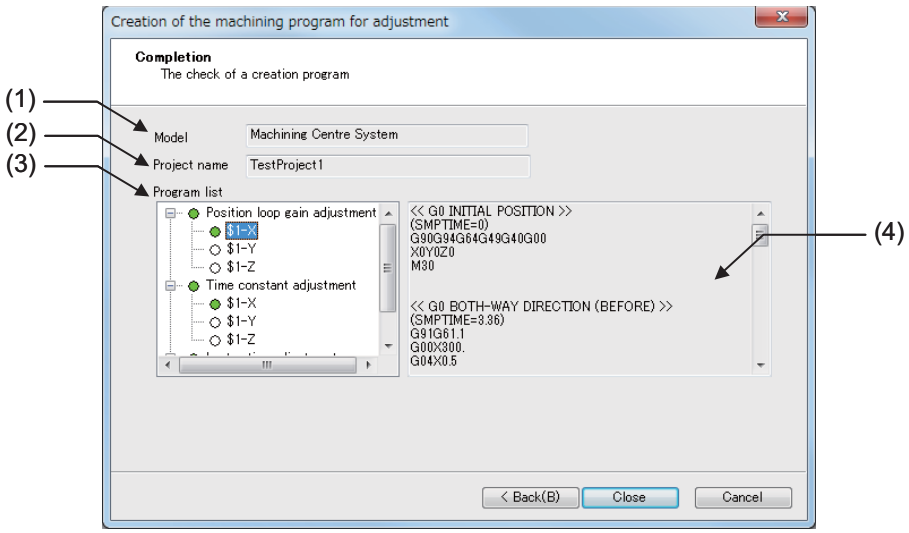
### Configuration of Lostmotion type 3 adjustment screen




| Display item | | | Details | Default | |
|---|---|---|---|---|---|
| (1) | Axis name | | This displays the target part system and axis name. | - | |
| (2) | Stroke | | This sets a stroke (mm). | 100 | |
| (3) | Speed | | This sets a cutting feedrate (mm/min). | 1000 | |
| (4) | Radius | | This sets a radius. | 100 | |
| (5) | Dwelling | Effect | This sets a dwell validity. It is valid when the checkbox is ON. | OFF | |
| | | Input | This sets a dwell time (s). | 0.5 | |
| (6) | Rotation direction | | This selects a rotation direction. | Clockwise | |
| (7) | Sampling Time | | This displays approx. time automatically calculated based on rapid traverse, time constant, stroke and dwell. | - | |
| (8) | Position/Turn | | This sets each axis starting position (mm) on the workpiece coordinates and traveling order. When all axes simultaneously travel, set a same number to all axes.<br>These settings can be input by double-clicking the cell. | Position | (Note) |
| | | | | Turn | (Note) |
| (9) | Make | | This creates the machining programs (two or more) based on the input data. | | |
| (10) | Test | | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. | | |
| (11) | Machining program list | | This displays the creating machining program list. | | |
| (12) | Machining program display | | This displays the machining program selected from the machining program list. The displayed program can be edited. | | |
| (13) | Hint | | This displays a hint for the input item where the cursor is put. | | |

(Note) When the position loop gain adjustment (rapid traverse/cutting feedrate) or time constant adjustment (rapid traverse/cutting feedrate) has been executed, the set amount there is the initial amount here. When neither is executed, the initial amount is "0".

### Configuration of Completion screen




| Display item | | Details |
|---|---|---|
| (1) | Model | This displays the selected model. |
| (2) | Project name | This displays the input project name. |
| (3) | Program list | This displays the machining programs created for each axis of each adjustment item.<br>The ● is displayed next to the axis for which the machining program has been created.<br>The ○ is displayed next to the axis for which the machining program has not been created. |
| (4) | Program display | This displays the program contents selected from the program list. |

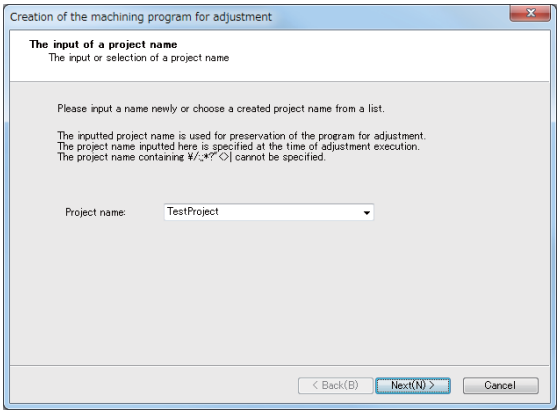
**Operation method**

(1) Select "IndividualAdjust" - "Program creation".

(This function can be selected from the function bar also.)

When NC is not connected, the massage "E001 Connect NC Failed." is displayed.

The "The input of a project name" screen is displayed.



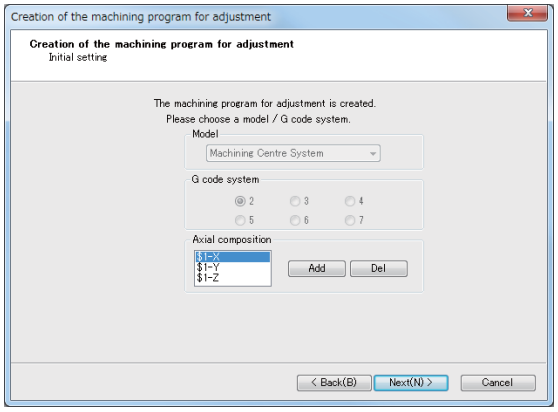

(2) Select the project name. When a project is created newly, input the project name.

After selected, press the "Next" button.

The selected project name is used to save the programs for adjustment.

When the adjustment is executed, specify the project name selected here.

The "Creation of the machining program for adjustment" screen is displayed.



(3) Set the model, G code system and axis configuration.

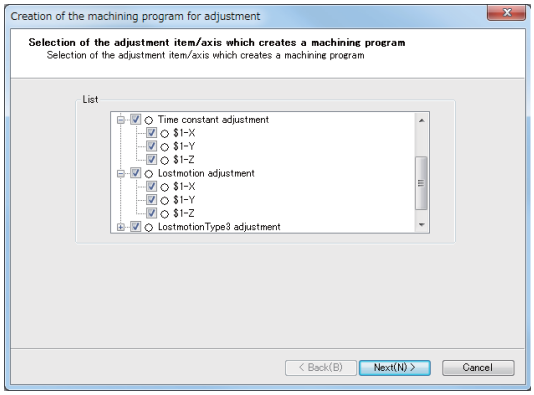
When the settings are completed, press the "Next" button.

When NC is connected, the axis configuration is automatically acquired from NC.

When NC is not connected or the axis configuration is changed, press the "OK" button after pressing the "Add" or "Del" button, and then inputting the added/changed axis name to the displayed dialog. When canceling, press the "Chancel" button.

(Note) When the NC model is lathe system, G code system can be selected.

The "Selection of the adjustment item/axis which creates a machining program" screen is displayed

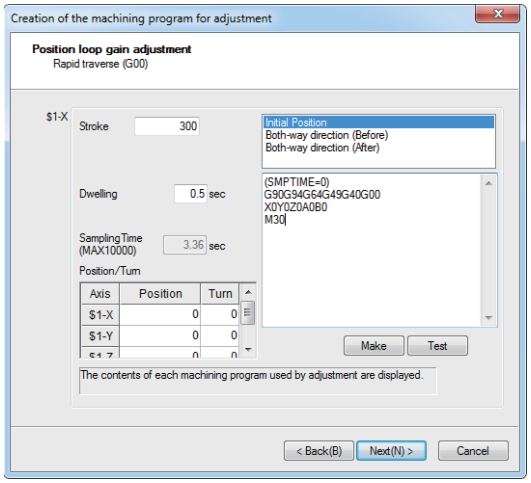



(4) Set whether to create the adjustment machining program for each adjustment item of each axis.

Press the "Next" button after the axis creating machining program is selected (the checkbox is ON).

If  is displayed ahead of axis name, the machining program for the axis has already been created. But if the checkbox is turned ON, the program will be overwritten.

The "Creation of the machining program for adjustment" for position loop gain screen is displayed.




(5) Create the machining program per axis for position loop gain (rapid traverse, cutting feedrate).

After the settings are input, press the "Make" button.

When the cursor is moved to the input area, a hint is displayed.

Create each machining program for adjustment.

After the "Make" button is pressed, the content of the machining program selected from the list of created machining programs is displayed.

(6) Carry out the machining program operation test.

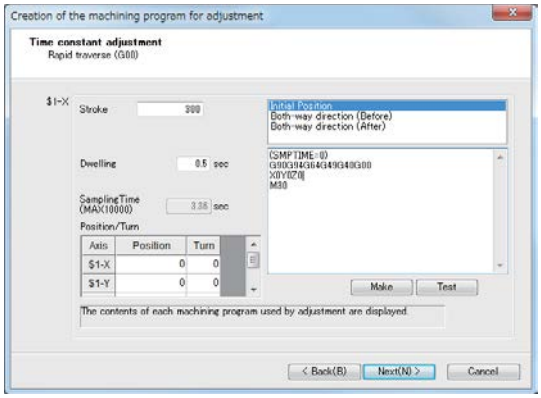
Press the "Test" button.

(Note) Set the NC operation mode to the MDI mode beforehand.

The displaying machining program is transmitted to NC (as MDI program), and MDI setting is completed.

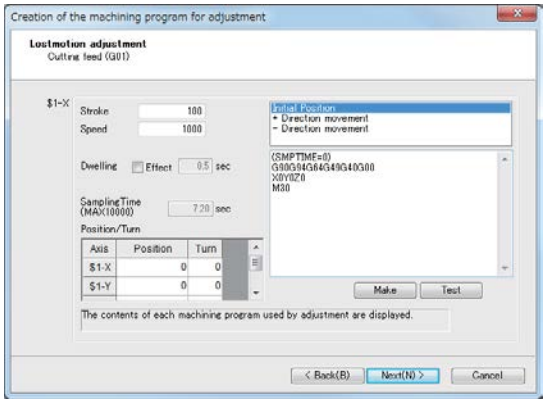
Then, the transmitted program is executed by inputting the cycle start.

(7) After all axes' adjustment machining programs are created, press the "Next" button again.
When there are two or more axes which should require the machining program to be created, the next axis' "Creation of the machining program for adjustment" screen is displayed after pressing the "Next" button.
The "Creation of the machining program for adjustment" for time constant adjustment screen is displayed.



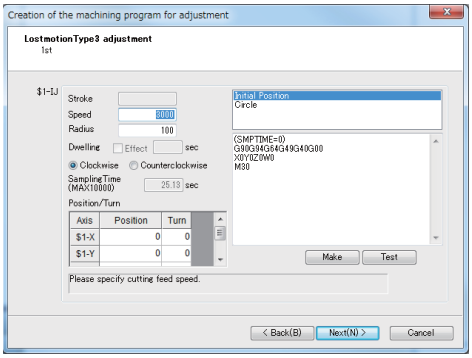

(8) Create the machining program per axis for time constant adjustment (rapid traverse, cutting feedrate).
The operation method is the same as (5).

(9) After all axes' adjustment machining programs are created, press the "Next" button again.
When there are two or more axes which should require the machining program to be created, the next axis' "Creation of the machining program for adjustment" screen is displayed after pressing the "Next" button.
The "Lostmotion adjustment" screen is displayed.

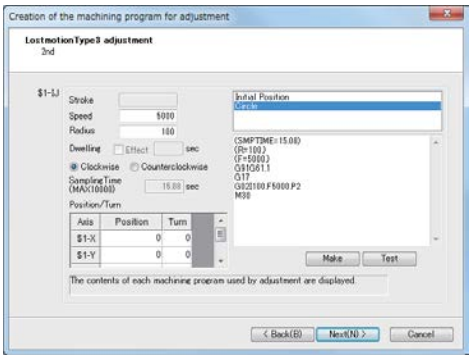



(10) Create the machining program per axis for lostmotion adjustment.
The operation method is the same as (5).

(11) After all axes' adjustment machining programs are created, press the "Next" button again.
When there are two or more axes which should require the machining program to be created, the next axis' "Creation of the machining program for adjustment" screen is displayed after pressing the "Next" button.
The "Lostmotion type 3 adjustment" screen is displayed.
The first machining program (low speed operation) is created.




(12) Next, the second machining program (high speed operation) is created.




(13) All created machining programs are displayed per axis for each adjustment item.
If necessary, finish the program creation by pressing the "Complete" button after confirming the contents of each machining program.

**Precautions**

(1) Program for reference position traveling
Set the traveling order and traveling start position so that each axis should not collide. Especially, be careful about traveling order when the adjustment program for vertical axis is created.
(2) Stroke setting amount
When the set amount of the stroke is too short, the motor decelerates before it reaches at the maximum speed. So a correct adjustment cannot be executed. (Oppositely, when the set amount of the stroke is too long, sampling rate roughens. So a current peak cannot be acquired appropriately.)
Set about 500 as a standard of the stroke. If problem occurs, set the maximum stroke. Depending on the machine configuration, even if the maximum stroke is set to the short stroke axis, the above problem could occur, and the adjustment may not be executed correctly.
(3) Dwell setting amount of lostmotion adjustment
Usually validate the dwell, and set 0.5 seconds to it.

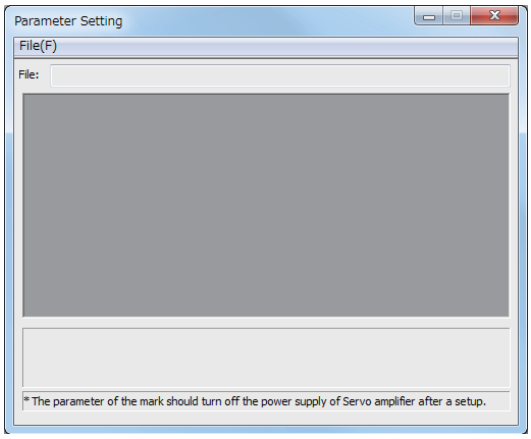
# 3.3 Assistance Setting Function

## 3.3.1 Parameter Setup

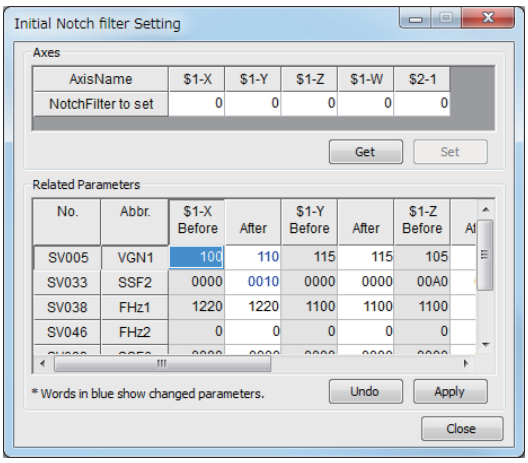
With this function, the servo parameter SV001 to SV128 can be saved/changed.
Note that the system setting parameters (SV066 to SV080) are not displayed.

**Operation method**

(1) Select "Setup" - "Parameter setup".
The "Parameter Setting" screen is displayed.




(2) Select "File" - "Open" or "ReadNC" to read the parameters.
The parameters are read.




(3) Edit the parameters.

(4) Select "File" - "Save" or "Save As" to save the parameters.
Select "File" - "WriteNC" to write the parameters into the NC.

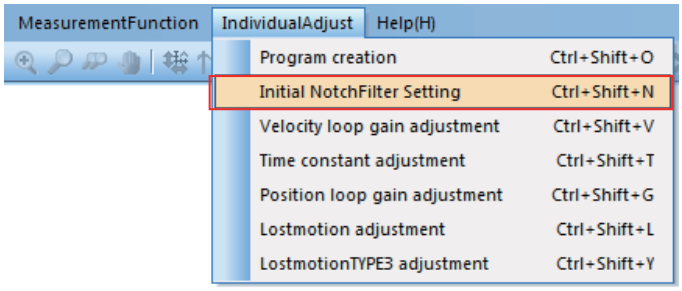
# 3.4 Servo Automatic Adjustment

## 3.4.1 Initial Notch Filter Setup

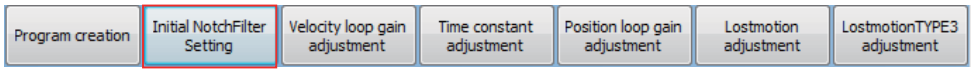
**Operation method**

(1) Select "Initial NotchFilter Setting" from the menu, etc.
When NC is not connected, the massage "E001 Connect NC Failed." is displayed.

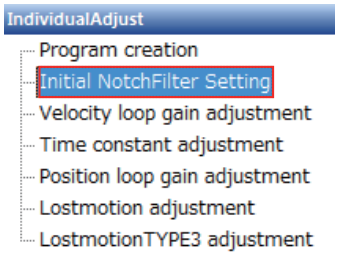
Select from the menu.




Select from the function bar.

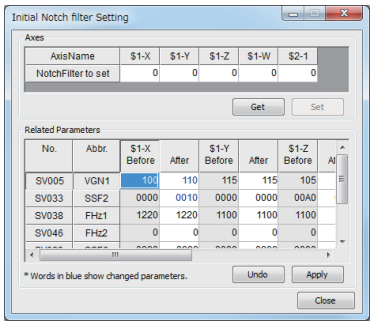



Select from the navigation window and double-click the item.




(2) Press the "Get" button, and acquire the setting value of the notch filter.
When the value of the AFLT frequency is "0", the set value keeps "0".

(3) Change the setting value of notch filter to an arbitrary value, press the "Set" button.



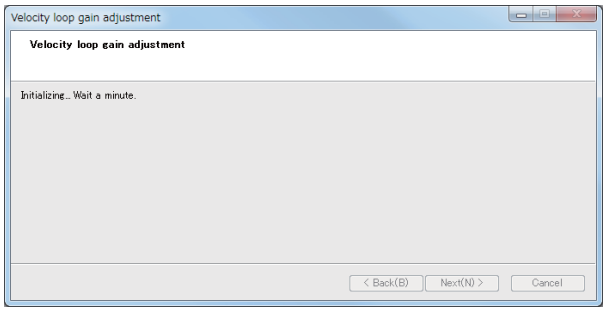

(4) The changed parameter list is displayed. After the changed settings are confirmed, press the "OK" button and the process is finished.

## 3.4.2 Velocity Loop Gain Adjustment

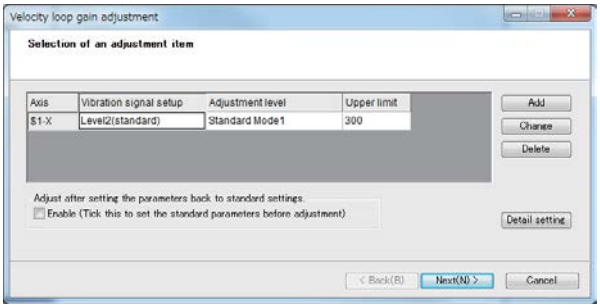
With this function, the speed loop gain is adjusted.

**Operation method**

(1) Select "IndividualAdjust" - "Velocity loop gain adjustment".
This function can be selected from the function bar also.
The screen to initialize the communication setting is displayed.
The initialization time depends on the number of axes. When the initialization completes, it automatically proceeds to the screen to select axes.



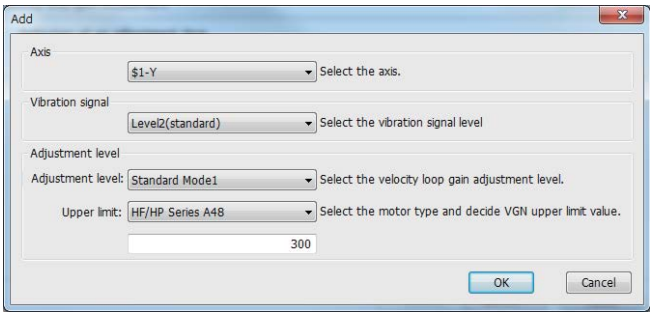

(2) The "Velocity loop gain adjustment" screen is displayed.
All the servo parameters are automatically saved in the PC before adjusting the velocity loop gain, which enables to restore the original parameters if any problem occurs afterwards.
However, the parameters which can be restored from the screen to restore parameters are limited to those targeted for the velocity loop gain adjustment.




| Button name | Operation |
|---|---|
| Add | The Selection of adjustment item screen will appear.<br>Invalid when an adjustment target axis is not selected. |
| Change | Adjustment method for the selected axis will be changed. |
| Delete | The selected axis is deleted from velocity loop gain adjustment execution axes.<br>It is disabled when no axis is selected. |
| Detailed setting | The depth compensation value is set. |
| Back | Disabled |
| Next | Standard parameter setup screen will appear. |
| Cancel | Velocity loop gain adjustment will be cleared. |

| Setting item | Detail | Initial value | Setting range |
|---|---|---|---|
| Axis | The adjustment target axis will be displayed. | 1st time -> No display | - |
| | | 2nd time and after -> The axis which was selected the previous time will be displayed in $ △ - ○ format. (*)<br>(*) $ △ indicates the part system, ○ indicates the axis name.<br>(*) When the selected axis is synchronous axis, it will be displayed in $ △ - ○ ( □ ) format. $ △ indicates the part system, ○ indicates the axis name (primary axis), and □ indicates the axis name (secondary axis).<br><br>Be aware that resetting will be necessary after changing the construction of the drive unit. | |
| Vibration signal setup | Select the level of vibration signals. | Level 2 (standard) | - |
| Adjustment level | Select the velocity loop gain adjustment level. | Standard Mode 1 | - |
| Adjust after setting the parameters back to standard settings. | Select whether to return the parameter value to the standard value before adjustment.<br>Enable = standard value.<br>NC Analyzer's standard value will be displayed on the parameter setup screen as the setting value.<br>Not enabled = Current NC setting will be displayed. The setting value in NC will be displayed on the parameter setup screen as the setting value. | Disable | Enable/ Disable |

(3) Press "Add" to display the screen below.




| Button name | Operation |
|---|---|
| OK | Saves the setting and closes the screen. |
| Cancel | Closes the axis adding screen.<br>Returns to the velocity loop gain adjustment screen. |

| Setting item | | Detail | Initial value | Setting range |
|---|---|---|---|---|
| Axis | | Select the adjustment target axis. | 1st time -> The 1st axis of the 1st part system will be displayed in $ △ - ○ format. $ △ indicates the part system, ○ indicates the axis name. | - |
| | | | 2nd time and after -> The axis which was selected the previous time will be displayed. The axis which has been selected is not displayed. When the synchronous axis is selected, the axis that synchronizes with the selected axis is not displayed either.<br>Be aware that resetting will be necessary After changing the construction of the drive unit. | |
| Vibration signal setup | | Select the level of vibration signals. | Level 2 (standard) | Level 1 to 6 |
| Velocity loop gain adjustment level | Adjustment level | Select the velocity loop gain adjustment level. | Standard Mode 1 | Standard Mode 1 (short) to 3 (short)<br>Standard Mode 1 to 3<br>High Accuracy Mode 1 to 2 |
| | Upper limit | Set the upper limit of the velocity loop gain.The velocity loop gain to be adjusted will not exceed this value.Select the motor type and the setting value will be switched. The value can be set manually after the switching. | Motor type: HF/HP Series A48<br>Setting value : 300 | 1 to 9999<br>Refer to the table "Motor type and initial upper limit value velocity loop gain". |

Vibration signal level

| Level | Magnitude of the vibration signal |
|---|---|
| Level 1 | Small ↑ ↓ Big |
| Level 2 (Standard) | |
| Level 3 | |
| Level 4 | |
| Level 5 | |
| Level 6 | |

Velocity loop gain adjustment level

| Level | Accuracy | Time |
|---|---|---|
| Standard Mode 1 (short)(Note) | Low ↑ ↓ High | Short ↑ ↓ Long |
| Standard Mode 2 (short) | | |
| Standard Mode 3 (short) | | |
| Standard Mode 1 (Initial value) | | |
| Standard Mode 2 | | |
| Standard Mode 3 | | |
| High Accuracy Mode 1 | | |
| High Accuracy Mode 2 | | |

(Note) Short mode
Adjustment level Standard Mode 1 to 3 (short) shortens the adjustment time but secures less adjustment accuracy compared to Standard Mode 1 to 3 and High Accuracy Mode 1 and 2.
When there is no peripheral axis or when high accuracy is not required, use Standard Mode 1 to 3 (short).

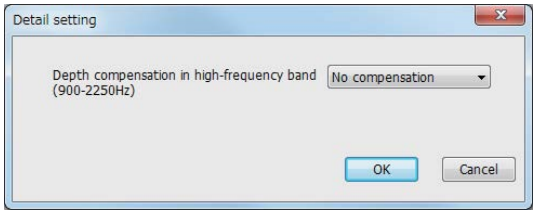
Motor type and initial upper limit of the velocity loop gain

| Motor type | Initial upper limit value |
|---|---|
| HF/HP Series A48 | 300 |
| HF/HP Series A51 | 350 |
| HF/HP Series A74 | 500 |
| HF-KP Series | 100 |
| Linear/DD motor (normal) | 1000 |
| Linear/DD motor (special)(Note) | 5000 |

(Note) "Linear/DD motor (special)" is used for the axis configuration of large inertia ratio.
Adjust by selecting "Linear/DD motor (normal)" at first and if the velocity loop gain reaches the upper limit, select "Linear/DD motor (special)" and adjust again from the procedure of "3.4.2 Velocity Loop Gain Adjustment".

The previous values are retained for vibration signal level, adjustment level, motor type, and upper limit while the application is running.

(4) Press " Detailed setting" to display the screen below.



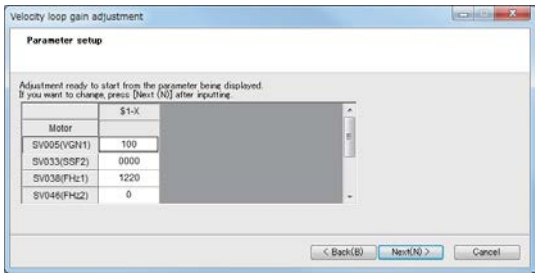

| Button name | Operation |
|---|---|
| OK | Saves the setting and closes the screen.<br>Returns to the velocity loop gain adjustment screen. |
| Cancel | Closes the screen without saving.<br>Returns to the velocity loop gain adjustment screen. |

| Setting item | Detail | Initial value | Setting range |
|---|---|---|---|
| Depth compensation in high-frequency band | Sets the depth compensation value for high-frequency band. | No compensation | 4 steps shallower to 4 steps deeper |

Depth compensation value

| Depth compensation value |
|---|
| 4 steps shallower |
| 3 steps shallower |
| 2 steps shallower |
| 1 step shallower |
| No compensation <- Initial value |
| 1 step deeper |
| 2 steps deeper |
| 3 steps deeper |
| 4 steps deeper |

(5) Press "Next" to display the parameter setup screen.
The motor type will be identified from the readout parameter and fix the standard parameter value.
If the motor is not among the target motors, [Motor] field will be blank.

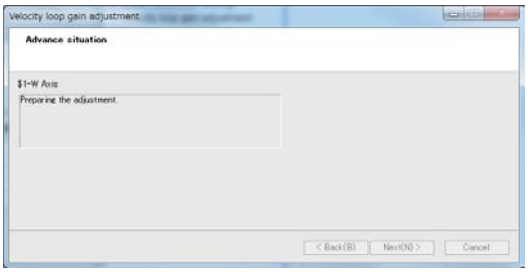



| Button name | Operation |
|---|---|
| < Back (B) | Displays the axis selection screen. |
| Next (N) > | Starts adjustment. |
| Cancel | Stops velocity loop gain adjustment.<br>Returns to the NC Analyzer main screen. |

The initial value varies depending on the setting for [Adjust after setting the parameters back to standard settings] on the axis selecting screen.

| Setting item | Enable | Disable |
|---|---|---|
| Motor | Motor name | Motor name |
| SV005(VGN1) | Standard parameter setting file value | Parameter SV005 in NC |
| SV033(SSF2) | XXXX (Bit1 to 3=0、Bit5 to 7=0) | Parameter SV033 in NC |
| SV038(FHz1) | 0 | Parameter SV038 in NC |
| SV046(FHz2) | 0 | Parameter SV046 in NC |
| SV083(SSF6) | XXXX (Bit1 to 3=0、Bit5 to 7=0) | Parameter SV083 in NC |
| SV087(FHz4) | 0 | Parameter SV087 in NC |
| SV088(FHz5) | 0 | Parameter SV088 in NC |

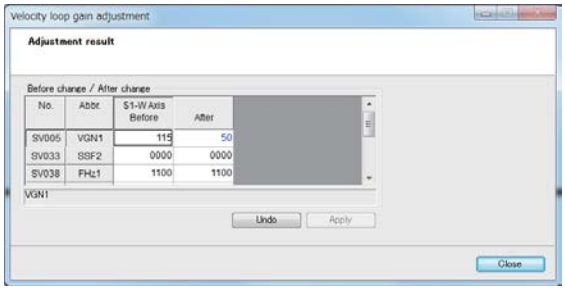
(6) Press "Next" to display the advance situation.




| Item | Detail |
|---|---|
| Axis name | This displays the axis which is being adjusted. |
| Advance situation (status) display | Messages will appear according to the adjustment advance situation.<br>The correspondence between the advance situation and messages are as follows.<br><br>Situation / Messages:<br>Initializing — Preparing the adjustment.<br>Cycle start waiting — Preparation of adjustment was completed. Execution of a cycle start starts adjustment.<br>Sampling — The data is being sampled.<br>Analyzing data — The data is being analyzed. The parameter is changed.<br>Adjustment completed — The adjustment ended. Please click the next.<br>Error stop — The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped.<br><br>* When an error occurs and stops, the message "The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped." will appear in a dialogue.<br>Press "OK" to restore the parameter (before the adjustment was made).<br>Also, if no response returns from the NC due to an illegal mode, alarm or other, it will time out after ten seconds and stops by an error. |
| Back | Disabled. |
| Next | The next screen will appear.<br>This button will be enabled when the status changes to [Adjustment completed].<br>If there are any axis which is not adjusted, the axis will be adjusted.<br>When all the axes are adjusted, the next adjustment will be performed. |
| Cancel | Disabled. |

(7) The message "The adjustment ended...." tells the completion of the adjustment. Press the "Next" button.

(8) The adjustment result will appear when the velocity loop gain adjustment is completed.




| Item | Detail |
|---|---|
| After change/before change | Settings for the target parameters before/after the adjustment is displayed per axis for each adjustment item.<br>Settings for the non-target parameters are also displayed if there are any changes before/after the adjustment.<br>The changed parameter is displayed in blue.<br>The adjusted settings can be edited directly.<br>When selecting the synchronous axis, the axis that synchronizes with the selected axis is also displayed in the adjustment result. |
| Apply | When the "Apply" button is pressed, the dialog "It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are changed to the edited adjustment settings.<br>The "Apply" button is valid when the adjusted parameter is edited and it is invalid when "Apply" or "Undo" is executed. |
| Undo | If the "Undo" button is pressed, the dialog "It returns, before adjusting a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are returned to the settings before the parameters are adjusted. |
| Close | The wizard is closed.<br>If the "Close" button is pressed when the "Apply" button is valid, the dialog "The parameter after adjustment is changed. Does it end without applying?" is displayed. When "OK" is selected, the wizard is closed without applying the parameter change. When "Cancel" is selected, it returns to the adjustment result screen. |

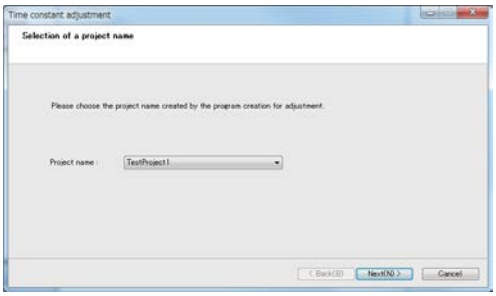
(9) Check the changes and press "OK" to finish the velocity loop gain adjustment.

### 3.4.3 Time Constant Adjustment

With this function, the time constant is adjusted.
[View] - [Setup PositionDroopView] - [Return] is selected, the graph will loop-back at the specified width.

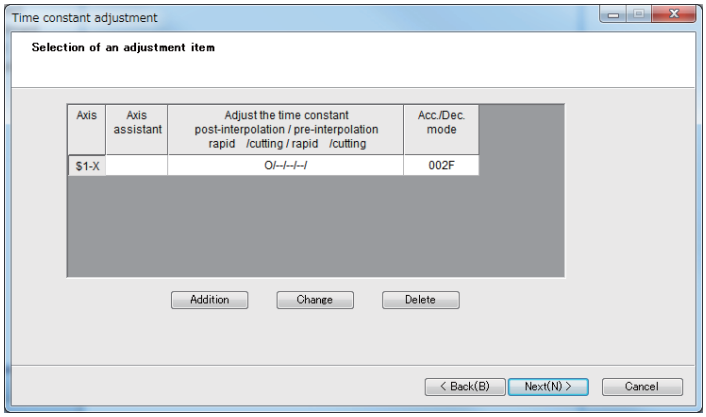
**Operation method**

(1) Select "IndividualAdjust" - "Time constant adjustment".
This function can be selected from the function bar also.
The "Time constant adjustment" screen is displayed.
Select the project name created by "Program creation". Press the "Next" button.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.




| Item | Detail |
|---|---|
| Project name | Select the project name created by "Program creation".<br>Click ▼ to see the list of available project names. |
| Back | Displays the startup screen. |
| Next | Displays the next screen. The next button becomes valid after selecting a project name. |
| Cancel | Closes the wizard. |

(2) The "Time constant adjustment" screen is displayed.
Select the axis to adjust.



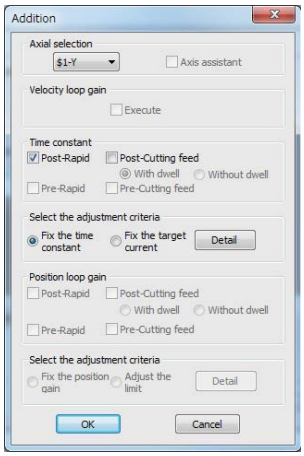
| Item | Detail |
|---|---|
| Axis | Selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed. Spindle, spindle/C axis and PLC axis are not displayed.<br>Displays the axes which are set in NC. (Note1) |
| Axis assistant | Displays the validities of axis assistant operation. (Note2) |
| Adjust the time constant post-interpolation rapid traverse/post-interpolation cutting feed | Displays the validities of executing time constant adjustment. |
| Acc./Dec. mode | Displays the value of acceleration/deceleration mode. |
| Addition | Adds adjustment axes. |
| Change | Changes the selected axis setting. If an axis has not been selected, the button cannot be used. |
| Delete | Deletes the selected axis. If an axis has not been selected, the button cannot be used. |
| Back | Returns to the previous screen. |
| Next | Goes to the next screen.<br>An error dialogue will appear when pressing "OK" if machining program is not created for any of the adjustment items. In that case, clear the checkbox for the adjustment item without machining program. |
| Cancel | Stops the wizard. |

(Note 1) The servo axis is displayed in $ ○ - △ format. The spindle and PLC axis are displayed in "SP- △ ", "PLC △ " format. "$ ○ " indicates a part system, and " △ " indicates an axis name.

(Ex)The 1st axis of 1st part system -> $1-X

(Note2) The time constant (G0tL, G1tL) will be set at the maximum between adjusted assistant axes

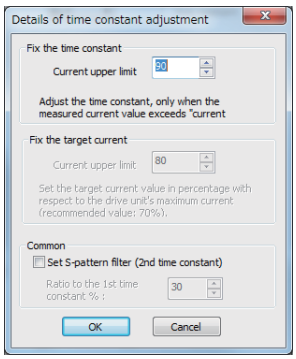
(3) Press "Addition" and "Change" to display the axis addition screen.




(Note) Only the axes which the time constant adjustment machining program has been created can be selected.

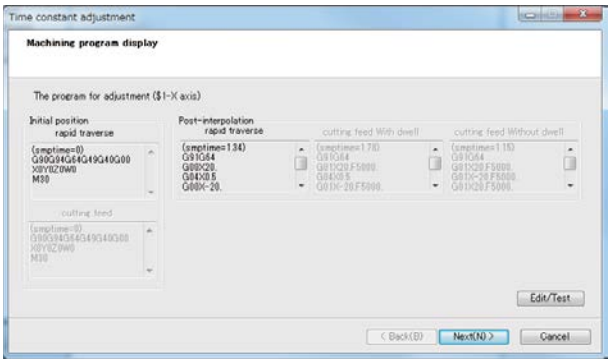
| Item | | Detail |
|---|---|---|
| Axis selection | | Select the adjustment target axis.<br>Enabled only when the "Addition" button is pressed. |
| Axis assistant | | When the checkbox is ON, the axis assistant operation is executed.<br>It is validated when the position loop gain adjustment checkbox is ON. |
| Speed loop gain | Execute | Not used. |
| Time constant adjustment | After-Fast | When the checkbox is ON, rapid traverse adjustment is executed after interpolation. |
| | After-Cutting delivery | When the checkbox is ON, cutting feedrate adjustment is executed after interpolation. |
| | With/Without dwell | This selects with dwell/without dwell. It is validated when rapid traverse after interpolation of Time constant adjustment checkbox is ON. |
| Select the adjustment criteria | Fix the time constant/Fix the target current | This selects the criteria. It is validated when the adjustment method of Time constant adjustment checkbox is ON. |
| | Detail | This displays Select the adjustment criteria screen of the time constant adjustment when the button is pressed. It is validated when adjustment method of Time constant adjustment checkbox is ON. |
| Position loop gain | After-Fast | Not used. |
| | After-Cutting delivery | |
| | With/Without dwell | |
| | Before-Fast | |
| | Before-Cutting delivery | |
| Select the adjustment criteria | Fix the position gain/ Adjust the limit | |
| | Detail | |
| OK | | The settings are saved, and the screen is closed. |
| Cancel | | The settings are cleared, and the screen is closed. |

(4) Press "Detail" to display the "Details of time constant adjustment" screen.
"Common" is not checked at default.
The setting items change depending on the settings chosen in the axis selection screen.



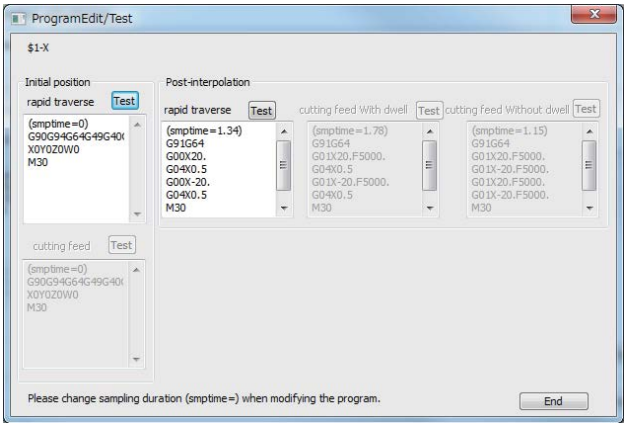

| Item | | Detail |
|---|---|---|
| Fix the time constant | Current upper limit % | It is validated when the checkbox for "Fix the time constant" is checked when selecting the axis. |
| Fix the target current | Current upper limit % | It is validated when the checkbox for "Fix the target current" is checked when selecting the axis. |
| Common | Set S-pattern filter (2nd time constant) | When the checkbox is ON, the S-pattern filter (2nd time constant) will be set. |
| | Ratio to the 1st time constant % | It is validated when the checkbox for "Set S-pattern filter (2nd time constant)" is ON. |
| OK | | The settings are saved, and the screen is closed. |
| Cancel | | The settings are cleared, and the screen is closed. |

(5) Press "Next" to display machining program display screen.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.
Adjustment program will be displayed. Programs used for adjustment will be in black. Others will be grayed out.



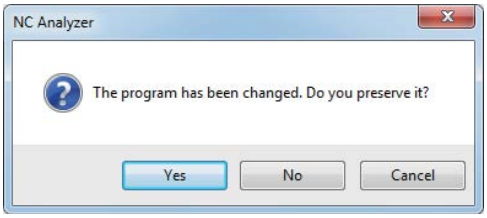

| Item | Detail |
|---|---|
| Edit/Test | Program edit/test screen will be displayed. |
| Adjustment Program | Machining programs used for adjusting the specified axis will be displayed. |
| Back | Disabled. |
| Next | The next screen will appear after setting the program in NC. |
| Cancel | Stops the wizard. |

(6) Press "Edit/Test" to display machining program edit screen.
Time constant machining program can be edited.
Only the programs used for adjusting will be able to be edited from the dialogue.
Also, these programs can be tested (by transmitting them to NC and operate them in NC).
Editing will be prohibited for other programs (these will be grayed out) and test cannot be performed on these programs.
If a program is changed, the background color will change.



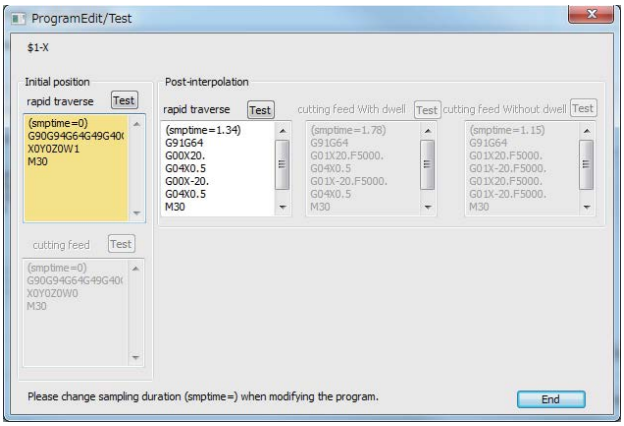
| Item | Detail | Default |
|---|---|---|
| $ ○ - △ axis | This displays the target axis name. | - |
| Program display edit box | Program for adjustment will be displayed. | The adjustment program stored in PC. |

| Button name | Operation |
|---|---|
| Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. An error dialogue will appear if the operation mode of the NC's test target part system is not set to MDI mode.<br>An error dialogue will also appear when the program does not exist (when no program is displayed in the program display edit box). |
| End | Clears the program edit/test screen and returns to the machining program display screen.<br>If any of the program was changed, a dialogue to ask whether to confirm the change will appear.<br>An error dialogue will appear when the program does not exist (when no program is displayed in the program display edit box). |



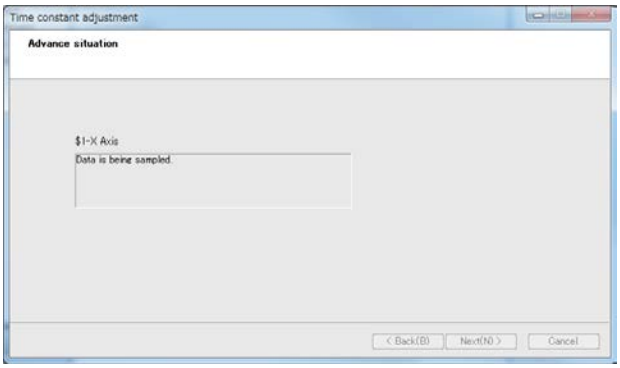

| Button name | Operation |
|---|---|
| Yes | Saves the programs on the program edit/test screen and returns to the machining program display screen. |
| No | Returns to the machining program display screen without saving the programs on the program edit/test screen. |
| Cancel | Returns to the programs on the program edit/test screen. |

If a program is changed, the background color will change.
Check the detail and press "End".



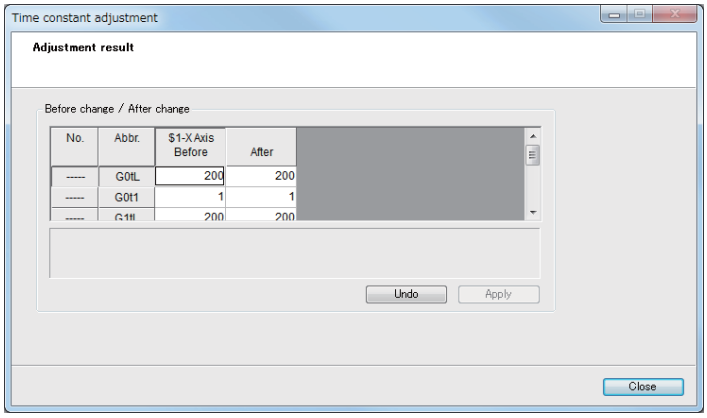

Horizontal scroll bars are not provided because it will narrow the text area. The hidden part can be viewed by moving the cursor. The vertical scroll bars will become operable when programs are too long to fit in the edit box.

(7) Press "Next" to display the advance situation screen.




| Item | Detail |
|---|---|
| Axis name | This displays the axis which is being adjusted. |
| Advance situation (status) display | Messages will appear according to the adjustment advance situation.<br>The correspondence between the advance situation and messages are as follows.<br><br>Situation / Messages:<br>Initializing — Preparing the adjustment.<br>Cycle start waiting — Preparation of adjustment was completed. Execution of a cycle start starts adjustment.<br>Sampling — The data is being sampled.<br>Analyzing data — The data is being analyzed. The parameter is changed.<br>Adjustment completed — The adjustment ended. Please click the next.<br>Error stop — The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped.<br><br>* When an error occurs and stops, the message "The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped." will appear in a dialogue.<br>Press "OK" to restore the parameter (before the adjustment was made).<br>Also, if no response returns from the NC due to an illegal mode, alarm or other, it will time out after ten seconds and stops by an error. |
| Back | Disabled. |
| Next | The next screen will appear.<br>This button will be enabled when the status changes to [Adjustment completed].<br>If there are any axis which is not adjusted, the axis will be adjusted.<br>When all the axes are adjusted, the next adjustment will be performed. |
| Cancel | The dialogue "Adjustment ended?" will appear and, if "OK" is selected, the wizard will stop.<br>The cancel button will be enabled when the advance situation turns to [Cycle start waiting], [Sampling], [Analyzing data] or [Adjustment was completed], or when the parameter restoration is completed after [Error stop]. |

(8) The adjustment result is displayed when the time constant adjustment is completed.
Target parameters of time constant adjustment and the other parameters whose value differs before and after the adjustment.



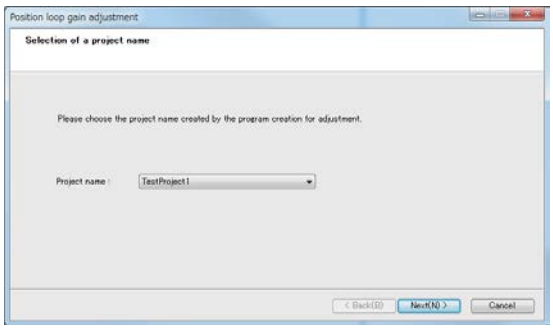

| Item | Detail |
|---|---|
| After change/before change | Settings for the target parameters before/after the adjustment is displayed per axis for each adjustment item.<br>Settings for the non-target parameters are also displayed if there are any changes before/after the adjustment.<br>The changed parameter is displayed in blue.<br>The adjusted settings can be edited directly. |
| Apply | When the "Apply" button is pressed, the dialog "It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are changed to the edited adjustment settings.<br>The "Apply" button is valid when the adjusted parameter is edited and it is invalid when "Apply" or "Undo" is executed. |
| Undo | If the "Undo" button is pressed, the dialog "It returns, before adjusting a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are returned to the settings before the parameters are adjusted. |
| Close | The wizard is closed.<br>If the "Close" button is pressed when the "Apply" button is valid, the dialog "The parameter after adjustment is changed. Does it end without applying?" is displayed. When "OK" is selected, the wizard is closed without applying the parameter change. When "Cancel" is selected, it returns to the adjustment result screen. |

## 3.4.4 Position Loop Gain Adjustment

With this function, the position loop gain is adjusted.
[View] - [Setup PositionDroopView] - [Return] is selected, the graph will loop-back at the specified width.

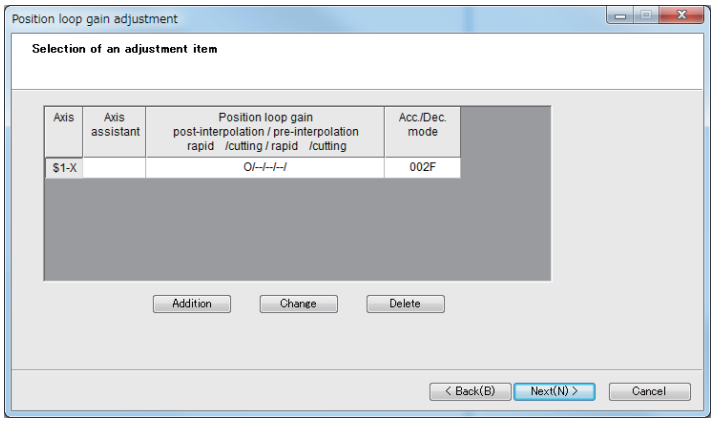
**Operation method**

(1) Select "IndividualAdjust" - "Position loop gain adjustment".
This function can be selected from the function bar also.
The "Selection of a project name" screen is displayed.
Select the project name created by "Program creation". Press the "Next" button.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.




| Item | Detail |
|---|---|
| Project name | Select the project name created by "Program creation".<br>Click ▼ to see the list of available project names. |
| Back | Displays the startup screen. |
| Next | Displays the next screen. The next button becomes valid after selecting a project name. |
| Cancel | Closes the wizard. |

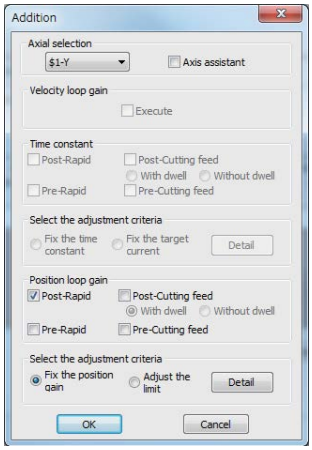
(2) The "Position loop gain adjustment" screen is displayed.
Select the axis to adjust.




| Item | Detail |
|---|---|
| Axis | Selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed. Spindle, spindle/C axis and PLC axis are not displayed.<br>Displays the axes which are set in NC. (Note1) |
| Axis assistant | Displays the validities of axis assistant operation. |
| Position loop gain<br>post-interpolation rapid traverse/post-interpolation cutting feed/pre-interpolation rapid traverse/pre-interpolation cutting feed | Displays the validities of executing position loop gain adjustment. |
| Acc./Dec. mode | Displays the value of acceleration/deceleration mode. |
| Addition | Adds adjustment axes. |
| Change | Changes the selected axis setting. If an axis has not been selected, the button cannot be used. |
| Delete | Deletes the selected axis. If an axis has not been selected, the button cannot be used. |
| Back | Returns to the previous screen. |
| Next | Goes to the next screen.<br>An error dialogue will appear when pressing "OK" if machining program is not created for any of the adjustment items. In that case, clear the checkbox for the adjustment item without machining program. |
| Cancel | Stops the wizard. |

(Note 1) The servo axis is displayed in $ ○ - △ format. The spindle and PLC axis are displayed in "SP- △ ", "PLC △ " format. "$ ○ " indicates a part system, and " △ " indicates an axis name.
(Ex)The 1st axis of 1st part system -> $1-X

(3) Press "Addition" and "Change" to display the axis addition screen.




(Note) Only the axes which the position loop adjustment machining program has been created can be selected.

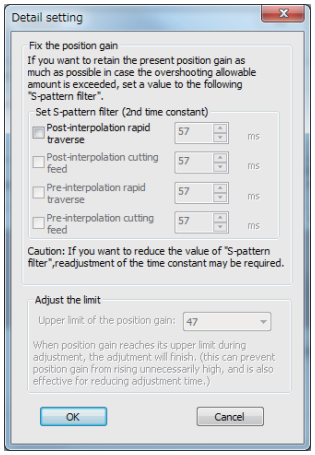
(Note) "Before-Fast" and "Before-Cutting delivery" are disabled when using a lathe system.

| Item | | Detail |
|---|---|---|
| Axis selection | | Select the adjustment target axis.<br>Enabled only when the "Addition" button is pressed. |
| Axis assistant | | When the checkbox is ON, the axis assistant operation is executed.<br>It is validated when the position loop gain adjustment checkbox is ON. (Note) |
| Speed loop gain | Execute | Not used. |
| Time constant adjustment | After-Fast | |
| | After-Cutting delivery | |
| | With/Without dwell | |
| | Before-Fast | |
| | Before-Cutting delivery | |
| Select the adjustment criteria | Fix the time constant/Fix the target current | |
| | Detail | |
| Position loop gain | After-Fast | When the checkbox is ON, rapid traverse adjustment is executed after interpolation. |
| | After-Cutting delivery | When the checkbox is ON, cutting feedrate adjustment is executed after interpolation. |
| | With/Without dwell | This selects with dwell/without dwell. It is validated when rapid traverse after interpolation of Time constant adjustment checkbox is ON. |
| | Before-Fast | When the checkbox is ON, rapid traverse adjustment is executed before interpolation.<br>This is invalidated when using a lathe system. |
| | Before-Cutting delivery | When the checkbox is ON, cutting feedrate adjustment is executed before interpolation.<br>This is invalidated when using a lathe system. |

| Item | | Detail |
|---|---|---|
| Select the adjustment criteria | Fix the position gain/ Adjust the limit | This selects the criteria. It is validated when the adjustment method of Position loop gain adjustment checkbox is ON. |
| | Detail | This displays Select the adjustment criteria screen of the position loop gain adjustment when the button is pressed. It is validated when adjustment method of Position loop gain adjustment checkbox is ON. |
| OK | | The settings are saved, and the screen is closed. |
| Cancel | | The settings are cleared, and the screen is closed. |

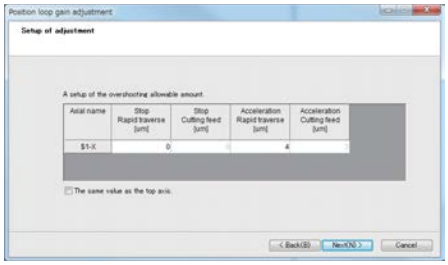
(Note) The time constant (PGN1, PGN2, SHGC) will be set at the minimum between adjusted assistant axes

(4) Press "Detail" to display the "Detail setting" screen.
"After-Fast" is checked at the initial status.
The setting items changes depending on the settings chosen in the axis selection screen.




| Item | | Detail |
|---|---|---|
| Fix the position gain | S-pattern filter setting | It is validated when the checkbox for "Fix the position gain" is checked when selecting the axis. |
| Adjust the limit | Position gain upper limit | It is validated when the checkbox for "Adjust the limit" is checked when selecting the axis. |
| OK | | The settings are saved, and the screen is closed. |
| Cancel | | The settings are cleared, and the screen is closed. |

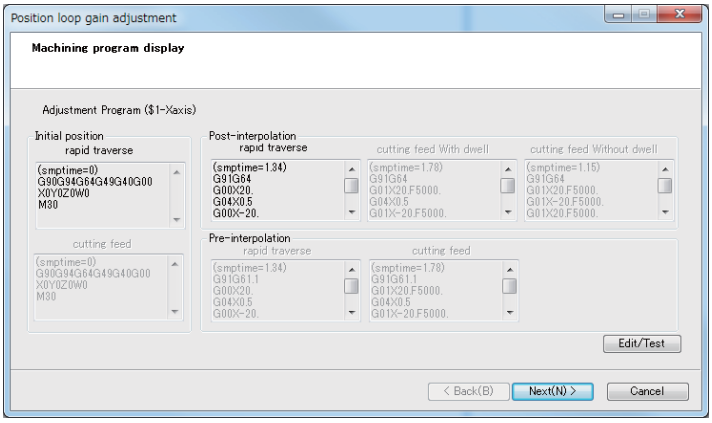
(5) Press "Next" to display the Setup of adjustment screen.
Select the position loop gain adjustment level and then press "Next".




| Item | Detail |
|---|---|
| Axis name | Displays the adjustment target axis. |
| Stop Rapid traverse (G00) | When Position loop gain "Before/After-fast" is checked when selecting the axis, the overshooting allowable amount for "Stop Rapid traverse" can be set.<br>The initial value is "0". (Note) |
| Stop Cutting feed (G01) | When Position loop gain "Before/After-Cutting delivery" is checked and also "With dwell" is checked when selecting the axis, the overshooting allowable amount for "Stop Cutting feed" can be set. The initial value is "0".(Note) |
| Acceleration Rapid traverse (G00) | When Position loop gain "Before/After-fast" is checked when selecting the axis, the overshooting allowable amount for "Acceleration Rapid traverse" can be set.<br>The initial value is "4". (Note) |
| Acceleration Cutting feed (G01) | When Position loop gain "Before/After-Cutting delivery" is checked when selecting the axis, the overshooting allowable amount for "Acceleration Cutting feed" can be set.<br>The initial value is "3". (Note) |
| The same value as the top axis. | When the checkbox is ON, the same value as the top axis will be applied to the following axes. |
| Back | Returns to the previous screen. |
| Next | Goes to the next screen. |
| Cancel | Stops the wizard. |

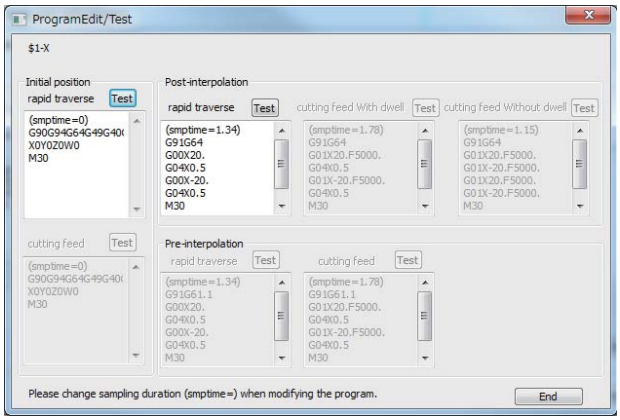
(Note) Even when "0" is set, an overshoot of up to 0.5μm may occur.

(6) Adjustment program for position loop gain will be displayed.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.
Adjustment program will be displayed. Programs used for adjustment will be in black. Others will be grayed out.
Check the details and press "Next".



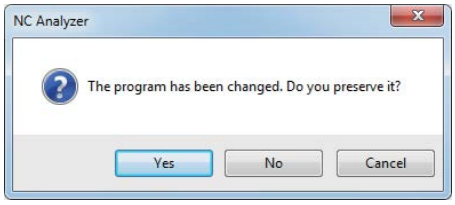

| Item | Detail |
|---|---|
| Edit/Test | Program edit/test screen will be displayed. |
| Adjustment Program | Machining programs used for adjusting the specified axis will be displayed. |
| Back | Disabled. |
| Next | The next screen will appear after setting the program in NC. |
| Cancel | Stops the wizard. |

(7) Press "Edit/Test" to display machining program.
Adjustment program for position loop gain can be edited.
Only the programs used for adjusting will be able to be edited from the dialogue.
Also, these programs can be tested (by transmitting them to NC and operate them in NC).
Editing will be prohibited for other programs (these will be grayed out) and test cannot be performed on these programs.
If a program is changed, the background color will change.



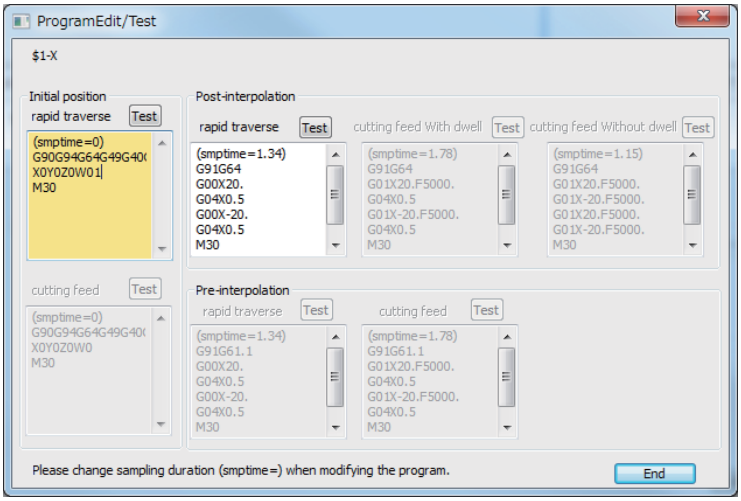
| Item | Detail | Default |
|---|---|---|
| $ ○ - △ axis | This displays the target axis name. | - |
| Program display edit box | Program for adjustment will be displayed. | The adjustment program stored in PC. |

| Button name | Operation |
|---|---|
| Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. An error dialogue will appear if the operation mode of the NC's test target part system is not set to MDI mode.<br>An error dialogue will also appear when the program does not exist (when no program is displayed in the program display edit box). |
| End | Clears the program edit/test screen and returns to the machining program display screen.<br>If any of the program was changed, a dialogue to ask whether to confirm the change will appear.<br>An error dialogue will appear when the program does not exist (when no program is displayed in the program display edit box). |



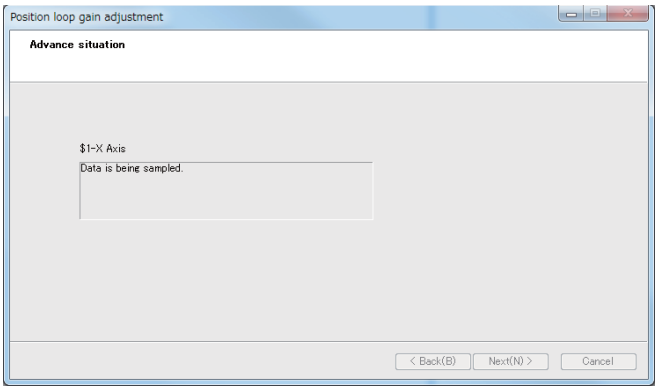

| Button name | Operation |
|---|---|
| Yes | Saves the programs on the program edit/test screen and returns to the machining program display screen. |
| No | Returns to the machining program display screen without saving the programs on the program edit/test screen. |
| Cancel | Returns to the programs on the program edit/test screen. |

If a program is changed, the background color will change.
Check the detail and press "End".



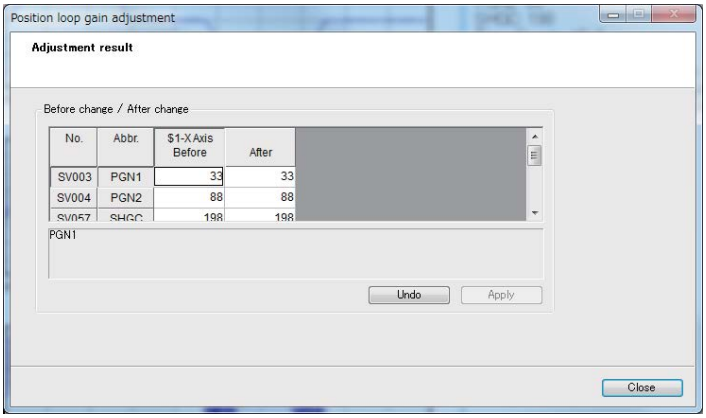

Horizontal scroll bars are not provided because it will narrow the text area. The hidden part can be viewed by moving the cursor. The vertical scroll bars will become operable when programs are too long to fit in the edit box.

(8) Press "Next" to display the advance situation screen.
NC Analyzer will enter "Cycle start waiting" status.
(Note) If the "automatic start" button is pressed before this screen appears, the axis may move.




| Item | Detail |
|---|---|
| Axis name | This displays the axis which is being adjusted. |
| Advance situation (status) display | Messages will appear according to the adjustment advance situation.<br>The correspondence between the advance situation and messages are as follows.<br><br>Situation / Messages:<br>Initializing — Preparing the adjustment.<br>Cycle start waiting — Preparation of adjustment was completed. Execution of a cycle start starts adjustment.<br>Sampling — The data is being sampled.<br>Analyzing data — The data is being analyzed. The parameter is changed.<br>Adjustment completed — The adjustment ended. Please click the next.<br>Error stop — The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped.<br><br>* When an error occurs and stops, the message "The error occurred during adjustment. It returns, before adjusting a parameter..." will appear in a dialogue.<br>Press "OK" to restore the parameter (before the adjustment was made).<br>Also, if no response returns from the NC due to an illegal mode, alarm or other, it will time out ten seconds after it found no response from the NC and stops by an error. |
| Back | Disabled. |
| Next | The next screen will appear.<br>This button will be enabled when the status changes to [Adjustment completed].<br>If there are any axis which is not adjusted, the axis will be adjusted.<br>When all the axes are adjusted, the next adjustment will be performed. |
| Cancel | The dialogue "Adjustment ended?" will appear and, if "OK" is selected, the wizard will stop.<br>The cancel button will be enabled when the advance situation turns to [Cycle start waiting], [Sampling], [Analyzing data] or [Adjustment was completed], or when the parameter restoration is completed after [Error stop]. |

(9) When the message "Adjustment was completed. Please..." is displayed, the adjustment is completed. Press the "Next" button.
The adjustment result is displayed.




| Item | Detail |
|---|---|
| After change/before change | Settings for the target parameters before/after the adjustment is displayed per axis for each adjustment item.<br>Settings for the non-target parameters are also displayed if there are any changes before/after the adjustment.<br>The changed parameter is displayed in blue.<br>The adjusted settings can be edited directly. |
| Apply | When the "Apply" button is pressed, the dialog "It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are changed to the edited adjustment settings.<br>The "Apply" button is valid when the adjusted parameter is edited and it is invalid when "Apply" or "Undo" is executed. |
| Undo | If the "Undo" button is pressed, the dialog "It returns, before adjusting a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are returned to the settings before the parameters are adjusted. |
| Close | The wizard is closed.<br>If the "Close" button is pressed when the "Apply" button is valid, the dialog "The parameter after adjustment is changed. Does it end without applying?" is displayed. When "OK" is selected, the wizard is closed without applying the parameter change. When "Cancel" is selected, it returns to the adjustment result screen. |

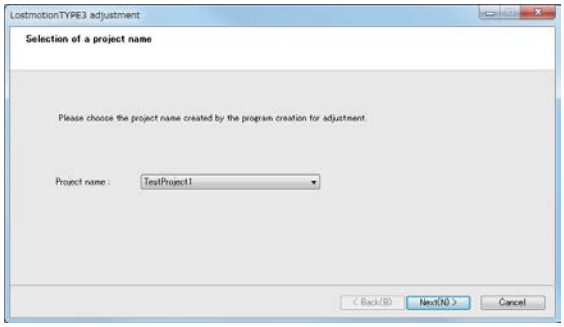
(10) Confirm the changes, and press "OK" to finish the time constant adjustment.

## 3.4.5 Lost Motion Type 3 Adjustment

With this function, the lost motion type 3 is adjusted.

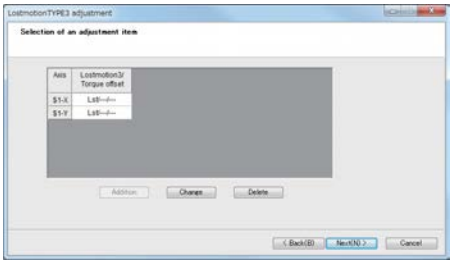
**Operation method**

(1) Select "IndividualAdjust" - "LostmotionTYPE3 adjustment".
Select the project name created by "Program creation".
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.




| Item | Detail |
|---|---|
| Project name | Select the project name created by "Program creation".<br>Click ▼ to see the list of available project names. |
| Back | Displays the startup screen. |
| Next | Displays the next screen. The next button becomes valid after selecting a project name. |
| Cancel | Stops the wizard. |

(2) Press the "Next" to go to the screen to select axes.
Two axes must be selected for the lost motion type 3. You cannot go to the next process if two axes are not selected.
Only two axes in a same part system can be selected.



| Item | Detail |
|---|---|
| Axis | Selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed. Spindle, spindle/C axis and PLC axis are not displayed.<br>Displays the axes which are set in NC. (Note1) |
| Lost motion/Torque offset | Displays whether to execute an adjustment. |
| Addition | Adds adjustment axes.<br>When two axes are already selected, this button is disabled.<br>An error dialogue will appear if this button is pressed without creating a machining program. |
| Change | Changes the selected axis setting. If an axis has not been selected, the button cannot be used. |
| Delete | Deletes the selected axis. If an axis has not been selected, the button cannot be used. |
| Back | Returns to the previous screen. |
| Next | Goes to the next screen.<br>An error dialogue will appear if this button is pressed without creating a machining program. |
| Cancel | Stops the wizard. |

(Note 1) Servo axis:

The servo axis is displayed in $ ○ - △ format. The spindle and PLC axis are displayed in "SP-△ ", "PLC △ " format.

"$ ○ " indicates a part system, and " △ " indicates an axis name.

(Ex) The 1st axis of 1st part system -> $1-X

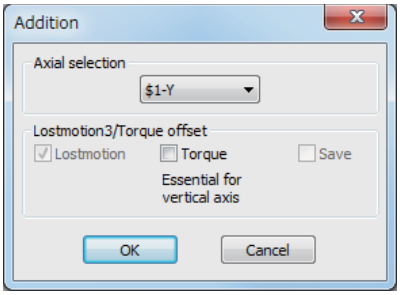
Synchronous control axis:

The synchronous control axis is displayed in $ ○ - △ ( □ ) format.

$ ○ indicates the part system, △ indicates the axis name (primary axis), and □ indicates the axis name (secondary axis).

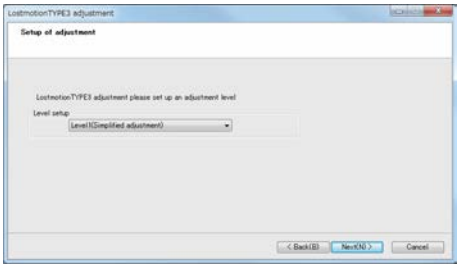
(Ex) X axis of 1st part system is the primary axis and U axis is the secondary axis -> $1-X(U)

(3) Press "Addition" and "Change" to display the screen to select axes.
(Note) Only the axes which the lost motion type 3 adjustment machining program has been created can be selected.




| Item | | Detail |
|---|---|---|
| Axis selection | | Select the adjustment target axis.<br>Enabled only when the "Addition" button is pressed.<br>The axis which has been selected is not displayed. When the synchronous axis have been selected, the axis that synchronizes with the selected axis is not displayed either. |
| Lost motion/Torque offset | Lost motion | Displays whether to execute an adjustment. |
| | Torque offset | Displays whether to execute an torque offset adjustment.<br>Always check this checkbox when using a vertical axis. |
| OK | | The settings are saved, and the screen is closed. |
| Cancel | | The settings are cleared, and the screen is closed. |

(4) After all adjustment axes are added and the settings are confirmed, press the "Next" button.
(Note 1) If the settings are changed, point the cursor to the axis to change, and press the "Change" button.
(Note 2) To delete an axis from the adjustment axes list, point the cursor to the axis to be deleted, and press the "Delete" button.



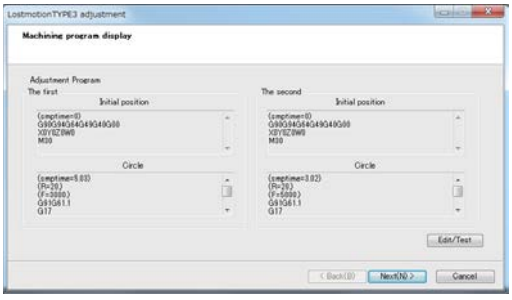

| Item | Detail |
|---|---|
| Level setting | Set the level (from 1 to 5).<br>The initial value is 1. |
| Back | Returns to the previous screen. |
| Next | Goes the next screen. |
| Cancel | Stops the wizard. |

Set the adjustment level according to the accuracy required by your machine.

| | | Adjustment level | Times of fine adjustment |
|---|---|---|---|
| ↕ | Accuracy-oriented | Level 5 | 4 |
| | | Level 4 | 3 |
| | | Level 3 | 2 |
| | | Level 2 | 1 |
| | Simple adjustment | Level 1 | 0 |

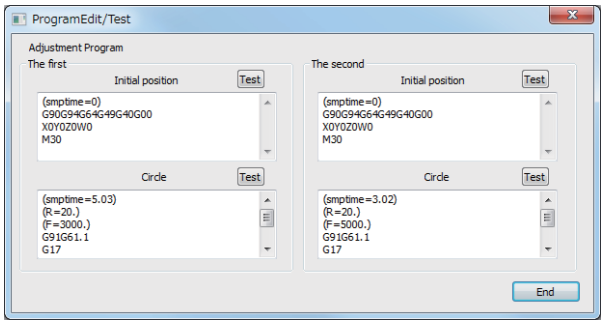
(5) Set the adjustment level. Press the "Next" button after setting.
(Note 1) The message of operation mode error appears when the operation mode is not the memory mode.

(6) The machining program for lost motion type 3 adjustment is displayed. Press the "Next" button after confirming the contents.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears.



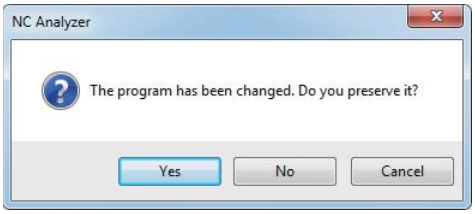

| Item | Detail |
|---|---|
| Edit/Test | Program edit/test screen will be displayed. |
| Adjustment Program | Machining programs used for adjusting the specified axis will be displayed. |
| Back | Disabled. |
| Next | The next screen will appear after setting the program in NC. |
| Cancel | Stops the wizard. |

(7) Press "Edit/Test" to display ProgramEdit/Test screen.
Only the programs used for adjusting will be able to be edited from the dialogue.
Also, these programs can be tested (by transmitting them to NC and operate them in NC).
Editing will be prohibited for other programs (these will be grayed out) and test cannot be performed on these programs.



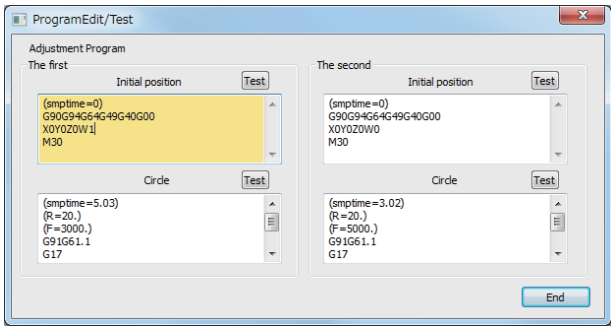

| Item | Detail | Default |
|---|---|---|
| $ ○ - △ axis | This displays the target axis name. | - |
| Program display edit box | Program for adjustment will be displayed. | The adjustment program stored in PC. |

| Button name | Operation |
|---|---|
| Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. An error dialogue will appear if the operation mode of the NC's test target part system is not set to MDI mode.<br>An error dialogue will also appear when the program does not exist (when no program is displayed in the program display edit box). |
| End | Clears the program edit/test screen and returns to the machining program display screen.<br>If any of the program was changed, a dialogue to ask whether to confirm the change will appear.<br>An error dialogue will appear when the program does not exist (when no program is displayed in the program display edit box). |




| Button name | Operation |
|---|---|
| Yes | Saves the programs on the program edit/test screen and returns to the machining program display screen. |
| No | Returns to the machining program display screen without saving the programs on the program edit/test screen. |
| Cancel | Returns to the programs on the program edit/test screen. |

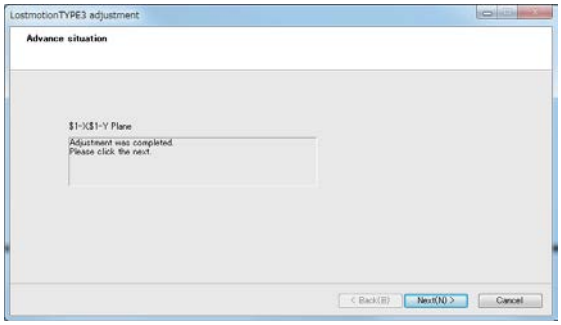
If a program is changed, the background color will change.
Check the detail and press "End".




Horizontal scroll bars are not provided because it will narrow the text area. The hidden part can be viewed by moving the cursor. The vertical scroll bars will become operable when programs are too long to fit in the edit box.

(Note) The high-accuracy control I (G61.1/G08) is enabled only for the 1st part system when using machining type NC.
When selecting the 2nd part system and the following for axial selection, replace G61.1 in the machining program with G64 since an illegal G code is generated.

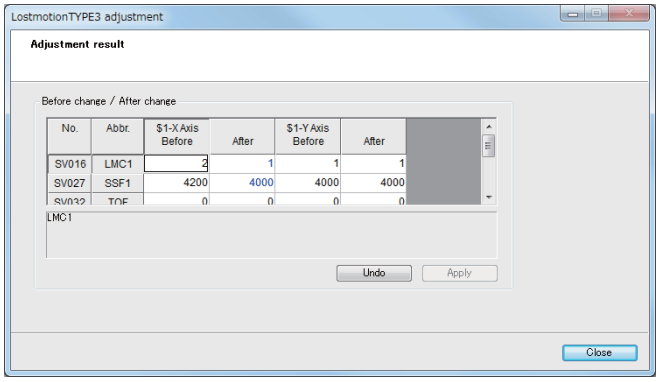
(8) Press "Next" to start the lost motion type 3 adjustment. Input the cycle start after the message "Preparation of adjustment was completed. Execution..." is displayed.




| Item | Detail |
|---|---|
| Axis name | This displays the axis which is being adjusted. |
| Advance situation (status) display | Messages will appear according to the adjustment advance situation.<br>The correspondence between the advance situation and messages are as follows.<br><br>Situation / Messages:<br>Initializing — Preparing the adjustment.<br>Cycle start waiting — Preparation of adjustment was completed. Execution of a cycle start starts adjustment.<br>Sampling — The data is being sampled.<br>Analyzing data — The data is being analyzed. The parameter is changed.<br>Adjustment completed — The adjustment ended. Please click the next.<br>Error stop — The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped.<br><br>* When an error occurs and stops, the message "The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped." will appear in a dialogue.<br>Press "OK" to restore the parameter (before the adjustment was made).<br>Also, if no response returns from the NC due to an illegal mode, alarm or other, it will time out ten seconds after it found no response from the NC and stops by an error. |
| Back | Disabled. |
| Next | The next screen will appear.<br>This button will be enabled when the status changes to [Adjustment completed].<br>If there are any axis which is not adjusted, the axis will be adjusted.<br>When all the axes are adjusted, the next adjustment will be performed. |
| Cancel | The dialogue "Adjustment ended?" will appear and, if "OK" is selected, the wizard will stop.<br>The cancel button will be enabled when the advance situation turns to [Cycle start waiting], [Sampling], [Analyzing data] or [Adjustment was completed], or when the parameter restoration is completed after [Error stop]. |

(9) When the message "Adjustment was completed. Please..." is displayed, the adjustment is completed. Press the "Next" button to proceed to the next screen.

(10) The list of changed parameter by adjustment is displayed.
Confirm the changed contents, and press the "OK" button to finish the lost motion type 3 adjustment.




| Item | Detail |
|---|---|
| After change/before change | Settings for the target parameters before/after the adjustment is displayed per axis for each adjustment item.<br>Settings for the non-target parameters are also displayed if there are any changes before/after the adjustment.<br>The changed parameter is displayed in blue.<br>The adjusted settings can be edited directly.<br>When selecting the synchronous control axis, the axis that synchronizes with the selected axis is also displayed in the adjustment result. |
| Apply | When the "Apply" button is pressed, the dialog "It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are changed to the edited adjustment settings.<br>The "Apply" button is valid when the adjusted parameter is edited and it is invalid when "Apply" or "Undo" is executed. |
| Undo | If the "Undo" button is pressed, the dialog "It returns, before adjusting a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are returned to the settings before the parameters are adjusted. |
| Close | The wizard is closed.<br>If the "Close" button is pressed when the "Apply" button is valid, the dialog "The parameter after adjustment is changed. Does it end without applying?" is displayed. When "OK" is selected, the wizard is closed without applying the parameter change. When "Cancel" is selected, it returns to the adjustment result screen. |

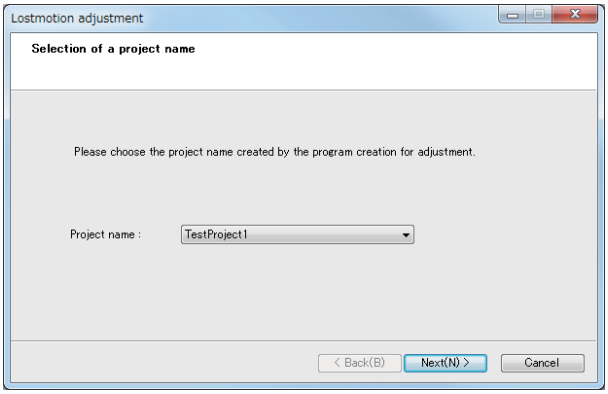
## 3.4.6 Lost Motion Adjustment

With this function, the lost motion is adjusted.

(Note) Normally, the lost motion adjustment is not used. Use lost motion type 3 adjustment.

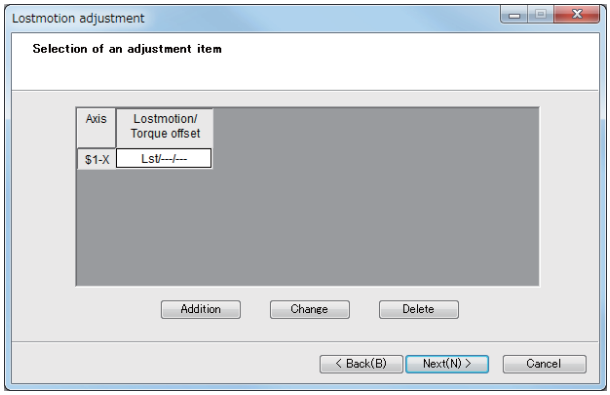
**Operation method**

(1) Select "IndividualAdjust" - "Lostmotion adjustment".
This function can be selected from the function bar also.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.




| Item | Detail |
|---|---|
| Project name | Select the project name created by "Program creation".<br>Click ▼ to see the list of available project names. |
| Back | Displays the startup screen. |
| Next | Displays the next screen. The next button becomes valid after selecting a project name. |
| Cancel | Stops the wizard. |

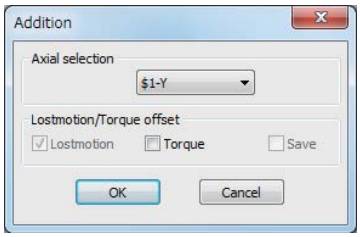
(2) Select the project name created by "Program creation". Press the "Next" button.
The "Lost motion adjustment" screen is displayed.




| Item | Detail |
|---|---|
| Axis | Selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed. Spindle, spindle/C axis and PLC axis are not displayed.<br>Displays the axes which are set in NC. (Note1) |
| Lost motion/Torque offset | Displays whether to execute an adjustment. |
| Addition | Adds adjustment axes. |
| Change | Changes the selected axis setting. If an axis has not been selected, the button cannot be used. |
| Delete | Deletes the selected axis. If an axis has not been selected, the button cannot be used. |
| Back | Returns to the previous screen. |
| Next | Goes to the next screen.<br>An error dialogue will appear when pressing "OK" if machining program is not created. |
| Cancel | Stops the wizard. |

(Note 1) The servo axis is displayed in $ ○ - △ format. The spindle and PLC axis are displayed in "SP- △ ", "PLC △ " format. "$ ○ " indicates a part system, and " △ " indicates an axis name.
(Ex) The 1st axis of 1st part system -> $1-X

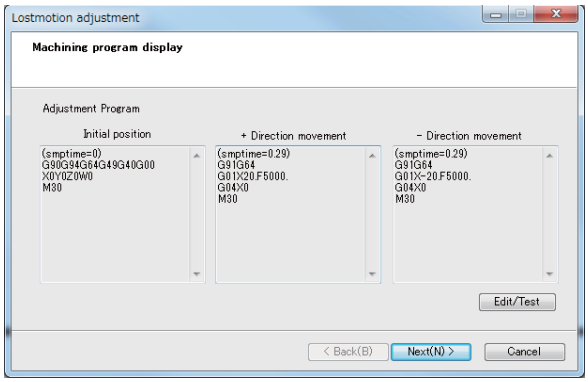
(3) Press "Addition" and "Change" to display the screen to select axes.
"Lostmotion" checkbox is checked at default.




| Item | | Detail |
|---|---|---|
| Axis selection | | Select the adjustment target axis.<br>Enabled only when the "Addition" button is pressed. |
| Lost motion/Torque offset | Lost motion | This checkbox is checked and cannot be changed. |
| | Torque offset | When this checkbox is checked, adjustment is executed with torque offset. |
| OK | | The settings are saved, and the screen is closed.<br>An error dialogue will appear when pressing "OK" if machining program is not created while adjustment is set to be executed and the screen cannot be closed. In that case, clear the checkbox for OMR-FF adjustment. |
| Cancel | | The settings are cleared, and the screen is closed. |

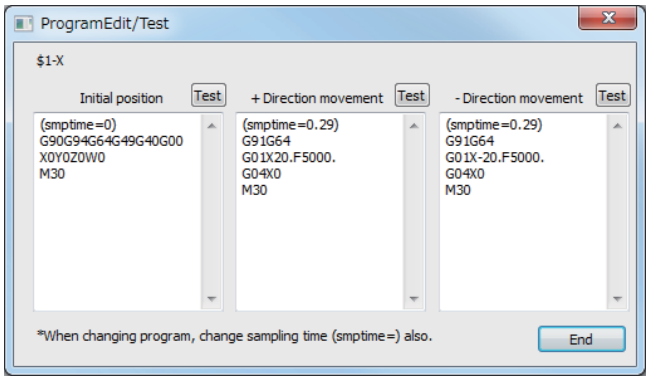
(4) Select the adjustment axis.
Press the "OK" button after setting is completed.
(Note)When the horizontal axis is selected, do not select the torque offset.
The screen will return to the "Lost motion adjustment" screen.

(5) Machining program display screen will appear.
After adding all adjustment axes and confirming the settings, press the "Next" button.
Adjustment program will be displayed. Programs used for adjustment will be in black. Others will be grayed out.
When the operation mode of all part systems set to NC are not normal, the message (the operation mode is abnormal) appears, and the screen is not changed.



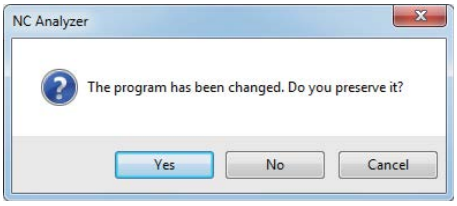

| Item | Detail |
|---|---|
| Edit/Test | Program edit/test screen will be displayed. |
| Adjustment Program | Machining programs used for adjusting the specified axis will be displayed. |
| Back | Disabled. |
| Next | The next screen will appear after setting the program in NC. |
| Cancel | Stops the wizard. |

(6) Press "Edit/Test" to display ProgramEdit/Test screen.
Only the programs used for adjusting will be able to be edited from the dialogue.
Also, these programs can be tested (by transmitting them to NC and operate them in NC).
Editing will be prohibited for other programs (these will be grayed out) and test cannot be performed on these programs.



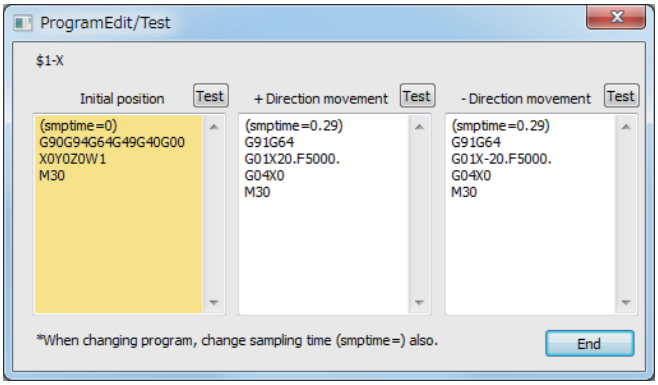

| Item | Detail | Default |
|---|---|---|
| $ ○ - △ axis | This displays the target axis name. | - |
| Program display edit box | Program for adjustment will be displayed. | The adjustment program stored in PC. |

| Button name | Operation |
|---|---|
| Test | This transmits the displayed machining program to NC.<br>The transmitted machining program can be operated (tested) with MDI mode. An error dialogue will appear if the operation mode of the NC's test target part system is not set to MDI mode.<br>An error dialogue will also appear when the program does not exist (when no program is displayed in the program display edit box). |
| End | Clears the program edit/test screen and returns to the machining program display screen.<br>If any of the program was changed, a dialogue to ask whether to confirm the change will appear.<br>An error dialogue will appear when the program does not exist (when no program is displayed in the program display edit box). |



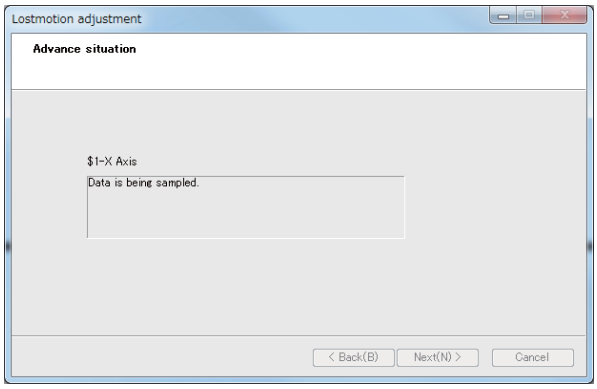

| Button name | Operation |
|---|---|
| Yes | Saves the programs on the program edit/test screen and returns to the machining program display screen. |
| No | Returns to the machining program display screen without saving the programs on the program edit/test screen. |
| Cancel | Returns to the programs on the program edit/test screen. |

If a program is changed, the background color will change.
Check the detail and press "End".



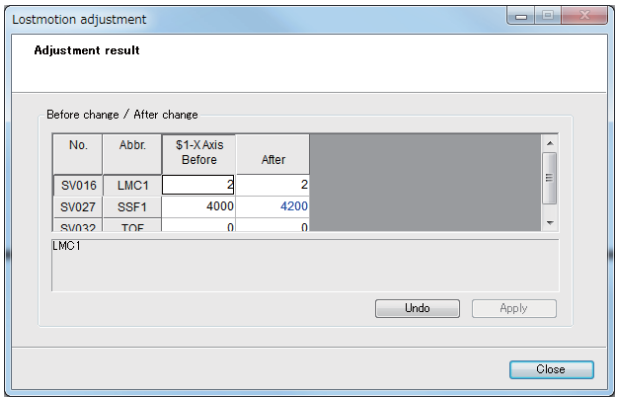

Horizontal scroll bars are not provided because it will narrow the text area. The hidden part can be viewed by moving the cursor. The vertical scroll bars will become operable when programs are too long to fit in the edit box.

(8) Press "Next" after confirming the settings.
NC Analyzer will enter "Cycle start waiting" status.
(Note) If the "automatic start" button is pressed before this screen appears, the axis may move.




| Item | Detail |
|---|---|
| Axis name | This displays the axis which is being adjusted. |
| Advance situation (status) display | Messages will appear according to the adjustment advance situation.<br>The correspondence between the advance situation and messages are as follows.<br><br>Situation / Messages:<br>Initializing — Preparing the adjustment.<br>Cycle start waiting — Preparation of adjustment was completed. Execution of a cycle start starts adjustment.<br>Sampling — The data is being sampled.<br>Analyzing data — The data is being analyzed. The parameter is changed.<br>Adjustment completed — The adjustment ended. Please click the next.<br>Error stop — The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped.<br><br>* When an error occurs and stops, the message "The error occurred during adjustment. It returns, before adjusting a parameter, and adjustment is stopped." will appear in a dialogue.<br>Press "OK" to restore the parameter (before the adjustment was made).<br>Also, if no response returns from the NC due to an illegal mode, alarm or other, it will time out ten seconds after it found no response from the NC and stops by an error. |
| Back | Disabled. |
| Next | The next screen will appear.<br>This button will be enabled when the status changes to [Adjustment completed].<br>If there are any axis which is not adjusted, the axis will be adjusted.<br>When all the axes are adjusted, the next adjustment will be performed. |
| Cancel | The dialogue "Adjustment ended?" will appear and, if "OK" is selected, the wizard will stop.<br>The cancel button will be enabled when the advance situation turns to [Cycle start waiting], [Sampling], [Analyzing data] or [Adjustment was completed], or when the parameter restoration is completed after [Error stop]. |

(9) When the message "Adjustment was completed. Please..." is displayed, the adjustment is completed. Press the "Next" button.
The adjustment result is displayed.




| Item | Detail |
|---|---|
| After change/before change | Settings for the target parameters before/after the adjustment is displayed per axis for each adjustment item.<br>Settings for the non-target parameters are also displayed if there are any changes before/after the adjustment.<br>The changed parameter is displayed in blue.<br>The adjusted settings can be edited directly. |
| Apply | When the "Apply" button is pressed, the dialog "It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are changed to the edited adjustment settings.<br>The "Apply" button is valid when the adjusted parameter is edited and it is invalid when "Apply" or "Undo" is executed. |
| Undo | If the "Undo" button is pressed, the dialog "It returns, before adjusting a parameter. Is it all right?" is displayed. When "OK" is selected, the NC parameters are returned to the settings before the parameters are adjusted. |
| Close | The wizard is closed.<br>If the "Close" button is pressed when the "Apply" button is valid, the dialog "The parameter after adjustment is changed. Does it end without applying?" is displayed. When "OK" is selected, the wizard is closed without applying the parameter change. When "Cancel" is selected, it returns to the adjustment result screen. |

(10) Confirm the changes and press the "OK" button to finish the lost motion adjustment.

Auto scaling for graph display

The followings are the auto scaling values for lostmotion adjustment.

| Axis | Auto scaling value |
|---|---|
| X-axis | Minimum value:<br>Minimum value of actual data<br>Maximum value:<br>Maximum value of actual data rounded up to two significant digits is the auto scaling value |
| Y-axis | Minimum value:<br>Round up the calculation result of (minimum value of actual data/5)<br>5 × (the value rounded up - 1) = auto scaling value<br>Maximum value:<br>Round off the calculation result of (minimum value of actual data/5)<br>5 × (the value rounded off + 1) = auto scaling value |

Refer to "Auto scaling value for Standard/Logarithm/Arbitrary path graph" for the auto scaling value on Axis setting screen or when opening a file.

# 3.5 Measurement Function

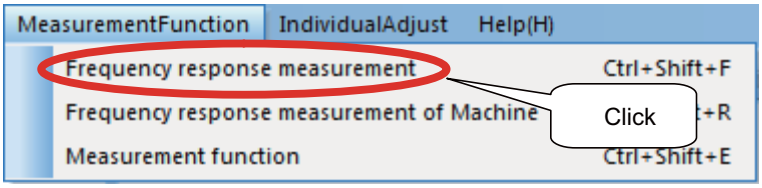
## 3.5.1 Frequency Response Measurement (Servo)

A random signal is applied to the speed command by specified axis and vibration amount, and the frequency characteristic is measured by that data (speed command/speed feedback). The result is displayed by the Bode diagram and the text data.
The traveling commands by G code etc. are not needed.

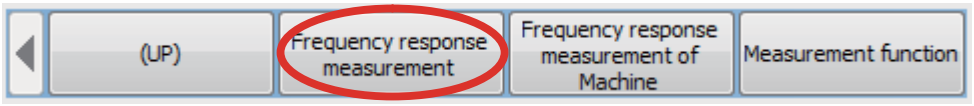
**Frequency response measurement  Configuration of Details setting screen**

(1) Select from the following menu, etc. and display the MeasurementFunction menu.

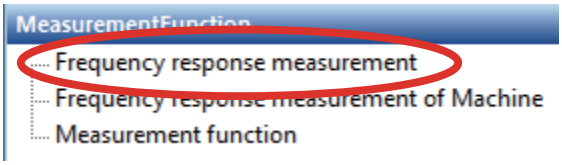
Selection from the menu
Select [MeasurementFunction] - [Frequency response measurement] from the menu.




Selection from the function bar
Select [MeasurementFunction] - [Frequency response measurement] from function bar.

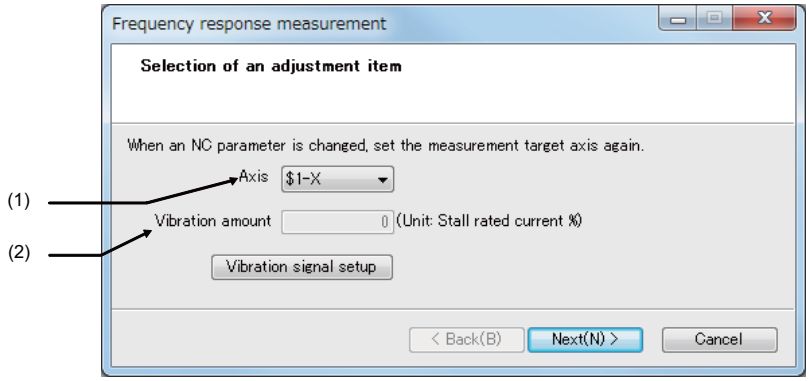



Selection from the navigation window
Select [MeasurementFunction] - [Frequency response measurement] from navigation window and double-click the item.




Execute the communication initialization process. The communication initialization time depends on the number of axes. When the initialization is completed, it goes to the next screen automatically.

(2) The "Frequency response measurement setup" screen is displayed.
When it is not connected to NC, an error message to indicate no connection with NC will be displayed and this screen will not appear.
When the operation mode is illegal, an error message for an operation mode illegal will be displayed and this screen will not appear.



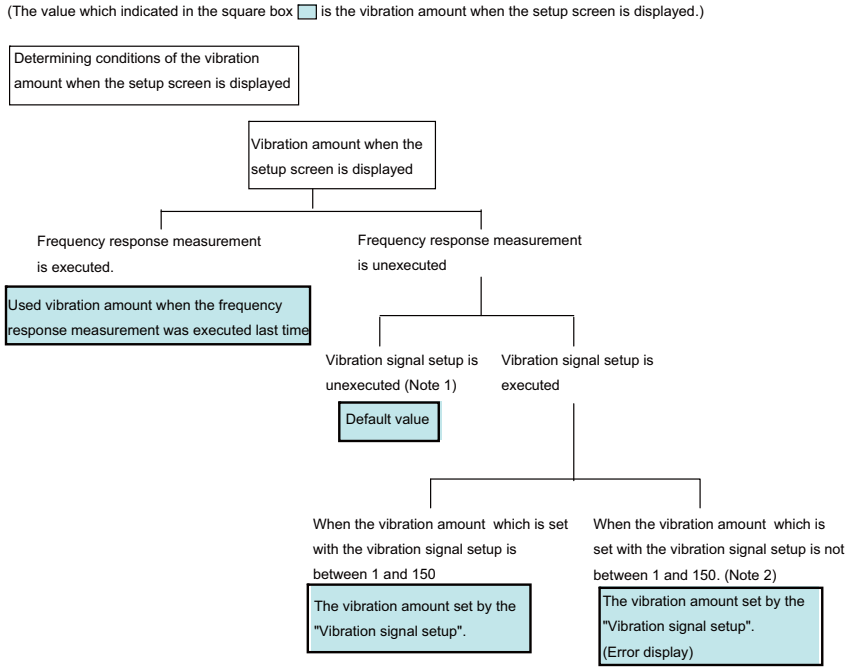

| Display item | | Detail | Default value | Unit |
|---|---|---|---|---|
| (1) | Axis | This selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed.<br>Spindle, spindle/C axis and PLC axis are not displayed. | The 1st part system's first axis set to NC (It is displayed with the format "$1- ○ " (Note 1).) | - |
| (2) | Vibration amount | The vibration amount during measurement (vibration) is displayed in vibration display area.<br>To change the vibration amount, press the "Vibration signal setup" button. | 0 | Stall rated current% |

(Note 1) "$1" indicates the 1st part system, and " ○ " indicates the first axis name.

| Button name | Operation |
|---|---|
| Vibration signal setup | Display "Vibration signal setup" screen. |
| Back | Disabled |
| Next | Execute the frequency response measurement.<br>Go to the state display screen.<br>When the operation mode is illegal, an error message for an operation mode illegal will be displayed. |
| Cancel | Terminate the frequency response measurement.<br>Go back to the NC Analyzer main screen. |

(3) Select the measurement target axis.
The measurement target axis can be selected from the servo NC axes which are set in the NC currently connected.
When the setting screen is displayed, the axis which was selected when executing the last frequency response measurement is displayed in the combo box for the measurement target selection.
If the frequency response measurement is unexecuted, the 1st part system's first axis set in NC currently connected is displayed.

The vibration amount while displaying the details setting screen is set/displayed according to the following conditions.

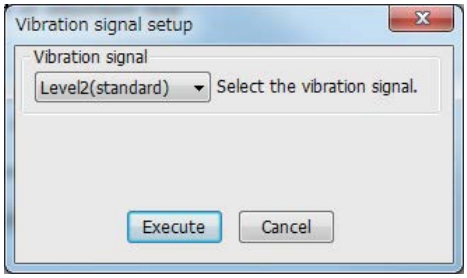



(Note 1) When the frequency response measurement or the vibration signal setup is unexecuted or NC Analyzer is started up for the first time, the default value "0" will be set/displayed.

(Note 2) When the vibration amount set in the vibration amount setup is not between 1 and 150 (integer), the message shown below is displayed.
"An illegal value is set to the vibration amount. Set an appropriate value (1 to 150 (integer number))."

(4) Select "$1-X" as the measurement target axis.
Press the [Vibration signal setup] button.

(5) The "Vibration signal setup" screen is displayed.




| Setting item | Details | Default value | Setting range |
|---|---|---|---|
| Vibration signal | Select the vibration signal. | Level 2(standard) | Level1 |
| | | | Level2(standard) |
| | | | Level3 |
| | | | Level4 |
| | | | Level5 |
| | | | Level6 |

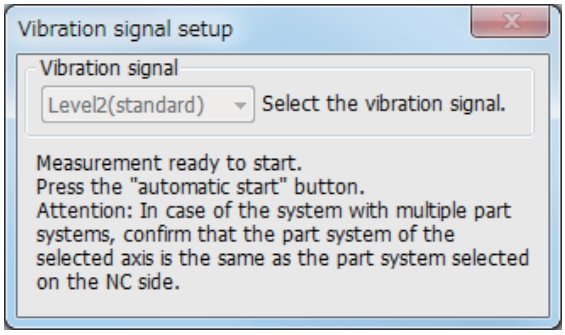
| Button name | Operation |
|---|---|
| Execute | Execute the vibration signal setup. It takes about 30 seconds to finish, depending on the connection speed and installation state of the machine. |
| Cancel | Close the vibration signal setup screen and return to the axis selection screen.<br>Change of the setting will not be reflected. |

(6) Select the level and click the "Execute" button.
When "Measurement ready to start. Press the "automatic start" button." is displayed , press the automatic start button.

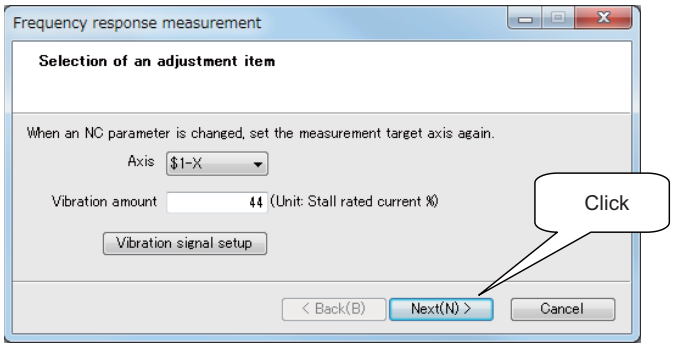
The message to be displayed in the Vibration Signal Setup screen will automatically change with the following order.
"Preparing the measurement."
-> "Measurement ready to start. Press the "automatic start" button."
-> "Measuring."
-> "Measurement completed. Click the "Close" button."

"Preparing the measurement." will automatically change to "Measurement ready to start. Press the "automatic start" button." in about 3 seconds.

Make sure to check that only the part system of the measurement target axis is selected before pressing the automatic start button. An error will occur if automatic operation is executed for the other part system, and the measurement will be canceled.
If the connection with NC fails, an error "Some error occurred while measuring. The measurement is discontinued." will be displayed in about 10 seconds.

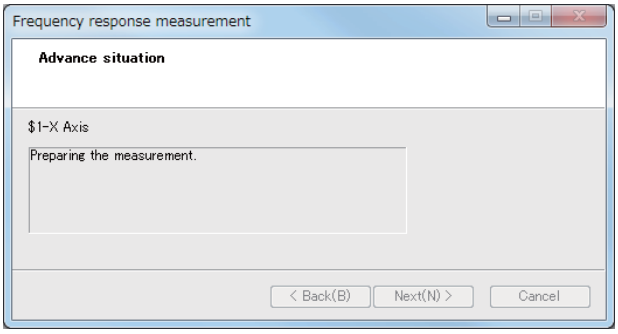



(7) Press [Next] button

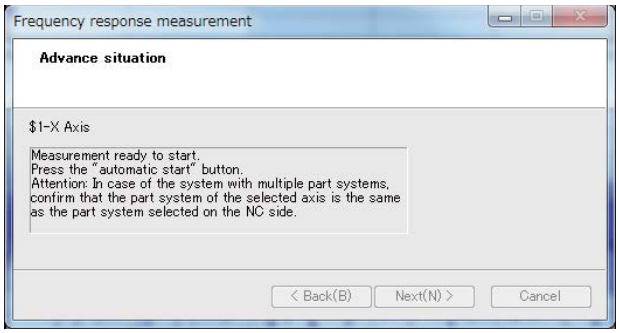


(8) Advance situation screen is displayed.
The message to be displayed in the Advance situation screen will partly automatically change with the following order.
"In preparation screen"
-> "Queuing to start screen"
-> "Measuring screen"
-> "Completion state screen"

"In preparation screen" will automatically change to the "Queuing to start screen" in about 3 seconds.
If the connection with NC fails as "In preparation screen" changes to "Queuing to start screen", an error "Some error occurred while measuring. The measurement is discontinued." will be displayed in about 10 seconds.

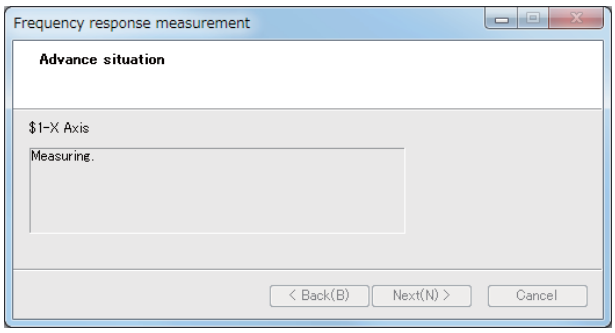



(9) The "Frequency response advance situation" screen is displayed.

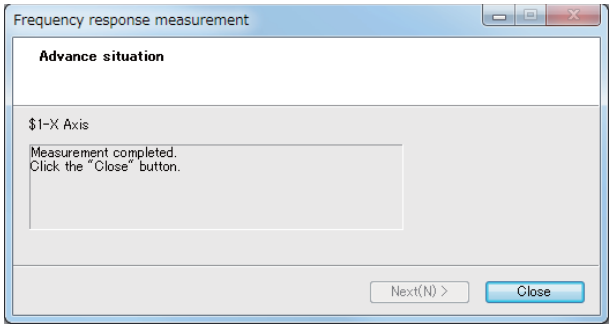



Press the NC automatic start button when this screen is displayed. Until the NC automatic start button is pressed, NC Analyzer remains in the standby state with this screen displayed.

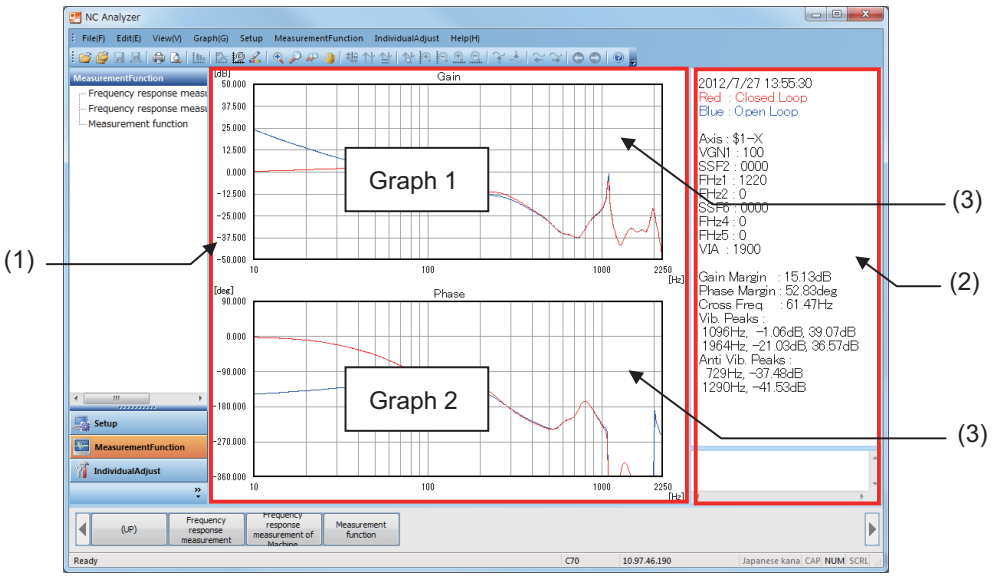
(10) The measurement "advance situation" screen is displayed.



(11) The completion state "advance situation" screen is displayed.
Press the "Close" button.



### Configuration of measurement result screen (Bode diagram)




| Display item | | Details |
|---|---|---|
| (1) Graph area | | This displays the frequency responses (Bode diagram). |
| | Graph 1 | This displays the frequency responses (gain).<br>Red line : Gain curve of speed closed loop frequency responses<br>Blue line : Gain curve of speed open loop frequency responses |
| | Graph 2 | This displays the frequency responses (phase).<br>Red line : Phase curve of speed losed loop frequency responses<br>Blue line : Phase curve of speed open loop frequency responses |

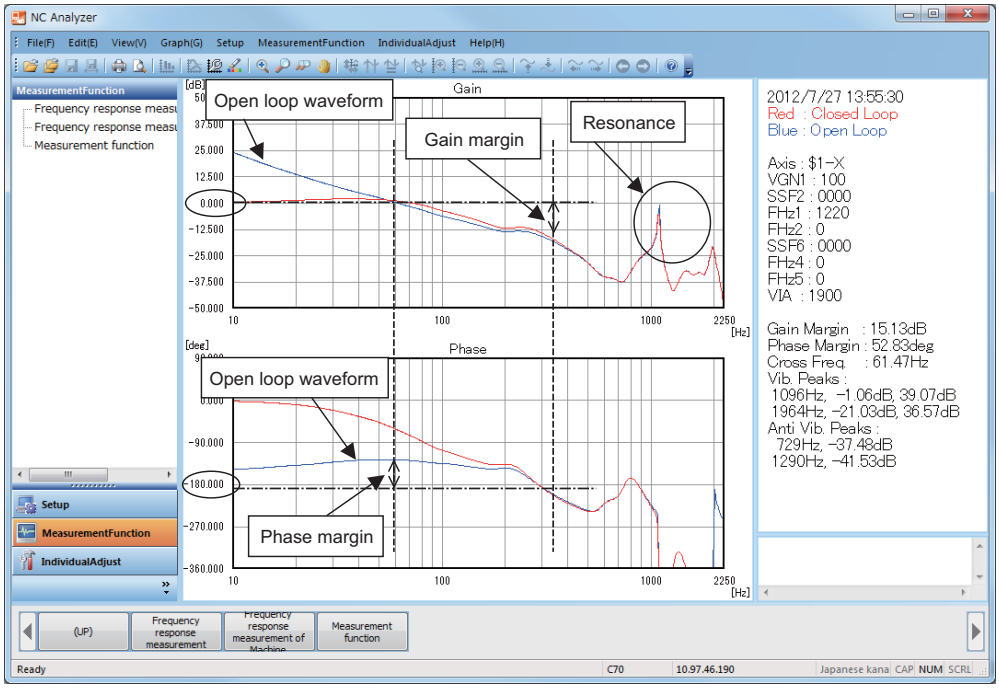
<table>
<tr><th colspan="2">Display item</th><th>Details</th></tr>
<tr><td>(2)</td><td>Text area</td><td>This displays the information (text data) at measuring.<br><br>Frequency response measurement (servo)
<table>
<tr><th>Display item</th><th>Details</th><th>Remarks/Unit</th></tr>
<tr><td>Red</td><td>Closed loop</td><td>Fixed character string</td></tr>
<tr><td>Blue</td><td>Open loop</td><td>Fixed character string</td></tr>
<tr><td>Target Sys / Axis</td><td>The part system/axis No. of measuring target</td><td>Part system (1 to)<br>/Axis No. (1 to)</td></tr>
<tr><td>VGN1</td><td>VGN1(SV005) value set with NC</td><td>-</td></tr>
<tr><td>SSF2</td><td>SSF2(SV033) value set with NC</td><td>-</td></tr>
<tr><td>FHz1</td><td>FHz1(SV038) value set with NC</td><td>(Hz)</td></tr>
<tr><td>FHz2</td><td>FHz2(SV046) value set with NC</td><td>(Hz)</td></tr>
<tr><td>SSF6</td><td>SSF6(SV083) value set with NC</td><td>-</td></tr>
<tr><td>FHz4</td><td>FHz4(SV087) value set with NC</td><td>(Hz)</td></tr>
<tr><td>FHz5</td><td>FHz5(SV088) value set with NC</td><td>(Hz)</td></tr>
<tr><td>VIA</td><td>VIA(SV008) value set with NC</td><td>-</td></tr>
<tr><td>Gain Margine</td><td>Gain Margine</td><td>dB</td></tr>
<tr><td>Phase Margine</td><td>Phase Margine</td><td>deg</td></tr>
<tr><td>Cross Frequency</td><td>Cross Frequency</td><td>Hz</td></tr>
<tr><td>Anti Vib. Peaks</td><td>Anti vibration peaks</td><td>Hz: Anti vibration frequency<br>dB: Anti vibration peak value</td></tr>
<tr><td>Vib. Peaks</td><td>Vibration peaks</td><td>Hz: Vibration frequency<br>dB: Vibration peak value<br>dB: Vibration wave high</td></tr>
</table>
Frequency response measurement of machine (servo)
<table>
<tr><th>Display item</th><th>Details</th><th>Remarks/Unit</th></tr>
<tr><td>Target Sys / Axis</td><td>The part system/axis No.<br>of measuring target</td><td>Part system (1 to)<br>/Axis No. (1 to)</td></tr>
<tr><td>Cross Frequency</td><td>Crossover Frequency</td><td>Hz</td></tr>
<tr><td>Anti Vib. Peaks</td><td>Anti vibration peaks</td><td>Hz, dB</td></tr>
<tr><td>Vib. Peaks</td><td>Vibration peaks</td><td>Hz, dB, dB</td></tr>
<tr><td>Motor Inertia</td><td>Motor inertia</td><td>kgcm2</td></tr>
<tr><td>Load Inertia</td><td>Load inertia</td><td>kgcm2</td></tr>
<tr><td>Inertia Ratio</td><td>Inertia ratio</td><td>%</td></tr>
<tr><td>Cursor</td><td>Coordinate position at the cursor</td><td>Frequency[Hz], Gain[dB], Phase[deg]</td></tr>
</table>
(Note) Only when the cursor is displayed, "Cursor" is displayed.</td></tr>
<tr><td>(3)</td><td>Cursor</td><td>The cursor can be moved per one plot point by keyboard [Left/Right key]. The cursor can be moved per ten plot points by keyboard [Shift key + Left/Right key] or [Up/Down key]. Synchronizing with the movement of the cursor, the cursor coordinates position in test display area is changed.<br>The cursor display/non-display can be switched with the search button of the NC Analyzer menu. After the cursor is changed to non-display, the cursor is set at the left end when the cursor is displayed again.</td></tr>
</table>

**Interpretation of frequency response waveform (Bode diagram)**

Bode diagram consists of a gain diagram and a phase diagram.

A diagram whose horizontal axis is a common logarithm of the frequency and vertical axis is a gain (dB) is called a gain diagram. A diagram whose horizontal axis is a common logarithm of the frequency and vertical axis is a phase is called a phase diagram.

Using the bode diagram, information about resonance frequency, control stability (gain margin, phase margin), crossover frequency (quick response) can be obtained in a batch.




(1) Resonance frequency

Machine resonance occurs when the speed loop gain is increased to improve the control accuracy. The machine resonance is a phenomenon that occurs when the servo's speed loop control acts on the machine's specific frequency (specific resonance frequency), resulting in an increase of vibration. When adjusting the speed loop gain, a notch filter must be set to suppress this machine resonance (vibration).

(2) Gain margin and phase margin

The gain margin is defined by the value in which a negative title was applied to the gain when the delay of the phase gives 180 degrees in the phase curve of the open loop waveform.

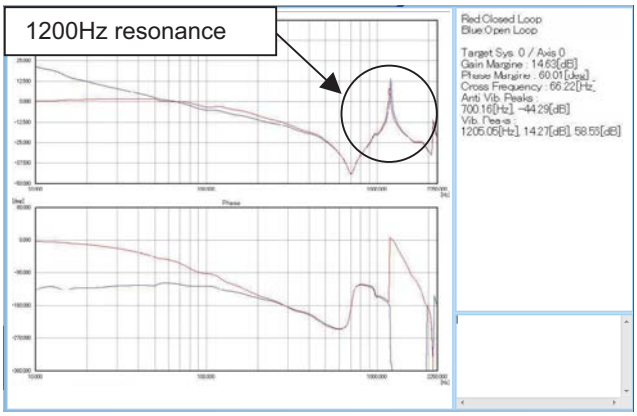
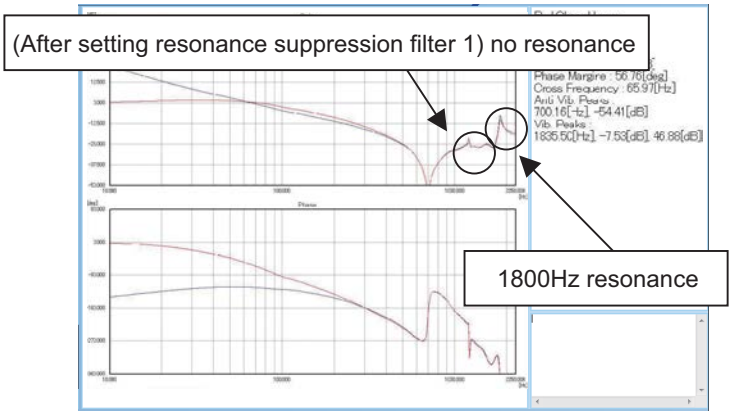
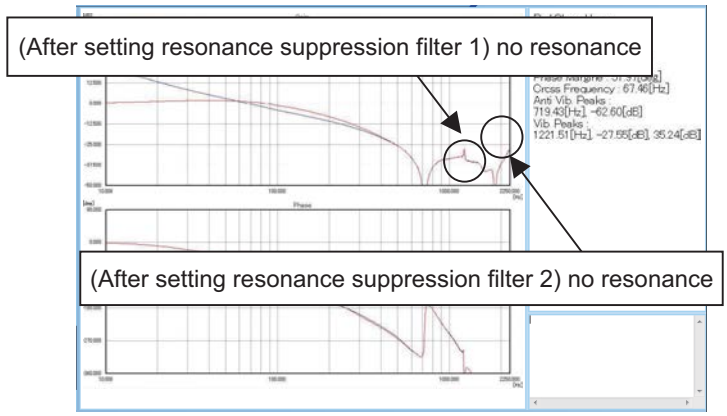
The phase margin is defined by the phase value in which 180 degrees is added to the delay of the phase on crossover frequency. When seeking stability, it is general that the gain margin aims at 8-20dB and the phase margin aims at 40-60 degrees.

(3) Crossover frequency (quick-response)

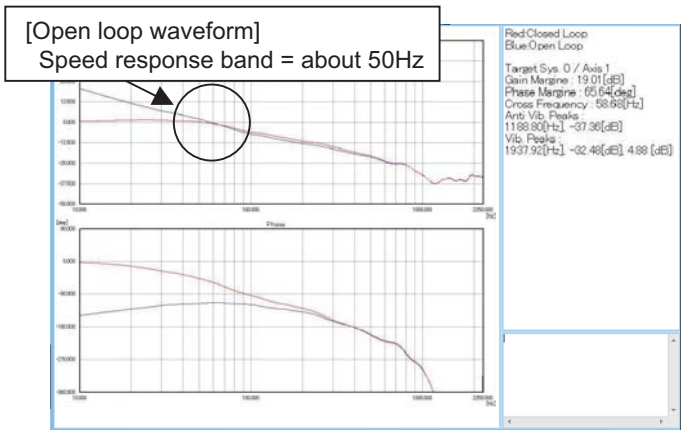
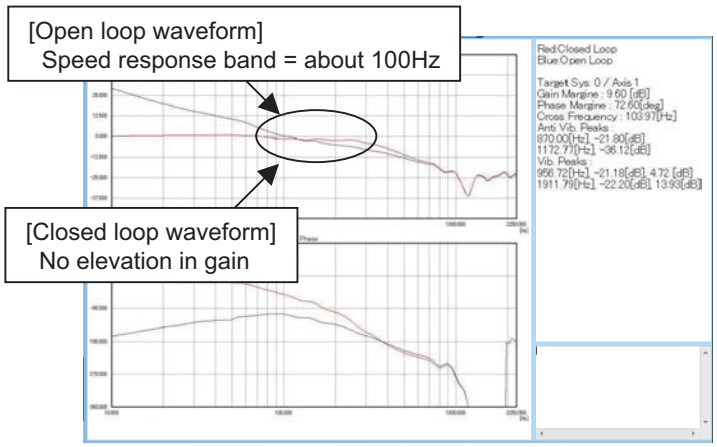
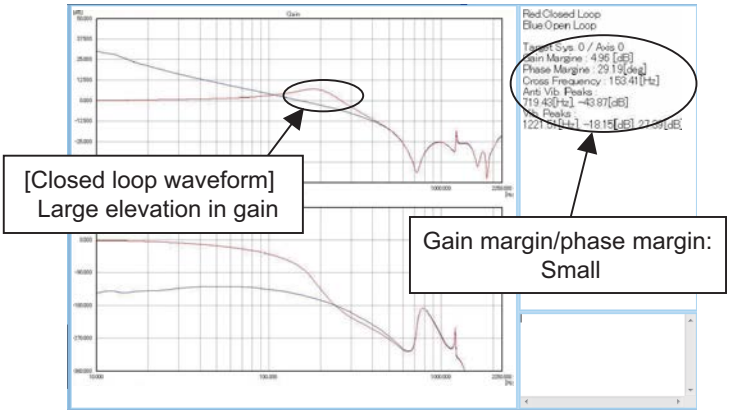
When the frequency response curves downward as shown in the graph above, there must be frequency in which a gain of open loop frequency becomes 0dB. This frequency is called crossover frequency (or speed response band). This value indicates the quick-response of the control system. When the larger the value is, the more excellent a quick-response is.

For the machine tools, 70Hz to 100Hz of crossover frequency is normally considered enough to secure a high-level of quick-response.

**Example of the resonance suppression filter setting**

| Measurement condition | Bode diagram (Example) |
|---|---|
| Resonance<br>Speed gain (VGN1)=100<br>Resonance suppression filter 1 (FHz1)=0<br>Resonance suppression filter 2 (FHz2)=0<br>Filter depth (SSF2)=0000 |  |
| After setting one notch filter<br>Speed gain (VGN1)=100<br>Resonance suppression filter 1<br>(FHz1)=1200<br>Resonance suppression filter 2 (FHz2)=0<br>Filter depth (SSF2)=0000 |  |
| After setting two notch filters<br>Speed gain (VGN1)=100<br>Resonance suppression filter 1<br>(FHz1)=1200<br>Resonance suppression filter 2<br>(FHz2)=1800<br>Filter depth (SSF2)=0040 |  |

**Example of speed gain setting (limit)**

| Measurement condition | Bode diagram (Example) |
|---|---|
| Speed gain Default<br>Speed gain (VGN1)=100<br>Gain margin: about 19 [dB]<br>Phase margin: about 65 [deg] |  |
| Speed gain Appropriate value<br>Speed gain (VGN1)=200<br>Gain margin: about 10 [dB]<br>Phase margin: about 73 [deg] |  |
| Speed gain Excessive<br>(Gain margin/Phase margin:small)<br>Speed gain (VGN1)=300<br>Gain margin: about 5 [dB]<br>Phase margin: about 29 [deg] |  |

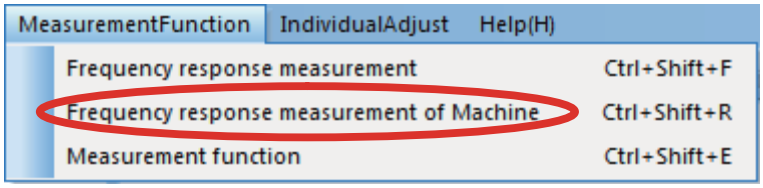
## 3.5.2 Frequency Response Measurement of Machine (Servo)

A random signal is applied to the current command by specified axis and vibration amount, and the frequency characteristic is measured by that data (torque command/speed feedback). The result is displayed by the Bode diagram and the text data.
The traveling commands by G code etc. are not needed.

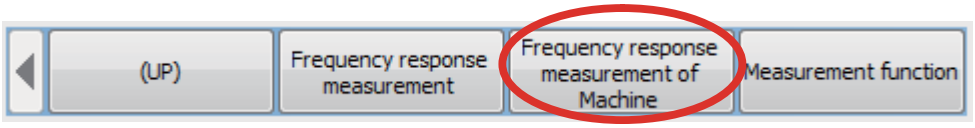
**Frequency response measurement of machine Operating procedure**

(1) Select from the following menu, etc. and display the MeasurementFunction menu.

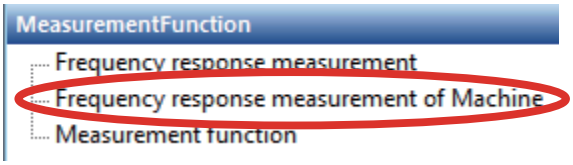
Selection from the menu
Select [MeasurementFunction] - [Frequency response measurement of Machine] from the menu.




Selection from the function bar
Select [MeasurementFunction] - [Frequency response measurement of Machine] from function bar.

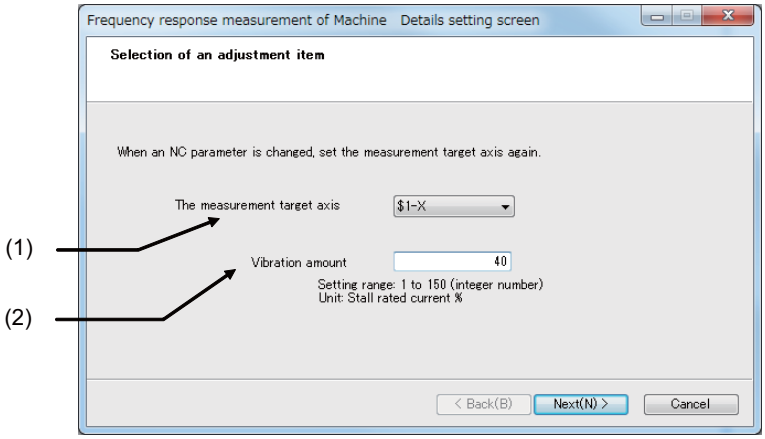



Selection from the navigation window
Select [MeasurementFunction] - [Frequency response measurement of Machine] from navigation window and double-click the item.




Refer to "3.5.1 Frequency Response Measurement (Servo)" for more procedure.

### Frequency response measurement of machine  Configuration of Details setting screen




| Display item | | Details | Default |
|---|---|---|---|
| (1) | The measurement target axis | This selects the target axis for measurement.<br>In the combo box for the measurement target axis selection, the servo NC axes which are set in NC currently connected are displayed.<br>Spindle, spindle/C axis and PLC axis are not displayed. | The 1st part system's first axis set to NC (It is displayed with the format "$1-*" (Note 1).) |
| (2) | Vibration amount | The vibration amount during measurement (vibration) is displayed in vibration display area. | 0 |

(Note 1)  "$1" indicates the 1st part system, and "*" indicates the first axis name.

### Configuration of measurement result display screen (Bode diagram)

Refer to "3.5.1 Frequency Response Measurement (Servo)" for details.

### 3.5.3 Waveform Measurement Function (Program Creation Function)

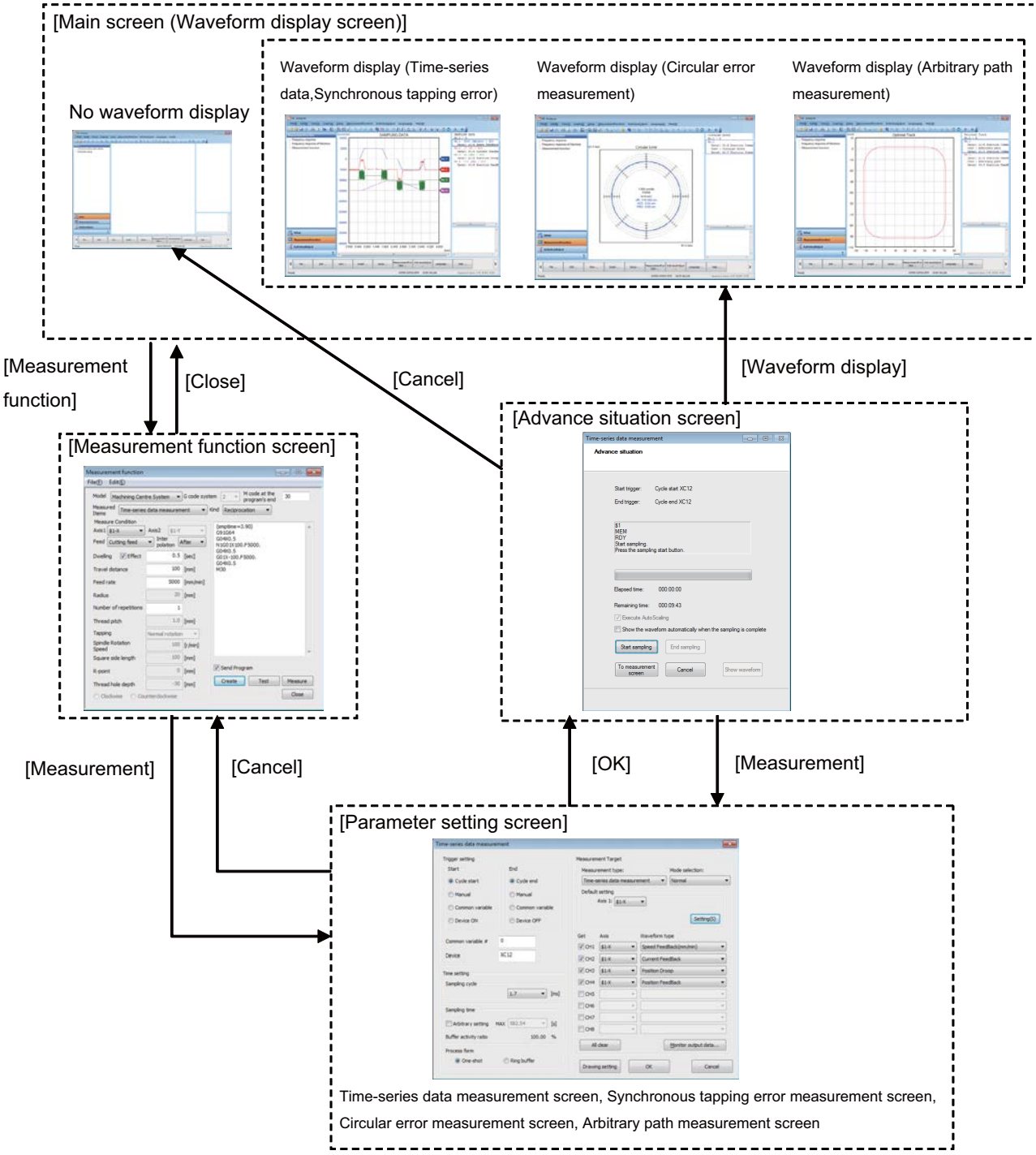
The created measurement program and the sampling conditions of the measurement target function are selected from the measurement function screen, and then an arbitrary program creation/measurement process is executed.

The value of waveform to be drawn is displayed with radius value. It is not affected by the setting for parameter "#1019 dia".

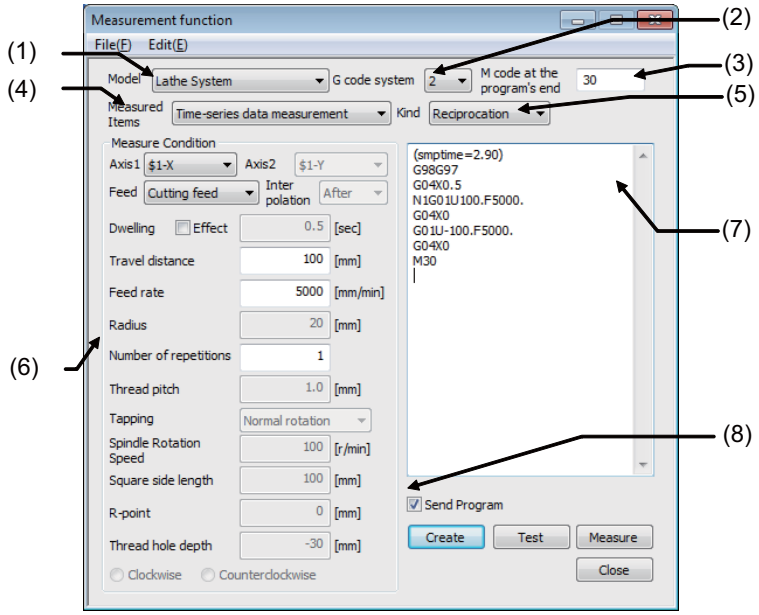
The measurement functions are as follows.

| Function | Details | Setting item | Axis | Measurement data |
|---|---|---|---|---|
| Time-series data measurement | This measures an arbitrary chronological data of current and speed etc. | Sampling condition | 1 to 8 | Either the following:<br>Position command<br>Speed command<br>Current command<br>Position feed back<br>Speed feed back<br>Current feed back<br>Position droop<br>Model Position / Model Error<br>Motor End Position / Load meter /<br>Control input/output |
| Circular error measurement | This measures the circular error. | Sampling condition | 2 | Position command , Motor End Position, and Position FB & Motor End Pos position feed back for both the 1st axis and the 2nd axis |
| Synchronous tapping error measurement | This measures the synchronous error of servo axis (mainly Z axis) and spindle during synchronous tapping measurement. | Sampling condition | 2 | Position command or position feed back for both the servo axis and the spindle |
| Arbitrary path measurement | This displays the path of an arbitrary plane by two axis plane in an arbitrary NC program operation. | Sampling condition | 2 | Position Command&Position FB, Model Position&Position FB, and Motor End Position&Position FB for both the 1st axis and the 2nd axis |

The measurement function screen is shifted as follows.



### Waveform Measurement Function  Configuration of Details setting screen




| Display item | | Details | Default |
|---|---|---|---|
| (1) | Model | This selects "Lathe System" or "Machining Centre System". | Machining Centre System |
| (2) | G code system | This selects the G code system. The setting is valid when "Lathe" is selected. | 2 |
| (3) | M code at the program's end | This sets the M code of the program end. | 30 |
| (4) | Measured Items | This selects the measuring method. | Time-series data measurement |
| (5) | Kind | This selects the kind of the created program. | Reciprocation |

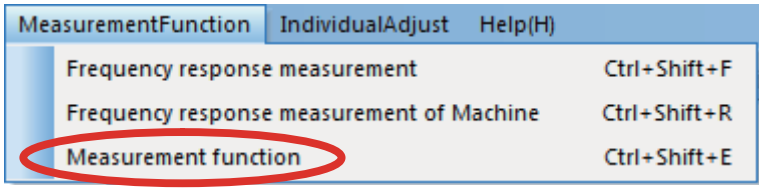
| Display item | | Details | Default |
|---|---|---|---|
| (6) | Measure Condition | | |
| | Axis1 | This selects the axis set to "Axis1".<br>When "Items measured" is "Synchronous tapping error" or "Kind" is "Sync. tapping": Servo axis (not including spindle C)<br>When "Items measured" is other than above and "Kind" is "Reciprocation" : Servo axis (including spindle C), PLC axis, spindle<br>When "Kind" is other than "Reciprocation": Servo axis (not including spindle C) | None |
| | Axis2 | This selects the axis set to "Axis2".<br>When "Items measured" is "Synchronous tapping error" or when "Items measured" is "Time-series data measurement" and "Kind" is "Reciprocation" or "Sync. tapping": Cannot be selected<br>When "Items measured" is "Time-series data measurement" and "Kind" is "Circle" or "Square"<br>or when "Items measured" is "Circular error measurement" or "Arbitrary path measurement": Servo axis (including spindle C) | None<br>(Grayout when Reciproca-tion is selected) |
| | Feed | This selects the feed status. | Cutting feed |
| | Interpolation | This selects the before/after interpolation. | After |
| | Dwelling Effect | This sets the validities of dwell. | Checked |
| | Dwelling value | This sets the dwell. | 0.5 |
| | Travel distance | This sets the traveling distance. | 100 |
| | Feed rate | This sets the feedrate.<br>When the rapid traverse is selected in [Feed], this cannot be input. | 1000 |
| | Radius | This sets a drawn arc radius or a corner radius of arbitrary track. | 20 |
| | Number of repetitions | This sets the repeat count. | 1 |
| | Thread pitch | This sets the screw pitch used when the tap machining. | 1.0 |
| | Spindle Command Polarity | This sets the spindle rotation direction. | Normal rotation |
| | Spindle Rotation Speed | This selects the spindle rotation speed. | 100 |
| | Square side length | This sets the length of one side at square drawing. | 100 |
| | R-point | This sets R point. | 0 |
| | Thread hole depth | This sets the screw hole depth. | -30 |
| | Rotation direction | This sets the rotation direction. | Clockwise |
| (7) | Machining program input area | This displays/inputs the machining program.<br>The value which is displayed in the machining program display area is enabled as the machining program. | - |
| (8) | Send Program | This selects whether to send the program displayed in machining program input area to NC.<br>Operation search is executed after sending the program.<br>The search No. will be "0" after the measurement. | Checked<br>(Sending) |

**Operation method**

(1) Select from the following menu, etc. and display the MeasurementFunction menu.

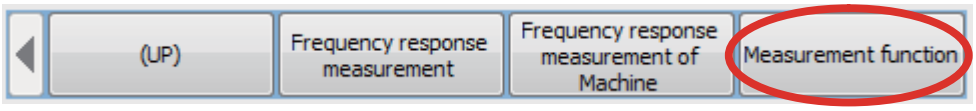
Selection from the menu

Select [MeasurementFunction] - [Measurement function] from the menu.



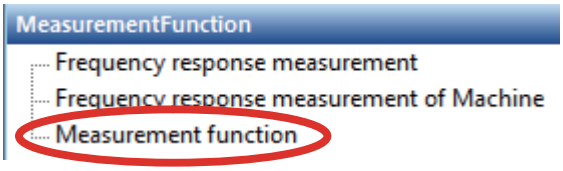

Selection from the function bar

Select [MeasurementFunction] - [Measurement function] from function bar.



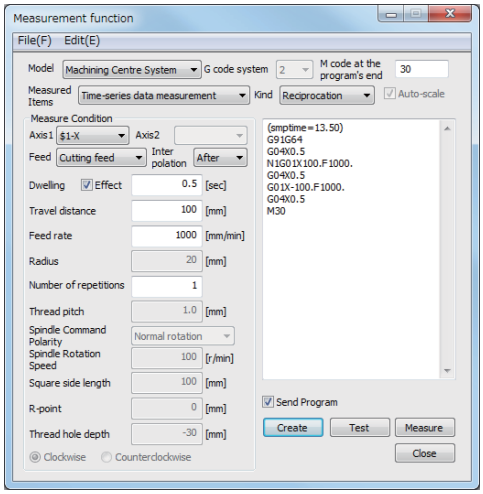

Selection from the navigation window

Select [MeasurementFunction] - [Measurement function] from navigation window and double-click the item.



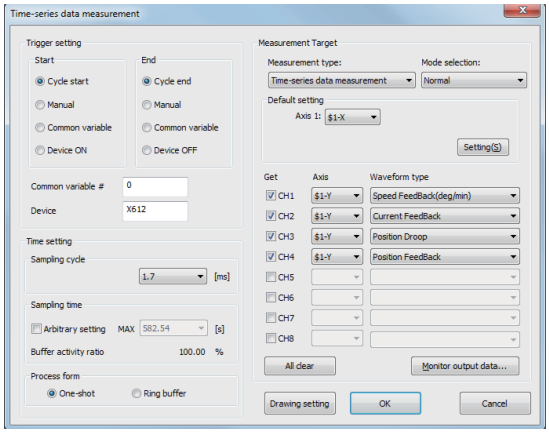

(2) Press the [Create] button.

The created machining program is displayed in the machining program display area.

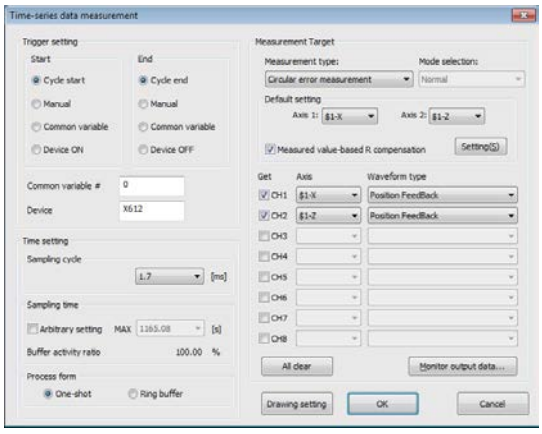



(3) Press the [Measure] button.

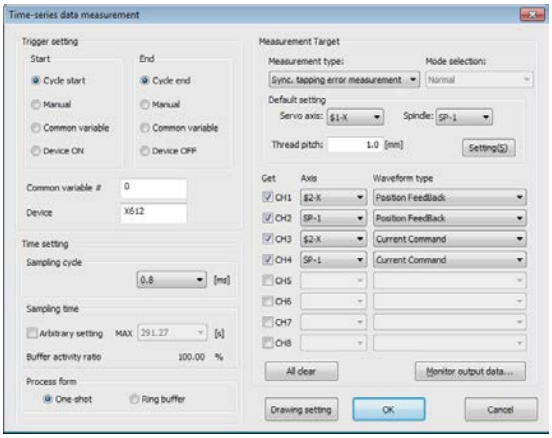
(4) The parameter setting screen of each selected measurement item is displayed.



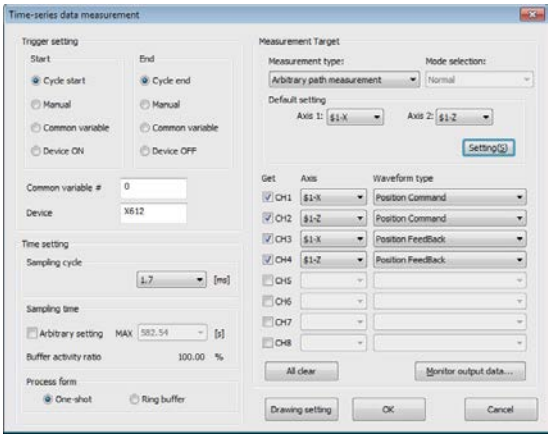

Time-series data measurement




Circular error measurement

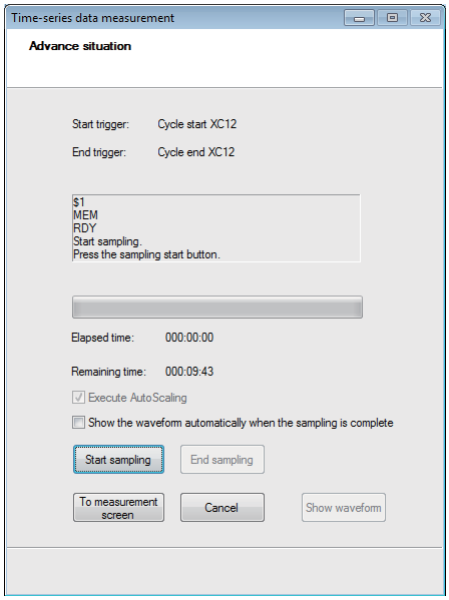



Synchronous tapping error measurement



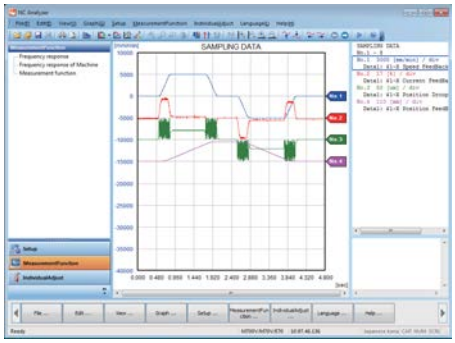

Arbitrary path measurement

(5) Input the value on each screen and press the [OK] button.
Change to the Advance situation display screen.

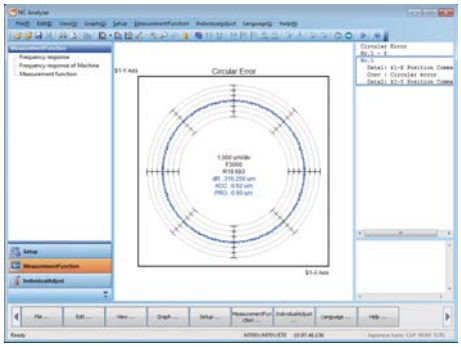



(6) Execute sampling.

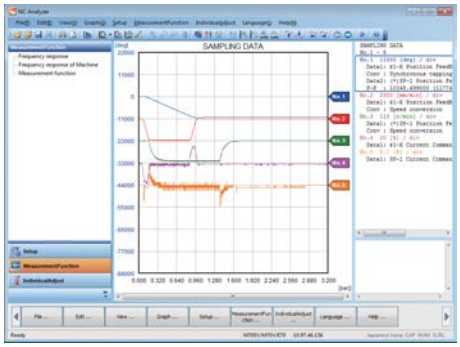
(7) Press the [Show waveform] button when sampling is completed.
The waveform is displayed.



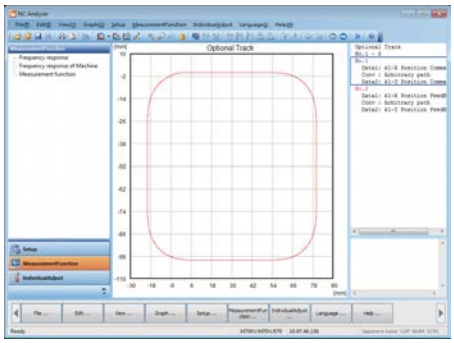
Time-series data measurement



Circular error measurement



Synchronous tapping error measurement



Arbitrary path measurement

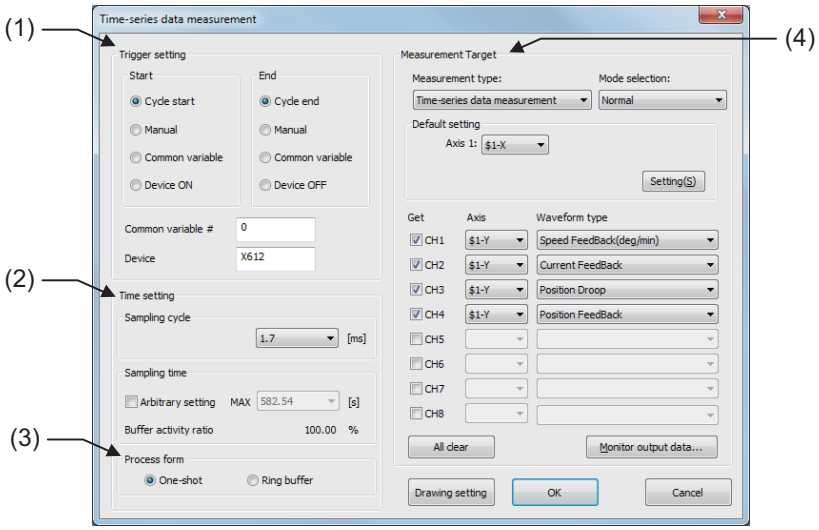
### 3.5.3.1 Time-series Data Measurement

The waveform data (such as a position feed back) can be obtained with specified condition and the waveform display is available.
Up to 8 channel data can be measured (sampling).
Based on that data, difference can be obtained and it is possible to convert into speed and acceleration rate from a positional information.

**List of measurement function**

| Items | Specification |
|---|---|
| Axis available to obtain | Servo axis (Note 1), PLC axis (No.1), spindle (Note 2) |
| Data available to obtain | Position cmmand (mm), position feedback (mm), position droop (µm),<br>model position (mm), model error (µm), motor end position (mm),<br>current command (Stall current %), current feedback (Stall current %),<br>Load meter (%), speed command (mm/min or r/min) and<br>speed feedback (mm/min or r/min)<br>Monitor output data<br>[Supplement] Monitor output data is an obtainable form of D/A data which is output from the drive unit. |
| Signal available to obtain | Control input 1 to 6, control output 1 to 6<br>PLC Signal (PLC(bit)/PLC(1word)/PLC(2word)) |
| Number of channels available to obtain | 8 channels |
| Sampling cycle | M700V/M70V/M700/M70/E70 Series: 1.7ms × n (n=1 to 255)<br>C70: 0.8ms × n or 1.7ms × n (n=1 to 255)<br>0.8ms or 1.7ms is automatically switched depending on the number of part systems or number of axes. |
| Number of measurements | Up to 1310720.<br>The number of measurement per channel is "1310720/(the number of obtained channel)" |
| Measurement start condition | Cycle start/Manual/Common variable/Device ON |
| Measurement end condition | Cycle end/Manual/Common variable/Device OFF |

### 3.5.3.1.1 Configuration of Time-series Data Measurement Screen



(1) Trigger setting

| Setting item | Contents | Setting range | Default value<br>(a) Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|---|
| Start | Select a start trigger for the measurement. | Cycle start<br>Manual<br>Common variable<br>Device ON | (a) Cycle start<br>(b) A value previously set |
| End | Select a end trigger for the measurement.<br>Measurement will finish when the conditions of end trigger are met or the buffer is full. | Cycle end<br>Manual<br>Common variable<br>Device OFF | (a) Cycle end<br>(b) A value previously set |

| Settings | Input required item |
|---|---|
| Cycle start | Detect the start (or end) of automatic operation, and start (or end) the measurement.<br>- If it is selected, the device value will become equivalent to the operation signal (OP1) of 1st part system.<br>- A device to designate the cycle start or cycle end is a signal which is allocated to CNC’s PLC -> NC interface.<br>For multi-part system, designate the cycle start or cycle end to the signal of part system to execute the sampling operation.<br>- Keep in mind that if the cycle start or end is selected again after setting the device value, it will return to the original value.<br>- If one of the triggers is changed to the cycle (start/end), other trigger will become the cycle (end/start). If it is changed to the condition other than the operation from that state, the other will be changed to the equivalent level.<br>EX. If either of Start or End trigger is changed to Cycle start/end, the another one changes to Cycle start/end. From that state, if either one is changed to other condition, the another will change to the corresponding condition.<br>if the end condition is changed to "Cycle end", the stat condition becomes "Cycle start". Then if the start condition is changed to "Device ON", the end condition becomes "Device OFF". |
| Cycle end | |
| Manual | At the start: If [Start sampling] button is pressed in the advance situation display screen, the measurement begins.<br>At the end: If [End sampling] button is pressed in the advance situation display screen, the measurement ends. |
| Common variable | At the start: Operation will start when the value other than "0" (or empty) is set by the machining program to the variable set in the "Common variable #" box.<br>At the end: Operation will end when "0" (or empty) is set by the machining program to the variable set in the "Common variable #" box.<br>- The common variable trigger is enabled when it is rewritten by the machining program during the automatic operation startup. If it is rewritten either by the screen or the PLC program, it will not be recognized as a trigger.<br>- Common variable is a floating point type. If the operation result is used, it may not be recognized as "0" because of error.<br>- For multi-part system, the start trigger becomes ON if even one of the part systems meets the conditions.<br>- If either trigger is changed to Common variable, another trigger also becomes common variable. And if it is changed to other than common variable from that state, another trigger will be changed to the corresponding condition.<br>EX. When the start condition is "Cycle start" or the end condition is "Cycle end":<br>If the end condition is changed to "Common variable", the start condition is also changed to "Common variable". Then the start condition is changed to "Device ON", the end condition is also changed to "Device OFF". |
| Device ON | The measurement starts when the signal which is set with device is ON. |
| Device OFF | The measurement ends when the signal which is set with device is OFF |

| Setting | Contents | Condition for setting | Setting range | Default value |
|---|---|---|---|---|
| Common variable # | Set the common variable No. to become "start/end" trigger.<br>0: System variable (#1299)<br>Other than 0: Specified common variable (from #100, from #500)<br>An error will occur if the common variable does not exist in the system even within the setting range. | "Common variable" is selected either by trigger "Start" or "End". | 0 to 999 | (a) 0<br>(b) A value previously set |
| Device | Set the device to become "start/end" trigger.<br>0: Sampling start/stop signal (M700V/M70V/M700/M70/E70 series: Y72C, C70 series: Y321)<br>Other than 0: Specified device.<br>If "*" added at the head of the device name, ON/OFF for the device will be switched. | "PLC device" is selected either by trigger "Start" or "End". | [M700V/M70V/M700/M70/E70 series]<br>(*) X0 to X1FFF,<br>(*) Y0 to Y1FFF,<br>[C70 series]<br>(*) X0 to XAFF,<br>(*) Y0 to YE7F,<br>(*) B0 to B1FFF | (a) Operation signal (OP1) for the machine (Because the start trigger is Cycle start)<br>(b) A value previously set |

(2) Time setting

| Setting item | Details | Default value<br>(a) Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|
| Sampling cycle | Set the cycle to perform sampling.<br>M700V/M70V/M700/M70/E70 Series: 1.7ms × n (n=1 to 255)<br>C70: 0.8ms × n or 1.7ms × n (n=1 to 255)<br>0.8ms or 1.7ms is automatically switched depending on the number of part systems or number of axes.<br>For Monitor output data, the measurement in 0.8ms cycles is available.<br>For high-cycle sampling mode, it is fixed to 0.2ms. | (a) 1.7ms<br>(b) A value previously set |
| Arbitrarily setting | - When it is ON, the sampling time can be set.<br>- When it is OFF, the sampling time cannot be set.<br>The value is set to become the maximum sampling time (buffer activity ration 100%) | (a) Deselected<br>(b) A value previously set |
| MAX | Set the maximum duration of sampling time and display it.<br>- Select the value from the pulldown menu. The values for selection depend on the "sampling cycle" and "the number of measurement target channels".<br>Sampling time [s] = ((Sampling cycle [ms]) / 1000) * (((n+1) * 1024) / (the number of obtained channels)))<br>The n value for M700V/M70V/M700/C70/E70 is 0 to 1279, and 0 to 639 for M70.<br>The sampling time is displayed two places of decimal. (It is rounded off to two decimal places.)<br>EX. When the sampling cycle 1.7 ms and the number of obtained channels is 8, the values in the pulldown menus are ;<br>0.27s, 0.45s, ... 145.63s ... 291.27s.<br>When n=0:<br>(1.7777 / 1000) * {(0 + 1) * 1024 / 8} = 0.227[s]<br>When n= 1:<br>(1.7777 / 1000) * {(1 + 1) * 1024 / 8} = 0.455[s]<br>:<br>When n=639:<br>(1.7777 / 1000) * {(639 + 1) * 1024 / 8} = 145.635[s]<br>:<br>When n=1279:<br>(1.7777 / 1000) * {(1279 + 1) * 1024 / 8} = 291.271[s]<br>- The value will be updated when the sampling channel or the number of obtained channels is changed.<br>- When the number of obtained channels is 0, the sampling time is 0.00[s]. | (a) The value for n = MAX<br>When the sampling cycle is 1.7ms, it's 291.27s.<br>(b) A value previously set. |
| Buffer activity ratio | It displays the buffer activity ratio.<br>- The higher the value is, the longer time is needed to draw the waveform.<br>- The ratio is obtained from the sampling time setting value:<br>(n + 1) / 640 [the sampling time setting value n = 0 to 639] (M70)<br>(n + 1) / 1280 [the sampling time setting value n = 0 to 1279] (M700V/M70V/M700/C70/E70)<br>- The ratio is displayed two places of decimal. (It is rounded off to two decimal places.) | - |

(3) Process form

| Setting item | Details | Default value<br>(a) Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|
| One-shot | Sampling will finish when it reaches the set sampling time even without the end trigger. | (a) One-shot<br>(b) A value previously set |
| Ring buffer | Sampling will continue until the sampling trigger is entered.<br>When it reaches the set sampling time, the sampling will continue by deleting the oldest data.<br>Therefore, the data to be obtained represents the data which was sampled until before the end trigger is entered.<br>If it is selected, the progress bar and "Remaining time" on the Advance situation screen will not be displayed | (a) One-shot<br>(b) A value previously set |

(4) Measurement target

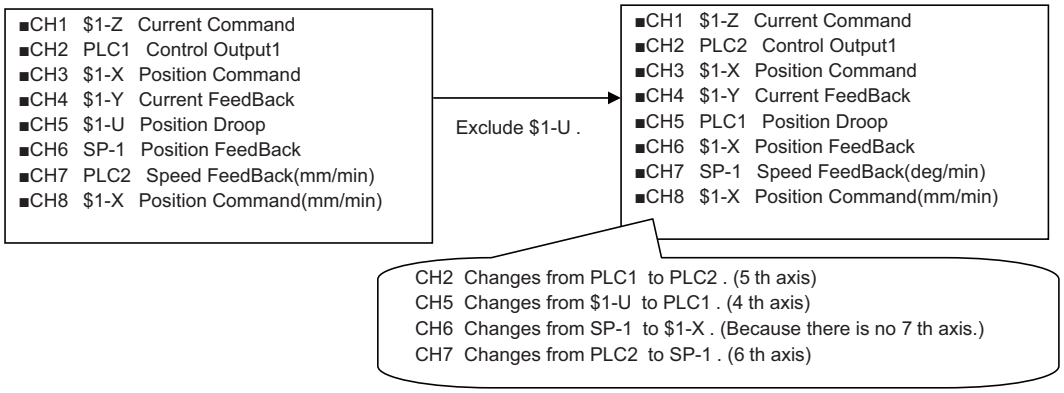
| Setting | Contents | Setting range | Default value<br>(a) Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|---|
| Measurement type | Select the measurement type to measure. Select "Time-series data measurement" when executing the time-series data measurement. | 1: Time-series data measurement<br>2: Circular error measurement<br>3: Sync. tapping error measurement<br>4: Arbitrary path measurement<br>The measuring method which has been selected for "Items measured" in measuring function screen is initially selected. | (a) The measuring method which has been selected for "Items measured"<br>(b) A value previously set |
| Mode selection | Select the mode to measure. | 1: Normal (default)<br>2: High-cycle sampling<br>Enabled only when"Time-series data measurement" is selected for measurement type. Otherwise it is disabled and always "Normal" is selected.<br>Normal: Execute the normal time-series data measurement and Monitor output measurement.<br>High-cycle sampling: Execute the time-series data measurement with high-cycle sampling. | (a) Normal<br>(b) A value previously set |
| Default setting Axis 1 | Select the default setting of the axis to be measured. | Connected servo axis , PLC axis and spindle | (a) The axis set in [Axis 1] on the measurement function screen<br>(b) A value previously set |
| Check box for "GET" | Select whether to measure the set content. | Checked (to measure)<br>Unchecked (not to measure)<br>- "Axis" and "Waveform type" will be grayed out and cannot be changed if it is deselected.<br>- When it is selected, gray out will be cleared and "Axis" and "Waveform type" can be changed. | (a)<br>1st to 4th channel : ON<br>5th to 8th channel : OFF<br>(b) A value previously set |
| Axis | Set the target axis to get | Blank<br>Connected servo axis , PLC axis and spindle<br>(The axis which is set as spindle C can also be selected.)<br>(Note 4)<br>PLC signal (PLC(bit)/PLC(1word)/PLC(2word)) | (a) Servo 1st part system 1st axis<br>(b) A value previously set |
| Waveform type | Set the waveform type to get<br><br>The waveform data displayed in the combo box of waveform type switches depending on the selected measurement type and mode.<br>The control switches from the combo box to edit box only when PLC signal is selected for axis. | Refer to "3.5.3.1.2 PLC Signal Data Measurement" or "3.5.3.1.3 Waveform Type List" for details. | (a)<br>1st to 4th channel:<br>Speed feed back<br>Current feed back<br>Position droop<br>Position feed back<br>5th to 8th channel:<br>Gray out<br>(b) A value previously set |

| Setting | Contents | Setting range | Default value (a) Startup at first time (b)Startup at second and subsequent |
|---|---|---|---|
| All clear | Display the confirmation window. When [OK] button is pressed in confirmation window, the window will be closed and the setting contents for all channels are cleared. "GET" checkbox will be unchecked and "Axis" and "Saveform type" will be blank. At the same time, the storing process for the measurement target is executed. The window is closed by pressing [Cancel] button in the confirmation window. | - | - |
| Monitor output setting button | Displays Monitor output setting screen. Enabled only when selecting "Monitor output" for mode selection (Refer to "Monitor output setting screen" for details). | - | - |

(Note 1) Display unit for speed (mm/min) differs according to the axis type. When the axis type is not selected, the unit for a linear axis is displayed. Unit type for the waveform type changes when switching between linear axis and rotary axis.
The display unit system of mm and inch will also be switched by I_inch parameter (#1041).

(Note 2) The set axis names may differ, when the axis configuration differs as the connection destination CNC is different. This is because the axis information is controlled with the axis No. of servo, PLC, and spindle, starting from No.1. If there is no corresponding axis, it will be changed to the 1st servo axis. Note that the waveform type does not change.

EX: The servo 4th axis($1-U) is detached and NC Analyzer is restarted, when the axes are configured with 4 servo axes ($1-X, $1-Y, $1-Z and $1-U), 2 PLC axes (PLC1, PLC2) and 1 spindle (SP-1) and the measurement target setting is as follows.



(Note 3) The following combination of the waveform type cannot be set for the same axis. An error message will appear if one of the following combinations is selected and [OK] button is pressed.
It cannot be measured in the following combination since a spindle C axis (a spindle which carries out a contour control of the NC axis (C axis) (#1020 sp_ax=1)) is handled as a spindle.
Example) $1-C Position command
SP-1 Current command

**Waveform type combination that can be used**

| Axis type | Combination that can be used |
|---|---|
| Servo axis, PLC axis | -"Speed Command" and "Current Command"<br>-"Model Position" and "Model Error" |
| Spindle | -"Speed Command" and "Current Command"<br>-"Speed Command" and "Current FB"<br>-"Current Command" and "Current FB"<br>-"Model Position" and "Model Error" |

If the measurement target is changed, "drawing setting screen" will be affected.
When the measurement target is changed (check box for "GET", Axis, Waveform type), and [OK] or [Drawing setting] button is pressed, all the setting of "Drawing setting screen" and "Axis setting screen" will return to the default value.

Setting example

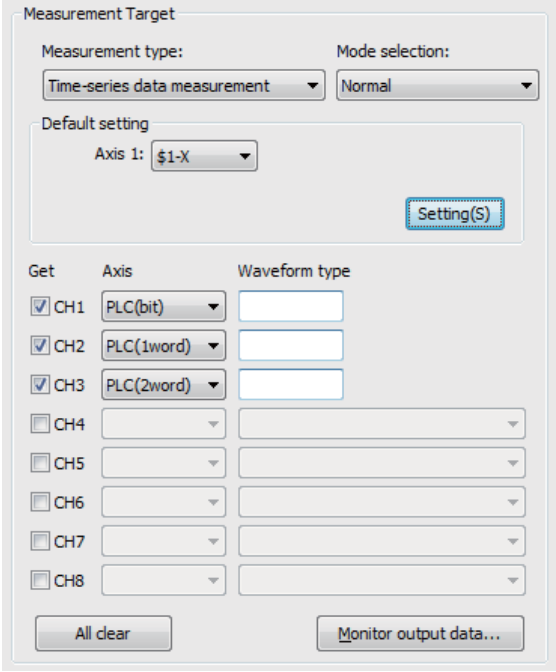
Setting example 1: Select Speed feed back (mm/min) for the servo 1st part system 1st axis ($1-X) as an axis data in channel 1.
1) Select [$1-X] from the axis combo box of channel 1.
2) Select "Speed FeedBack (mm/min)" from the waveform type combo box of channel 1.

Setting example 2: Select "During in-position" (INP) for the servo 1st part system 1st axis ($1-X) as a control signal in channel 5.
1) Select [$1-X] from the axis combo box in channel 5.
2) Select "Control output 1" from the waveform type combo box of channel 5. (Because "During in-position" is control output 1 bitC.)

(Note 4) Spindle C axis function is an option for C70 and M700V/M700. It is the standard specification for M70V/M70 and E70. The axis which is set can be selected as either the servo or spindle.

### 3.5.3.1.2 PLC Signal Data Measurement

PLC signal data can be set only when PLC signal is selected on the "axis" combo box in the measurement target setting area. The control of the waveform type switches from the combo box to edit box.
Up to 1-bit unit for bit device and 1-word or 2-word unit for word device can be specified.




Measurement target setting area (When PLC signal is selected)

| | Item | Contents | Setting range |
|---|---|---|---|
| (1) | Axis Combo box | Set the PLC signal to get. | PLC(bit), PLC(1word), PLC(2word)<br><br>PLC(bit): Set the bit device by 1 bit.<br>PLC(1word): Set the word device by 1 word.<br>PLC(2word): Set the word device by 2 word. |
| (2) | Device input Edit box | Input the device to get.<br>Nothing is displayed at default. | Bit device, word device<br>Input the device in "device name + device number" format. |

<The device which can be selected for M700/M70>

If other devices are set, or an odd-numbered device is set while multiple word is specified, an error message is displayed and cannot be set.

The device numbers for device X,Y,SB,SW,B,and W are described in hexadecimal and others are in decimal.

The device which can be specified when a bit device or word device is selected is shown in the row of "PLC signal type" of the following table.

| Device (Note 1) | Device range | Unit | PLC signal type |
|---|---|---|---|
| X | X0 to X1FFF | 1-bit | [Bit device]<br>-PLC(bit) |
| Y | Y0 to Y1FFF | 1-bit | |
| M | M0 to M10239 | 1-bit | |
| F | F0 to F1023 | 1-bit | |
| L | L0 to L511 | 1-bit | |
| SM | SM0 to SM1023 | 1-bit | |
| SB | SB0 to SB1FF | 1-bit | |
| SW | SW0 to SW1FF | 16-bit | [Word device]<br>-PLC(1word)<br>-PLC(2word) |
| T (Note 2) | T0 to T703 | 1-bit | [Bit device]<br>-PLC(bit) |
| ST (Note 2) | ST0 to ST63 | 1-bit | |
| C (Note 2) | C0 to C255 | 1-bit | |
| D | D0 to D2047 | 16-bit | [Word device]<br>-PLC(1word)<br>-PLC(2word) |
| R | R0 to R32767 | 16-bit | |
| B | B0 to B1FFF | 1-bit | [Bit device]<br>-PLC(bit) |
| V | V0 to V255 | 1-bit | |
| SD | SD0 to SD1023 | 16-bit | [Word device]<br>-PLC(1word)<br>-PLC(2word) |
| W | W0 to W1FFF | 16-bit | |

(Note 1) The device to be handled can be specified by NC side.

(Note 2) Output contact, setting value, and current value can also be obtained for T,ST,and C device.
The size specification is not required for the following devices.
Method of device specification and settings are shown in the following table.

| Device range | Unit | Contents |
|---|---|---|
| 1000 + Device No. | 1-bit | Output contact |
| 2000 + Device No. | 16-bit | Setting value |
| 3000 + Device No. | 16-bit | Current value |

Ex) - To obtain the output contact of T703: Specify T1703
- To obtain the setting value of C55 : Specify C2055
- To obtain the current value of ST1 : Specify ST3001

<The device which can be selected for C70>

If other devices are set, or an odd-numbered device is set while multiple word is specified, an error message is displayed and cannot be set.

The device numbers for device X,Y,SB,B,SW,and W are described in hexadecimal and others are in decimal.

The device which can be specified when a bit device or word device is selected is shown in the row of "PLC signal type" of the following table.

| Device (Note 1) | Device range | Unit | PLC signal type |
|---|---|---|---|
| X | X0 to XAFF | 1-bit | [Bit device]<br>-PLC(bit) |
| Y | Y0 to YE7F | 1-bit | |
| M | M0 to M8191 | 1-bit | |
| L | L0 to L255 | 1-bit | |
| F | F0 to F127 | 1-bit | |
| SM (Note 2) | SM0 to SM127 | 1-bit | |
| SB (Note 2) | SB0 to SB1FF | 1-bit | |
| B | B0 to B1FFF | 1-bit | |
| T | T0 to T255 | 1-bit | |
| | T1000 to T1255 | 1-bit | |
| | T2000 to T2255 | 16-bit | [Word device]<br>-PLC(1word)<br>-PLC(2word) |
| | T3000 to T3255 | 16-bit | |
| | T4000 to T4255 | 16-bit | |
| C | C0 to C127 | 1-bit | [Bit device]<br>-PLC(bit) |
| | C1000 to C1127 | 1-bit | |
| | C2000 to C2127 | 16-bit | [Word device]<br>-PLC(1word)<br>-PLC(2word) |
| | C3000 to C3127 | 16-bit | |
| | C4000 to C4127 | 16-bit | |
| SD (Note 2) | SD0 to SD2047 | 16-bit | |
| SW (Note 2) | SW0 to SW1FF | 16-bit | |
| D | D0 to D8191 | 16-bit | |
| R | R0 to R9215 | 16-bit | |
| ZR | ZR50000 to ZR52399 | 16-bit | |
| W | W0 to W1FFF | 16-bit | |
| Z | Z0 to Z15 | 16-bit | |

(Note 1) The device to be handled can be specified by NC side.

(Note 2) The following description can be used for setting the following device.

SM device -> E, N

SB device -> O

SD device -> P

SW device -> Q

### 3.5.3.1.3 Waveform Type List

The waveform types which can be selected on the waveform type combo box are listed below.

| Waveform type | Time-series data measurement, Synchronous tapping error measurement, Circular error measurement, Arbitrary path measurement | |
|---|---|---|
| **Mode** | **Normal (Note 5)** | **High-cycle sampling (Note 6)** |
| No.1 | Position command (mm) | q axis current command (Stall current %) |
| No.2 | Position feed back (mm) | d axis current command (Stall current %) |
| No.3 | Position droop (μm) | q axis current FB (Stall current %) |
| No.4 | Model position (mm) | d axis current FB (Stall current %) |
| No.5 | Model error (μm) | Speed command (mm/min) (Note 1) |
| No.6 | Motor end position (mm) | Speed command(r/min) |
| No.7 | Speed command(mm/min) (Note 1) | Speed feed back (mm/min) (Note 1) |
| No.8 | Speed command(r/min) | Speed feed back (r/min) |
| No.9 | Speed feed back (mm/min) (Note 1) | Speed error (mm/min) (Note 1) |
| No.10 | Speed feed back(r/min) | Speed error(r/min) |
| No.11 | Current command (Stall current %) | Command position(mm) |
| No.12 | Current feed back (Stall current %) | FB position |
| No.13 | Load meter (%) | Position droop(μm) |
| No.14 | Control input 1 to 6 (Note 2) | Droop error |
| No.15 | Control output 1 to 6 (Note 2) | - |
| No.16 | MON1 (Note 3, 4, 5) | - |
| No.17 | MON2 (Note 3, 4, 5) | - |

(Note 1) Display unit for speed (mm/min) differs according to the axis type. When the axis type is not selected, the unit for a linear axis is displayed. Unit type for the waveform type changes when switching between linear axis and rotary axis.
The display unit system of mm and inch will also be switched by I_inch parameter (#1041).

(Note 2) When the control input/output is selected, which bit to be displayed in a drawing setting window needs to be set. bitC is set as a default.

(Note 3) MON1 and MON2 (Monitor output data) are displayed with data number and output magnification which have been
currently set by the NC parameters.
(Example) Display when setting 1 for DA1NO and 100 for DA1MPY of servo parameters
-> "MON1 (1:100)"

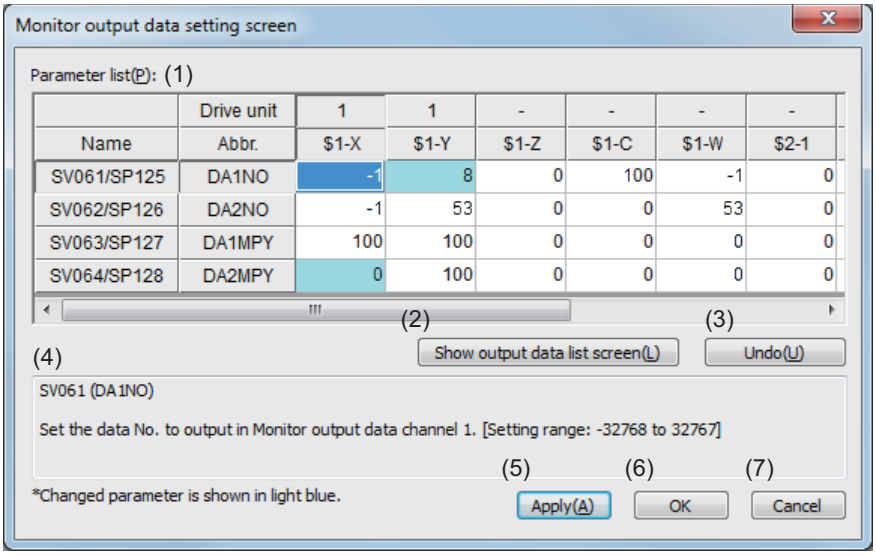
(Note 4) MON1 and MON2 (Monitor output data) are displayed in the unit of [V].

(Note 5) When selecting the sampling cycle of 0.8 for the NC which does not support the cycle of 0.8, the waveforms No.1 to No.15 (except for MON1 and MON2) will not be displayed. To select other waveform types, change the sampling cycle to 1.7 or more.

(Note 6) High-cycle sampling can be selected only for the time-series data measurement. The mode selection for the measurements other than the time-series data measurement is "Normal" and grayed out.

### 3.5.3.1.4 Monitor Output Data Setting Screen

The parameters for Monitor output data are set.



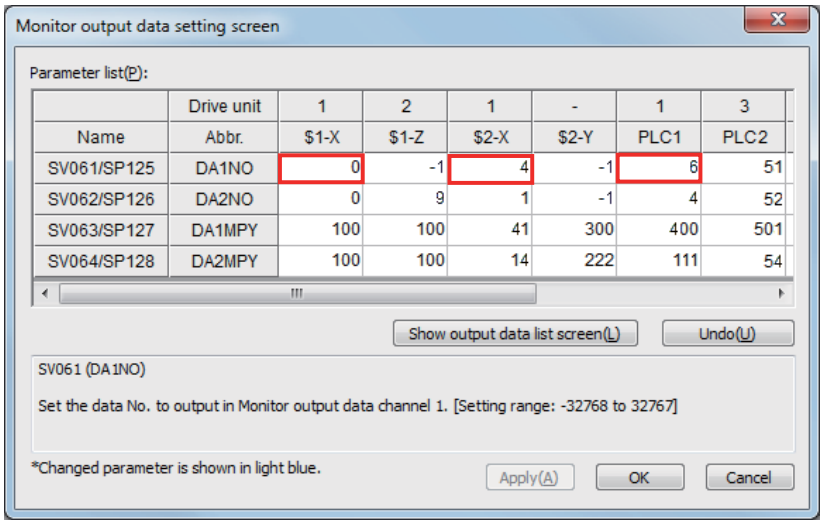

| Display item | Details |
|---|---|
| (1) Parameter list | Sets the parameters for Monitor output data.<br>Displays the current NC parameters read at the screen activation.<br><br>Displays the parameter setting field for each axis which is set with NC. Horizontal scroll bar will appear when the axes cannot be displayed on one screen.<br><br>Drive unit: Displays the index No. of the drive unit which is connected to the axis. The same number is used for the axes connected to the same drive unit. Displays "-" for the axis to which drive unit is not connected.<br><br>Line of Abbr. DA1NO: Sets the output data number of Monitor output data channel 1.<br>Line of Abbr. DA2NO: Sets the output data number of Monitor output data channel 2.<br>Line of Abbr. DA1MPY: Sets the output magnification of Monitor output data channel 1.<br>Line of Abbr. DA2MPY: Sets the output magnification of Monitor output data channel 2.<br><br>The parameter setting range is from -32768 to 32767. When a value outside of the setting range is input, an error message will appear and the value will return to the one before the input.<br>When the input value differs from the original value, it will be shown in light blue. |
| (2) Show output data list screen | Displays the Monitor output data list screen br clicking the button.<br>(Refer to "Monitor output data list screen") |
| (3) Undo | Return all the changed values (shown in light blue) to the original values.<br>The parameter will not be sent to NC. |
| (4) Help display area | Displays the help corresponding to the parameter in the selected cell.<br><br>Displays the parameter name and abbreviation at the beginning.<br><br><When selecting the cell in the line of DA1NO,DA2NO><br>"Set the data No. to output in Monitor output data channel n.<br>[Setting range：-32768 to 32767]" (n:Monitor output data channel No.)<br><br>< When selecting the cell in the line of DA1MPY,DA2MPY ><br>"Set the output scale of Monitor output data channel n with increment of 1/100.<br>When 0 is set, the scale is the same as when 100 is set.<br>[Setting range：-32768 to 32767]" (n: Monitor output data channel No.) |
| (5) Apply | Writes only changed parameters in the parameter list to the NC. |
| (6) OK | Writes only changed parameters in the parameter list to the NC.<br>Closes the screen after writing. |
| (7) Cancel | Closes the screen without sending the parameter to NC. |

**<-1 autosetting function of multi axis drive unit>**

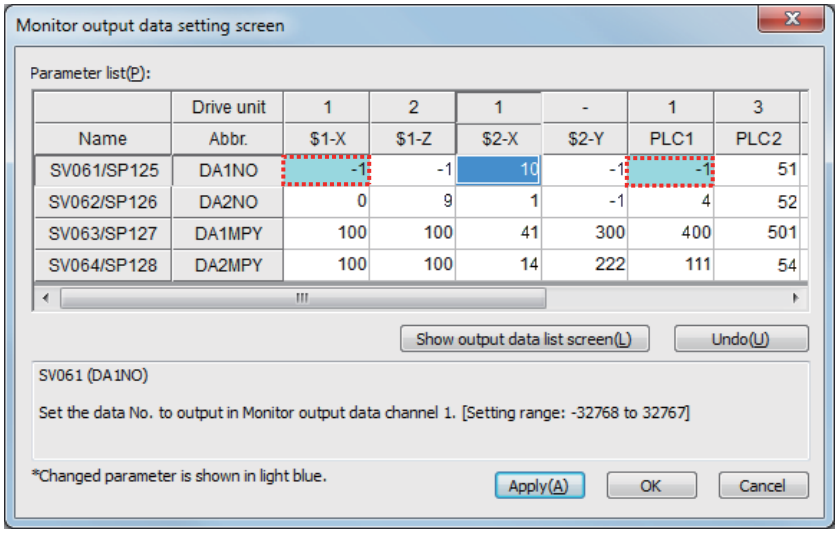
For example, when the value is changed by inputting a value other than -1 in the cell of DA1NO or DA2NO for an axis connected to the MDS-DM-SPVx drive unit, -1 is automatically set to the cell of DA1NO or DA2NO for the other axes connected to the same drive unit.

[Example] Condition: When the drive unit for $1-X, $2-X, and PLC1 is the same one

(1) The parameters before change are $1-X (0), $2-X (4), and PLC1(6). Input 10 to DA1NO of $2-X in this status.

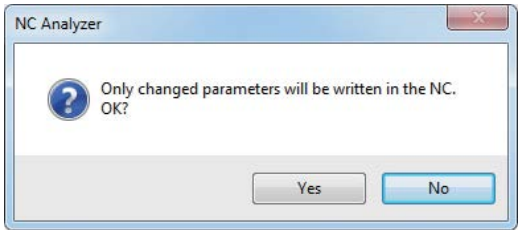



(2) -1 is automatically set to the cell of DA1NO for $1-X and PLC1.



**<Write confirmation message>**

When clicking the "Apply" or "OK" button, the following confirmation message is displayed. When selecting "Yes (Y)" on the confirmation message window, the parameters will be written in the NC. If selecting "No (N)", the parameters will not be written.




**<Error process>**

| Condition | Error message |
|---|---|
| An error occurred in communicating with NC when clicking the "Apply" or "OK" button. | E001 Connect NC Failed. |
| A value outside the setting range is input in a parameter. | Illegal or no data are set in parameter. Set an appropriate value (-32768 to 32767). |

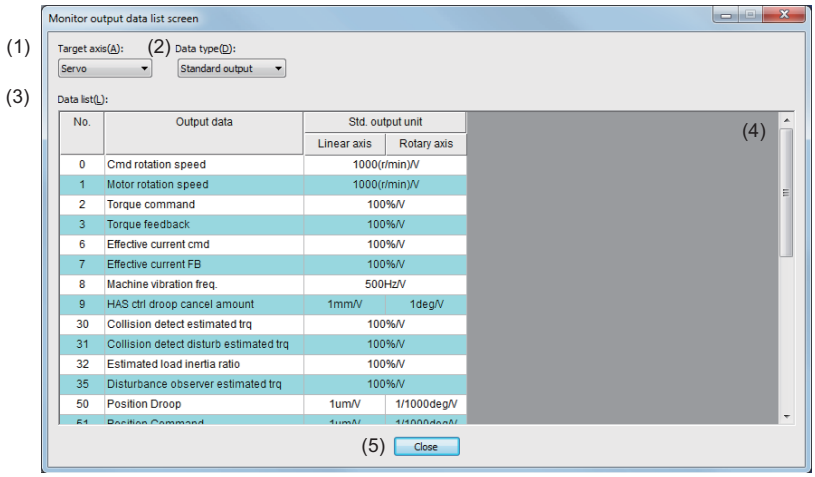
**<Handling of spindle C axis>**

The axis which is set as spindle C is displayed in gray and cannot be entered into the setting field.

The setting for a spindle C should be set to the spindle for which the spindle C is set.

### 3.5.3.1.5 Monitor Output Data List Screen

The registered data for Monitor output is displayed as a list.




| Display item | Details |
|---|---|
| (1) Axis selection combo box | Selects the axis type for output data list to display.<br><br>1: Servo axis (default)<br>2: Spindle |
| (2) Data type selection combo box | Selects the data type of Monitor output for output data list to display.<br><br>1: Standard output (default)<br>2: Control signal |
| (3) Data list | Displays the output data list corresponding to the selected axis and data type.<br><br>Odd number lines are shown in light blue. |
| (4) Vertical scroll bar | Vertical scroll bar will appear when the data cannot be displayed on one screen. |
| (5) Close | Click the button to close the screen. |

Monitor output data list screen is a modeless dialog. Monitor output setting screen can be operated with the Monitor output data list screen open.

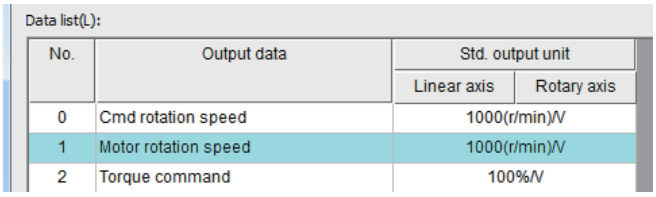
**<Restoration of the screen position>**

The last screen of the previous operation will be restored at the screen activation. When starting for the first time after the installation, it is displayed on Monitor output setting screen.

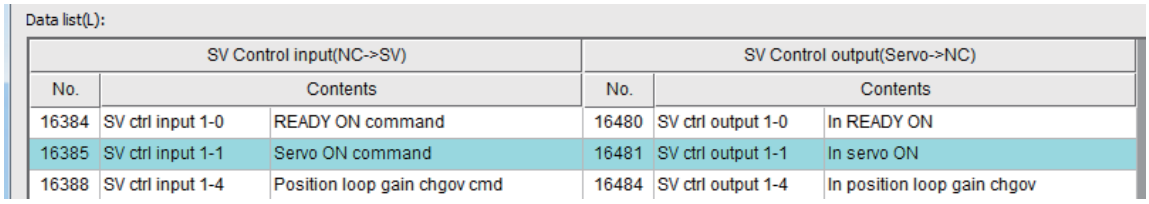
**<Display format for data list >**

Display format of the list is switched depending on the selected data type.

**[Standard output]**




**[Control signal]**



**<Display data>**

The followings are lists of each data item to display in the data list.

(a) Standard output data for servo

| No. | Output data | Standard output unit | |
|---|---|---|---|
| | | Linear axis | Rotary axis |
| 0 | Commanded rotation speed | 1000(r/min)/V | |
| 1 | Motor rotation speed | 1000(r/min)/V | |
| 2 | Torque command | Motor stall rated ratio 100%/V | |
| 3 | Torque feedback | Motor stall rated ratio 100%/V | |
| 6 | Effective current command | 100%/V | |
| 7 | Effective current feedback | 100%/V | |
| 8 | Machine vibration frequency | 500Hz/V | |
| 9 | HAS control droop cancel amount | 1mm/V | 1°/V |
| 30 | Collision detection estimated torque | 100%/V | |
| 31 | Collision detection disturbance estimated torque | 100%/V | |
| 32 | Estimated load inertia ratio (Note) | 100%/V | |
| 35 | Disturbance observer estimated disturbance torque | 100%/V | |
| 50 | Position droop | 1μm/V | 1/1000°/V |
| 51 | Position command | 1μm/V | 1/1000°/V |
| 52 | Position feed back | 1μm/V | 1/1000°/V |
| 53 | PositionF ⊿T | 1μm/s/V | 1/1000°/s/V |
| 54 | Deviation from ideal position | 1μm/V | 1/1000°/V |
| 60 | Position droop | 1mm/V | 1°/V |
| 61 | Position command | 1mm/V | 1°/V |
| 62 | Position feed back | 1mm/V | 1°/V |
| 63 | PositionF ⊿T | 1mm/s/V | 1°/s/V |
| 64 | Deviation from ideal position | 1mm/V | 1°/V |
| 70 | Position droop | 1m/V | 1000°/V |
| 71 | Position command | 1m/V | 1000°/V |
| 72 | Position feed back | 1m/V | 1000°/V |
| 73 | PositionF ⊿T | 1m/s/V | 1000°/s/V |
| 74 | Deviation from ideal position | 1m/V | 1000°/V |
| 126 | Saw tooth wave | 0V to 5V | |
| 127 | 2.5V test data | 2.5V | |

(Note) The estimated load inertia ratio (unit: 100%/V) is applied for the rotary motor, and the moving sections gross weight (unit: 100kg/V) for the linear motor.

(b) Control signal data for servo

**[Control input data**

| Servo control input (NC to Servo) | | |
|---|---|---|
| **No.** | **Details** | |
| 16384 | Servo control input 1-0 | READY ON command |
| 16385 | Servo control input 1-1 | Servo ON command |
| 16388 | Servo control input 1-4 | Position loop gain changeover command |
| 16390 | Servo control input 1-6 | Excessive error detection width changeover command |
| 16391 | Servo control input 1-7 | Alarm reset command |
| 16392 | Servo control input 1-8 | Current limit selection command |
| 16409 | Servo control input 2-9 | Speed monitor command valid |
| 16410 | Servo control input 2-A | In door closed (controller) |
| 16411 | Servo control input 2-B | In door closed (all drive units) |
| 16416 | Servo control input 3-0 | Control axis detachment command |

**[Control output data]**

| Servo control output (Servo to NC) | | |
|---|---|---|
| **No.** | **Details** | |
| 16480 | Servo control output 1-0 | In READY ON |
| 16481 | Servo control output 1-1 | In servo ON |
| 16484 | Servo control output 1-4 | In position loop gain changeover |
| 16486 | Servo control output 1-6 | In excessive error detection width changeover |
| 16487 | Servo control output 1-7 | In alarm |
| 16488 | Servo control output 1-8 | In current limit selection |
| 16492 | Servo control output 1-C | In in-position |
| 16493 | Servo control output 1-D | In current limit |
| 16494 | Servo control output 1-E | In absolute position data loss |
| 16495 | Servo control output 1-F | In warning |
| 16496 | Servo control output 2-0 | Z phase passed |
| 16499 | Servo control output 2-3 | In zero speed |
| 16503 | Servo control output 2-7 | In external emergency stop |
| 16505 | Servo control output 2-9 | In speed monitor |
| 16506 | Servo control output 2-A | In door closed (controller) |
| 16507 | Servo control output 2-B | In door closed (self drive unit) |
| 16512 | Servo control output 3-0 | In control axis detachment |

(c) Standard output data for spindle

| No. | Output data | Output unit for standard setting |
|---|---|---|
| 0 | Commanded motor rotation speed | 1000(r/min)/V |
| 1 | Motor rotation speed | 1000(r/min)/V |
| 2 | Torque current command | 100%/V |
| 3 | Torque current feedback | 100%/V |
| 35 | Disturbance observer estimated disturbance torque | 100%/V |
| 50 | Position droop | 1/1000˚/V |
| 51 | Position command | 1/1000˚/V |
| 52 | Position feed back | 1/1000˚/V |
| 53 | PositionF ⊿T | 1/1000˚/s/V |
| 54 | Deviation from ideal position | 1/1000˚/V |
| 60 | Position droop | 1˚/V |
| 61 | Position command | 1˚/V |
| 62 | Position feed back | 1˚/V |
| 63 | PositionF ⊿T | 1˚/s/V |
| 64 | Deviation from ideal position | 1˚/V |
| 70 | Position droop | 1000˚/V |
| 71 | Position command | 1000˚/V |
| 72 | Position feed back | 1000˚/V |
| 73 | PositionF ⊿T | 1000˚/s/V |
| 74 | Deviation from ideal position | 1000˚/V |
| 110 | 3.0V output load meter | 40%V, 120%/3V |
| 126 | Saw tooth wave | 0V to 5V |
| 127 | 2.5V test data output | 2.5V |

(d) Control signal data for spindle

**[Control input data]**

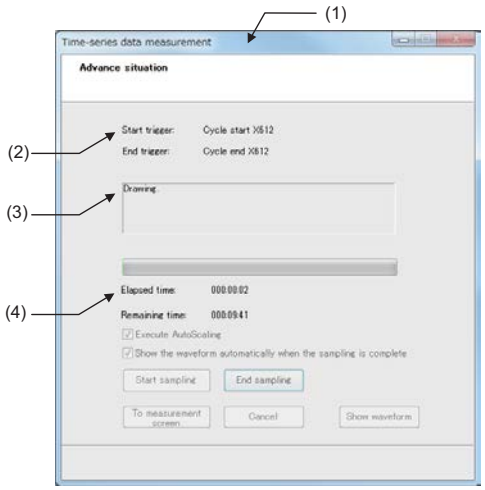
| Spindle control input (NC to Spindle) | | |
|---|---|---|
| **No.** | | **Details** |
| 16384 | Spindle control input 1-0 | READY ON command |
| 16385 | Spindle control input 1-1 | Servo ON command |
| 16391 | Spindle control input 1-7 | Alarm reset command |
| 16392 | Spindle control input 1-8 | Torque limit 1 selection command |
| 16393 | Spindle control input 1-9 | Torque limit 2 selection command |
| 16394 | Spindle control input 1-A | Torque limit 3 selection command |
| 16409 | Spindle control input 2-9 | Speed monitor command valid |
| 16410 | Spindle control input 2-A | In door closed (controller) |
| 16411 | Spindle control input 2-B | In door closed (all drive units) |
| 16432 | Spindle control input 4-0 | Spindle control mode selection command 1 |
| 16433 | Spindle control input 4-1 | Spindle control mode selection command 2 |
| 16434 | Spindle control input 4-2 | Spindle control mode selection command 3 |
| 16436 | Spindle control input 4-4 | Gear changeover command |
| 16437 | Spindle control input 4-5 | Gear selection command1 |
| 16438 | Spindle control input 4-6 | Gear selection command2 |
| 16445 | Spindle control input 4-D | L coil selection command |
| 16458 | Spindle control input 5-A | Phase synchronization suppression command |
| 16459 | Spindle control input 5-B | Minimum excitation rate 2 changeover request |
| 16460 | Spindle control input 5-C | Speed gain set 2 changeover request |
| 16461 | Spindle control input 5-D | Zero point re-detection request |
| 16462 | Spindle control input 5-E | Spindle holding force up |

**[Control output data**

| Spindle control output (Spindle to NC) | | |
|---|---|---|
| **No.** | | **Details** |
| 16480 | Spindle control output 1-0 | In ready ON |
| 16481 | Spindle control output 1-1 | In servo ON |
| 16487 | Spindle control output 1-7 | In alarm |
| 16488 | Spindle control output 1-8 | In torque limit 1 selection |
| 16489 | Spindle control output 1-9 | In torque limit 2 selection |
| 16490 | Spindle control output 1-A | In torque limit 3 selection |
| 16492 | Spindle control output 1-C | In in-position |
| 16495 | Spindle control output 1-F | In warning |
| 16496 | Spindle control output 2-0 | Z phase passed |
| 16499 | Spindle control output 2-3 | In zero speed |
| 16503 | Spindle control output 2-7 | In external emergency stop |
| 16505 | Spindle control output 2-9 | In speed monitor |
| 16506 | Spindle control output 2-A | In door closed (controller) |
| 16507 | Spindle control output 2-B | In door closed (self drive unit) |
| 16528 | Spindle control output 4-0 | In spindle control mode selection1 |
| 16529 | Spindle control output 4-1 | In spindle control mode selection2 |
| 16530 | Spindle control output 4-2 | In spindle control mode selection3 |
| 16532 | Spindle control output 4-4 | In gear changeover command |
| 16533 | Spindle control output 4-5 | In gear selection1 |
| 16534 | Spindle control output 4-6 | In gear selection2 |
| 16541 | Spindle control output 4-D | In L coil selection |

| Spindle control output (Spindle to NC) | | |
|---|---|---|
| **No.** | **Details** | |
| 16545 | Spindle control output 5-1 | Speed detection |
| 16550 | Spindle control output 5-6 | In coil changeover |
| 16554 | Spindle control output 5-A | In phase synchronization suppression |
| 16555 | Spindle control output 5-B | In minimum excitation rate 2 selection |
| 16556 | Spindle control output 5-C | In speed gain set 2 selection |
| 16557 | Spindle control output 5-D | Zero point re-detection complete |
| 16558 | Spindle control output 5-E | Spindle holding force up completed |
| 16559 | Spindle control output 5-F | In 2nd in-position |

### 3.5.3.1.6 Configuration of Advance Situation Screen




(1) The title bar display
The title bar display differs depending on the function. "Time-series data measurement", "Synchronous tapping error measurement", "Circular error measurement" or "Arbitrary path measurement" is displayed.

(2) The trigger display
Type of trigger to start and end and their contents (common variable value# and device) will be displayed in the trigger display area.

(3) Explanation for the advance situation display
The following will be displayed in the advance situation display area

```
$1 / $2 / $3
MEM / MEM / MEM
RDY / RDY / RDY
Start sampling.
Press the sampling start button.
```

"Part system" is displayed in the 1st line, "Operation mode" is displayed in the 2nd line and "Operation status" is displayed in the 3rd line. In the 4th line, a message will be displayed.

Operation mode

| Display | Mode |
|---|---|
| MEM | Memory mode |
| MDI | MDI mode |
| JOG | Jog feed mode |
| RPD | Rapid traverse mode |
| HDL | Handle feed mode |
| STP | Incremental mode |
| ZRN | Reference position return mode |

Operation status

| Display | Mode |
|---|---|
| EMG | In emergency stop |
| RST | Resetting NC |
| LSK | Paper tape reader is in label skip state |
| BST | In block stop |
| HLD | Operation halted |
| SYN | Synchronizing |
| AUT | In automatic operation |
| RDY | Operation completed state |

Message display

| Display item | Status | Details |
|---|---|---|
| Preparing the measurement. | Preparing | Communicating with NC. Wait for a while. |
| Start sampling.<br>Press the sampling start button. | Before sampling | Ready to start sampling.<br>Press "Start sampling" button.<br>When the condition to start sampling start is "manual", the sampling starts immediately after the button is pressed. If other condition is applied, it will be trigger waiting state. |
| Waiting for the trigger. | Waiting for the trigger | Waiting for the trigger.<br>When the trigger is entered (such as automatic startup), sampling begins. |
| Sampling | Measureing | Sampling is being executed.<br>The elapsed time is counted up and the remaining time is counted down.<br>Sampling completes when the end trigger is established, "End sampling" button is pressed or the buffer is full. |
| Sampling finished.<br>Press the waveform button. | Completed | Sampling completed.<br>Waveform will be displayed when [Show waveform] is pressed.<br>When "Show the waveform automatically when the sampling is complete" is selected, the waveform is displayed without showing this message. |
| Drawing. | Drawing | Waveform is being drawn. Wait for a while.<br>During this state, button operation is invalid.<br>After the process is finished, close the "Advance situation" screen, then the waveform will be displayed.<br>"_ _ _" will be updated to " " ->"_" -> "_ _" -> "_ _ _" -> (repetition of this pattern) every second. |
| An error occurred during communicating with the NC | Connection error | Cannot be measured as an error occurred.<br>Close the window by pressing [To measurement screen] or [Cancel] button. |

(Note 1) When there is no response from NC to the status "Preparing", "Waiting for the trigger", "Sampling" or "Drawing", it will time out after 10 seconds of no response and then it will be "Connection error" status.

(Note 2) In case of the system with multiple part systems, confirm that the part system of the selected axis is the same as the part system selected on the NC side.

(4) Time display

| Display item | Details | When the radio button "Ring buffer" is selected in "Time-series data measurement" |
|---|---|---|
| Elapsed time progress bar | Display the usage situation of sampling buffer | Not to display |
| Elapsed time | Display the elapsed time since the sampling has started by "HHHH:MM:SS". | Display |
| Remaining time | Remaining time for the sampling completion calculated with the remaining buffer is displayed by "HH:MM:SS". (It is not the time remained until the end buffer turns ON.) | Not to display |

Buttons and check boxes

| Button/Check box | Details | Status ( ○ : Available to operate X: Not available to operate) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Preparing | Connection error | Before sampling | Waiting for the trigger | Sampling | Completed | Drawing |
| Start sampling | Start sampling.<br>If it is pressed after the completion, the previous sampling result is voided and the sampling starts again. | × | × | ○ | × | × | × | × |
| End sampling | End sampling.<br>No matter how the end trigger is set, the sampling will end at the point of pressing this button. | × | × | × | ○ | ○ | × | × |
| To measurement screen | Return to the "Time-series data measurement" screen.<br>The sampling result is voided. | ○ | ○ | ○ | × | × | ○ | × |
| Cancel (the X button on the top right of the screen works same way) | Change to the NC Analyzer main screen.<br>When it pressed after finishing the sampling, the result is voided and the waveform drawing is not performed. | ○ | ○ | ○ | × | × | ○ | × |
| Show waveform | Change to the waveform drawing screen. | × | × | × | × | × | ○ | × |
| Execute AutoScaling | Auto scale is executed while displaying the waveform, if it is selected. The settings in the "Axis setting" screen are ignored.<br>Drawing is performed in the existing setting if it is unchecked. | × | × | (Note 1) | (Note 1) | (Note 1) | (Note 1) | × |
| Show the waveform automatically when the sampling is complete | The waveform iis automatically drawn after the sampling ends if it is selected.<br>The default is unchecked. | × | × | ○ | ○ | ○ | × | × |

(Note 1) About the operation status of the checkbox "Execute AutoScaling"

In the following cases, the checkbox is checked and cannot be changed:

- The first time
- After the measurement target, sampling time, cycle or process status is changed
- After opening the file to display the waveform

If the same settings (measurement target, sampling time and cycle) as last time are applied, the status of the checkbox can be changed and it will be unchecked at default.

When it is unchecked, the waveform drawing is performed with the same axis, drawing and graph setting as last time. However, if the drawing setting is changed, auto scaling for that changed No. will be executed forcibly.

(Note 2) About the check status of the checkboxes "Execute AutoScaling" and "Show the waveform automatically when the sampling is complete"
The status of the checkboxes change depending on the situation. The followings are the state transition.

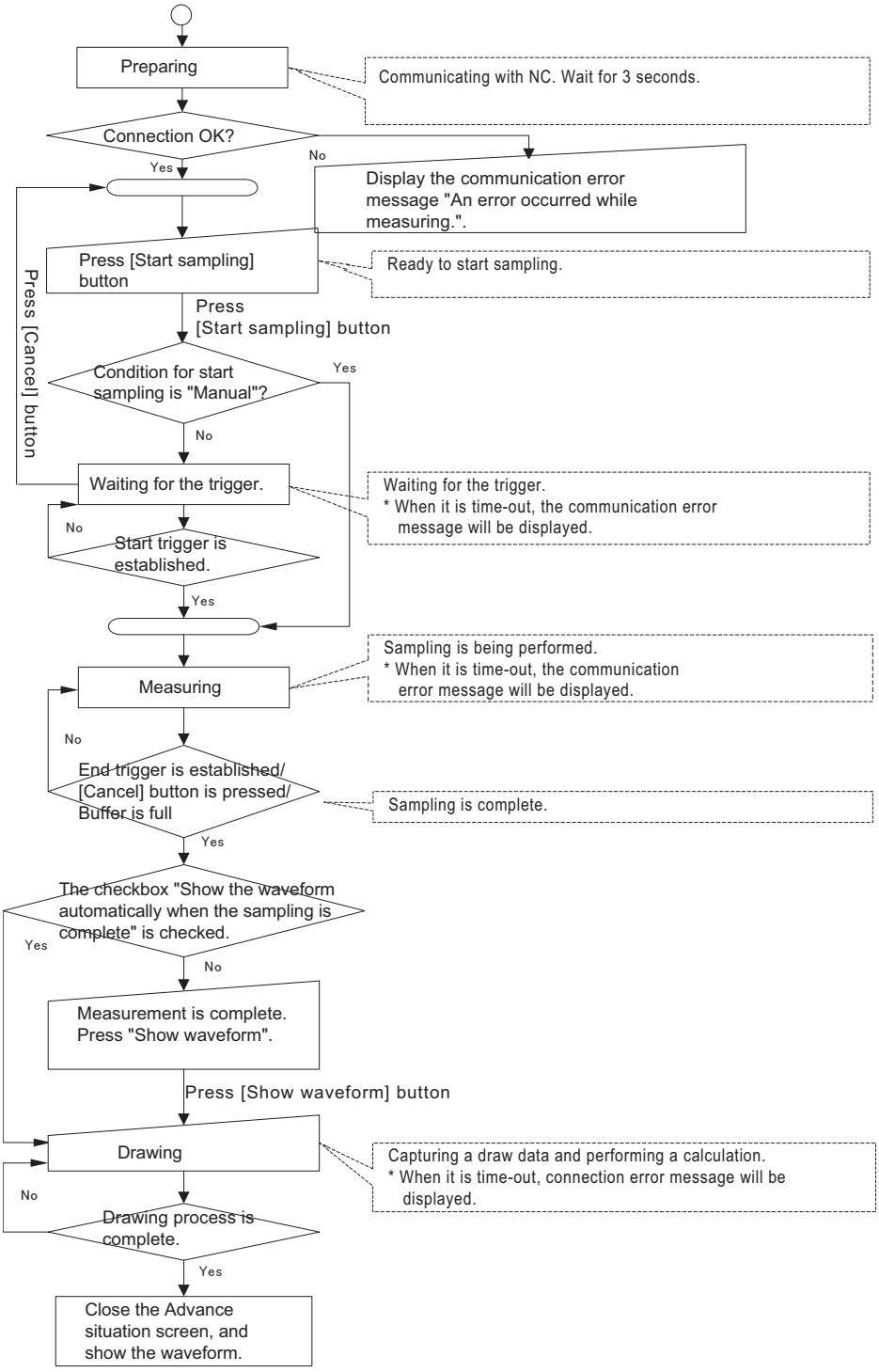
| Situation | Check status of Execute AutoScaling" | Check status of "Show the waveform automatically when the sampling is complete" |
|---|---|---|
| The first time after the activation | Checked (Cannot be changed) | Unchecked |
| When the condition is not changed | Unchecked | The same status as the last time |
| When the condition is changed (*) | Checked (Cannot be changed) | The same status as the last time |

(*) When the condition is changed
It is when the measure condition is changed from the last time measured on Time-series data measurement screen.
In the following condition, the measure condition is considered to be changed.
When measure condition is changed from the last time measured because time setting or measurement target has changed on Time-series data measurement screen

(Note 3) The performances for the state change of the checkboxes do not differ depending on the measurement type (time-series data, synchronous tapping error, circular error, or arbitrary path). It is all the same.

Process flow of Advance situation screen (Time-series data measurement)

Process flow is as follows.




[Remarks]

Measurement will stop if the emergency stop or reset is entered during the measurement (while the "Advance situation" screen is displayed). (Note 1)

When it stops, the error message "Emergency stop or reset was input. The measurement is discontinued." is displayed and returns to the NC Analyzer main screen.

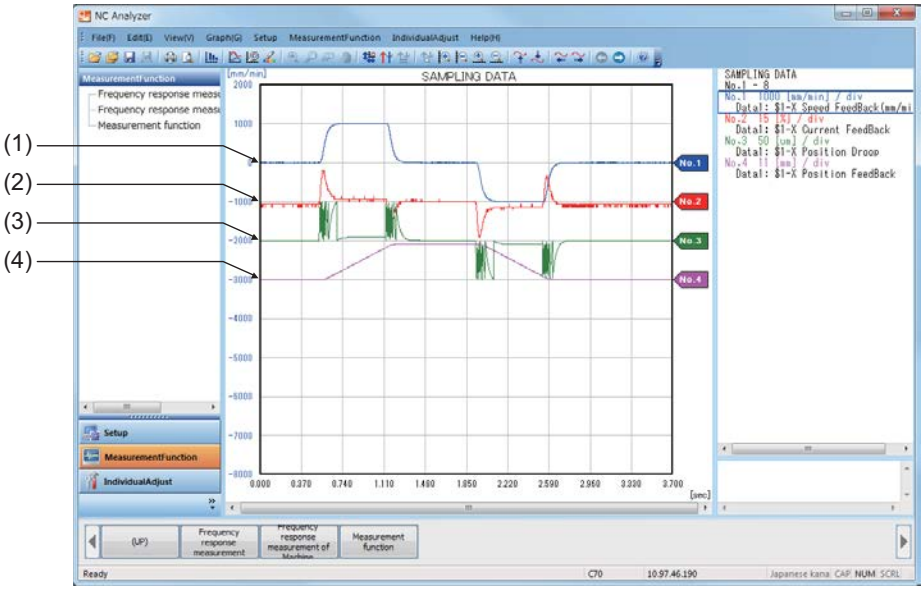
Also if some error (Note 2) occurs during the measurement, it returns to NC Analyzer main screen after a message that correspond to each error is displayed.

(Note 1) Reset is valid only during the program operation.

(Note 2) When there is no response from NC because of the illegal mode or alarm, it will time out after "the sampling time + 10 seconds" from the no response state.

### 3.5.3.1.7 Configuration of Measurement Result Display Screen

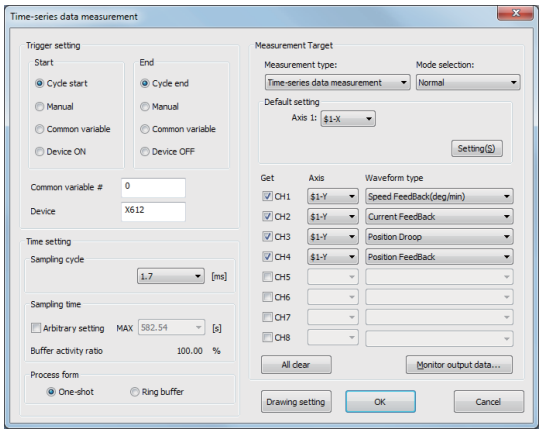
The time-series data of the measurement item selected on the time-series data measurement screen is displayed in the graph area.
The information (text data) at measurement is displayed in the text area.
Only the designated CH will be the displayed.



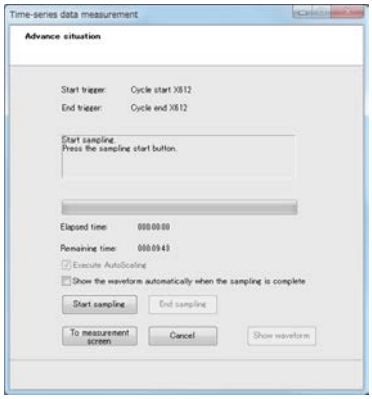

| Display item | | Details |
|---|---|---|
| (1) | No.1 | This displays the time-series data of the measurement item selected with CH1 on the time-series data measurement screen. |
| (2) | No.2 | This displays the time-series data of the measurement item selected with CH2 on the time-series data measurement screen. |
| (3) | No.3 | This displays the time-series data of the measurement item selected with CH3 on the time-series data measurement screen. |
| (4) | No.4 | This displays the time-series data of the measurement item selected with CH4 on the time-series data measurement screen. |

### 3.5.3.1.8 Operation Method

(1) Designate the measurement target and sampling condition.
Press the [OK] button.

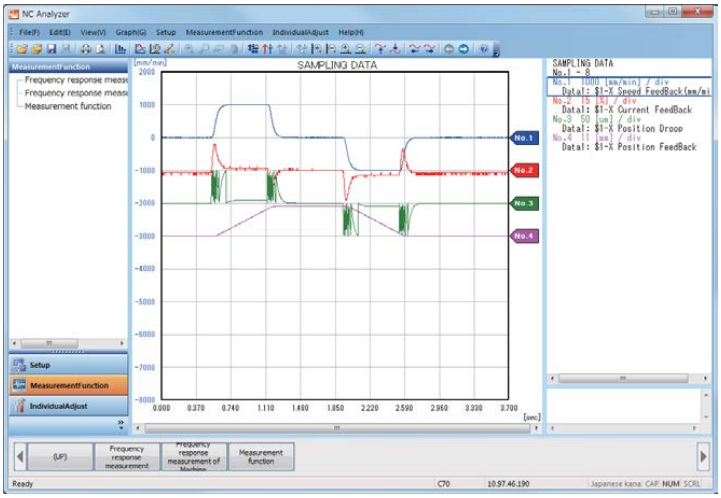



(2) Advance situation screen is displayed.
Press [Start sampling] button. When the trigger is established, it will be measuring.




(3) Sampling stops.
(The end conditions are met, the buffer is full, or press [End sampling] button.)

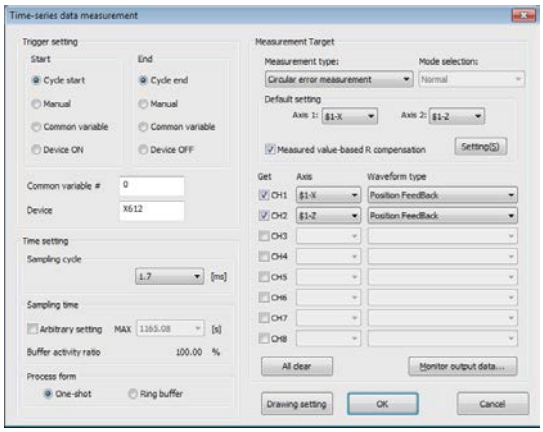
(4) Press [Show waveform] button.



### 3.5.3.2 Circular Error Measurement

An arbitrary machining program is executed with specified axis, and the arc shape error is measured by that data (position command , position feed back , model position, and motor end position for both 1st axis and 2nd axis). The result is displayed as the roundness graph and text data.

#### 3.5.3.2.1 Configuration of Circular Error Measurement Screen




(1) Trigger setting

It is the same as Time-series data measurement. Refer to "(1) Trigger setting" in "3.5.3.1.1 Configuration of Time-series data measurement screen".

(2) Time setting

It is the same as Time-series data measurement. Refer to "(2) Time setting" in "3.5.3.1.1 Configuration of Time-series data measurement screen".

(3) Process form

It is the same as Time-series data measurement. Refer to "(3) Process form" in "3.5.3.1.1 Configuration of Time-series data measurement screen".

(4) Measurement target

| Item | Contents | Setting range | Default value<br>(a)Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|---|
| Measurement type | Select the measurement type to measure. Select [Circular error measurement] when executing the circular error measurement. | 1: Time-series data measurement<br>2: Circular error measurement<br>3: Sync. tapping error measurement<br>4: Arbitrary path measurement<br>The measuring method which has been selected for [Items measured] in measuring function screen is initially selected. | (a) The measuring method which has been selected for [Items measured]<br>(b) A value previously set |
| Mode selection | It is fixed as [Normal]. | It is fixed as [Normal]. | It is fixed as [Normal]. |
| Default setting Axis 1 | Select [Axis 1] to be measured. (Note 1) | Servo axis (including C axis) | (a) The axis set in [Axis 1] on the measurement function screen<br>(b) A value previously set |
| Default setting Axis 2 | Select [Axis 2] to be measured. (Note 1) | Servo axis (including C axis) | (a) The axis set in [Axis 2] on the measurement function screen<br>(b) A value previously set |
| Default setting "Measured value-based R compensation" check box | Select whether to execute the measured value-based R compensation. | Checked (Measured value-based R compensation is executed)<br>Unchecked (Measured value-based R compensation is not executed) | (a) Checked<br>(b) A value previously set |
| Check box for "GET" | Select whether to measure the CH. | Checked (To be measured)<br>Unchecked (Not to be measured) | (a) All unchecked from CH1 to CH8<br>(b) A value previously set |
| Axis | Select the axis to be measured. | Servo axis (including C axis)<br>PLC axis<br>Spindle<br>PLC signal (Note 2) | (a) All blank<br>(b) A value previously set |
| Waveform type | Select the waveform type to be measured. | Refer to "(4) Measurement target" in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen". | (a) All blank<br>(b) A value previously set |

(Note 1) The selected axis of [Axis 1] is the target axis for CH1 and [Axis 2] is for CH2.

(Note 2) Circular error measurement can be selected but cannot be executed. (The waveform is not displayed.)

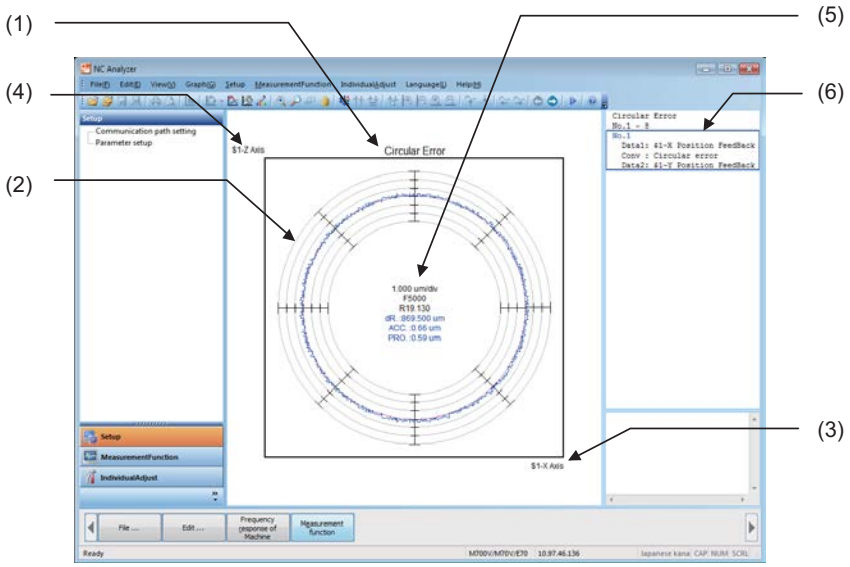
(Note 3) The measurement data other than position command, position feed back, model position, and motor end position cannot be displayed as an arc.

### 3.5.3.2.2 Configuration of Advance Situation Screen

It is the same as Time-series data measurement. Refer to "3.5.3.1.6 Configuration of Advance situation screen".

### 3.5.3.2.3 Configuration of Measurement Result Display Screen

The roundness graph of the circular error measurement result is displayed in the graph area.
The information (text data) at measurement is displayed in the text area.



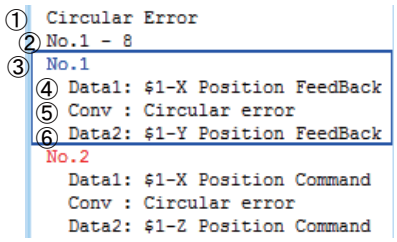

| Display item | | Details |
|---|---|---|
| (1) | Graph title | This displays the graph title which is set on the Drawing setting screen. |
| (2) | Graph | This displays roundness graph of the circular error measurement result. |
| (3) | Axis name (X axis label) | This displays the axis name for X axis label. |
| (4) | Axis name (Y axis label) | This displays the axis name for Y axis label. |
| (5) | Measurement result display area | Refer to "Display item" in the following table. |
| (6) | Text area | Refer to the following "Display status of the text area" and "Display item of the text area". |

Display item of the measurement result display area

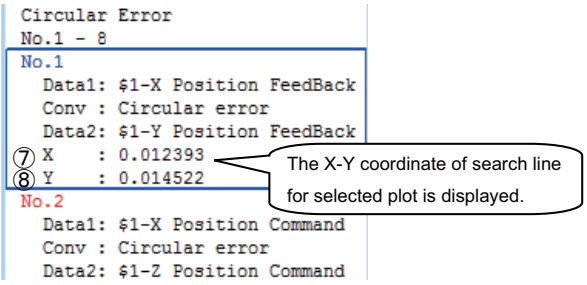
| Display Item | Contents | Remarks/Unit |
|---|---|---|
| X um/div | Division | μm/div (X is an arbitrary number)<br>(Displayed in the center of the circular graph.) |
| F | The feedrate specified on the measurement function screen | mm/min<br>(Displayed in the center of the circular graph.) |
| RXXXXXX.XXX | Standard radius | mm (X is an arbitrary number)<br>It is rounded down to three decimal places.<br>(Displayed in the center of the circular graph.) |
| dR.:XXXXXX.XXX um | Reduction in radius | μm (X is an arbitrary number)<br>It is rounded down to three decimal places.<br>(Displayed in the center of the circular graph.)<br>* The value of selected waveform in the text area is displayed in the selected waveform color. |
| ACC.:XXXXXX.XX um | Accuracy of the measurement result | μm (X is an arbitrary number)<br>It is rounded off to two decimal places.<br>(Displayed in the center of the circular graph.)<br>* The value of selected waveform in the text area is displayed in the selected waveform color. |
| PRO.:XXXXXX.XX um | Protrusion amount of the measurement result | μm (X is an arbitrary number)<br>It is rounded off to two decimal places.<br>(Displayed in the center of the circular graph.)<br>* The value of selected waveform in the text area is displayed in the selected waveform color. |

Display item of the text area

Normal display




Display during search mode




| | Display Item | | Details |
|---|---|---|---|
| ① | Graph title | - | This displays the graph title which is set on the Drawing setting screen. |
| ② | Displayed waveform No. | No.1 %d1 - %d2 | The No. of currently displayed waveform is shown.<br>(%d1,%d2: Either "No.1 - 8", "No.9 - 16", "No.17 - 24", or "No.25 - 32") |
| ③ | Waveform No. | No. %d1 | The No. of waveform is shown. （%d:1 to 32） |
| ④ | Data 1 | Data1: | The axes and titles of the waveform set in Data1 of the Drawing setting screen are displayed. |
| ⑤ | Conversion | Conv: | Circular error is displayed as conversion. |
| ⑥ | Data 2 | Data2: | The axes and titles of the waveform set in Data2 of the Drawing setting screen are displayed. |
| ⑦ | Searched X | X: | Searched coordinate X of the selected plot during search mode is displayed. (It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |
| ⑧ | Searched Y | Y: | Searched coordinate Y of the selected plot during search mode is displayed. (It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |

Details display

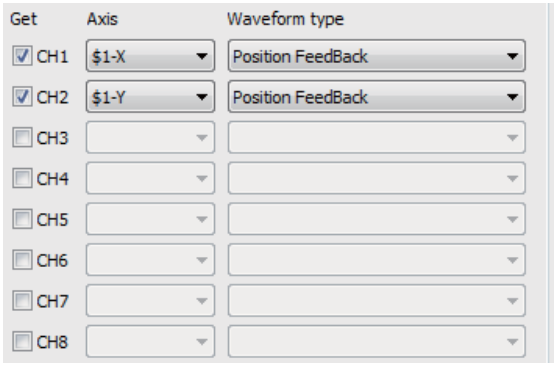
Details are not displayed because [Show the text area in detail] in the Drawing setting screen is masked and cannot be set in circular error.

### 3.5.3.2.4 Operation Method

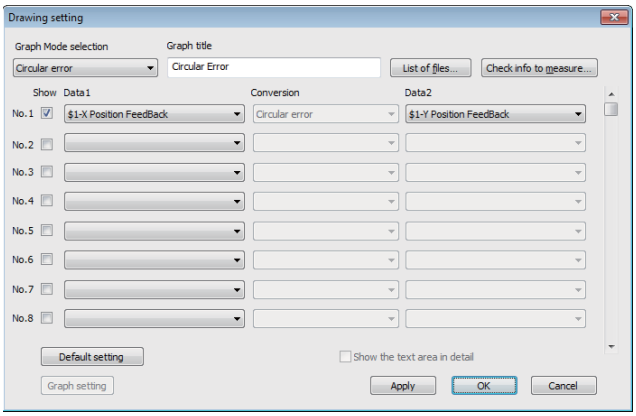
<Operation with the default setting>

(1) Select [Circular error measurement] for [Measurement type].

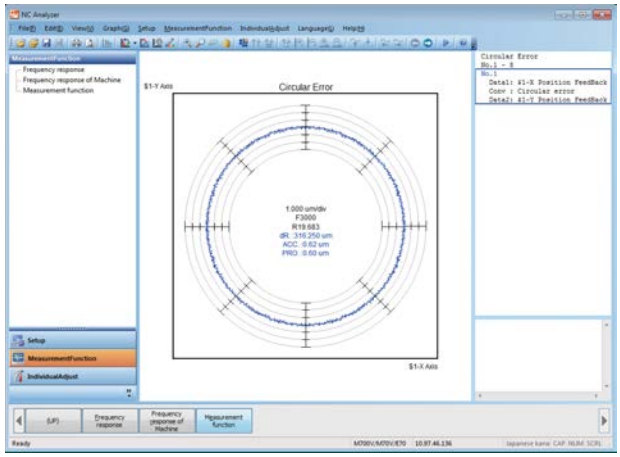
(2) Select the different axes for [Axis 1] and [Axis 2] in [Default setting].
Press [Setting] button.




(3) Press [Drawing setting] button to set as a circular error on the Drawing setting screen.



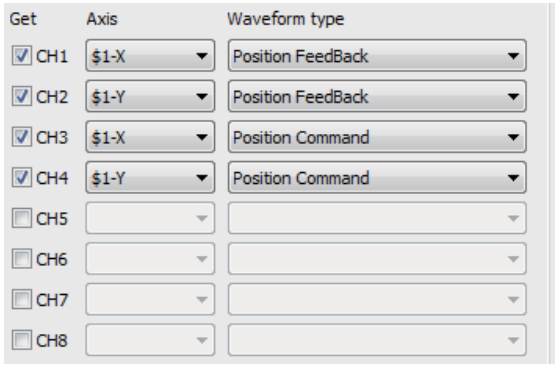

(4) Press [OK] button to change to the Advance situation screen. If it is measured after the screen change, it is measured as a circular error and displayed in circular-arc graph.

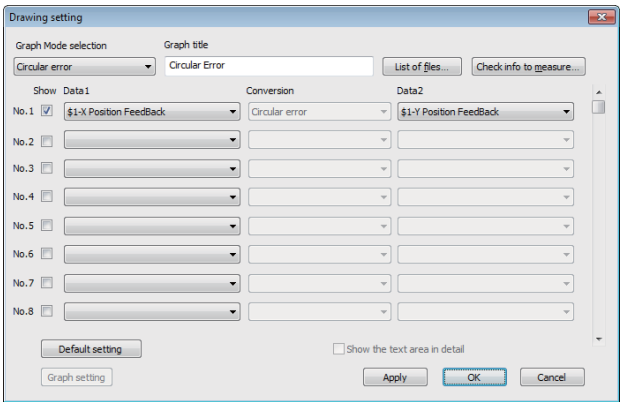


<Operation without the default setting>

(1) Select [Circular error measurement] for [Measurement type].
(2) Select [GET], [Axis], and [Waveform type].
(3) Press [OK] button to change to the Advance situation screen.

(Note 1) For the Drawing setting screen while selecting circular error
- When "Circular error measurement" is selected for "Measurement type", the setting which is specified for CH1 and CH2 is automatically set to No.1 on the Drawing setting screen as a conversion of "circular error".
- No.2 or later on the Drawing setting screen is set to blank.
- As for No.1 on the Drawing setting screen, it is automatically set for circular error measurement. The setting can also be set arbitrarily for No.2 or later.




(Note 2) The waveform type for Data1 and Data2 are not required to be the same.
However, the waveform type other than "Position command", "Position feedback", "Model position", and "Motor end position", which can be specified as a circular error, cannot be selected.

### 3.5.3.3 Synchronous Tapping Error Measurement

An arbitrary machining program is executed with specified axis, and the synchronous error of servo axis (mainly Z axis) and spindle at tapping measurement is measured by that data. The result is displayed as waveform.

(Note) When spindle is not connected/set to NC, this cannot be measured.

**<About high-speed synchronous tapping measurement>**

When bit5 of parameter #1281 is 1, the setting of high-speed synchronous tapping is enabled and high-speed synchronous tapping measurement can be executed.

(When setting 1 to #1281 bit5, high-speed synchronous tapping function is enabled.)

(1) Availability of waveform type measurement

Measurable waveform type is limited in high-speed synchronous tapping setting. Waveforms which are not listed in the following table cannot be measured.

| | Measurable waveform type |
|---|---|
| Servo, PLC axis | Position FB, Position Droop, Speed FB, Current FB, Control signal |
| Spindle | Position FB, Position Droop, Speed FB, Load Meter, Control signal |

(2) For spindle parameter #13228

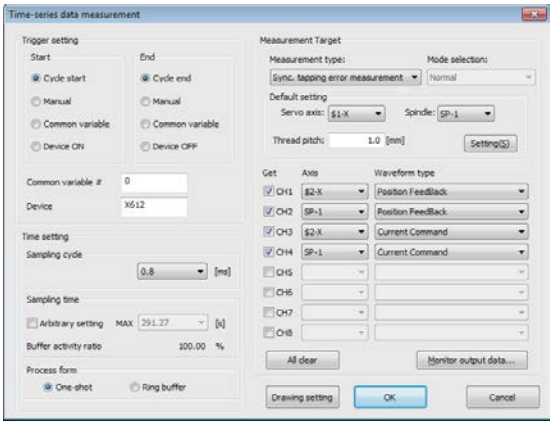
When measuring load meter in high-speed synchronous tapping setting, the following setting is recommended.

Recommended setting value: Bit 2 to 0 of #13228 are 100

When the recommended setting value is not set, warning message prompts you to change it to the recommended value.

(The execution will not be stopped because it is a warning. The measurement can be executed even when the setting value is not the recommended one.)

#### 3.5.3.3.1 Configuration of Synchronous Tapping Error Measurement Screen

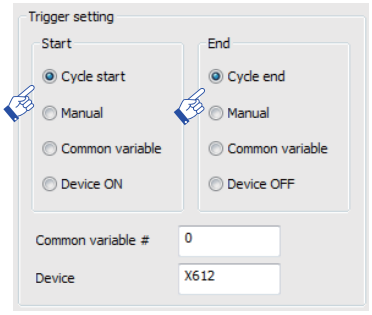


**<Setting procedures>**

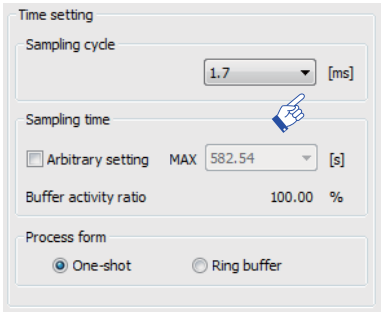
Measure the synchronous tapping error in the following example.

| No. | Details |
|---|---|
| Trigger | Sampling during auto operation |
| Sampling cycle | 1.7ms |
| Axis for Synchronous tapping | $1-Z and the 1st spindle (SP-1) |
| Measuring waveform | Error pulse, speed, and current |

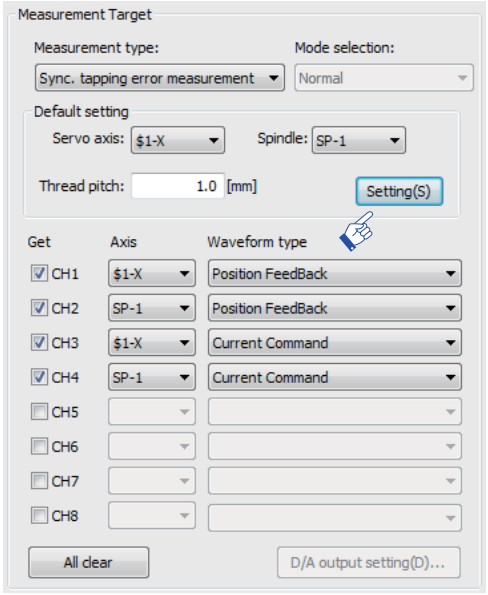
(1) Set the trigger for Start to "Cycle start" and End to "Cycle end" on trigger setting area.




(2) Select 1.7ms for Sampling cycle from the pulldown menu on time setting area.
Uncheck the Arbitrary setting for Sampling time and select "One-shot" for Process form.




(3) Select "$1-Z" for Servo and "SP-1" for Spindle on synchronous tapping setting area of Measurement Target and press [Setting] button.
The waveform types for the four channels are set in the bottom area.



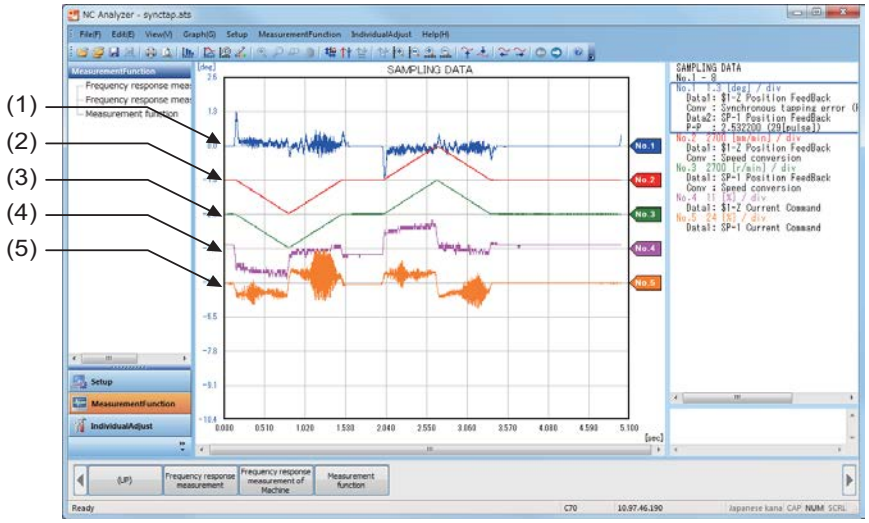

(4) Press [OK] button.
Change to the Advance situation screen.

### 3.5.3.3.2 Configuration of Advance Situation Screen

It is the same as Time-series data measurement. Refer to "3.5.3.1.6 Configuration of Advance Situation Screen".

### 3.5.3.3.3 Configuration of Measurement Result Display Screen

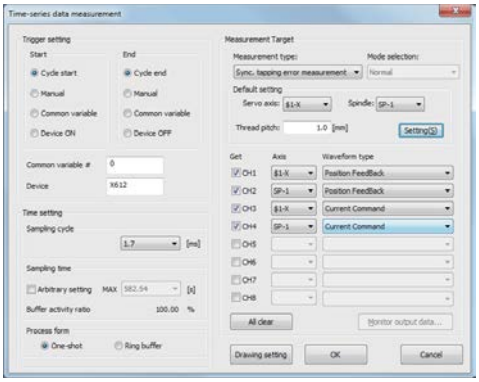
The synchronous error when the tapping is measured with data of servo (mainly Z axis) and spindle is displayed in the graph area as the chronological data.



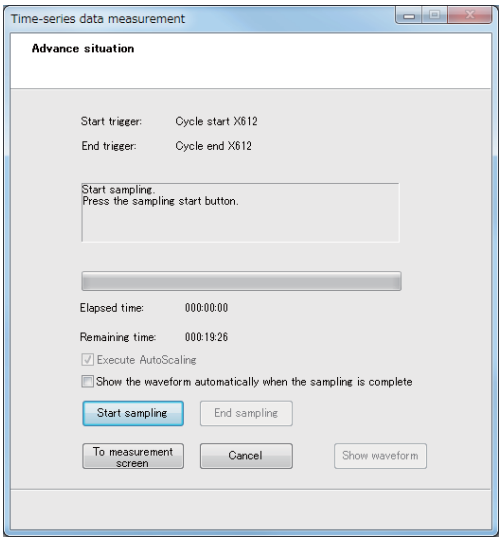

| Display item | | Details |
|---|---|---|
| (1) | Synchronous tapping error | Position error of spindle and servo axis |
| (2) | Servo speed | Speed feed back of servo |
| (3) | Spindle speed | Speed feed back of spindle |
| (4) | Servo current | Current feed back of servo |
| (5) | Spindle current | Current feed back of spindle |

### 3.5.3.3.4 Operation Method

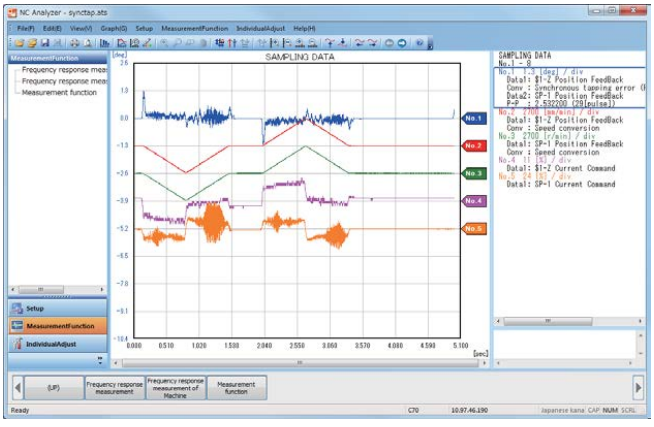
(1) Designate the measurement target and sampling condition.
Press the [OK] button.




(2) Advance situation screen is displayed.
Press automatic start button.



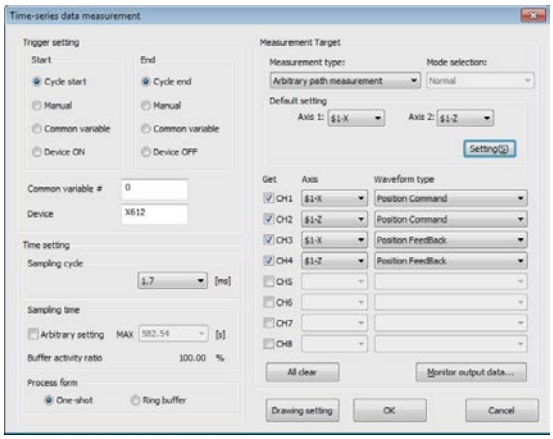

(3) The measurement result is displayed. Press [Cancel] to close the "Advance situation" screen.



### 3.5.3.4 Arbitrary Path Measurement

An arbitrary machining program is executed with specified axis, and an arbitrary path of plane by two axes to an arbitrary NC program operation is measured by that data (Position Command, Position FB, Model Position, and Motor End Position for both 1st axis and 2nd axis). The result is displayed as two dimension plot and text data.

#### 3.5.3.4.1 Configuration of Arbitrary Path Measurement Screen




(1) Trigger setting

It is the same as Time-series data measurement. Refer to "(1) Trigger setting" in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen".

(2) Time setting

It is the same as Time-series data measurement. Refer to "(2) Time setting" in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen".

(3) Process form

It is the same as Time-series data measurement. Refer to "(3) Process form" in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen".

(4) Measurement target

| Setting | Contents | Setting range | Default value<br>(a)Startup at first time<br>(b)Startup at second and subsequent |
|---|---|---|---|
| Measurement type | Select the measurement type to measure. Select [Arbitrary path measurement] when executing the arbitrary path measurement. | 1: Time-series data measurement<br>2: Circular error measurement<br>3: Sync. tapping error measurement<br>4: Arbitrary path measurement<br>The measuring method which has been selected for [Items measured] in measuring function screen is initially selected. | (a) The measuring method which has been selected for [Items measured]<br>(b) A value previously set |
| Mode selection | It is fixed as [Normal]. | It is fixed as [Normal]. | It is fixed as [Normal]. |
| Default setting Axis 1 | Select [Axis 1] to be measured. (Note 1) | Servo axis (including C axis) | (a) The axis set in [Axis 1] on the measurement function screen<br>(b) A value previously set |
| Default setting Axis 2 | Select [Axis 2] to be measured. (Note 1) | Servo axis (including C axis) | (a) The axis set in [Axis 2] on the measurement function screen<br>(b) A value previously set |
| Check box for "GET" | Select whether to measure the CH. | Checked (To be measured)<br>Unchecked (Not to be measured) | (a) All unchecked from CH1 to CH8<br>(b) A value previously set |
| Axis | Select the axis to be measured. | Servo axis (including C axis)<br>PLC axis<br>Spindle<br>PLC signal (Note 2) | (a) All blank<br>(b) A value previously set |
| Waveform type | Select the waveform type to be measured. | Refer to "(4) Measurement target" in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen". (Note 3) | (a) All blank<br>(b) A value previously set |

(Note 1) The selected axis of [Axis 1] is the target axis for CH1 and CH3, and [Axis 2] is for CH2 and CH4.

(Note 2) Arbitrary path measurement can be selected but cannot be executed. (The waveform is not displayed.)

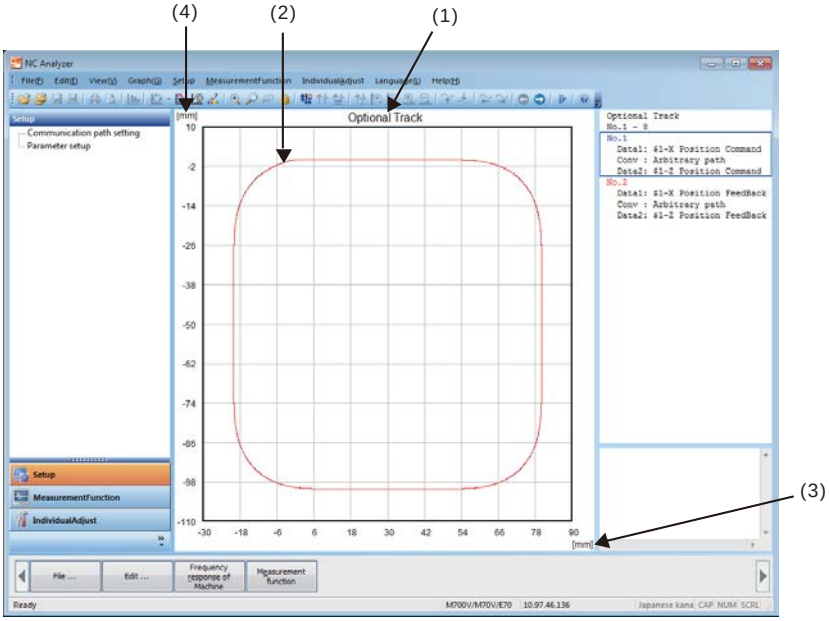
(Note 3) The measurement data other than position command, position feed back, model position, and motor end position cannot be displayed as an arbitrary.

### 3.5.3.4.2 Configuration of Advance Situation Screen

It is the same as Time-series data measurement. Refer to "3.5.3.1.6 Configuration of Advance Situation Screen".

### 3.5.3.4.3 Configuration of Measurement Result Display Screen (Arbitrary Path Measurement)

The two dimension plot data of the arbitrary path measurement result is displayed in the graph area.
The information (text data) at measurement is displayed in the text area.




| | Display Item | | Details |
|---|---|---|---|
| (1) | Graph title | Optional Track | This displays the graph title which is set on the Drawing setting screen. |
| (2) | Graph | - | This displays the two dimension plot data of the arbitrary path.<br>Blue line: Two dimension plot of No.1 waveform type<br>Red line: Two dimension plot of No.2 waveform type |
| (3) | X-axis scale and X-axis unit | [mm] (Note 1) | This displays X-axis scale value and X-axis unit. |
| (4) | Y-axis scale and Y-axis unit | [mm] (Note 1) | This displays Y-axis scale value and Y-axis unit. |

(Note 1) mm: The display is changed to mm or inch depending on the setting status of #1041 I_inch on the NC.

Auto scaling value for the graph right after a measurement (X-axis, Y-axis)

Minimum value:

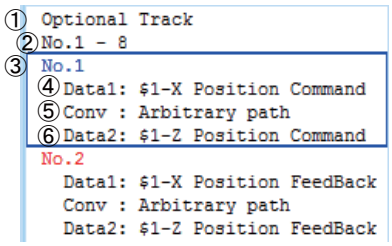
The value which is calculated by the expression "minimum value -((maximum value -minimum value )*0.1)" is the auto scaling value

Maximum value:

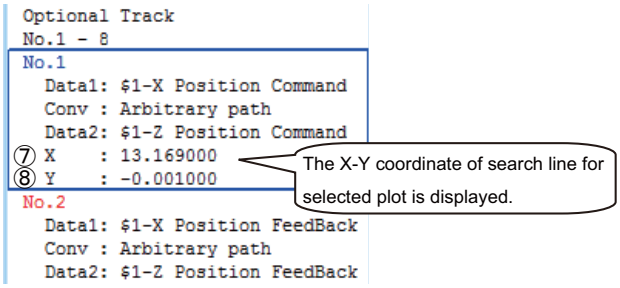
The value which is calculated by the expression "maximum value +((maximum value -minimum value )*0.1)" is the auto scaling value

Display item of the text area

Normal display




Display during search mode




| | Display Item | | Details |
|---|---|---|---|
| ① | Graph title | Optional Track | This displays the graph title which is set on the Drawing setting screen. |
| ② | Displayed waveform No. | No.1 %d1 - %d2 | The No. of currently displayed waveform is shown. (%d1,%d2: Either "No.1 - 8", "No.9 - 16", "No.17 - 24", or "No.25 - 32") |
| ③ | Waveform No. | No. %d1 | The No. of waveform is shown. （%d:1 to 32） |
| ④ | Data 1 | Data1: | The axes and titles of the waveform set in Data1 of the Drawing setting screen are displayed. |
| ⑤ | Conversion | Conv: | Arbitrary path is displayed as conversion. |
| ⑥ | Data 2 | Data2: | The axes and titles of the waveform set in Data2 of the Drawing setting screen are displayed. |
| ⑦ | Searched X | X: | Searched coordinate X of the selected plot during search mode is displayed. (It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |
| ⑧ | Searched Y | Y: | Searched coordinate Y of the selected plot during search mode is displayed. (It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |

Details display

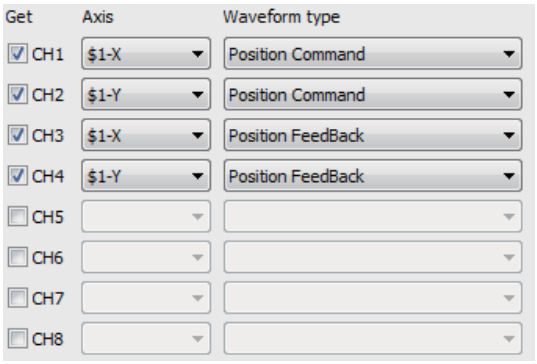
Details are not displayed because [Show the text area in detail] in the Drawing setting screen is masked and cannot be set in arbitrary path.

### 3.5.3.4.4 Operation Method (Arbitrary Path Measurement)

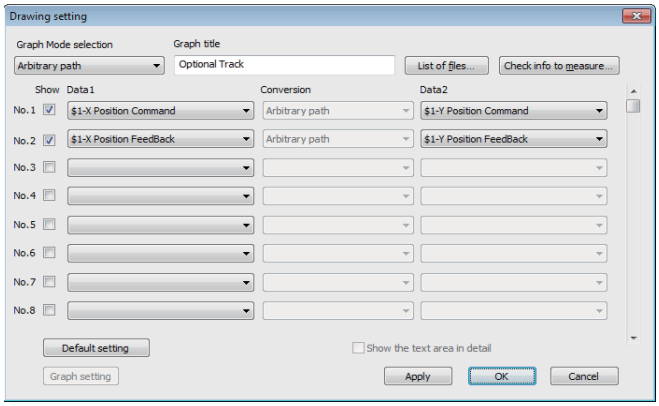
<Operation with the default setting>

(1) Select [Arbitrary path measurement] for [Measurement type].

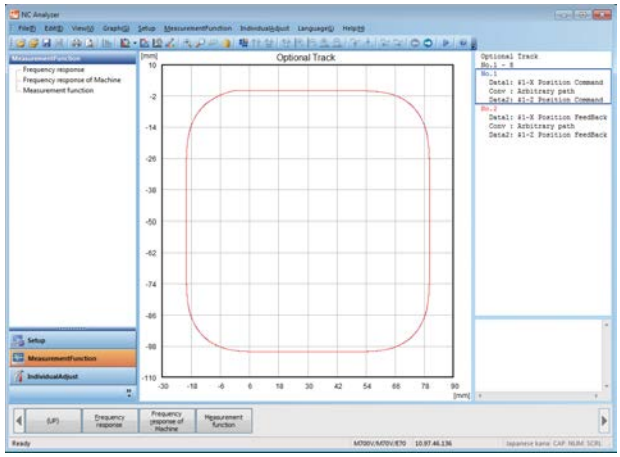
(2) Select the different axes for [Axis 1] and [Axis 2] in [Default setting].
Press [Setting] button.




(3) Press [Drawing setting] button to set as an arbitrary path on the Drawing setting screen.




(4) Press [OK] button to change to the Advance situation screen. If it is measured after the screen change, it is measured as an arbitrary path and displayed in arbitrary path graph.



<Operation without the default setting>

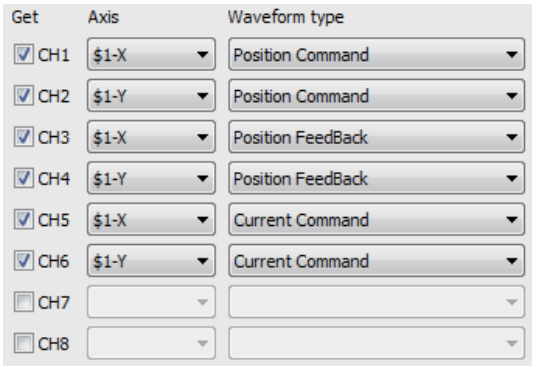
(1) Select [Arbitrary path measurement] for [Measurement type].

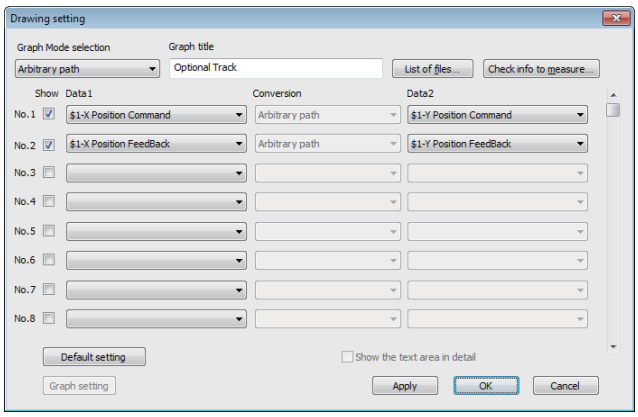
(2) Select [GET], [Axis], and [Waveform type].

(3) Press [OK] button to change to the Advance situation screen.

(Note 1) For the Drawing setting screen while selecting arbitrary path

- When "Arbitrary path measurement" is selected for "Measurement type", the setting which is specified for CH1, CH2, CH3 and CH4 is automatically set to No.1 and No.2 on the Drawing setting screen as a conversion of "arbitrary path".
- No.3 or later on the Drawing setting screen is set to blank.
- As for No.1 and No.2 on the Drawing setting screen, it is automatically set for arbitrary path measurement. The setting can also be set arbitrarily for No.3 or later.

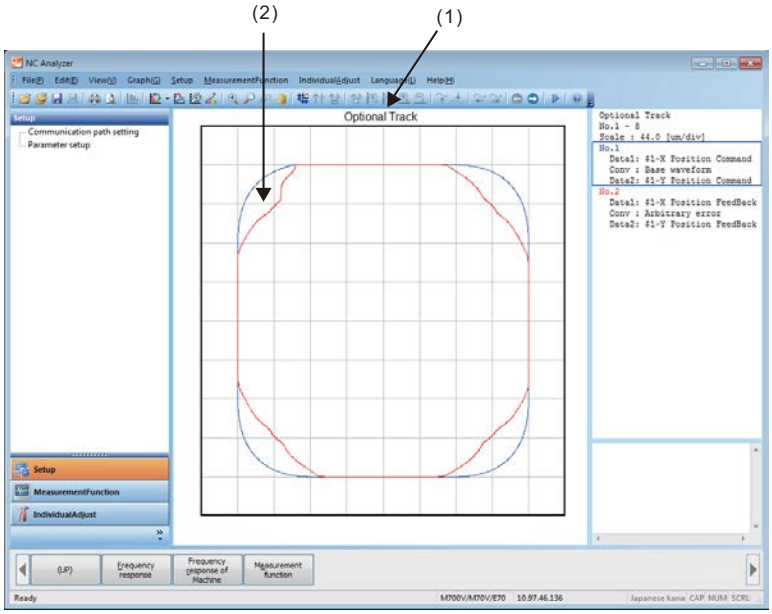



(Note 2) The waveform type for Data1 and Data2 are not required to be the same.
However, the waveform type other than "Position command", "Position feedback", "Model position", and "Motor end position", which can be specified as an arbitrary path, cannot be selected.

### 3.5.3.4.5 Configuration of Measurement Result Display Screen (Arbitrary Error)

The form error with a waveform to compare may be difficult to discriminate on the measurement result displayed in arbitrary path measurement.
The form error with the standard waveform can be checked with Arbitrary error expansion function by specifying the waveform to expand errors.
As for the graph area, the standard waveform of the arbitrary path measurement result and the waveform to expand the error are displayed in two dimension plot data. As for the text area, the standard waveform of the arbitrary path measurement result and information (text data) of the waveform to expand errors are displayed.




| Display Item | | Contents |
|---|---|---|
| (1) | Graph title | This displays the graph title which is set on the Drawing setting screen. |
| (2) | Graph | This displays the two dimension plot data of the Arbitrary error.<br>Blue line: Two dimension plot of waveform type (Base waveform) for the page top No.<br>Red line: Two dimension plot of waveform type (Arbitrary error) for other than the page top No. (No.2 in the example) |

Auto scaling value for the graph right after a measurement (X-axis, Y-axis)

Minimum value:

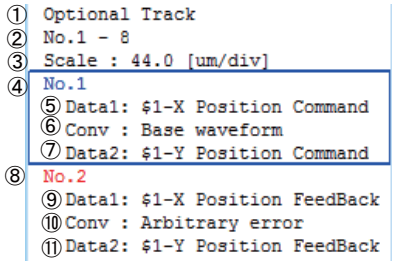
The value which is calculated by the expression "minimum value -((maximum value -minimum value )*0.1)" is the auto scaling value

Maximum value:

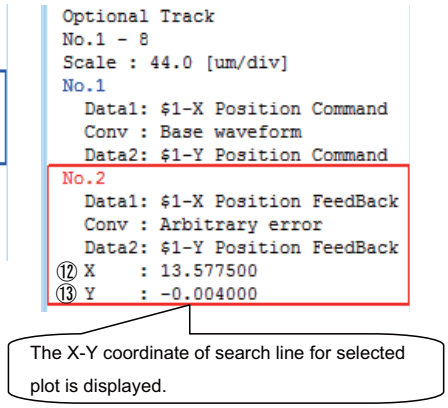
The value which is calculated by the expression "maximum value +((maximum value -minimum value )*0.1)" is the auto scaling value

Display item of the text area

Normal display




Display during search mode



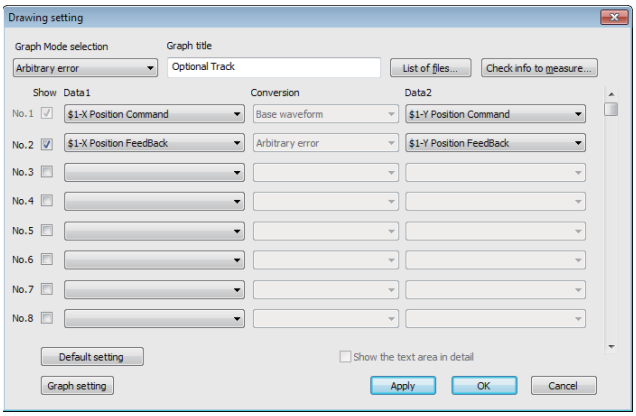

| | Display Item | | Contents |
|---|---|---|---|
| ① | Graph title | - | This displays the graph title which is set on the Drawing setting screen. |
| ② | Displayed waveform No. | No.1 %d1 - %d2 | The No. of currently displayed waveform is shown.<br>(%d1,%d2: Either "No.1 - 8", "No.9 - 16", "No.17 - 24", or "No.25 - 32") |
| ③ | Scale | Scale:%d [um/div] | - This displays the value per division. （%d: 0.001 to1000000）<br>- Display of scale will be omitted when the digits below the decimal point are all zero. (Ex. 1.100000 will be displayed as 1.1.) |
| ④ | Waveform No.<br>(Page top No. ) | No. %d1 | The No. of waveform is shown. （%d:1,9,17, and 25） |
| ⑤ | Data 1 | Data1: | The axes and titles of the waveform set in Data1 on the page top No. of the Drawing setting screen are displayed. |
| ⑥ | Conversion | Conv: | Standard waveform is displayed as conversion. |
| ⑦ | Data 2 | Data2: | The axes and titles of the waveform set in Data2 on the page top No. of the Drawing setting screen are displayed. |
| ⑧ | Waveform No.<br>(Other than the page top No.) | No.%d | The No. of waveform is shown. （%d:2 to 8,10 to 16,18 to 24, and 26 to 32） |
| ⑨ | Data 1 | Data1: | The axes and titles of the waveform set in Data1 of the Drawing setting screen are displayed. |
| ⑩ | Conversion | Conv: | Arbitrary error is displayed as conversion. |
| ⑪ | Data 2 | Data2: | The axes and titles of the waveform set in Data2 of the Drawing setting screen are displayed. |
| ⑫ | Searching X | X: | Searched coordinate X of the selected plot during search mode is displayed.<br>(It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |
| ⑬ | Searching Y | Y: | Searched coordinate Y of the selected plot during search mode is displayed.<br>(It is rounded off to six decimal places.)<br>* It is displayed only during search mode. |

Details display

Details are not displayed because [Show the text area in detail] in the Drawing setting screen is masked and cannot be set in Arbitrary error.

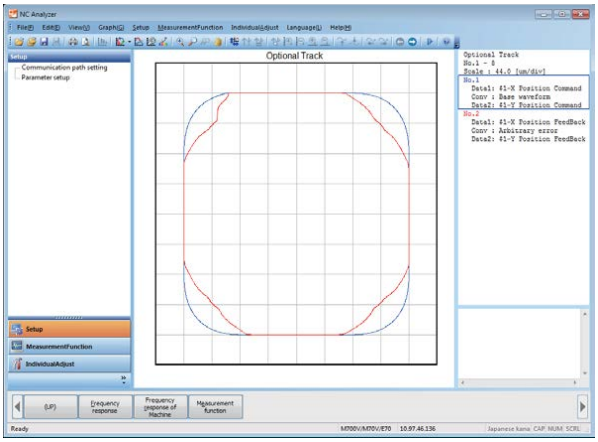
### 3.5.3.4.6 Operation Method (Arbitrary Error)

(1) Perform the arbitrary path measurement with the default setting and display the waveform.
(2) Display the Drawing setting screen.
(3) Select [Arbitrary error] from the combo box of [Graph Mode selection].
-> It is the default setting and automatically set as the following figure. Therefore, setting is not required (Note 1)




(Note 1) If it differs from the default setting, set as follows.
1) Set "$1-X Position Command" for Data1 of No.1.
-> Conversion for No.1 is automatically set to "Base waveform" and Data2 can be selected.
The value of Data2 is blank.
2) Set "$1-Y Position Command" for Data2 of No.1.
3) Set "Show" check box of No.2 to ON.
4) Set "$1-X Position FeedBack" for Data1 of No.2.
-> Conversion for No.1 is automatically set to "Arbitrary error" and Data2 can be selected.
The value of Data2 is blank.
5) Set "$1-Y Position FeedBack" for Data2 of No.2.

(4) Press the [OK] button.
->The Drawing setting screen closes and waveform is displayed as below.



## 3.5.4 Measure Again

### 3.5.4.1 Outline of Functions

It is the function to enable to perform replicate measurements simply and quickly under the same condition as the previous measurement.

### 3.5.4.2 Functional Scope

Re-measurement is enabled for time-series data measurement, circular error measurement, and arbitrary path measurement. It is disabled for frequency response measurement, frequency response measurement of machine, and each function of automatic adjustment.

| Function type | Function name | Correspondence |
|---|---|---|
| Measurement system | Frequency response measurement | × |
| | Frequency response measurement of machine | × |
| | Time-series data measurement (Synchronous tapping) | ○ |
| | Circular error measurement | ○ |
| | Arbitrary path measurement | ○ |
| Adjustment system | Velocity loop gain adjustment | × |
| | Time constant adjustment | × |
| | Position loop gain adjustment | × |
| | Lost motion adjustment | × |
| | Lost motion type 3 adjustment | × |

○ :Enable, × :Disable

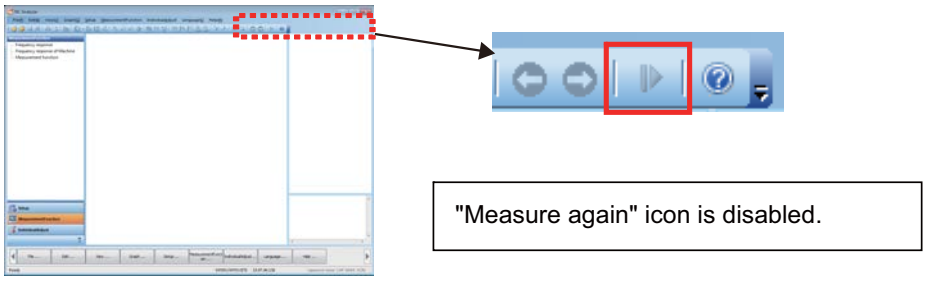
### 3.5.4.3 Condition to Enable the Function

Perform a measurement once with the function compatible with re-measurement (refer to "3.5.4.2 Functional Scope") to enable re-measurement. When re-measurement is executable, "Measure Again" icon on the tool bar is enabled.

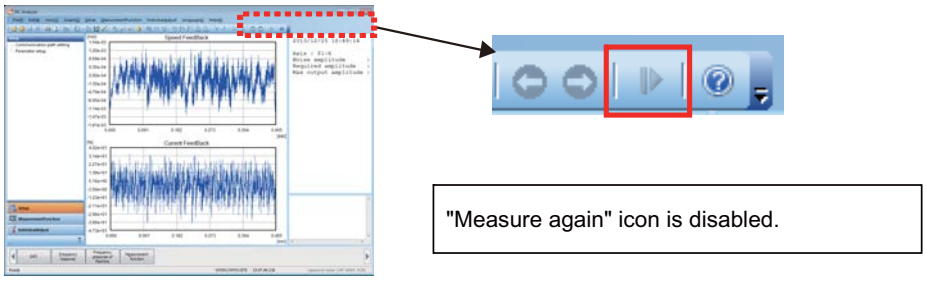
(Note 1) "Measure Again" icon is not enabled if a measurement or adjustment not compatible with re-measurement is executed.

(Note 2) Re-measurement is disabled if it is once enabled and then a measurement or adjustment not compatible with re-measurement is executed.

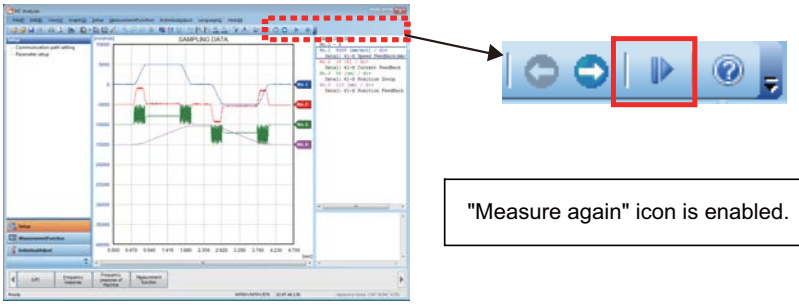
(1) When graph is not displayed




(2) When a measurement or an adjustment for the function not compatible with re-measurement is executed

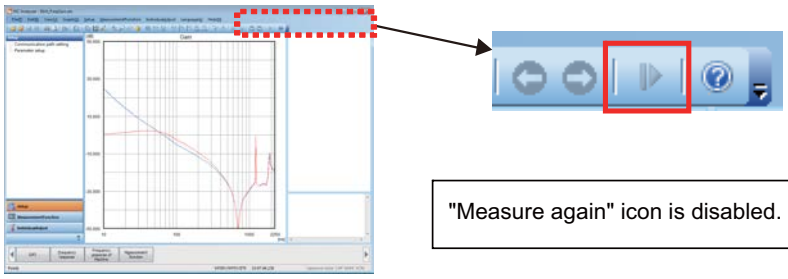


(3) When a measurement or an adjustment for the function compatible with re-measurement is executed



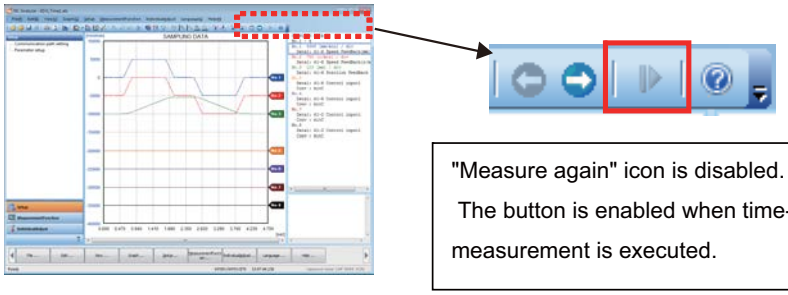
"Measure again" icon is enabled.

(4) When an ATS file of XY mode is opened



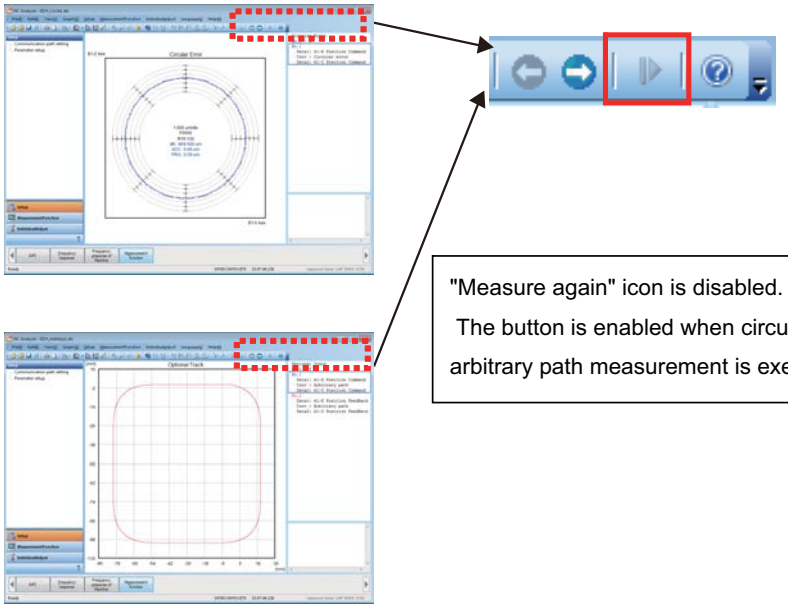
"Measure again" icon is disabled.

(5) When an ATS file of time-series is opened



"Measure again" icon is disabled.
The button is enabled when time-series data measurement is executed.

(6) When an ATS file of circular error or arbitrary path is opened



"Measure again" icon is disabled.
The button is enabled when circular error or arbitrary path measurement is executed.

### 3.5.4.4 Starting Re-measurement

There are two method to start the re-measurement function as follows:

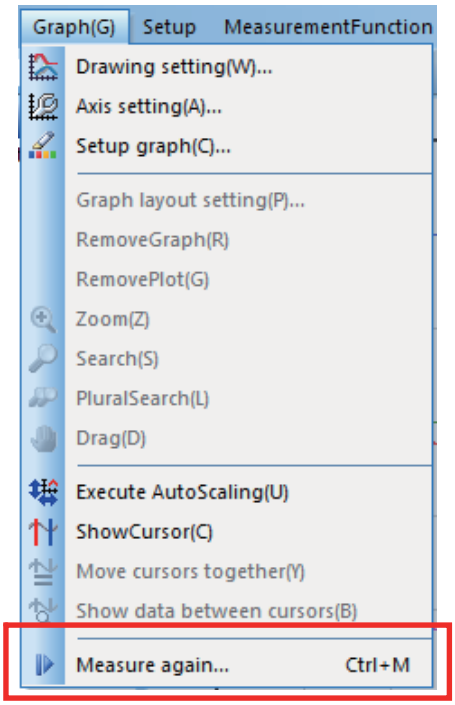
1. "Measure again" icon on the tool bar
2. [Graph(G)] - [Measure again...] menu

(1) "Measure again" icon on the tool bar

When re-measurement is executable, "Measure again" icon on the tool bar is enabled.

(2) [Measure again...] menu

[Measure again...] is displayed at the bottom of [Graph(G)] in the main menu.



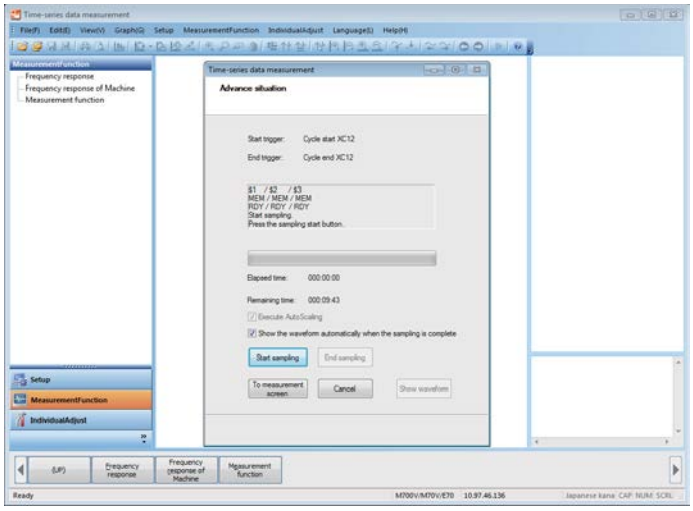
### 3.5.4.5 Operation Method

When re-measurement is started, "Advance situation screen" is directly displayed by skipping the "Creation of the machining program for adjustment screen" and "parameter setup screen". The setting information same as the previous measurement is automatically set to the NC for machining program, measure condition, and waveform type, etc. The current setting is retained for drawing setting. The operation after "Advance situation display screen" is the same as normal measurement.

The operation flow when executing re-measurement is displayed below.

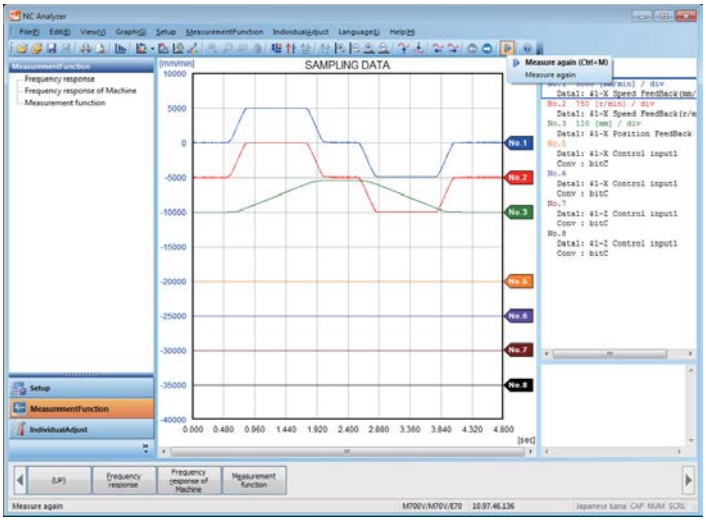
(1) Execute "Measure again" button or [Measure again...] menu.

(2) "Advance situation screen" is displayed. The same setting as the previous measurement is automatically set for machining program, measure condition, and measuring waveform.




(3) Execute "Start sampling" as with the normal measurement.

(4) The waveform which is measured under the same condition as the previous measurement is displayed.



### 3.5.4.6 Measurement Parameters to Be Taken Over

The measurement parameters to be taken over from the previous measurement are as follows.

| Setting Screen | Parameter | Status | Remarks |
|---|---|---|---|
| Measurement function screen | Machining program | ○ | |
| Condition setting screen | Start condition, End condition | ○ | |
| | Common variable | ○ | |
| | Device | ○ | |
| | Sampling cycle | ○ | |
| | Sampling time | ○ | |
| | Process configuration | ○ | One-shot or Ring buffer |
| | Measurement type | ○ | Time-series data measurement, Synchronous tapping error measurement, Circular error measurement, Arbitrary path measurement |
| | Mode selection | ○ | Normal or High-cycle sampling |
| | Measurement waveform information | ○ | All of channel No., axis, and waveform type are taken over. |
| | Measured value-based R compensation | ○ | |
| | Polarity conversion information | × | The setting at the execution of re-measurement is retained. |
| | Drawing setting | × | The setting at the execution of re-measurement is retained. |
| Communication path setup screen | Connection target information | × | |

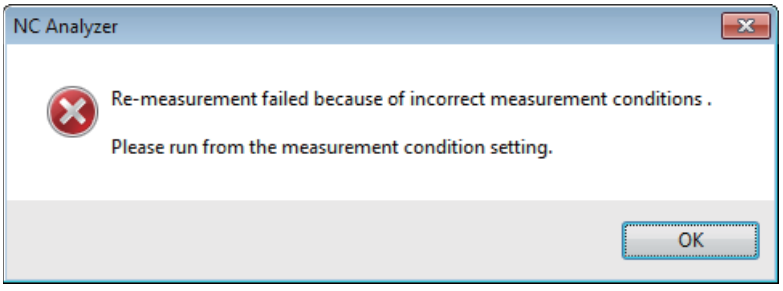
○ The values are taken over from the previous measurement

× The values are not taken over from the previous measurement

### 3.5.4.7 For Errors

The parameter setting and connection information may differ between the previous measurement and re-measurement. In this case, an error may occur if setting the previous measurement parameters to the NC.

The following message is displayed when an error occurs.




Check the followings.

(1) Each setting condition described on (6) Measure Condition in "3.5.3 Waveform Measurement Function (Program Creation Function)"

(2) Each setting condition described in "3.5.3.1.1 Configuration of Time-series Data Measurement Screen"

# 3.6 Graph Function of Tools

In NC Analyzer, various processes can be executed for the displayed graph.
Each process menu can be selected by the menu, the toolbar, the function bar and the mouse right-clicking in the graph area.

## 3.6.1 Switching Graph Display

Switch the graph display from time-series graph to circular error, arbitrary path, and Arbitrary error graph.
Also switch the graph display from circular error, arbitrary path, and Arbitrary error graph to time-series graph.

Operation method

When selecting from the list:

Press the pulldown button on the tool bar icon "Graph Mode selection" to display the list.
The graph display switches when selecting the graph to display from the list.
The left side of the graph mode name is checked for the displaying mode.
The listed graph mode name and order are as follows.

When switching by the button operation:

Press the pulldown button on the tool bar icon "Graph Mode selection". Each time the button is pressed, the graph display switches Time-series data, Circular error, Arbitrary path, Arbitrary error, and Time-series data, in that order.

## 3.6.2 Graph Function in XY Mode

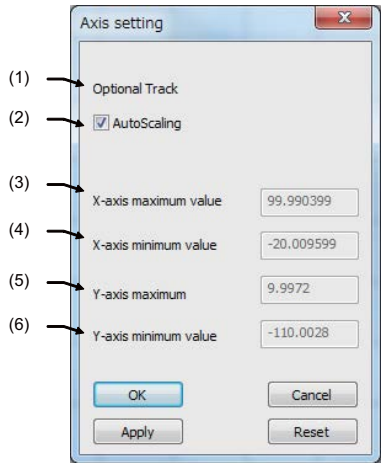
This section explains the graph function for automatic adjustment/waveform measurement.
Automatic adjustment:

Velocity loop gain, time constant adjustment, position loop gain, lost motion adjustment, lost motion type 3 adjustment

Waveform measurement:

Frequency response measurement, frequency response measurement of machine, circular error measurement, synchronous tapping error measurement, arbitrary path measurement

### 3.6.2.1 Standard/Logarithm graph  Configuration of Axis range setting dialog

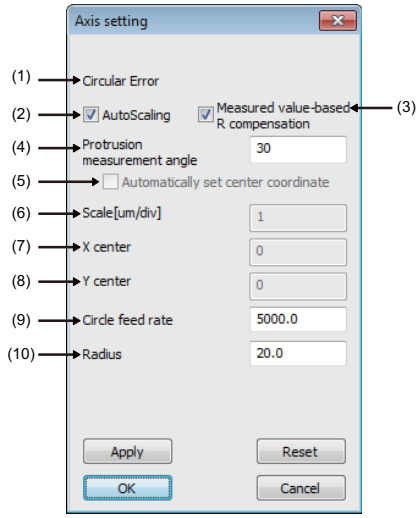



| Display item | | Details | Default |
|---|---|---|---|
| (1) | Graph title | displays the graph title. | - |
| (2) | AutoScaling Check box | This sets the auto scale ON/OFF.<br>ON: The graph is displayed with auto scale ON. Among displayed plots, the scale is set to the maximum value.<br>OFF: The graph is displayed with auto scale OFF.<br>When the drag mode and expansion/reduction mode are selected, auto scale OFF is set automatically. | ON |
| (3) | X-axis maximum value Text box | This sets the maximum value of x axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current x axis maximum value<br>Cannot be set. |
| (4) | X-axis minimum value Text box | This sets the minimum value of x axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current x axis minimum value<br>Cannot be set. |
| (5) | Y-axis maximum value Text box | This sets the maximum value of y axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current y axis maximum value<br>Cannot be set. |
| (6) | Y-axis minimum value Text box | This sets the minimum value of y axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current y axis minimum value<br>Cannot be set. |

**Auto scaling value for Standard/Logarithm/Arbitrary path graph**

| Graph | Axis | Auto scaling value |
|---|---|---|
| Standard | X-axis | Minimum value:<br>0 or more: The minimum value rounded down to two significant digits is the auto scaling value<br>Less than 0: The minimum value rounded up to two significant digitsis the auto scaling value<br>Maximum value:<br>0 or more: The maximum value rounded up to two significant digits is the auto scaling value<br>Less than 0: The maximum value rounded down to two significant digits is the auto scaling value |
| | Y-axis | When the data pass through 0:<br>Use the portion that is more distant from 0 to obtain the maximum and minimum values.<br>The obtained values multiplied by 1.05 and rounded up to two significant digits are the auto scaling values.<br>When the data do not pass through 0:<br>Minimum value is more than 0:<br>Minimum value: The minimum value multiplied by 0.95 and rounded down to two significant digits is the auto scaling value<br>Maximum value: The maximum value multiplied by 1.05 and rounded up to two significant digits is the auto scaling value<br>Maximum value is less than 0:<br>Minimum value: The minimum value multiplied by 1.05 and rounded up to two significant digits is the auto scaling value<br>Maximum value: The maximum value multiplied by 0.95 and rounded down to two significant digits is the auto scaling value |
| Logarithmic gain plot | X-axis | Minimum value:10 is the auto scaling value<br>Maximum value:<br>When the maximum value is in the range from 2000 to 2250: 2250 is the auto scaling value<br>When the maximum value is out of the range from 2000 to 2250:<br>The maximum value rounded up to two significant digits is the auto scaling value |
| | Y-axis | Minimum value:-50 is the auto scaling value<br>Maximum value:50 is the auto scaling value |
| Logarithmic phase plot | X-axis | Same as gain plot |
| | Y-axis | Minimum value:-360 is the auto scaling value<br>Maximum value:90 is the auto scaling value |
| Arbitrary path | X-axis<br>Y-axis | Minimum value:<br>The value which is calculated by the expression "minimum value -((maximum value -minimum value )*0.1)" is the auto scaling value<br>Maximum value:<br>The value which is calculated by the expression "maximum value +((maximum value -minimum value )*0.1)" is the auto scaling value |

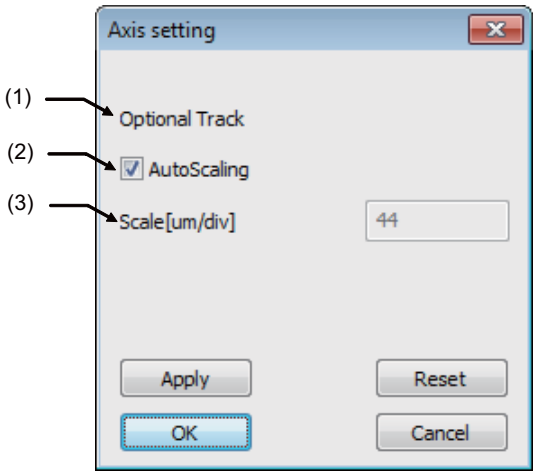
### 3.6.2.2 Roundness Graph  Configuration of Axis Range Setting Dialog




| Display item | | Details | Default |
|---|---|---|---|
| (1) | Graph title | This displays the graph title. | - |
| (2) | AutoScaling Check box | This sets the auto scale ON/OFF.<br>ON: The graph is displayed with auto scale ON.<br>OFF: The graph is displayed with auto scale OFF. | ON |
| (3) | Measured value-based R compensation<br>Check box | Execute an auto scaling so that the circle waveform is shown on the reference circle.<br>Measured value-based R compensation check box is ON when the auto scale check box is ON, and this cannot be set.<br>Checked (Measured value-based R compensation is executed)<br>Unchecked (Measured value-based R compensation is not executed) | Checked<br>Cannot be set. |
| (4) | Protrusion measurement angle<br>Text box | This designates the protrusion amount angle.<br>The protrusion amount calculated with a designated angle is displayed in the text area. | 30 |
| (5) | Automatically set center coordinate Check box | This sets the center coordinates automatically.<br>When the auto scale check box is OFF, this cannot be set.<br>Check ON: Automatic adjustment ON<br>Check OFF: Automatic adjustment OFF | Check OFF<br>Cannot be set. |
| (6) | Scale [μm/div] | This sets the division.<br>When the auto scale check box is ON, this cannot be set.<br>The range 0.001 to 1000000 can be designated. | - |
| (7) | X center Text box | This sets the center coordinate of x axis.<br>When the auto scale check box is ON, this cannot be set. | Current center x coordinate<br>Cannot be set. |
| (8) | Y center Text box | This sets the center coordinate of y axis.<br>When the auto scale check box is ON, this cannot be set. | Current center y coordinate<br>Cannot be set. |
| (9) | Circle feed rate<br>(Note 1) | This sets the feedrate.<br>This can be set regardless of whether the auto scale check box is checked. | The feedrate specified on the measurement function screen |
| (10) | Radius<br>(Note 1) | This sets the target radius.<br>This can be set regardless of whether the auto scale check box is checked. | The radius specified on the measurement function screen |

(Note 1)　It is not displayed for a circular error graph in XY mode.

### 3.6.2.3 Arbitrary Error Graph Configuration of Axis Range Setting Dialog

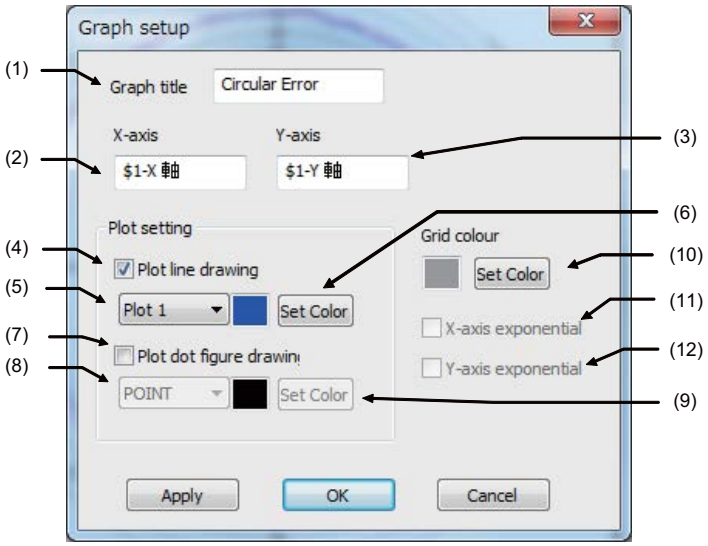



| Display Item | | Details | Default |
|---|---|---|---|
| (1) | Graph title | This displays the graph title. | - |
| (2) | AutoScaling<br>Check box | This sets the auto scale ON/OFF.<br>ON: The graph is displayed with auto scaling value.<br>The scale value returns to the default and this cannot be set.<br>OFF: The graph is displayed with auto scale OFF.<br>The scale can be set. | ON |
| (3) | Scale<br>[µm/div] | This sets the division.<br>When the auto scale check box is ON, this cannot be set.<br>The range 0.001 to 1000000 can be set. | Auto scaling value |

**Auto scaling value of Arbitrary error graph**

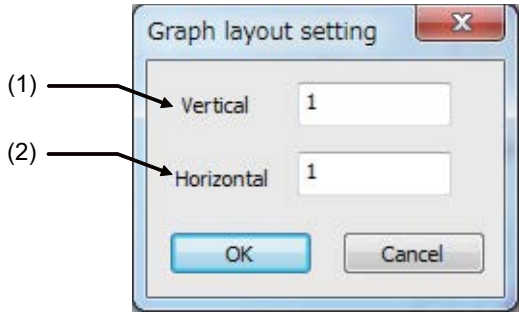
| Graph | Axis | Auto scaling value |
|---|---|---|
| Arbitrary error | X-axis<br>Y-axis | Minimum value:<br>The value which is calculated by the expression "minimum value -((maximum value -minimum value )*0.1)" is the auto scaling value<br>Maximum value:<br>The value which is calculated by the expression "maximum value +((maximum value -minimum value )*0.1)" is the auto scaling value |

### 3.6.2.4 Configuration of Graph Setup Dialog




| Display item | | Details | Default |
|---|---|---|---|
| (1) | Graph title | This displays the graph title.<br>Up to 32 one-byte characters can be input. | - |
| (2) | X-axis | This sets the character string displayed in x axis label.<br>Up to 32 one-byte characters can be input. | Displaying character strings |
| (3) | Y-axis | This sets the character string displayed in y axis label.<br>Up to 32 one-byte characters can be input. | Displaying character strings |
| (4) | Plot line drawing Check box | This sets the Plot line drawing.<br>Check ON: Draw<br>Check OFF: Do not draw | ON |
| (5) | Plot line drawing selection Combo box | This selects the setting target plot.<br>When the Plot line drawing check box is OFF, this cannot be input. | Plot 1 |
| (6) | Plot line color setting button | A setting dialog of the color is displayed when pressing, and the plot line color can be set.<br>When the Plot line drawing check box is OFF, this cannot be input. | - |
| (7) | Plot dot figure drawing Check box | This sets the Plot dot figure drawing<br>Check ON: Draw<br>Check ON: Do not draw | OFF |
| (8) | Plot dot figure drawing Combo box | This selects Plot dot figure drawing<br>When the Plot line drawing check box is OFF, this cannot be input. | - |
| (9) | Plot point color setting button | A setting dialog of the color is displayed when pressing, and the plot point color can be set.<br>When the Plot line drawing check box is OFF, this cannot be input. | - |
| (10) | Grid color setting button | A setting dialog of the color is displayed when pressing, and the grid display color can be set. | - |
| (11) | X-axis indexing Check box | This sets the index display of x axis when the unit is set to x axis.<br>When the unit is not set, this cannot be pressed.<br>Check ON: Exponential display ON<br>Check OFF: Exponential display OFF | ON |
| (12) | Y-axis indexing Check box | This sets the index display of y axis when the unit is set to y axis.<br>When the unit is not set, this cannot be pressed.<br>Check ON: Exponential display ON<br>Check OFF: Exponential display OFF | ON |

### 3.6.2.5 Configuration of Graph Layout Setting Dialog



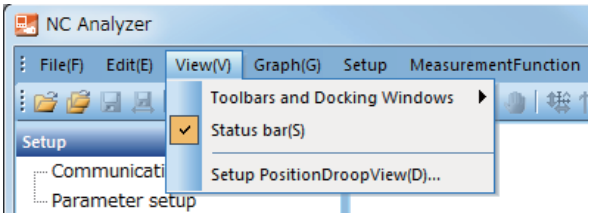

| Display item | | Details | Default |
|---|---|---|---|
| (1) | Vertical | This sets the number of graph arrangement for vertical direction.<br>1 to 10 can be set. | Number of displayed graph arrangement |
| (2) | Horizontal | This sets the number of graph arrangement for horizontal direction.<br>1 to 10 can be set. | Number of displayed graph arrangement |

### 3.6.2.6 How to Use the Graph

#### 3.6.2.6.1 Menu Bar Display Setting

Set whether to display the tool bar, the status bar, and the function bar.

(1) Select the menu [View].
The menu bar list to which display/non-display can be set is displayed.
This function can be selected from [View] of the function bar also.



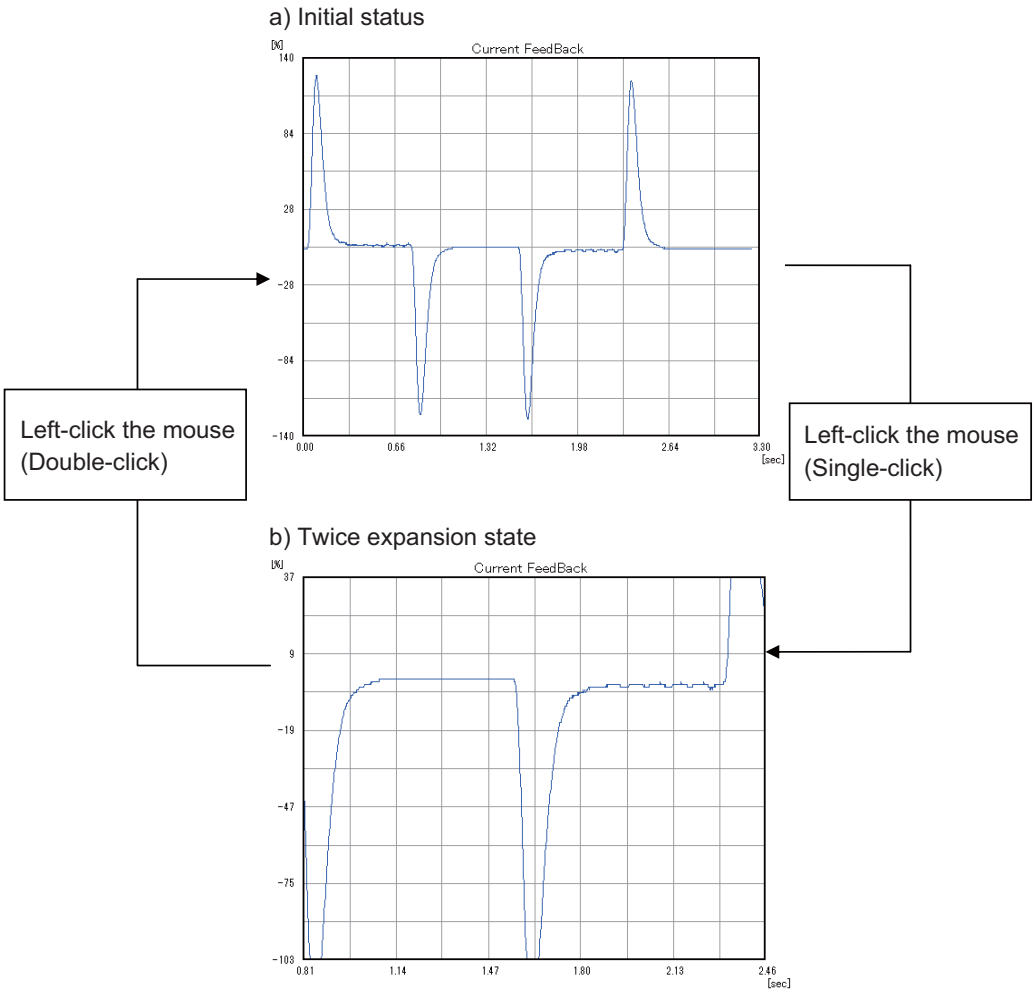

(2) Select the menu bar which sets display/non-display.
The check changes whenever pressing once.

### 3.6.2.6.2 Zoom Mode of the Graph

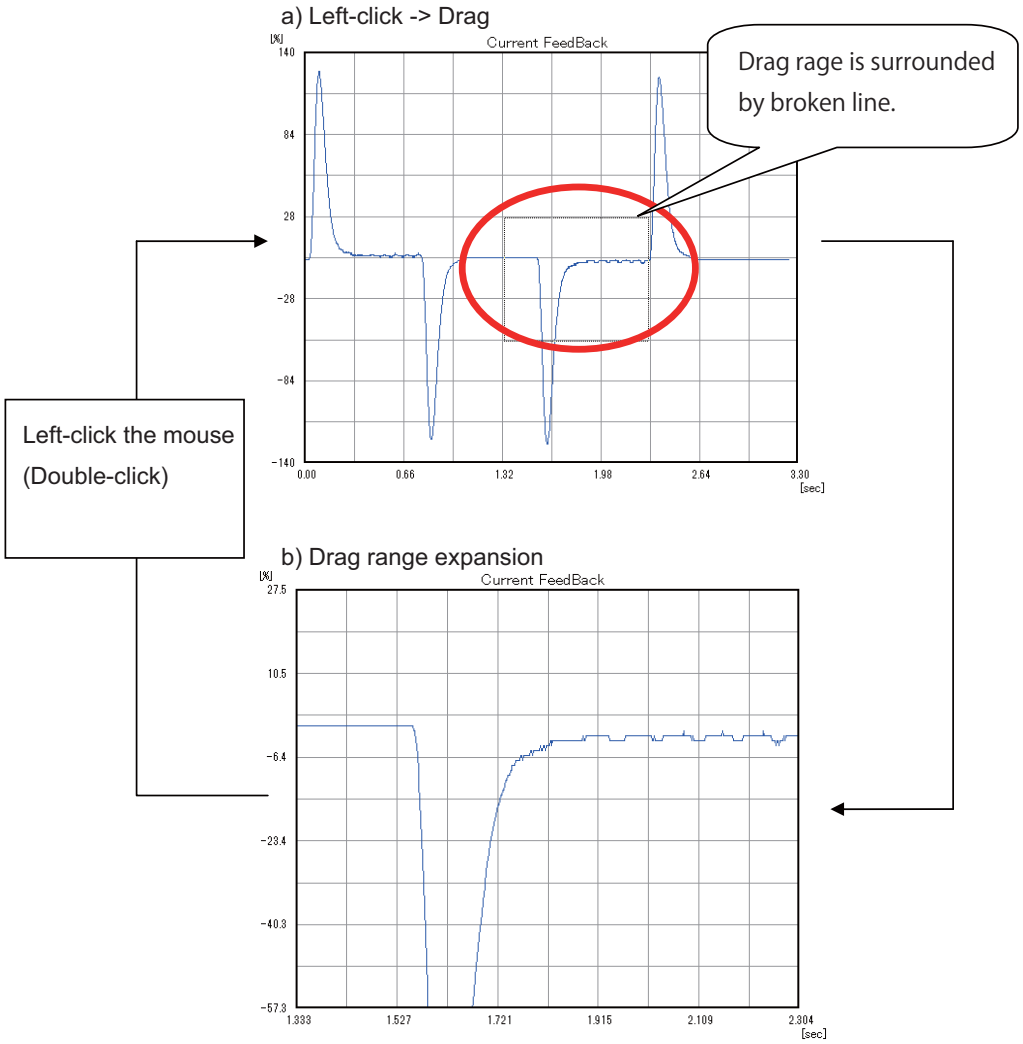
Execute expansion/reduction display of the graph.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Zoom].
This function can be selected from the function bar, right-click or tool box also.

(2) The zoom mode is applied.
- The mouse cursor is changed to the magnifying glass icon during zoom mode.
- When left-clicking the mouse, the display size can be doubled centering on the place where the mouse points.
- The zoom mode is canceled by double-clicking the mouse, and returns initial display.
- When the zoom mode is selected, an auto scale OFF is automatically set.
- Auto scale OFF mode is kept even after the zoom mode is canceled. Set the auto scale ON from axis range selection menu by manual.



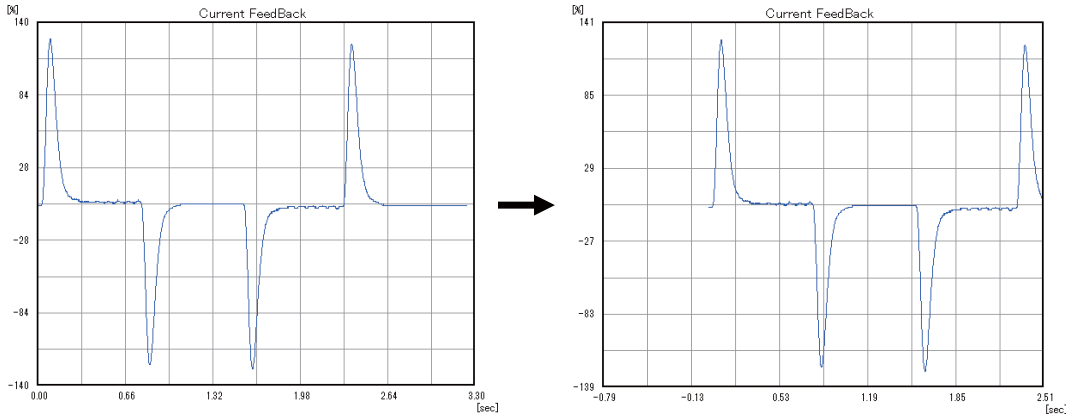
The area designated by dragging with the mouse left-clicked can be expanded.



### 3.6.2.6.3 Drag Mode of the Graph

The designated graph is dragged.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Drag].
This function can be selected from the function bar, right-click or tool box also.
(2) Left-click on the drag target graph area.
(3) The graph area selected by (2) is a drag mode.
The graph is dragged by moving the pointer.
All plots move at the same time when two or more plots exist.
When the mode is selected, an auto scale OFF is automatically set.



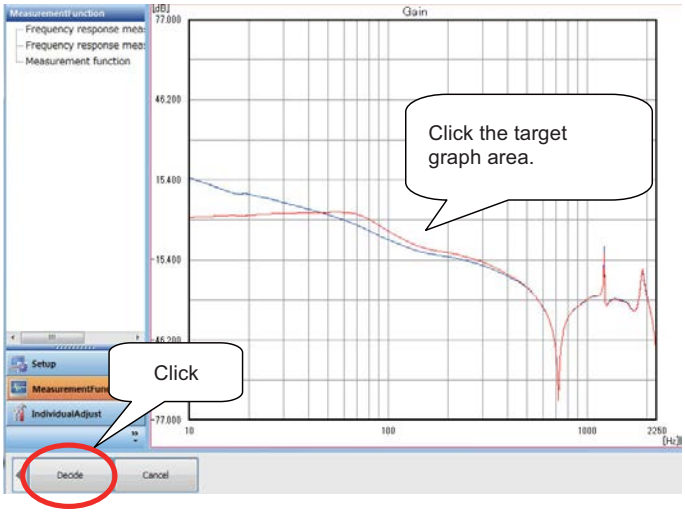

(4) When the [Drag] menu is selected again, the drag mode is canceled.
The auto scale OFF status is kept even after the mode is canceled.
Set the auto scale ON from axis range selection menu by manual.

### 3.6.2.6.4 Search Mode of the Graph

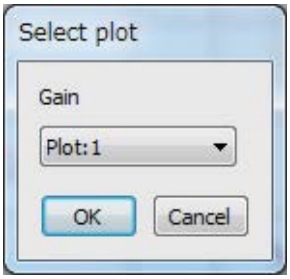
The value of the data point on the designated graph is read, and displayed it in the text area.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Search].
This function can be selected from the function bar, right-click or tool box also.

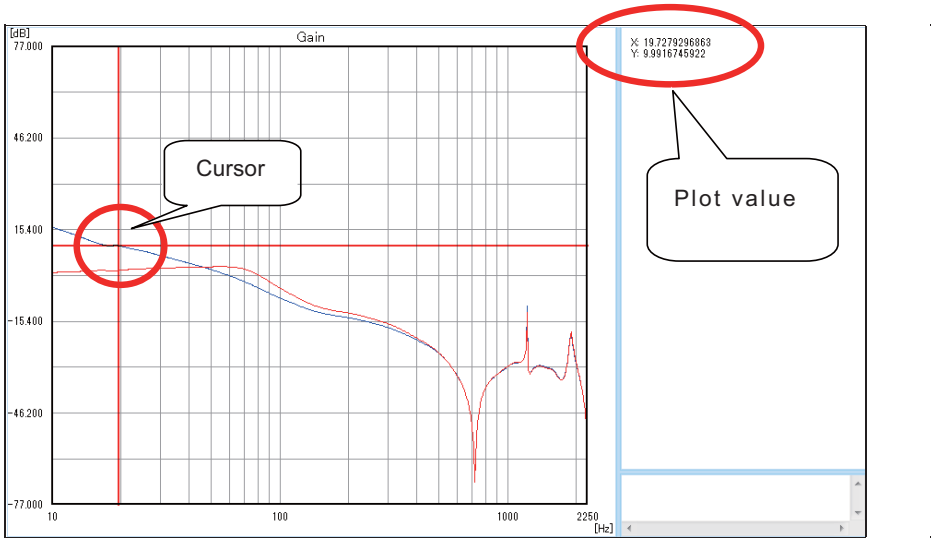
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.




(3) The Select plot dialog is displayed.
Designate the read target plot from plot selection combo box, and press the [OK] button.

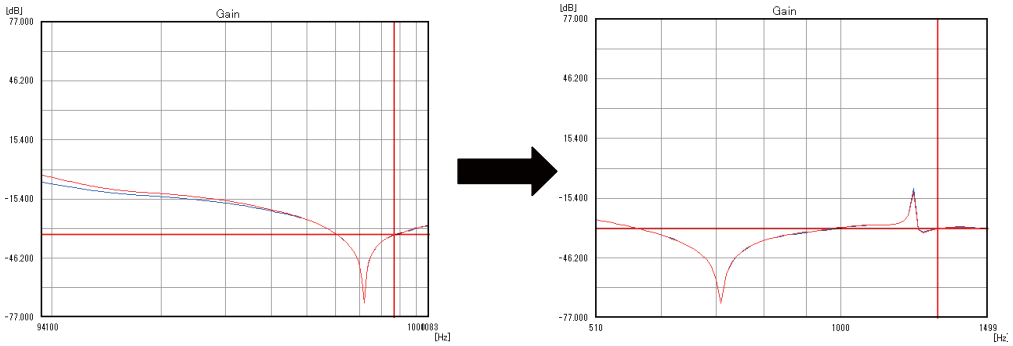


(4) The plot data selected by (3) is a search mode.
When the right cursor key is pressed, the red cross is displayed.
Move the red cross with the cursor key, and read the data point value on the designated graph.
The read value is displayed in the text area.
The cursor can be moved per one plot point by keyboard [Left/Right key].
The cursor can be moved per ten plot points by keyboard [Shift key + Left/Right key] or [Up/Down key].
Synchronizing the cursor movement, the cursor coordinates value of the text display area changes.
The thing to search only for the range displayed on the screen for X axis is possible.
For X axis, it is possible to search only for the range displayed on the screen.




**<Scrolling action during XY mode>**

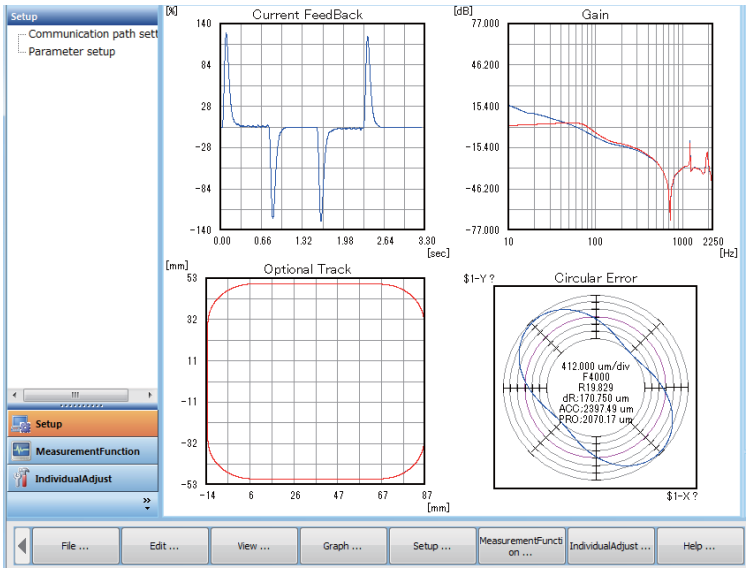
The screen is scrolled by pressing the cursor key when the overall graph is not displayed in the screen and search line appears at the end of the screen.
Continue to press the cursor key to scroll to the end or start point of the graph data.



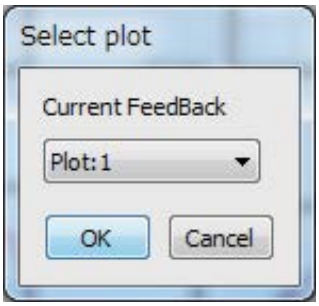
### 3.6.2.6.5 Multiple Search Mode of the Graph

The value of the data point is read in the most left side graph among the displayed graphs on the screen, and displayed it in the text area.
When two or more graphs are not displayed in the most left side, this cannot be selected.

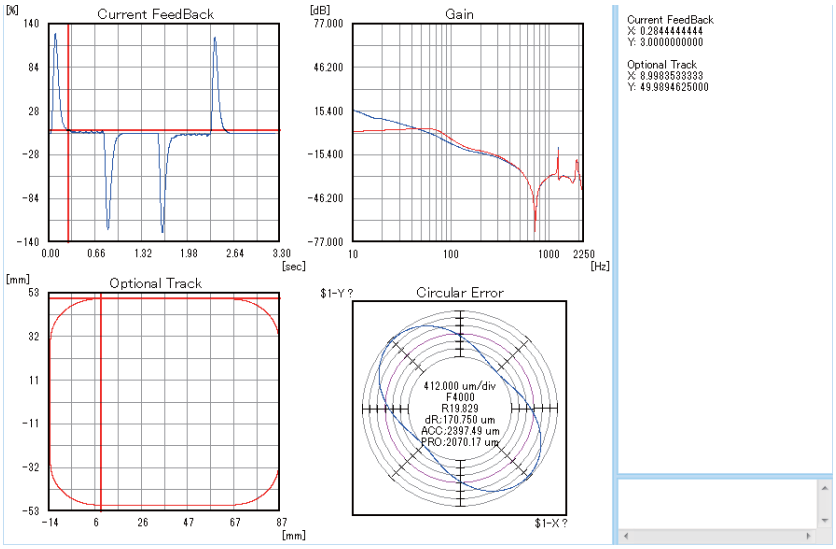
(1) Select the [Graph layout setting] from the menu, and set 2 to 10 of Vertical.
Refer to the contents of "Graph layout setting".
(2) Two or more graphs are displayed in vertical in the most left side. Plural search can be selected after displayed.
(3) Select the menu [Graph] - [PluralSearch].
This function can be selected from the function bar, right-click or tool box also.
(4) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.



(5) The plot selection dialog of the number of displayed graphs in the most left side is displayed.
Designate the read target plot each graph from plot selection combo box, and press the [OK] button.



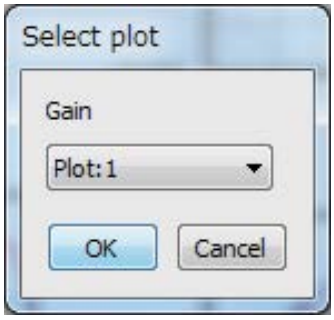

(6) The plot data selected by (5) is a search mode.
When the right cursor key is pressed, the red cross is displayed.
Move the red cross with the cursor key, and read the data point value on the designated graph.
The read value is displayed in the text area.
The cursor can be moved per one plot point by keyboard [Left/Right key].
The cursor can be moved per ten plot points by keyboard [Shift key + Left/Right key] or [Up/Down key].
Synchronizing the cursor movement, the cursor coordinates value of the text display area changes.
The thing to search only for the range displayed on the screen for X axis is possible.
For X axis, it is possible to search only for the range displayed on the screen.
The difference of the X axis scale value in 2 graphs is not considered.



### 3.6.2.6.6 Delete the Plot

The designated plot is deleted.
When the graph is not displayed, this cannot be selected.

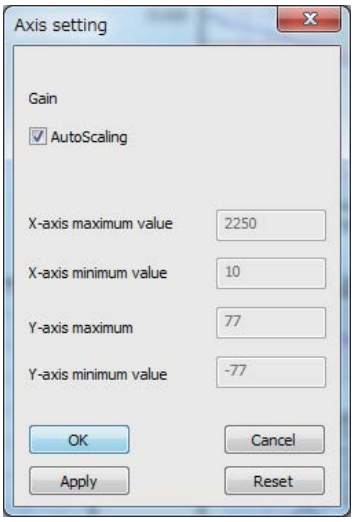
(1) Select the menu [Graph] - [RemovePlot].
This function can be selected from the function bar, right-click or tool box also.
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.
(3) When the plot is displayed in the selected graph area, the plot selection dialog is displayed.
Designate the read target plot from plot selection combo box, and press the [OK] button.
The selected plot is deleted.
When the graph is not displayed in the designated area, nothing happens.



### 3.6.2.6.7 Setup Axis Range of the Graph

This sets the maximum value, minimum value, and an auto scale ON/OFF etc. of the X and Y axis.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Setup axis range].
This function can be selected from the function bar, right-click or tool box also.
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.
(3) The Axis setting range dialog is displayed.
The displayed dialog is different depending on the selected graph.



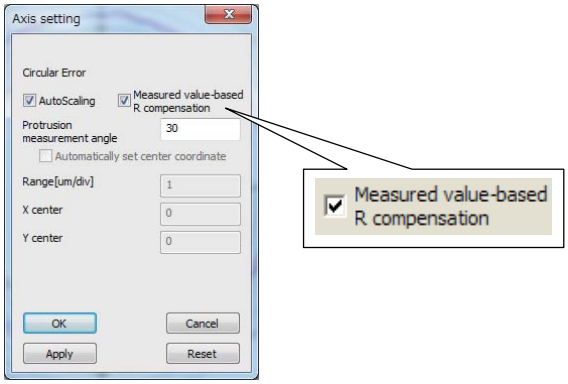
### 3.6.2.6.8 Measured Value-based R Compensation

| | |
|---|---|
| Enable | The radius of the drawn graph will be compensated as much as the reduction in radius which occurs due to servo’ s delay in tracking while cutting a circle.<br>Enable this function to enlarge the display of accuracy error and to check the protrusion. |
| Disable | Disable this function to check the reduction in radius which occurs due to servo’s delay in tracking while cutting a circle. Servo’ s delay in tracking can be improved by the high-accuracy control (Pre-interpolation acceleration/deceleration control + Feed forward control). |

Measured value-based R compensation: Enable

Circle waveform will be drawn using the reference circle (red line) of the roundness graph as the circle with measured radius.

The measured circle waveform will be shown on top of the reference circle.




Roundness graph

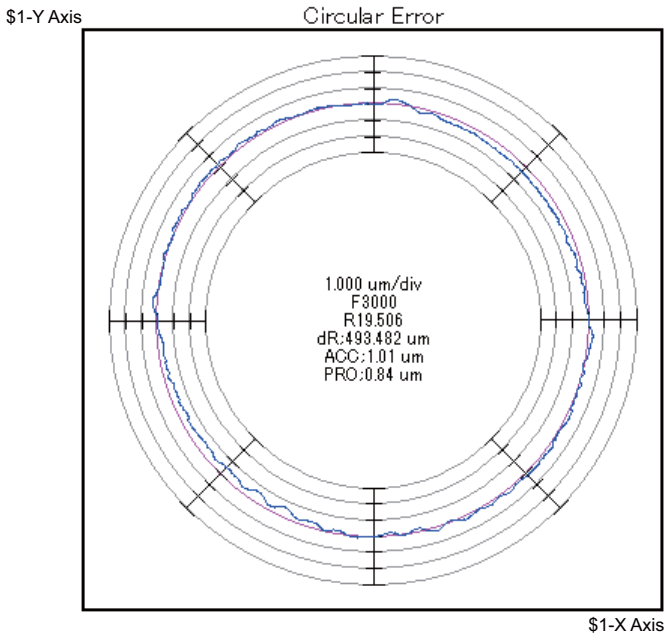
The display example when "measured value-based R compensation" is enabled.

Commanded radius: 25.000mm

Measured value based radius: 24.999mm

Reference circle of the roundness graph: Measured value based radius (R24.999)

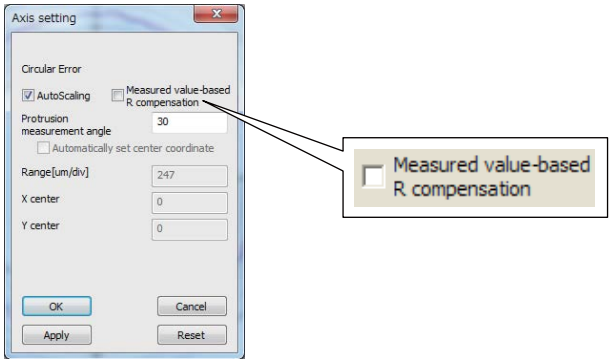
Radius error (dR: 1.000um)



**Measured value-based R compensation: Disable**

Circle waveform will be drawn using the reference circle (red line) of the roundness graph as the circle with commanded radius.

The measured circle waveform will be smaller than the reference circle by the error amount between the commanded radius and the measured value based radius.




Roundness graph

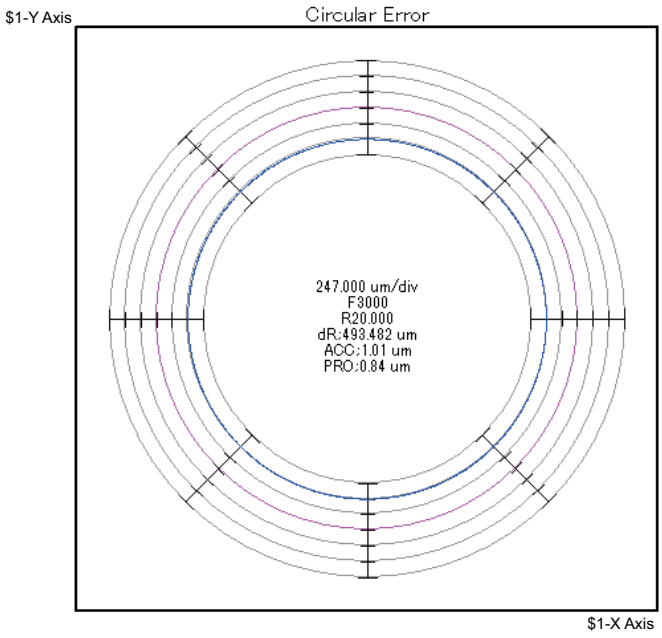
The display example when "measured value-based R compensation" is disabled.

Commanded radius: 25.000mm

Measured value based radius: 24.999mm

Reference circle of the roundness graph: Commanded radius (R25)

Radius error (dR: 1.000um)



### 3.6.2.6.9 Delete the Graph

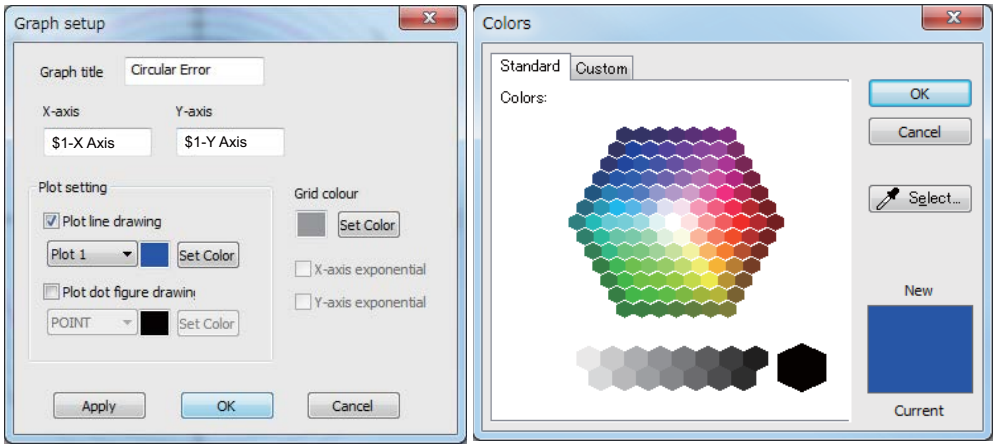
This deletes the displayed graph.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Remove].
This function can be selected from the function bar, right-click or tool box also.
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.
(3) The designated graph is deleted.

### 3.6.2.6.10 Graph Setting

This sets the displayed graph title, plot, etc.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Setup graph].
This function can be selected from the function bar, right-click or tool box also.
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.
(3) The Graph setup dialog is displayed.

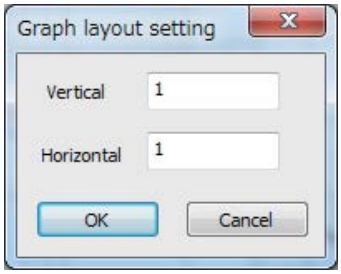


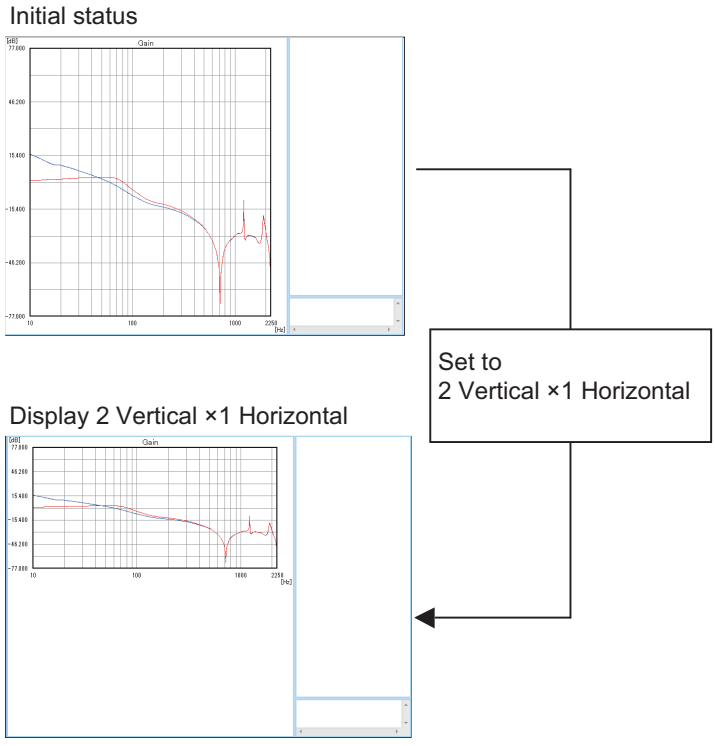
### 3.6.2.6.11 Graph Layout Setting

This sets the number of the displayed graphs.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [Graph] - [Graph layout setting].
This function can be selected from the function bar also.

(2) The Graph layout setting dialog is displayed.
Press the [OK] button after inputting an arbitrary number.
100 graphs (10 (Vertical) x 10 (Horizontal)) in total can be displayed in maximums.



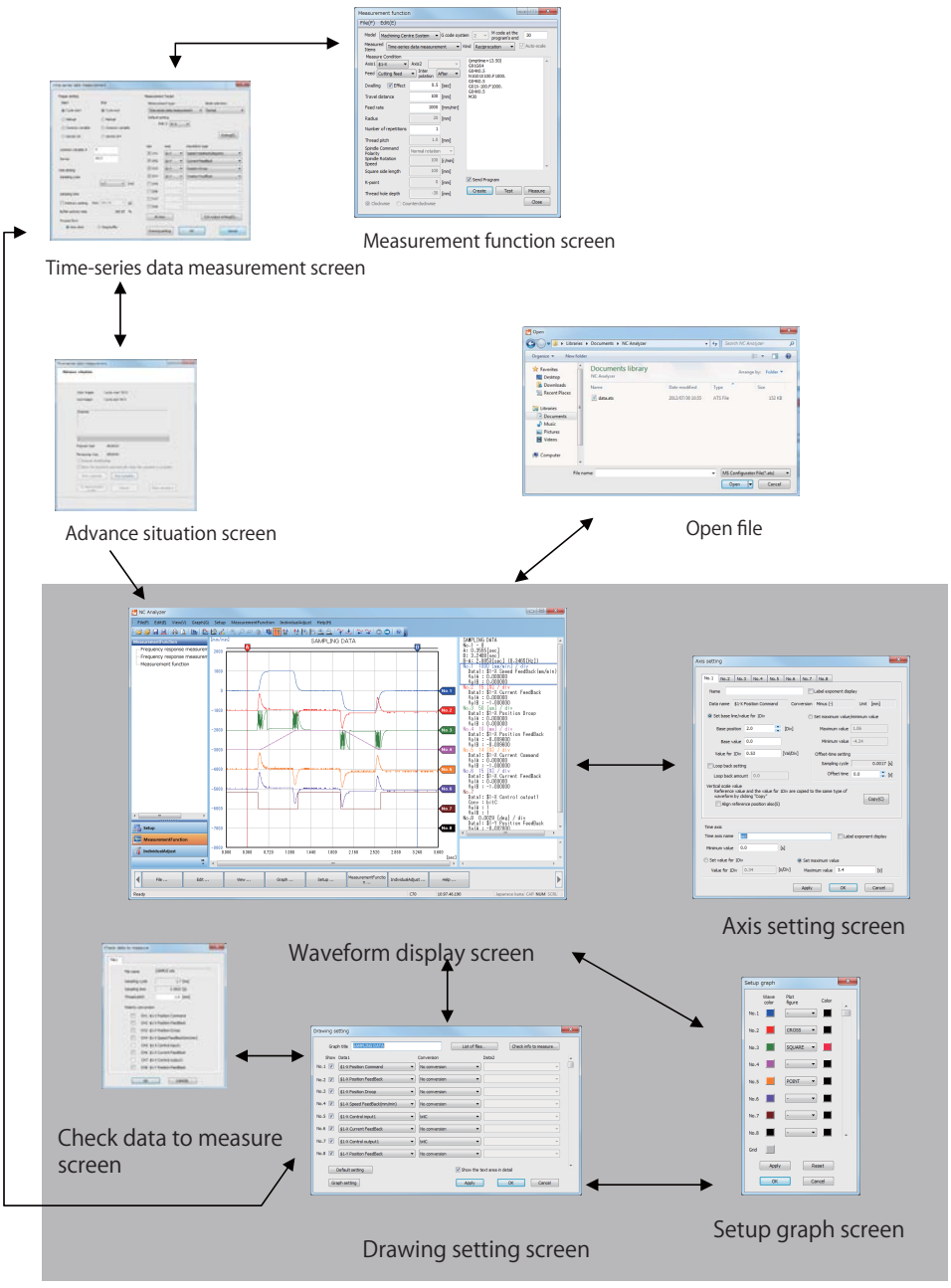



## 3.6.3 Graph Function in Time Mode

This section explains the graph function for time-series data measurement.

### 3.6.3.1 Screen Configuration

#### 3.6.3.1.1 Operation Procedure (Time mode)




The explanation of this section is related to the shaded area in the above figure.

(Note 1) If you go to the Drawing setting screen from the Time-series data measurement screen, you cannot go to the Axis setting screen and the Setup graph screen.

(Note 2) You are allowed to go to the Advance situation screen from Waveform display screen only right after the measurement.

The operation to display waveform in time mode is divided into "Waveform Display" and "Setting and Operation".

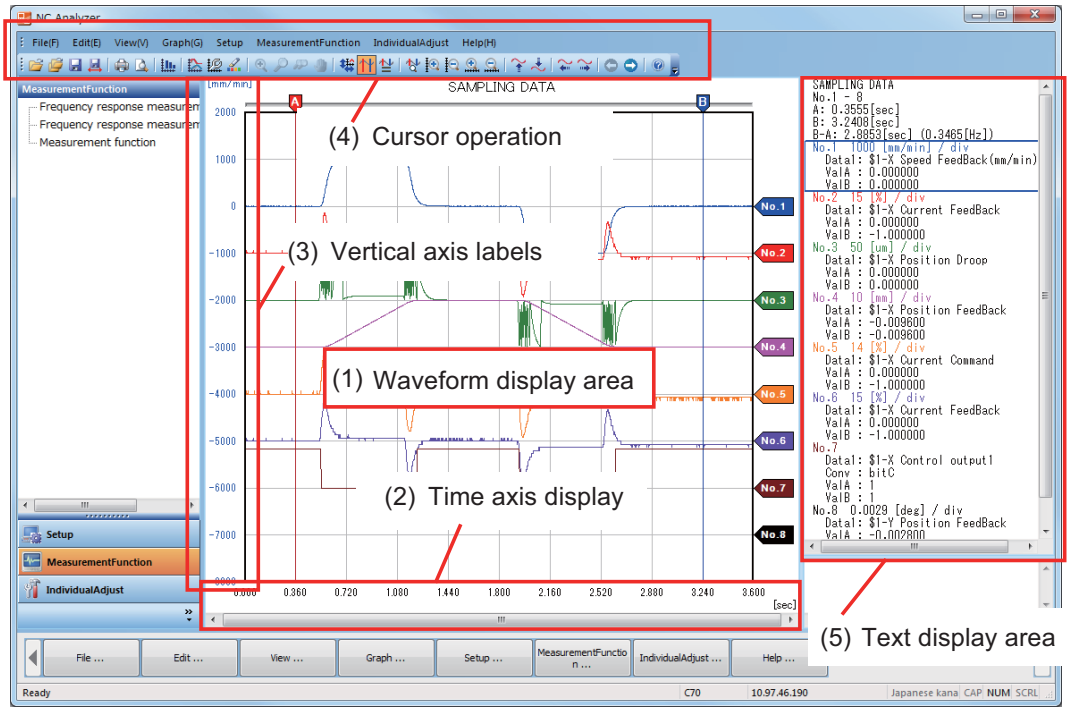
"Waveform Display" is the operation to display waveforms. Perform either of the following operation to display waveforms.
- Execute the measurement function (Time-series data measurement).
- Open a waveform file saved in time mode format.

In "Setting and Operation", set whether to show/hide cursors and perform waveform data processing (calculation of difference, speed conversion, etc.)

It is allowed to go to the Drawing setting screen from the Time-series data measurement screen. Also, it is allowed to go to the Check data to measure screen from the Drawing setting screen. Access to the Setup graph screen and the Axis setting screen are not available. If the "OK" or "Cancel" button is pressed on the Drawing setting screen, it returns to the original screen (Time-series data measurement screen). You cannot go to the Waveform display screen.

### 3.6.3.1.2 Contents of Waveform Display

The figure below shows the waveform display screen's graph display area.




(1) Waveform display area

- Maximum of 32 waveforms (8 per screen) can be viewed. Press the display No. changing buttons to change the displayed waveforms.
- Waveforms No.1 to 8 are displayed at default. An auto scaling is executed when opening a file. When you reach the waveform display screen from the Advance situation screen, you can select whether to execute auto scaling or to use the previously used value, depending on the settings for the Advance situation screen.
- The labels on the vertical axis will be displayed in the same color as the selected waveform.
- The graph title will be displayed in the middle of the graph.
- The zero position of each graph will be marked on the right side of the graph. It will not be marked if there is no zero in a waveform.
- There are following types of plotting.

| | |
|---|---|
| Thin-out plot | ⋯ Used when the display area is relatively small compared to the number of display plots and it is impossible to plot all the data. For example, when displaying 10000 data in an area of 800 pixels wide, one in 12 or 13 data will be plotted. |
| All-data plot | ⋯ Used when the display area is relatively large compared to the number of display plots and the space between plots is not one pixel. For example, when displaying 120 data in an area of 800 pixels wide, the interval between plots is six or seven pixels. |

(2) Time axis display

Scroll to move along the time axis.

The label display follows the following rules.

When the index is not displayed, down to three places of decimals are shown. When the unit of display time is small, same labels may appear due to rounding.

When the index is displayed, the value will be displayed in "#.##e±##" format. But when the value is one or more and 10 or less, "e±##" will be omitted.

Also, for both cases, the next digit after the display digits will be rounded.

(3) Vertical axis labels

The vertical axis labels show the labels for currently selected waveform. The color of labels is same as that of waveform.

The label's display digits follow the following rules.

When the index is not displayed, the display digits differ according to the gap between the maximum and minimum display value.

Vertical axis labels without index

| Gap between the maximum and minimum display value | Label display | Example |
|---|---|---|
| 100 or more | Integer only | 123 |
| 10 or more and less than 100 | Down to one place of decimal | 1.2 |
| 1 or more and less than 10 | Down to two place of decimal | 1.23 |
| 0.1 or more and less than 1 | Down to three places of decimal | 1.234 |
| | : | |
| 0.00001 or more and less than 0.0001 | Down to seven places of decimal | 1.2345679 |

When the index is displayed, the value will be displayed in "(-)#.##e±##" format.

(Ex.) -9876.5 -> -9.88e+03

Also, for both cases, the next digit after the display digits will be rounded.

(4) Cursor operation

There are cursors A and B.

- The values of the time where the cursor is placed will be displayed in the text area.
- Also, values (P-P, average, etc.) between cursors will be displayed in the text area.

(5) Text display area

Various informations will be displayed in the text area.

Active waveform can be selected. The selected waveform will be marked with a frame of the same color as the waveform.

If the informations are too long to fit in the text area, it can be viewed by scrolling right and left or up and down.

The informations differ depending on the situation.

**Contents of the text display area**

| Display item | Display contents | Display example | Display | |
|---|---|---|---|---|
| | | | Cursor | No cursor |
| Graph title | Graph title.<br>Set by the Drawing setting screen. | (arbitrary) | ○ | ○ |
| Displayed waveform No. | The No. of currently displayed waveform is shown.<br>Display is either "No.1 - 8", "No.9 - 16", "No.17 - 24", or "No.25 - 32". | No.1 - 8 | ○ | ○ |
| A | The time where the cursor A is placed is indicated on the second time scale. | A: 0.8888[sec] | ○ | × |
| B | The time where the cursor B is placed is indicated on the second time scale. | B: 4.6222[sec] | ○ | × |
| B-A | The time gap between cursor A and B is displayed on the second time scale and its reciprocal.<br>When the cursor A and B overlap, the reciprocal on the second time scale will be displayed as "N/A". | B-A: 3.7333[sec]<br>0.268[Hz] | ○ | × |
| Information for Sync. tapping error measurement | This displays thread pitch.<br>Displays only when Sync. tapping error measurement waveform is in the drawing data.<br>When displaying multiple waveforms simultaneously, [n] is added to the head of the value. ("n" is 1 for the first file and 2 for the second file) | Screw Pitch:<br>1.000[mm]<br>Screw Pitch: [1]<br>1.000[mm] | ○ | ○ |
| Waveform No. and Value for 1Div | The waveform No. and the value per division (Value for 1Div) are displayed.<br>Display of 1Div will be omitted when the digits below the decimal point are all zero. (Ex. 1.100000 will be displayed as 1.1.)<br>This is displayed in the color specified by the Setup graph screen.<br>But when a control input/output or PLC signal is selected for Data1 and a bit for Conversion.<br><br>For defined data, the standard output unit multiplied by the set magnification is displayed when displaying Monitor output data.<br><br>The output unit is not displayed and only the division is displayed when a word device of PLC signal is displayed. | No.1 1.1[%]/div<br><br>[Monitor output data display]<br>Defined data<br>No.1 1[V] /div<br>(1000[r/min] /V)<br>Undefined data<br>No.1 1[V] /div<br><br>[PLC signal (word) display]<br>No.1 5000 /div | ○ | ○ |
| Title | Titles of each waveform set by the Axis setting screen are displayed.<br>Nothing will be displayed when titles are not set. | (arbitrary) | ○ | ○ |

| Display item | Display contents | Display example | Display | |
|---|---|---|---|---|
| | | | Cursor | No cursor |
| Data1 | Titles of the waveform set in Data1 of the Drawing setting screen are displayed.<br>When displaying multiple waveforms simultaneously, [n] is added to the head of the value. ("n" is 1 for the first file and 2 for the second file)<br>(*) is added to the head of the value for polarity-converted waveform.<br>When executing multiple waveform display and polarity conversion at the same time, multiple waveform display is displayed at first.<br><br>When displaying Monitor output data, MON1 and MON2, which indicate CH1 and CH2, are added, and the data number and setting magnification are added to the ending.<br><br>"PLC(bit) device name" is displayed when a bit device of PLC signal is displayed.<br>"PLC(word number) device name" is displayed when a word device of PLC signal is displayed. | [Normal]<br>Data1: $1-X Current FeedBack<br>[Multiple waveform display]<br>Data1: [1]$1-X Current FeedBack<br>[Polarity conversion]<br>Data1: (*)$1-X Current FeedBack<br><br>[Monitor output data display]<br>Data1:$1-X MON1 Position FeedBack (62:100)<br><br>[PLC signal (bit) display]<br>Data1:PLC(bit) Y300<br>[PLC signal (word) display]<br>Data1:PLC(1word) R140<br>Data1:PLC(2word) R140 | ○ | ○ |
| Conversion | This displays the data processing method.<br>Nothing will be displayed when "Conversion" is set to "No conversion". | Conv : gap(-) | ○ | ○ |
| Data2 | Titles of the waveform set in the data 2 of the Drawing setting screen are displayed.<br>The specifications for polarity conversion, multiple waveform display, and Monitor output data display are the same as "Data1". | Data2: $1-Y Current feedback | ○ (Note 1) | ○ (Note 1) |
| ValA | This displays the time value of cursor A. | ValA: 1.000000 | ○ | × |
| ValB | This displays the time value of cursor B. | ValB: 0.000000 | ○ | × |
| Maximum value<br>Minimum value | Displays the maximum value and the minimum value.<br>Also displays the number of seconds. If the maximum or minimum value is recorded more than once, the earlier one will be displayed.<br>When the cursor is displayed, the value between the cursors is displayed. | Max: 1.012000 (0.8888[sec])<br>Min: -1.008000 (3733.3333[sec]) | ○ (Note 2,3) | ○ (Note 2,3) |
| P-P | This displays the maximum vibration amplitude.<br>When the cursor is displayed, the value between the cursors is displayed.<br>However, when "Conversion" is set to "Synchronous tapping error", error pulse value is also displayed. Error pulse is obtained by converting P-P into pulses (multiplying by 4096/360) and rounding to the nearest integer. | [Normal]<br>P-P: 2.020000<br>[Sync. tapping]<br>P-P: 2.020000 (23[pulse]) | ○ (Note 2,3,4) | ○ (Note 2,3,4) |
| Ave | This displays average value between the cursors. | Ave: 0.004000 | ○ (Note 2,3) | × |
| RMS | This displays the root-mean-square between the cursors. | RMS: 0.002000 | ○ (Note 2,3) | × |

- The time is indicated on the second time scale. Down to four places of decimals are displayed and others are rounded off.
- Others than time are displayed down to six places of decimals. The value is rounded off to six decimal places.

(Note 1) Displayed only when "Conversion" is set to "Minus (-)".

(Note 2) Not displayed when a control input/output or PLC signal is selected for Data1 and a bit for Conversion.

(Note 3) Not displayed when the "Show the text area in detail" check box in the Drawing setting screen is not checked.

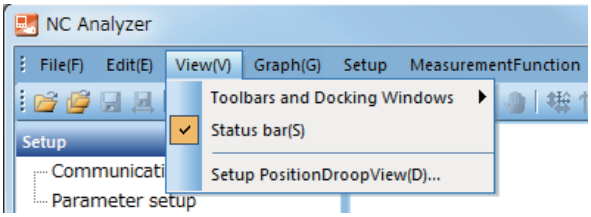
(Note 4) Always displayed regardless of the state of the "Show the text area in detail" check box when "Conversion" is set to "Synchronous tapping error".

### 3.6.3.2 How to Use the Graph

#### 3.6.3.2.1 Menu Bar Display Setting

Set whether to display the tool bar, the status bar, and the function bar.

(1) Select the menu [View].
The menu bar list to which display/non-display can be set is displayed.
This function can be selected from [View] of the function bar also.




(2) Select the menu bar which sets display/non-display.
The check changes whenever pressing once.

### 3.6.3.2.2 Auto Scaling

Auto scaling shows all the area from the start to the end of measurement.
When there are several waveforms, they are arranged by their No. in ascending order from the top.
- Auto scaling is applied to the default waveform display.
- Auto scaling while the cursors are displayed changes the apparent cursor position. But it will not change the times they point at.

(1) Details of time label
All the area from the start to the end of measurement is displayed.
The far right label indicates the measurement time rounded up to the second significant figure.
Ex. When the sampling time is 12.34 sec.
The far right label will be 13.0 sec. which means 1Div is about 1.30 sec.

(2) Arranging several waveforms
Base lines are allocated to waveforms by their No. in ascending order from the top. When No.1 to 8 are displayed, the second Div from the top is the base line for No.1. The base line value is 0. Likewise, the third Div from the top is the base line for No.2.
"Set base line/value for 1Div" on the Axis setting screen is checked.
For the vertical axis, the arrangement applies to the currently displayed eight waveforms. For the horizontal axis, the whole area gets changed.

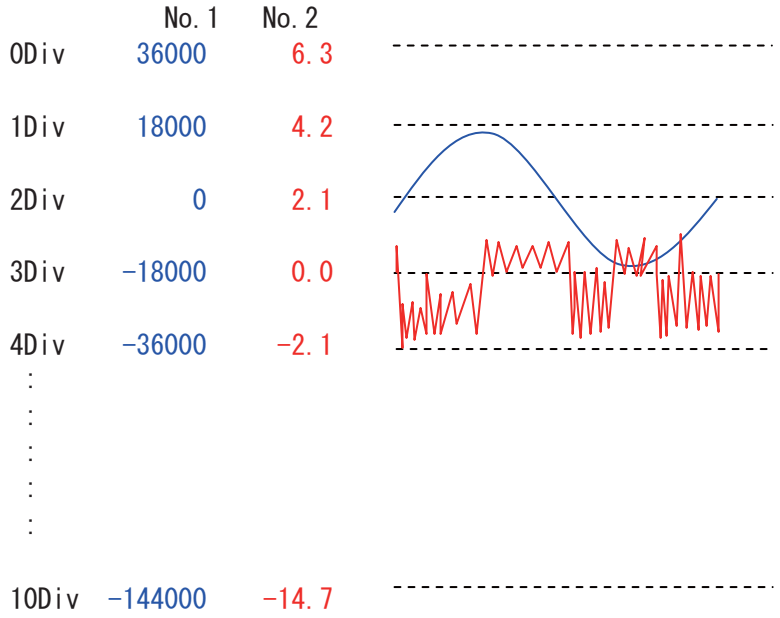
[Axis data waveform or PLC signal (word device)]
It is arranged that the waveform falls inside the range of ±1Div of the vertical axis with the reference line indicating 0.
The unit per Div is the upper two significant figures (round up the third figure) of the absolute value of either the maximum or minimum value, whichever larger.
When all the axis data is 0, the unit per Div is 10.
When loop back function is valid, the unit per Div corresponds to the loop back amount. As for the position droop, only when "Conversion" is set to "No conversion", the loop back function becomes valid and the line-wrap width will be 50[μm].

Ex.: Waveform No.1 Maximum value 17221, Minimum value -16880
Waveform No.2 Maximum value 1.000, Minimum value -2.000

No.1
The base line is the second Div.
The absolute value of the positive (maximum) value 17221 is larger than the negative (minimum) value.
The unit per Div, which is to say the upper two significant figures, is 18000.
(On the Axis setting screen, "Base position" is 2.0 Div, "Base value" is 0, "Value for 1Div" is 18000 Val/Div, and "Loop back amount" is 0.)

No.2
The reference line is the third Div.
The absolute value of the negative value -2.000 is larger than the positive value.
The unit per Div, which is to say the upper two significant figures, is 2.100.
(On the Axis setting screen, "Base position" is 3.0 Div, "Base value" is 0, "Value for 1Div" is 2.1 Val/Div, and "Loop back amount" is 0.)

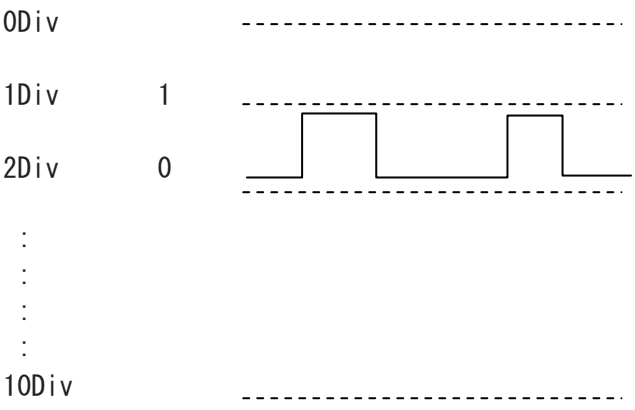
**Explanation drawing of vertical axis auto scale (axis data)**




[Control signal or PLC signal (bit device)]
Displays "0" on the base line (2.0Div) and "1" on the line 1Div above the base line. There is no exception.
It will not change even by enlarging or reducing the waveform in vertical direction.

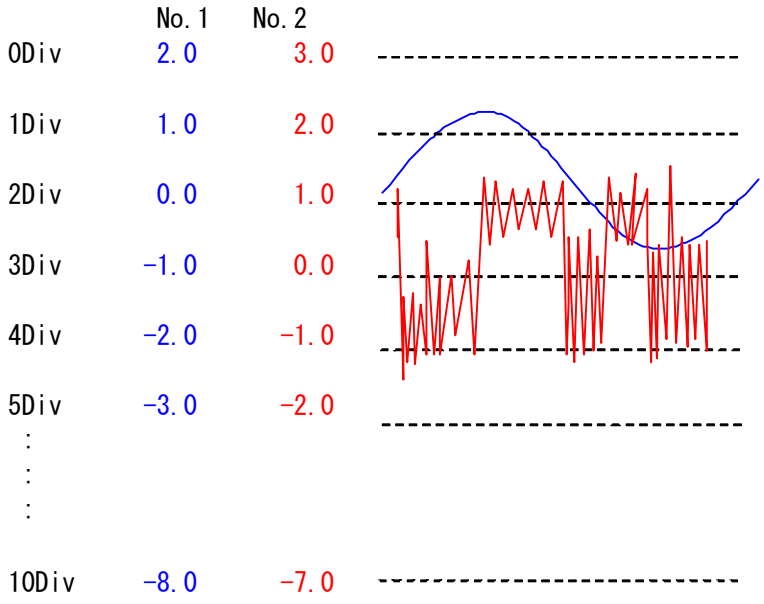
Ex: No.1 control signal waveform

**Explanation drawing of vertical axis auto scaling (control signal)**



[Monitor output data]
Base value for all the axes is 0 and the unit per Div is fixed to 1.

**Explanation drawing of vertical axis auto scale (Monitor output data)**




(Note) When the Monitor data is not a control signal, the unit per Div is 1.

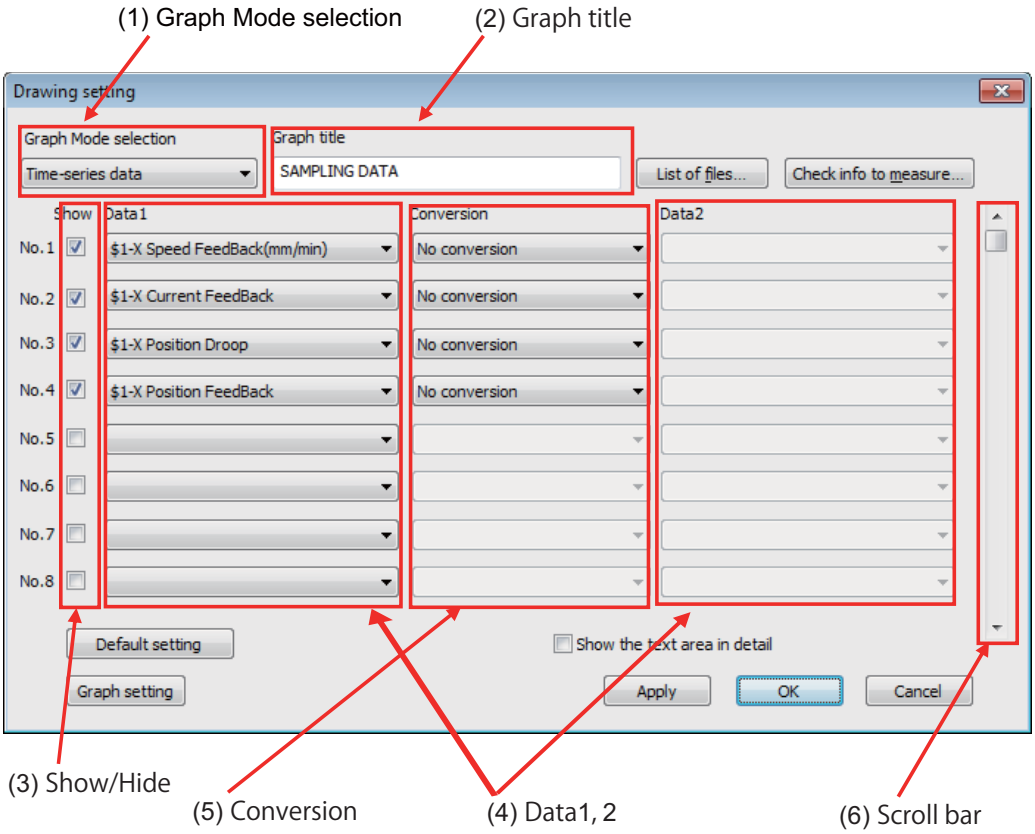
**Auto scaling operation method**

(1) Select the menu [Graph] - [Execute AutoScaling].
This function can be selected from the function bar, right-click or tool box also.

### 3.6.3.2.3 Drawing Setting Screen

On the drawing setting screen, perform data processing according to the measured data displayed on the screen. It is possible on this screen to view the difference between waveforms of same type, to convert control signals into bit, and to convert positional information into speed and acceleration.
The waveform of time mode (Time-series data measurement, Sync. tapping error measurement, Circular error, Arbitrary path, and Arbitrary error) can be set on this screen.
The currently displayed waveform No. will appear when opening the drawing setting screen. Also, the currently displayed waveform No. will reappear on the waveform display screen when the drawing setting screen is closed.

**The display contents of the Drawing setting screen**




(1) Graph Mode selection

Specify the type of drawing setting. The item to be set differs as follows.

| Graph mode selection | Conversion to be selected | Waveform type displayed on Data1 and 2 | Graph display |
|---|---|---|---|
| Time-series data | All | All waveform types | Time-series graph |
| Circular error | Circular error | Position command,<br>Position FB,<br>Model position,<br>and Motor end position | Circular graph |
| Arbitrary path | Arbitrary path | Position command,<br>Position FB,<br>Model position,<br>and Motor end position | Arbitrary path graph |
| Arbitrary error | Base waveform and<br>Arbitrary error | Position command,<br>Position FB,<br>Model position,<br>and Motor end position | Arbitrary error graph |

(2) Graph title

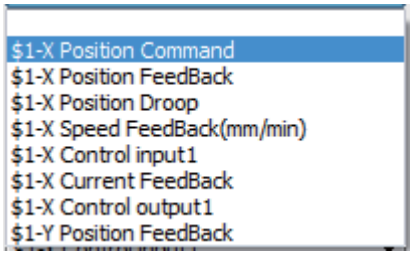
Give a name of up to 32 one-byte characters to the whole waveforms.
The name will be displayed on top of the graph and in the text display area.
Right after the measurement, the name is fixed to "SAMPLING DATA" for time-series data, ."Circular Error" for circular error, and "Optional Track" for arbitrary path.

(3) Show/Hide

Select whether to show or hide waveforms. When turned ON, waveforms appear.
More than 1310720 data as a total cannot be displayed in a page. "Show" check boxes are grayed out if the total data exceeds this limit when they are checked. "Data1" check boxes remain selectable.
Ex.: When sampled 327680 points for four channels
When check boxes of four waveforms are checked (1310720 = 327680 points x 4 waveforms), the check boxes for the rest of four waveforms are grayed out. Take OFF any of the checks to remove the grayout.
When "Arbitrary error" is selected on "Graph Mode selection", "Show" check boxes of the top No. (No.1,9,17,and 25) are grayed out with ON.

(4) Data1

"Data1" combo box includes the data of CH1 to 8 on the Check data to measure screen and "Blank".
Ex.: When the data of CH1 to 8 is as shown in the "Example of Check data to measure screen".
-> The choice is as shown below.
Example of Data1 choices




The combo box includes the followings when PLC signal is selected.

| PLC signal type | Display contentsDisplay example | 表示例 |
|---|---|---|
| PLC(bit) | "PLC(bit) device name" is displayed. | PLC(bit) Y300 |
| PLC(1word) | "PLC(1word) device name" is displayed. | PLC(1word) R140 |
| PLC(2word) | "PLC(2word) device name" is displayed. | PLC(2word) R140 |

- When "Data1" of a No. is selected, "Conversion" of the same No. shows the default value. The default value for axis data is "No conversion" and for control output signal is "bitC". Also, "Data2" is cleared and becomes invalid.
- If "blank" is set to "Data1" of a No., its "Conversion" and "Data2" are cleared and becomes invalid.

(5) Conversion and Data2

Select the conversion. Available conversions are as follows.

| Conversion | Details | Selectable choices for Data1 |
|---|---|---|
| No conversion | The data of Data1 will not be converted.<br>This is not available when a control output data or PLC signal (bit device or word device) is selected for Data1. | Position command,<br>position feedback,<br>position droop,<br>speed command,<br>speed feedback,<br>current command,<br>current feedback |
| Minus (-) | The result of calculation (Data1) - (Data2) will be displayed.<br>When this is selected, "Data2" will be cleared and invalidated.<br>The unit of "Data2" must be same as that of "Data1". The combo box displays only "blank" and "the waveform data whose unit is same as Data1".<br>- The difference between position droop [µm] and position command [mm] cannot be calculated.<br>- Even when the type of waveforms matches, the difference cannot be calculated if one is a linear axis [mm] and another is a rotary axis [deg].<br>- As for speed, the difference between rotation [r/min] and length [mm/min] cannot be calculated. | Position command,<br>position feedback,<br>position droop,<br>speed command,<br>speed feedback,<br>current command,<br>current feedback |
| Acceleration conversion | Converts positional information (position command, position feedback) into speed.<br>The first value is treated as 0.<br>The display unit is [mm/min] or [deg/min]. | Position command,<br>Position feedback |
| Acceleration conversion | Converts positional information (position command, position feedback) into speed.<br>The first and second values are treated as 0.<br>The display unit is [m/s2] or [deg/s2]. | Position command,<br>Position feedback |
| bit0<br>:<br>bitF | Specify the control signal's bit to perform drawing. | Control input 1 to 6,<br>control output 1 to 6 |
| Synchronous tapping error | Obtains the synchronous tapping error between servo and spindle.<br>Synchronous tapping error can be calculated by the following expression.<br>Synchronous tapping error [deg] =<br>(Servo position infomation[mm] x 360[deg] / Thread pitch [mm])<br>- Spindle position infomation [deg]Select the position information of servo for Data1 and that of spindle for Data2. | Position command and position feedback for servo |
| Circular error | Circular error is displayed.<br>- Displayed as a circular error graph in XY mode.<br>- When the graph display is a circular error, only circular error can be selected for conversion. | Position command<br>Position FB<br>Model position<br>Motor end position |
| Arbitrary path | Arbitrary path is displayed.<br>- Displayed as an arbitrary path graph in XY mode.<br>- When the graph display is an arbitrary path, only arbitrary path can be selected for conversion. | Position command<br>Position FB<br>Model position<br>Motor end position |
| Base waveform | Base waveform is displayed.<br>- Displayed as an Arbitrary error graph in XY mode.<br>- When "Arbitrary error" is selected on "Graph Mode selection", conversion for the page top No. (No.1,9,17,and 25) will be Base waveform forcibly. | Position command<br>Position FB<br>Model position<br>Motor end position |
| Arbitrary error | Arbitrary error is displayed.<br>- Displayed as an Arbitrary error graph in XY mode.<br>- When "Arbitrary error" is selected on "Graph Mode selection", conversion for other than the page top No. will be Base waveform forcibly. | Position command<br>Position FB<br>Model position<br>Motor end position |

- When other than "Minus (-)" is set to "Conversion", "Data2" is cleared and becomes invalid.
- When "Conversion" is "Minus (-)" and "Data2" is not set, the displayed waveform will be as same as when "Conversion" is "No conversion".
- For control signal data or unregistered data of Monitor output data "No conversion" is always selected for "Conversion".
- For PLC signal (bit device or word device), "No conversion" is always selected for "Conversion" and the combo box is disabled.

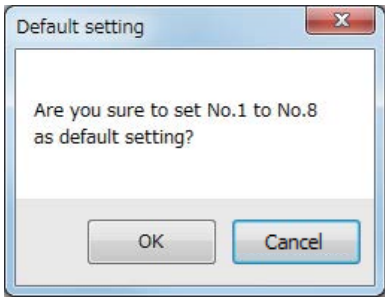
(6) Scroll bar

By moving the scroll bar, the drawing setting screen changes between No.1 to 8, 9 to 16, 16 to 24, and 25 to 32.

(7) Buttons and check boxes

| Conversion | Details |
|---|---|
| Check data to measure | Displays the "Check data to measure" screen. |
| Default setting | When pressed, the confirmation window will appear. Press [OK] to turn all the processing settings back to default status.<br>[Default setting]<br>- The data of channel 1 to 8 of measurement data (ATS file) will be applied to No.1 to 8. All the polarity conversion settings will also be OFF.<br>- The default setting of "Conversion" is "bit0" for the control input and output and "No conversion" for the others.<br>- Graph title and settings for No.9 to 32 will not change.<br>[Circular error or Arbitrary path]<br>When Circular error or Arbitrary path is selected for graph display, "Circular error" or "Arbitrary path" is selected for "Conversion".<br>[Arbitrary error]<br>When Arbitrary error is selected for graph display, "Base waveform" is selected for "Conversion" of CH1 and "Arbitrary error" is selected for CH2. |
| Graph setting | Settings will be saved and "Setup graph" screen will appear. |

**The image of confirmation window before applying default settings**




**Check box on drawing setting screen**

| Name | Details |
|---|---|
| Show the text area in detail | Check this check box to view details, including the maximum and minimum value, in the text display area of the waveform display screen.<br>This is unchecked at default.<br>Details display is not available because there is no data to display for circular error, arbitrary path, and Arbitrary error and it is masked when selecting circular, arbitrary and arbitrary error. |

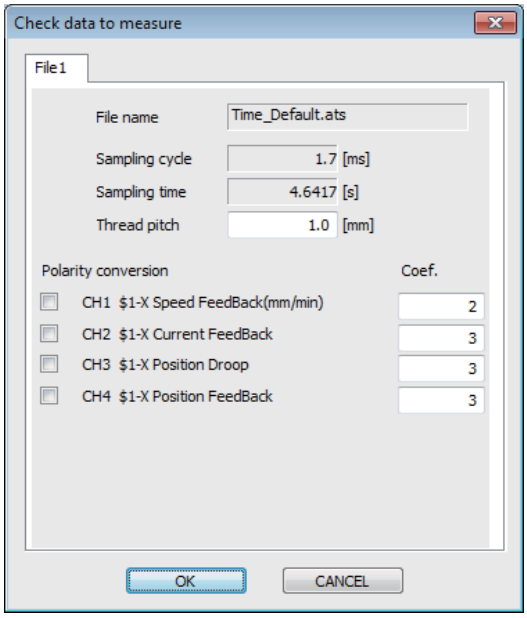
(8) Check data to measure screen

Polarity (positive or negative) can be converted for each channel. The measurement data can also be checked.

Furthermore, the measurement data conversion coefficient can be set.

The waveform applied a magnification to the measurement data can be drawn by setting a coefficient for the measurement data with the measurement data conversion function.

The error between the measurement data can easily checked with the waveform drawing which is multipled with the coefficient.




Display contents include file name, sampling cycle, time, thread pitch, measured waveforms, presence of polarity conversion, and the coefficient of the measurement data.

**<Polarity conversion>**

The polarity of the channel data is inverted when it is ON or the coefficient is not 1. Polarity conversion is also performed for the waveforms which are obtained through calculation such as speed conversion.

[*] is added to the head of the measurement waveform when the check box for polarity conversion is ON.

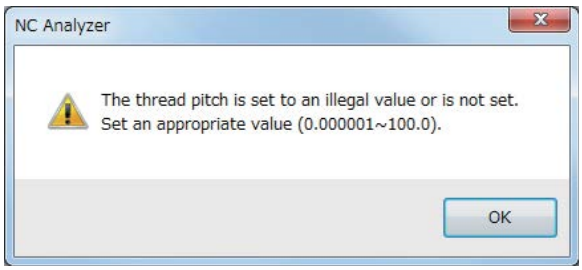
Polarity conversion is always OFF for control input/output or PLC signal (bit device) waveforms, as the check box is disabled and cannot be changed.

**<File name display>**

"NC" is displayed for file name display before and just after the measurement.

**<Thread pitch>**

Current thread pitch is displayed and can be changed. Change the value of "Thread pitch" and close with "OK" button to change thread pitch. The following error message will appear when the value outside the setting range is input.

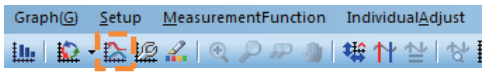
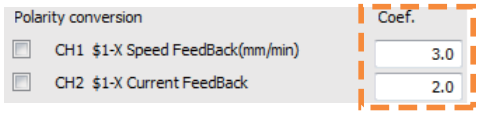
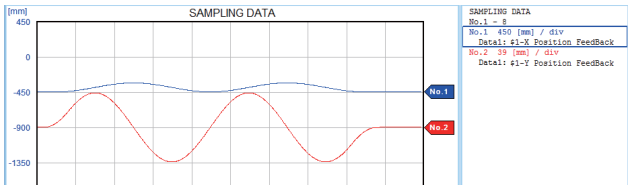


**<Coefficient>**

Current measurement data conversion coefficient is displayed and can be changed. Change the value of "Coef." and close with "OK" button to change the coefficient.
The coefficient previously set is displayed when changing to Check data to measure screen. The error message will appear when the value outside the setting range (0.001 to 99999.999) is input.

[*] is added to the head of the measurement waveform when the coefficient is not 1 or the check box for polarity conversion is ON.
When the check box for polarity conversion is checked, the data is handled as a minus one even if the positive data is set.
Polarity conversion is always grayed out for control input/output or PLC signal (bit device) waveforms, as the check box is disabled and cannot be changed.

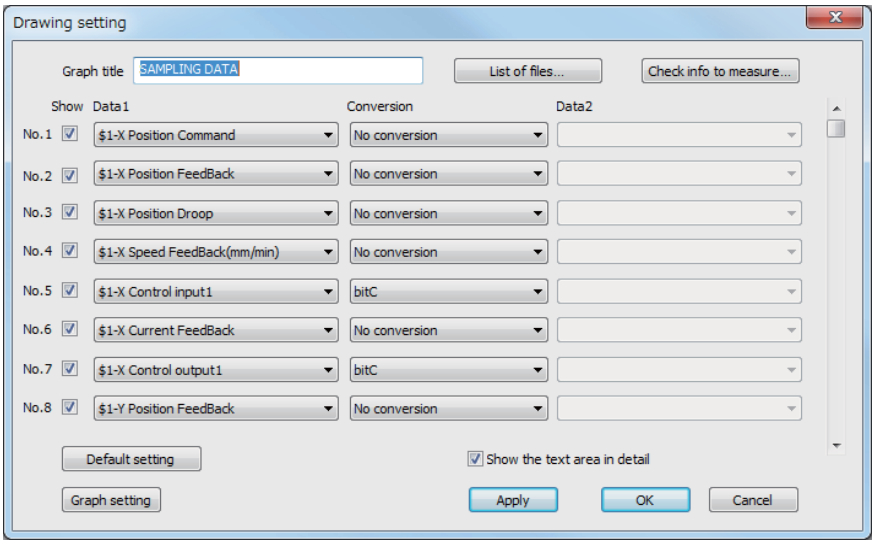
Operating procedure to display a drawing by setting a coefficient

| Operation | | Performance |
|---|---|---|
| (1) | Press the "drawing setting" button on the drawing screen. |  Drawing setting screen is displayed. |
| (2) | Press the "Check info to measure" button on the Drawing setting screen. |  Check data to measure screen is displayed. |
| (3) | Input the coefficient corresponding to the channel. |  Input coefficient is displayed. |
| (4) | Press the "OK" button in sequence on Check data to measure screen and Drawing setting screen. |  Input coefficient is displayed.<br>Return in sequence to Drawing setting screen and drawing screen.<br>The waveform multipled with the coefficient is drawn.  |

**Operation Method of the Drawing Setting Screen**

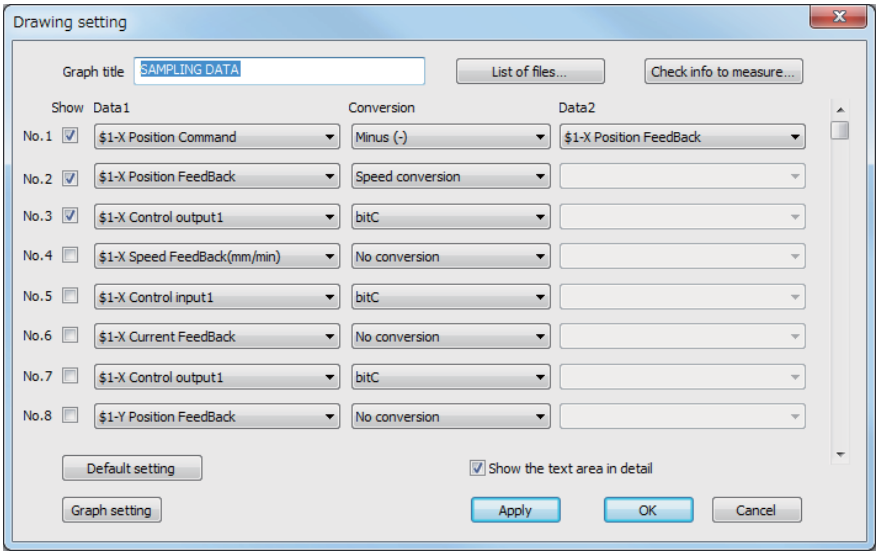
The following procedure shows how to conduct measurement and display the difference between position command and position feedback, the acceleration calculated from position feedback, and the waveform of imposition (Control output 1 bitC) without drawing setting.

(1) Conduct measurement and display the waveform.
(2) Display the Drawing setting screen.
Select the menu [Graph] - [Drawing setting].
This function can be selected from the function bar, right-click or tool box also.
-> Drawing setting screen appears. The default settings are applied as below.



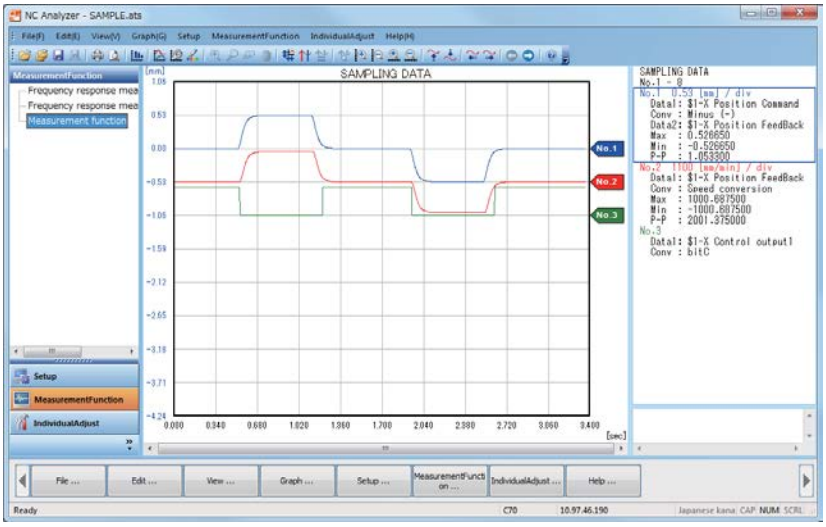

(3) Set "$1-X Position Command (mm/min)" to Data1 of No.1.
(4) Set "Minus (-)" to "Conversion" of No.1.
-> The Data2 of No.1 becomes valid. Data2 is blank.
(5) Set "$1-X Position FeedBack (mm/min)" to Data2 of No.1.
(6) Set "Speed conversion" to "Conversion" of No.2 "$1-X Position FeedBack".
(7) Set "$1-X Control output1" to No.3 Data1 and "bitC" to "Conversion".
(8) Uncheck the check box No.4 to 8.

**Drawing setting completed**



(9) Press the "OK" button.

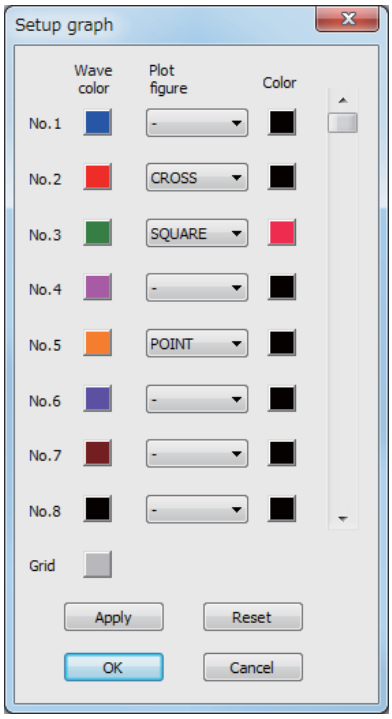
->The Drawing setting screen closes and waveform is displayed as below.



### 3.6.3.2.4 Setup Graph Screen

Specify show/hide and color of waveforms by the Setup graph screen.
Waveforms No.1 to 8 appears when opening the Setup graph screen. Also, the currently displayed waveform No. will reappear on the waveform display screen when the drawing setting screen is closed.

**Display Contents of the Setup Graph Screen**



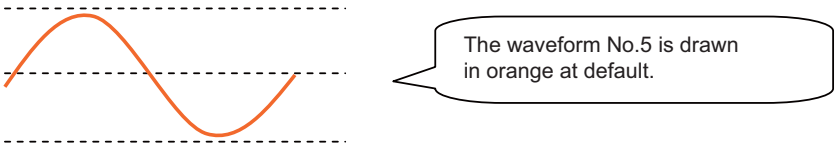

| Item | Details | Default value |
|---|---|---|
| Wave color | The colors of waveforms.<br>Press to show the Color dialogue. | No.1: Blue<br>No.2: Red<br>No.3: Green<br>No.4: Pink<br>No.5: Orange<br>No.6: Purple<br>No.7: Brown<br>No.8: Black<br>The above color cycle repeats for No.9 and later. |
| Plot figure | Select a plot from the dialogue box.<br>- : No plotting<br>POINT : Plot ■ .<br>CIRCLE: Plot ○ .<br>CROSS : Plot × .<br>TRIANGLE: Plot △ .<br>SQUARE: Plot □ . | - |
| Color | The colors of waveforms.<br>Press to show the Color dialogue. | Black |
| Grid | The color of grid.<br>Press to show the Color dialogue. | Gray |

If "white" is set for any of the above items, it disappears.

**The operation of Setup graph screen**

Ex.: When the No.5 waveform color is set to red. And the plot figure is "SQUARE" and blue.

(1) Choose one of waveforms as No.5 and draw the waveform.

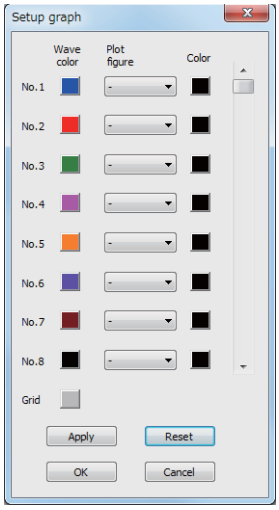



(2) Call up the Setup graph screen.

Select the menu [Graph] - [Setup graph].

This function can be selected from the function bar, right-click or tool box also.

-> "Setup graph" screen appears. The default settings are applied as below.

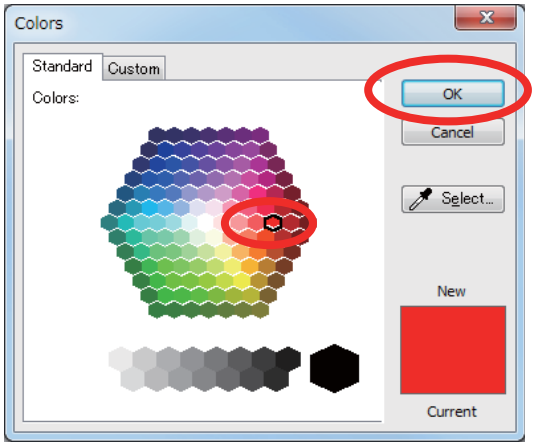



(3) Press the No.5 color button.

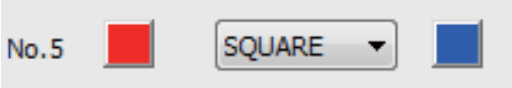
-> Color dialogue appears.


(4) Select red from the Color dialogue and press [OK].

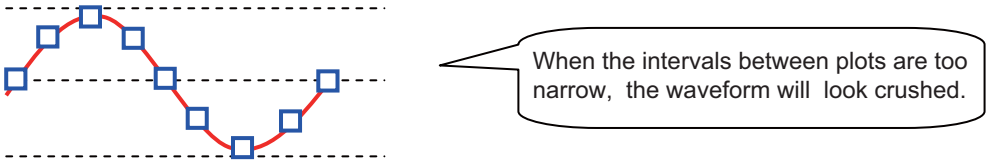
-> Dialogue closes and the No.5 color button turns into red.



(5) Select "SQUARE" from the No.5 Plot figure combo box.
(6) Press No.5 Plot color button to show Color dialogue.
(7) Select "blue" and press the "OK" button.
-> The No.5 looks like below.




(8) Press the "OK" button on the Setup graph screen.
-> The Graph setup dialog closes. No.5 waveform is drawn in red and [SQUARE] plot figures are in blue.




**Performance when changing the graph mode**

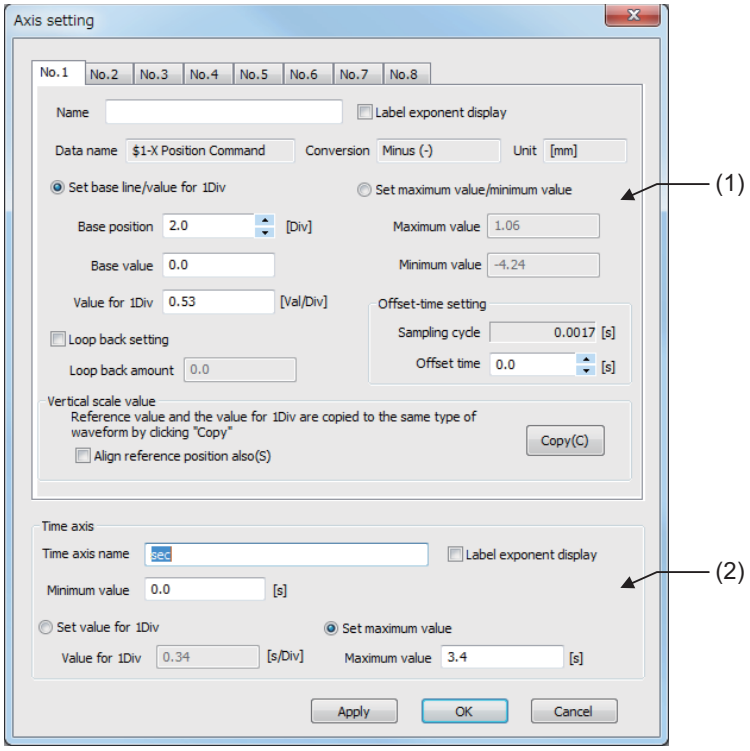
The conventional Setup graph screen during XY mode is displayed when changing to circular error, arbitrary path, or Arbitrary error mode other than time-series graph.
The graph setting information is retained individually in each graph mode. Therefore the previous graph setting is restored even if the graph mode is changed.

## 3.6.3.2.5 Axis Setting Screen

Set axis-related information, such as the maximum and minimum display value, by the Axis setting screen.

**Display Contents of the Axis Setting Screen**

The Axis setting screen consists of (1) Vertical axis setting area and (2) Time axis setting area.




(1) Vertical axis setting area

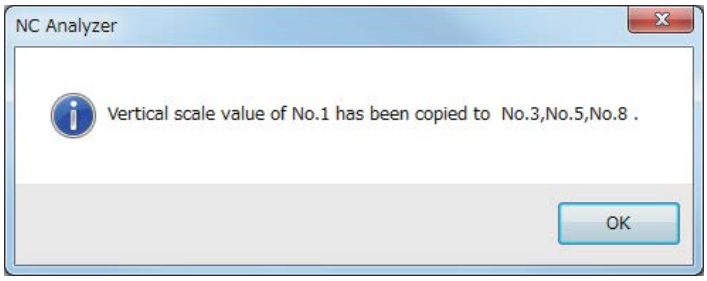
In this area, a tab is provided for each waveform No. When the screen opens, the tab of the currently active waveform is selected.

- Only the currently displayed eight waveforms are available for setting. The setting will be applied only to these eight waveforms.
- Nos. which are not used or not displayed are all grayed out and unavailable for setting.
- When the type of waveform is "Control I/O" or "PLC signal (bit device)", only Name and Base value are valid. Others are grayed out. "Set base line/value for 1Div" is selected.
- Either "Set base line/value for 1Div" or "Set maximum value/minimum value" can be selected for the Vertical axis. "Set base line/value for 1Div" is checked at default.
- When "Set base line/value for 1Div" is checked, "Base position", "Base value", and "Value for 1Div" become valid. Refer to "Auto Scaling (2) Arranging several waveforms" for specific setting example.
- When "Set maximum value/minimum value" is checked, apparent "maximum value" and "minimum value" become valid.
- Check "Loop back setting" check box to set loop back amount.
  This is useful for viewing a waveform with relatively stable big value, such as position droop.When the loop back function is applied, each plot value of a waveform will be divided by a set loop back value and the remainder will be drawn.
  For example, when the loop back amount is set to 1500, 1504 will be divided by 1500, and the remainder 4 will be plotted.
  After changing the loop back amount or enabling the "loop back setting", press [Apply] to reflect the "loop back amount" to "Value for 1Div".
  "Loop back setting" check box is not checked at default. It, however, will be checked when the waveform is "Position Droop".

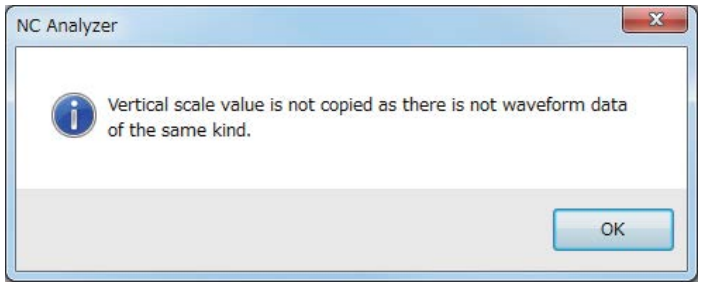
- Values of "Set base line/value for 1Div" and "Set maximum value/minimum value" are linked.
  When values for "Set base line/value for 1Div" are changed, values for "Set maximum value/minimum value" are updated.
  When "Set maximum value/minimum value" is selected, "Base value" of "Set base line/value for 1Div" changes to 5.0Div.
  When the settings in "Set base line/value for 1Div" are changed, "Base value" (5.0Div from top) and "Value for 1Div" for "Set maximum value/minimum value" are updated.
- Auto scaling will update all the values for "Set base line/value for 1Div" and "Set maximum value/minimum value" on the displayed page.
- Changing the value of "Data1" on the Drawing setting screen resets all the values for "Set base line/value for 1Div" and "Set maximum value/minimum value".
- Offset time can be set on "Offset-time setting" to shift waveform data to left or right.
  Input the time to offset on "Offset time" and press "OK" or "Apply" to offset the waveform to right or left by the input time. (Refer to "Move offset" for details of the specification for moving offset to right or left.)
- Vertical axis setting of selected axis is automatically copied to the same type of waveforms when pressing "Copy" button for "Vertical scale value". The same type of waveform indicates data as which all three of the waveform type, unit, and conversion are the same. When there are multiple waveforms of the same type, the setting will be copied to all the waveforms of the same type at once. The reference position is also copied when checking "Align reference position also" and pressing "Copy".
  Vertical scale value cannot be executed for the waveform of control input/output signal. In this case, "Vertical scale value" is disabled.

  After pressing "Copy", axis No. of copy source and copy destination will be displayed on a message window.

  (Example) When copying the vertical axis setting of No.1 to No.3, No.5, and No.8




  When there is no waveform data of the same type and copy is not executed, the following message will appear.



**Axis Setting Screen Setting Items in Vertical Axis Setting Area (Set base line/value for 1Div)**

| Category | Item | Details | etting range | Default value (Note 2) |
|---|---|---|---|---|
| Common | Name | Waveform title for each waveform No. | Character string of up to 32 one-byte characters. | (blank) |
| | Unit | Waveform display unit | Cannot be set. | The unit used for measuring<br>Ex.: [mm/min] |
| | Data name | Waveform data name | Cannot be set. | - |
| | Conversion | Conversion method for waveform | Cannot be set. | - |
| | Label exponent display | Check this check box to set exponent value for the label. Setting is required for each display No. | ON/OFF | Not checked. |
| Set base line/ value for 1Div | Base position | Set the base position.<br>This will be the center line for enlarging and reducing the waveform in vertical direction. | -1000.0 to 1000.0 Div.<br>By 1.0Div unit for control input and output or PLC signal (bit device).<br>For others, by 0.5Div unit.<br>(Note 5) | Divide the displayed No. by 8 and plus 1 to the remainder. When the displayed No. is divisible by 8, it will be "9.0Div".<br>Ex.: No.1 -> "2.0Div". |
| | Base value | The value for the base position. When this base value is "0", the base position locates on the zero line, which makes it easier to read the graph. | (Note 1,4) | 0 |
| | Value for 1Div | The value per division. | (Note 1,3,4)<br>The maximum value and the minimum value must be within -2147183648 to 214783647. | Divide the value between currently displayed maximum value and minimum value by 10.<br>For position droop, it is fixed to 50[μm] at default. |
| Set maximum value/minimum value | Maximum value | The maximum value to be displayed on the graph | (Note 1,3,4) | The currently displayed maximum value |
| | Minimum value | The minimum value to be displayed on the graph. | (Note 1,3,4) | The currently displayed minimum value |
| Loop back setting | Loop back amount | Loop back amount | 0 to 2147483647<br>Down to six decimal places can be set.<br>When set to "0", loop back will not be conducted. | 0<br>For position droop, it is fixed to 50[μm] at default. |
| Offset-time setting | Sampling cycle | Sampling cycle for waveform | Cannot be set. | - |
| | Offset time | The time to offset waveform data to left or right | ± Sampling time for waveform | 0.0 |
| Vertical scale value | Align reference position also (S) | Check to copy reference position also by pressing "Copy". | ON/OFF | Not checked. |
| | Copy (C) | Click to copy the vertical scale value to the same type of waveform as current waveform. | Cannot be set. | - |

(Note 1) The integer must be within -2147483648 and 2147483647.
Down to six decimal places can be set.

(Note 2) "Default value" is the value that is set to the Axis setting screen when it is opened right after performing a Time-series Data Measurement and displaying waveforms with auto scaling valid.

(Note 3) Auto scaling in vertical direction will be applied to waveforms when 0 is input (when both maximum value and minimum value are set to "0"). By recalling the Axis setting screen, the values will be updated to the currently displayed values.

(Note 4) If this screen appears after setting a new channel to be measured and before executing measurement in the time mode, the base value/Value for 1Div/Maximum value/Minimum value cannot be fixed because the waveform has not been displayed yet. Set "0" to these values in this case.

(Note 5) Change the value by unit with the spin button. Or directly input a value. The input value will be rounded up to the nearest unit value. (Ex.: If "-0.7Div" is entered for position command, "-0.5Div" will be set.)

(2) Time axis setting area

As well as the Vertical axis setting, either "Set base line/value for 1Div" or "Set maximum value/minimum value" can be selected for Time axis setting. "Set maximum value" is checked at default.
Setting the time axis updates the whole graph. (It updates even the waveforms on undisplayed pages.)

**Axis setting screen setting items in time axis setting area**

| Category | Item | Details | Setting range | Default value |
|---|---|---|---|---|
| Common | Time axis name | Give a title to the time axis. | Character string of up to 32 one-byte characters. | The unit which was automatically added when measured.<br>Ex.: [sec] |
| | Label exponent display | Check this check box to set exponent value for the label. | ON/OFF | Not checked. |
| | Minimum value | The minimum value to be displayed on the graph | "0 or more" and "less than the Sampling Time" | 0.0000[sec] |
| Set the value for 1Div | Value for 1Div | The value per division. | Between "one-tenth of sampling cycle or more" and "ten times the sampling time or less" (Note 1) | Divide the value between currently displayed maximum value and minimum value by 10.<br>(Note 2) |
| Set the maximum value. | Maximum value | The maximum value to be displayed on the graph | "The difference between displayed maximum value and minimum value is same as sampling cycle or more" and "100 times the sampling time or less" (Note 1) | The currently displayed maximum value<br>(Note 2) |

(Note 1) "0" can be set. When set to "0", the minimum value will be ignored and auto scaling will be applied in horizontal direction. After executing auto scaling, the value will be updated to other than "0".

(Note 2) The default value is "0" when this screen opens right after installation and before executing a measurement in the time mode.

**Error display**

Error check is performed when pressing the [Apply] or [OK] button and when changing the tab.
An error window will appear in the following cases and settings cannot be applied.

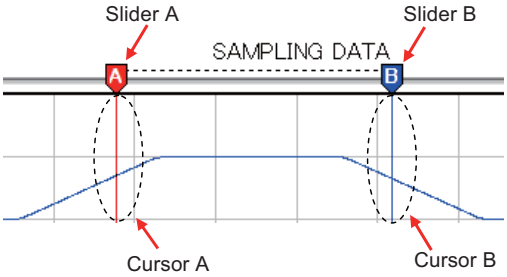
| Error messages | Error condition | Remedy |
|---|---|---|
| Input value is invalid. | - The minimum value is larger than the maximum value.<br>- A value outside the setting range is entered.<br>- A negative value was entered into the time axis. | Input a value within the setting range. |

### 3.6.3.2.6 Cursor

**Cursor specification**

(1) Show/Hide

By setting to show cursors, two cursors, A (red) and B (blue) will appear.
When these two cursors are interlocked, a wave line appears between the cursors.




**Cursor button specification**

| Image | Name | Details |
|---|---|---|
|  | Show/Hide | Change whether to show or hide the cursors.<br>It switches between ON and OFF by every click. The cursors are shown when this button is ON.<br>The cursor's initial position differs according to the plotting method. (Note 1) |
|  | Interlocking the Cursors | When this button is ON, cursors A and B are interlocked.<br>When interlocked, a broken line appears between sliders A and B.<br>When interlocked, cursors A and B move simultaneously.<br>Hiding the cursors will force this setting to turn OFF. |

(Note 1) The cursors move as follows according to the plotting method.
For thin-out plot, the cursor A is placed at the first Div from the left and the cursor B at the first Div from the right.
For all-data plot, the cursor A is placed at the first plot after the first Div from the left and the cursor B at the first plot after the first Div from the right.

- The cursors are not displayed when there is no graph in the display area.
However, it is possible to show and move the cursors even when displaying the No. without drawing setting if any waveform exists for Nos. which is out of the display area.

(2) Specifications of Cursor Movement

- Slider A and B also appears by showing the cursors.
- When the cursors are not interlocked, dragging a slider moves the corresponding cursor. The movement is limited within the display area. If you want to move the cursors outside the display area, change the time axis setting or scroll the area.
- When the cursors are interlocked, dragging a slider moves both cursors while keeping the distance between A-B time differences. While the dragging slider should move only within the display area, the other slider can go out of the display area.
- Nonetheless, the sliders cannot move to the left of zero and beyond the sampling time, so the dragging slider may not be able to move. In that case, the sliders move as much as they can.
- After dragging and dropping the cursor, the waveform values in the text area will be updated. The time and time difference indicated by the cursors update even they are being dragged.
- The cursors' position does not change when the displayed waveforms change.
- For thin-out plot, the cursors move by 1 pixel.
- For all-data plot, the cursors move by 1 block.
- The cursors A and B do not change the time to point even when the time axis settings are changed. Therefore, the cursors may disappear from the display area depending on the setting changes by the time axis setting screen and other time axis changes, such as enlarging/reducing the waveform in vertical direction, auto scaling, and scrolling in horizontal direction.
- The cursors cannot move to a time exceeding the sampling time. The cursor will just move to the time when the sampling completed.

### 3.6.3.2.7 Enlarging/Reducing the Waveform

While displaying the waveforms, they can be enlarged or reduced.

**Enlarging/Reducing the Waveform in Vertical Direction**

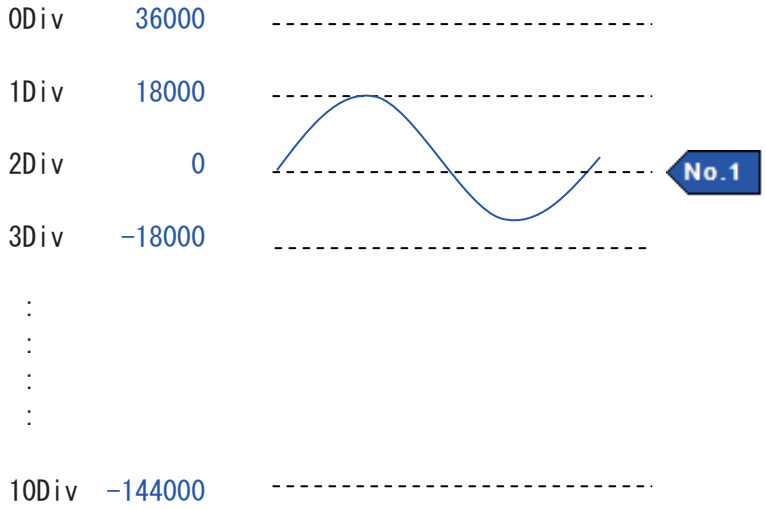
Press  (Enlarge the waveform in time axis direction button) to reduce the value per vertical axis division by half.

Press  (Reduce the waveform in time axis direction button) to double the value per vertical axis division.

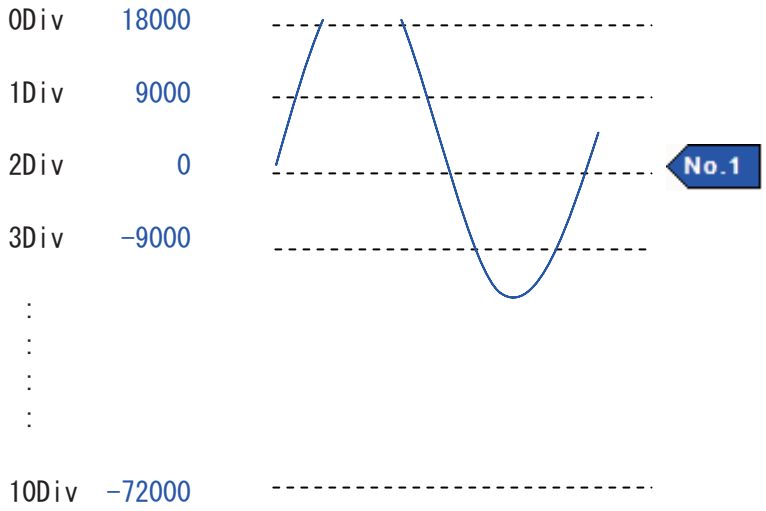
- Enlargement and reduction apply to the currently active waveforms.
- The center of enlargement and reduction depends on the vertical axis setting in the axis setting screen. When set to "Set base line/value for 1Div", the center will be the base line. When set to "Set maximum value/ minimum value", the fifth Div from the top will be the base line.

Ex.: When the second Div from the top is the base line, the base value is "0", and value per Div is "18000".

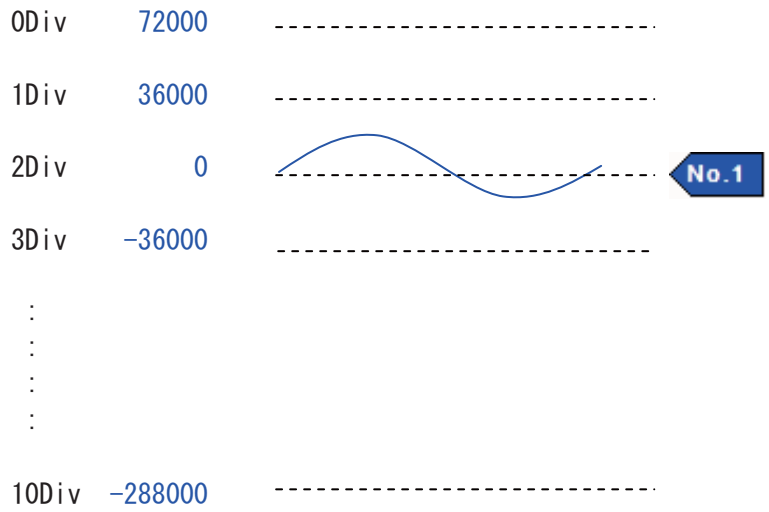
(Normal)




(Enlarged)



(Reduced)




- Enlargement is not available when the value for 1Div is 1.00e-06 (0.000001) or smaller. You can click the button but it will not work.
- Reduction is not available when the maximum display value is over 2147483647 or the minimum display value is below -2147483648. You can click the button but it will not work.

### 3.6.3.2.8 Enlarging/Reducing the Waveform in Time Axis Direction

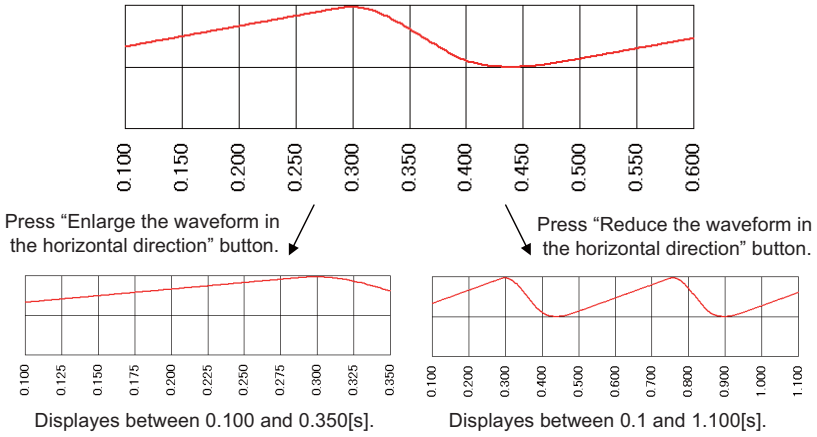
Press  (Enlarge the waveform in time axis direction button) to reduce the value per time axis division by half.

Press  (Reduce the waveform in time axis direction button) to double the value per time axis division.

Press  (Show data between cursors button) to view the waveform between the cursors.

- All the waveforms are subject to this enlargement and reduction, including those not displayed.
- The far left of the display area is the base point of enlarging/reducing buttons.

Ex.: When displaying between 0.100 and 0.600[s].

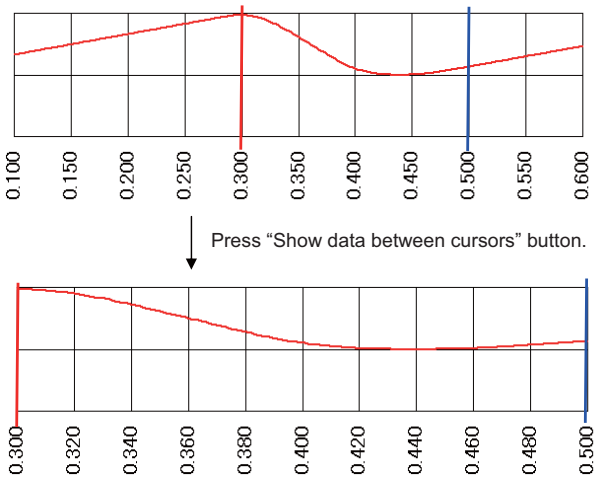



- Press the "Show data between cursors" button to enlarge (reduce) the waveform from the left cursor to the right cursors to fill the display area.

This is same as for, in the Time axis setting by the Axis setting screen, setting the time of the left cursor to "Minimum value" and, after checking the "Set maximum value/minimum value" check box, the time of the right cursor to "Maximum value".

Therefore, the settings in the Axis setting screen will change. If the enlarged or reduced waveform will exceed the setting range, enlargement or reduction are not executed.

Ex.: When displaying between 0.100 and 0.600[s] and the cursors are at 0.300 and 0.500.

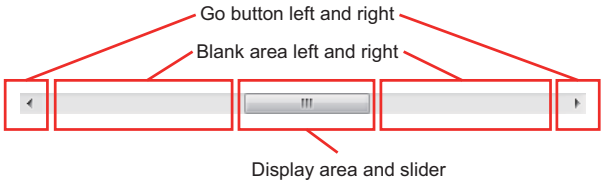


### 3.6.3.2.9 The Waveform Movement

The waveforms move in vertical and horizontal direction.

#### Horizontal Scroll

Waveforms move in the horizontal direction.



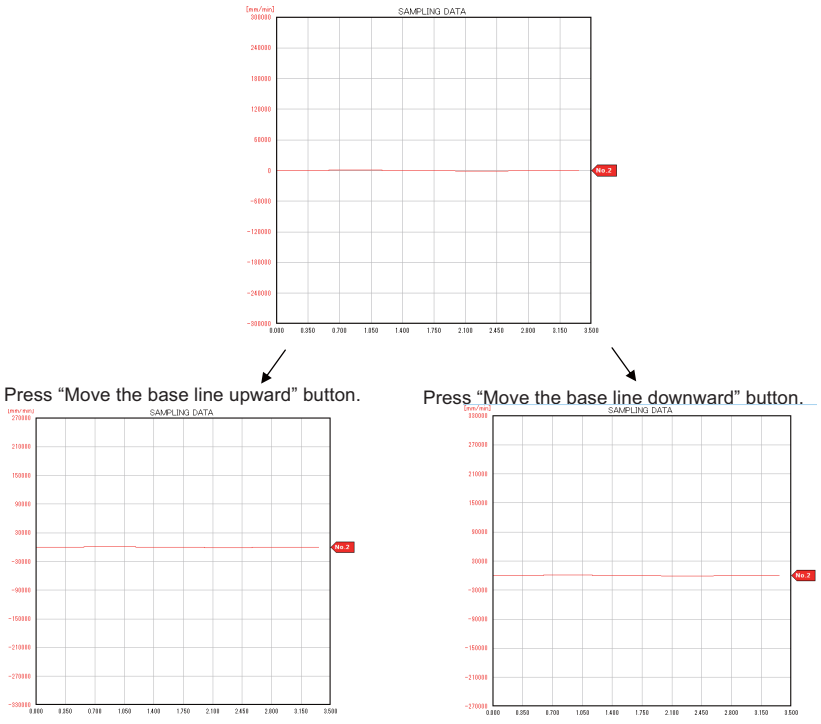

| Name | Details |
|---|---|
| Display area and slider | Indicates the currently displayed area.<br>Moves by 1 pixel by dragging. |
| Go button left and right | Moves the horizontal axis by 1Div. |
| Blank area left and right | Moves by 1 page (10Div). |

#### Vertical Scroll

Press  (Move the base line upward/downward) button to move the base line of the active waveform in vertical direction.

- Normal waveforms move by 0.5Div.
- Control input/output or PLC signal (bit device) waveforms move by 1.0Div.

Ex. When the 5.0Div is the base line, the base value is 0, and the value per 1Div is 60000.



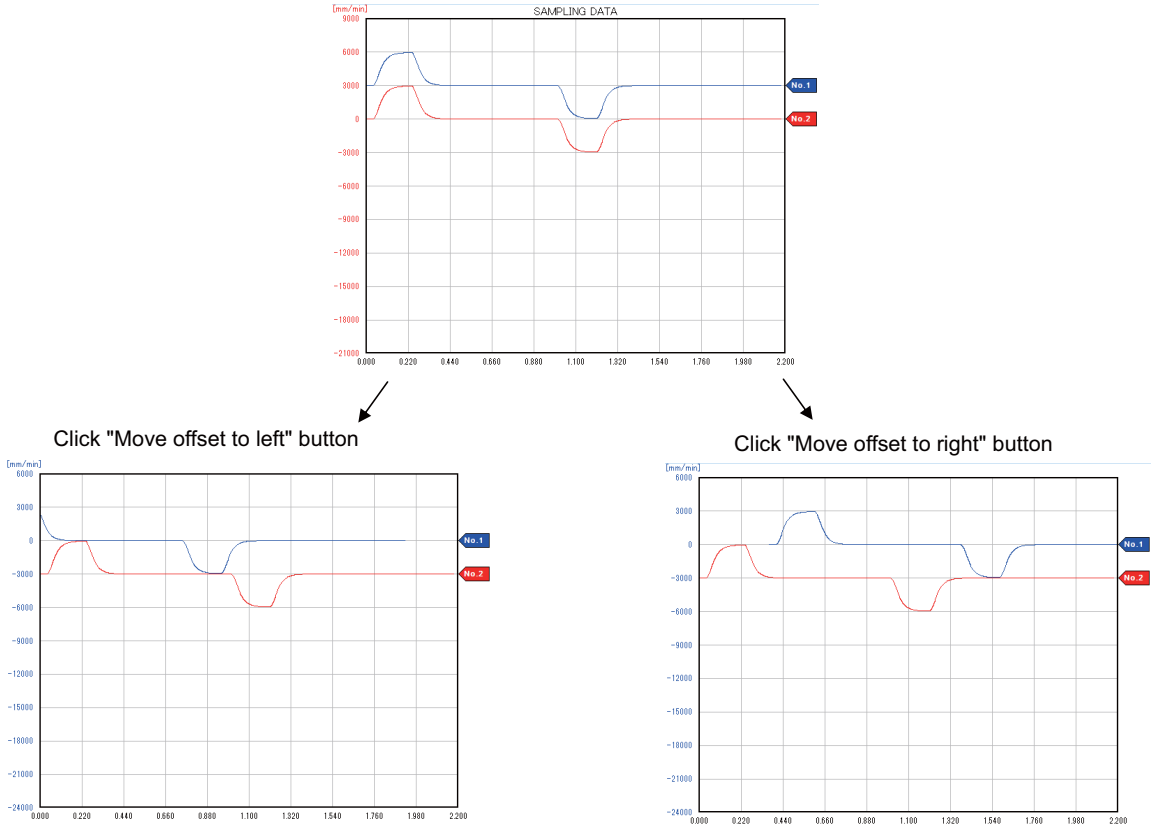

This function will not work in the following cases. You can click the button but it will not work.

- The new base line will exceed ±1000.0Div from the current base line (Check the current base line in the Axis setting screen).
- The maximum display value will be over 2147483647 or the minimum display value below -2147483648 when executed.

### 3.6.3.2.10 Move Offset

Selected waveform can be offset to left or right along the time axis with  (move offset to right or left) button.
Continue to press the button to move the data in succession.
- Move to right or left by one plot per one click
- When displaying multiple plots on one pixel, it moves to right or left by the multiple plots.
- The waveforms of the same file are moved together. When opening multiple files, selected waveform and the other waveform of the same file are moved to right or left together.

[Example]
Condition: Open multiple files and the waveforms No.1 and No.2 are those of different files
Operation: Select the waveform No.1 (blue) and click the icon for moving offset to right or left.




The available offset range to right or left is up to ±sampling time of the waveform. The maximum offset to left is -5.0 sec and the maximum offset to right is +5.0 sec for the waveform of 5.0 sec sampling time. When it is moved up to the left or right end, it cannot be moved any more even if clicking the button.

### 3.6.3.2.11 Change the Display No.

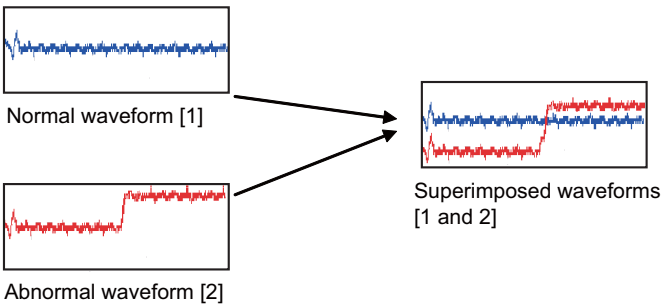
There are two buttons to change the display No. to the previous page  and next page  . Eight waveforms constitute a unit for changing pages.

- When displaying waveforms No.1 to 8, the "Change the display No. to the previous page" button  cannot be pressed. Likewise, when displaying waveforms No.25 to 32, the "Change the display No. to the next page" button  cannot be pressed.
- If switched to a page without drawing setting while the cursors are being displayed, the cursors cannot move on the page. They will be able to move again when switched to a page with drawing setting.
- The waveform with the smallest No. in the page will be active at default and when the display waveform Nos. are changed.

Ex.: When the display Nos. change from No.1 to 8 to No.9 to 16, the No. 9 will become active. If No.9 is not set or not displayed, No.10 will become active.

### 3.6.3.2.12 Simultaneous Display of Multiple Waveform Files

Multiple waveform files can be opened and superimposed when displayed.
For example, when abnormal phenomenon occurred, superimposing an abnormal waveform on a normal one is useful to investigate the cause.



| Category | Item | Specifications | Detail |
|---|---|---|---|
| All | The number of files to superimpose | 2 to 8 | 2 to a maximum of 8 waveform files (extension:ATS) can be selected and superimposed. |
| All | Superimposable file | ATS file drawn by time mode | Any ATS file drawn by time mode can be superimposed. The file of XY mode cannot be superimposed. |
| All | When sampling cycle is different | Disabled to be superimposed | When the ATS file of different sampling cycle from the master ATS file is selected, the error message is displayed. |
| All | When sampling time is different | Enabled to be superimposed | Enabled to be superimposed even when the sampling time is different.<br>When the files open, both waveforms are displayed from 0 second. |
| All | Saving data after superimposing | Disabled | The superimposed result cannot be saved on the file. Drawing setting, graph setting or time offset information cannot be retained. |
| Waveform display | Offset for time (horizontal axis) | Offset enabled | Offset for horizontal axis can be set in plot units. |
| Waveform display | Memo area for waveform display | Display the information of all the waveform files which are opened. | Display as follows.<br>[1]Glaph title of the first file<br>Memo for the firtst file<br>[2]Glaph title of the second file<br>Memo for the seconde file<br><br>Example: When the graph title of Nth file is "Nth data" and "measurement with condition N" is displayed on memo<br>[1] The first data<br>Measured with condition 1<br>[2] The second data<br>Measured with condition 2 |
| Drawing setting | Retaining the measuring channel | All the 8CH x 8 files are retained. | All waveform data of channel 1 to 8 on each waveform file are retained.<br>A waveform of first opened file is displayed as [1], a waveform of second opened file is displayed as [2] and a waveform name such as "[1]$1-X Position FeedBack" is displayed on the Drawing setting screen or in the text area. |
| Drawing setting | Retaining the drawing setting | Totally 32 files are displayed. Files which cannot be displayed are not read in. | - First opened file is given priority of retaining. The waveform No. of second opened file is set to the smallest No. among all the unused numbers<br>- The rest is not read in when it exceeds 32 files. Reset on the Drawing setting secreen if necessary.<br>-Information for polarity conversion is also retained.<br>-Information for coefficient is also retained.<br>- For synchronous tapping error waveform, the part which cannot be set is cannceled.<br>Example) When both files are set to No.1, 2, and 10 for drawing setting, the superimposed drawing settings are as follows.<br>No.1: No.1 of the first opened file<br>No.2: No.2 of the first opened file<br>No.3: No.1 of the second opened file<br>No.4: No.2 of the second opened file<br>No.5: No.10 of the second opened file<br>No.6 to 9: blank<br>No.10: No.10 of the first opened file<br>No.11 to 32: blank |
| Drawing setting | [Default setting] button | Specifications are different. | All the settings from No. 1 to 32 will be the same as when multiple files are opened for the first time. The specicications are totally different from those of single file. |
| Drawing setting | Calculation of waveform between files | Enabled to be calculated | The difference of the waveforms can be calculated between different files. However, the data must be in accordance with the table in "Conversion and Data2".<br>When there is blanked data on one waveform because of the difference of sampling time, etc., the result of the calculation will also be blanked data.Offset time is also reflected. |
| Graph setting | Retaining the graph setting | Retained | The setting of the file read in is used for the color and plot figure of the graph setting.<br>The setting of the first opened file is used for grid color. |

### 3.6.3.2.13 Open Multiple Files

(1) How to start [Open multiple files]

The following methods are available to open multiple files.

-Select [File (F)]-[Open multiple files] from the toolbar.

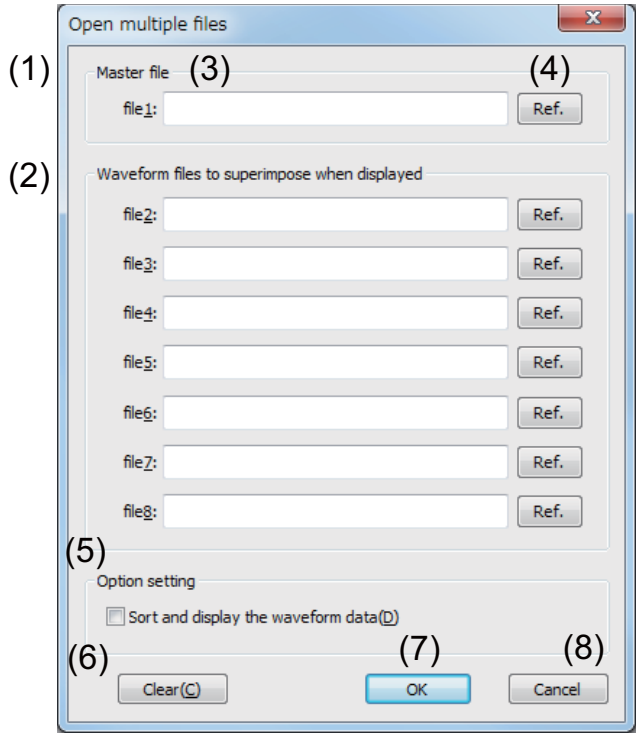
-Push the icon  .

-Select [Open multiple files] by right-clicking the graph area.

-Select [File]-[Open multiple files] from the function bar.

[Open multiple files] dialogue is displayed.

(2) [Open multiple files] dialogue




| Display item | | Details |
|---|---|---|
| (1) | Master file | Select the master file when opening multiple files.<br>The sampling cycle is based on the cycle of the master file. |
| (2) | Waveform files to superimpose when displayed | Select ATS file to superimpose onto the master file when displayed.<br>Up to 7 files can be selected from File 2 to File 8. |
| (3) | File path input area | Input the file path of the ATS file to be opened. When ATS file is dragged and dropped, the file path is input automatically. |
| (4) | Ref. | Display the file open dialogue to open ATS file.When ATS file is selected on the dialogue, the path of selected ATS file is set on the file path input area (3) on left. |
| (5) | Option setting | Display the "Sort and display the waveform data (D)" check box.<br>Checked: Open multiple files with the drawing setting of the master file.<br>Unchecked: Automatically sort and display the waveform data of multiple files to be opened.<br>The default setting at the startup of the tool is unchecked. While the tool is running, checked status is retained. |
| (6) | Clear | Clear all the contents of file path input area for File 1 to File 8. |
| (7) | OK | Open multiple files.<br>Error check is executed when clicking the button and if there is no error, open multiple files after closing the "Open multiple files" screen.<br>If an error is found, display the corresponding error message and return to the "Open multiple files" screen. |
| (8) | Cancel | Close the "Open multiple files" screen without opening multiple files. |

-At startup of the "Open multiple files" screen, the contents which were input when opening multiple files previously are restored. All the File 1 to File 8 fields will be blank right after installation.

-When opening multiple files with "Sort and display the waveform data" checked in option setting, the waveform data of each opened file will be sorted and displayed automatically.
The rules of sorting are as follows.

1.Sort the setting data of each file sequentially in ascending order starting from the data of the top No.
2.Rearrange the Nos. in order, even if the Nos. originally set in files are random.

As some examples, the followings are the drawing settings of each ATS file before opening multiple files and the sorted state of drawing settings after opening multiple files.

Drawing setting of each ATS file

| File1 | | File2 | | File3 | |
|---|---|---|---|---|---|
| **No.** | **Setting data** | **No.** | **Setting data** | **No.** | **Setting data** |
| 1 | $1-X Position Command | 2 | $1-X Position Command | 1 | $1-X Speed Command |
| 2 | $1-X Position FB | 5 | $1-X Position FB | 3 | $1-X Speed FB |
| 5 | $1-X Current Command | 6 | $1-X Current Command | 9 | $1-Y Current Command |
| - | - | 7 | $1-X Current FB | 10 | Control input 1 |

Drawing setting after opening multiple files

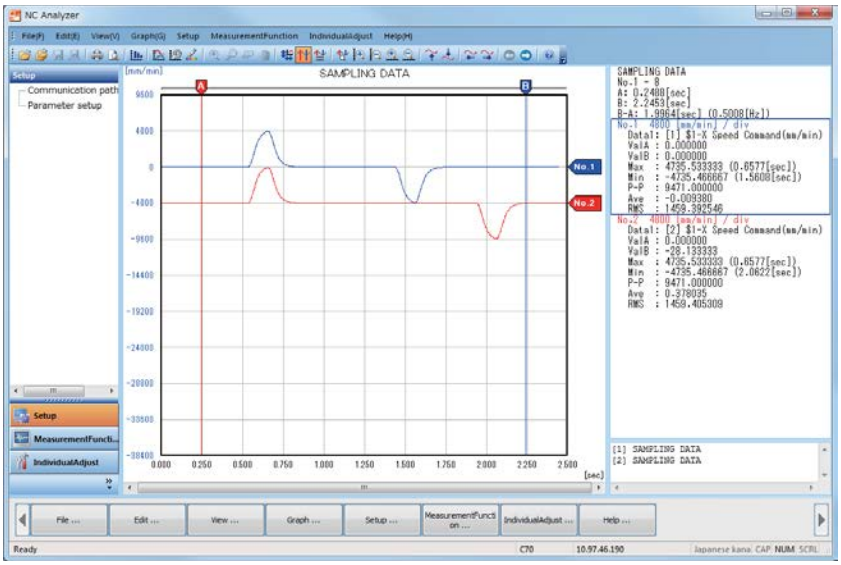
| No. | Setting data |
|---|---|
| 1 | [1] $1-X Position Command |
| 2 | [2] $1-X Position Command |
| 3 | [3] $1-X Speed Command |
| 4 | [1] $1-X Position FB |
| 5 | [2] $1-X Position FB |
| 6 | [3] $1-X Speed FB |
| 7 | [1] $1-X Current Command |
| 8 | [2] $1-X Current Command |
| 9 | [3] $1-Y Current Command |
| 10 | [2] $1-X Current FB |
| 11 | [3] Control input 1 |

-The input contents are checked when clicking "OK" button on "Open multiple files" screen and if an error is found, the corresponding error message is displayed.
Followings are error messages which can be displayed.

| No. | Error condition | Message details | Operation at error occurrence |
|---|---|---|---|
| 1 | A file other than ats file is selected. | File n is not ats file. Select an ats file of time mode. (n: No. of file in error) | Return to multiple file selection dialogue when closing the error message. |
| 2 | Master file is not selected. | Master file has not been selected. Select a master ats file for file 1. | Return to multiple file selection dialogue when closing the error message. |
| 3 | An ats file of XY mode is selected. | File n is ats file of XY mode. Select an ats file of time mode. (n: No. of file in error) | Return to multiple file selection dialogue when closing the error message. |
| 4 | A file whose sampling cycle is different from that of master file is selected. | File n cannot be selected as its sampling cycle is different from that of master file. (n: No. of file in error) | Return to multiple file selection dialogue when closing the error message. |
| 5 | The total number of sampling points is over 1.31 million. | Number of data points is over the limit of display. There is/are waveform(s) not displayed. | Open multiple files when closing the error message. |

### 3.6.3.2.14 Waveform Display When Displaying Multiple Waveforms Simultaneously

Following is an example of waveform when displaying multiple waveforms simultaneously.

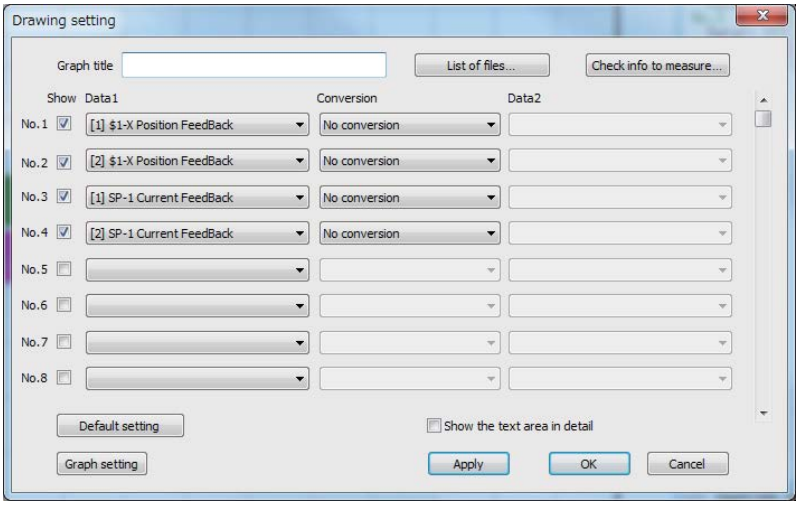



Only "$1-X Speed Command (mm/min)" waveforms from both files are displayed with cursors.
There is a time difference between the waveforms because only the trigger condition differs.

Refer to "Simultaneous display of multiple waveform files" for the differences in specifications for operation and display.
The specifications for the other operations such as auto scaling, cursor, and enlarging/reducing are the same as those of normal time mode.

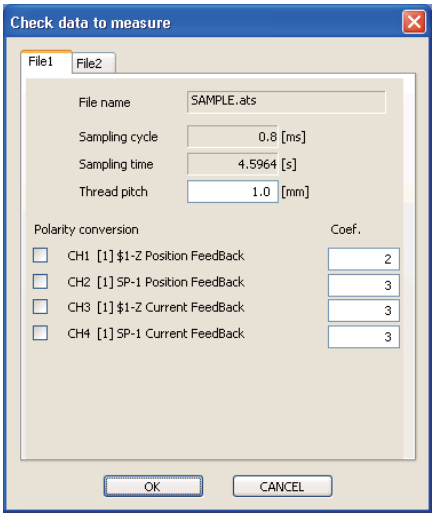
### Drawing setting when displaying multiple waveforms simultaneously

Following is an example of drawing setting screen when displaying multiple waveforms simultaneously.




Refer to "Simultaneous display of multiple waveform files" for the differences in specifications for operation and display.
The specifications for the other operations are the same as those of normal time mode.

The contents of multiple waveform files can be checked on the "Check data to measure" screen.
The same number of tabs as that of files being opened are displayed, which allow switching of file information to display.



## 3.6.3.2.15 FFT Graph Display

**Starting FFT display**

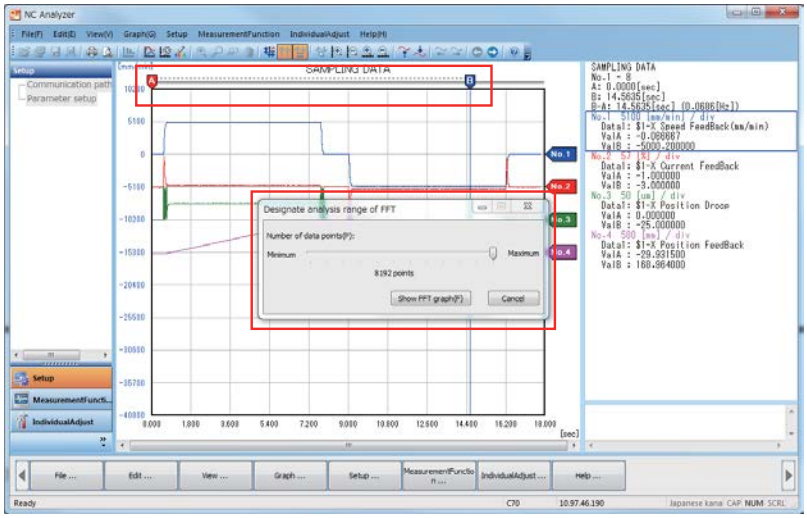
(1) How to start FFT display

Click the "FFT display" icon while displaying time-series data graph.

When the number of time-series data is less than four, "FFT display" icon is disabled and FFT display cannot be executed. FFT display cannot be executed either while displaying a graph of XY mode or no graph.

(2) Preparation for FFT display

The linkage cursor to designate analysis range of FFT and "Designate analysis range of FFT" dialog are displayed upon click of the "FFT display" icon.




If clicking "FFT display" icon while two-point cursor is displayed, the two-point cursor is cleared and the linkage cursor is displayed. In preparation for FFT display, the icon menus of two-point cursor (ShowCursor, Move cursors together, and Show data between cursors) are disabled.

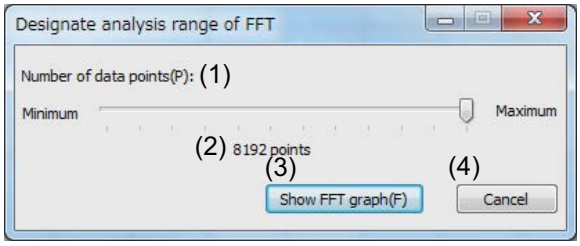
The default display position for the linkage cursor A is at the left end plot of the graph being displayed.
The default plot interval for linkage cursor is the largest power of 2 that is less than or equal to that for the waveform.

Example) For the waveform with 5000 data points

$2^{12}(4096) \leqq 5000 < 2^{13}(8192)$ and the default interval for linkage cursor is 4096 plots.

(3) "Designate analysis range of FFT" dialog

Designate the number of FFT conversion data points and display FFT graph.
Linkage cursor of the graph can be operated with this dialog displayed.



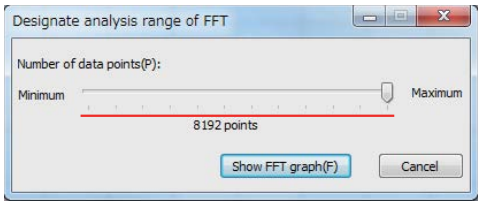

| Display item | | Details |
|---|---|---|
| (1) | Number of data points (P) | A slider to designate the number of analysis data points of FFT.Move the cursor of slider right or left and designate the number of data points.<br>The number of data points will increase when moving the cursor from left to right.<br><br>The minimum number of data points is 4 and the maximum is is the largest power of 2 that is less than or equal to the number of plots for the waveform.The default position of a cursor is at the right end (maximum value).<br><br>The width of linkage cursor is updated in conjunction with the slider movement. |
| (2) | Number of points | Displays the number of data points which the cursor of slider is currently pointing to. |
| (3) | Show FFT graph (F) | Executes Fourier transform in the range currently defined by the linkage cursor and displays FFT graph by clicking the button.The dialog is closed. |
| (4) | Cancel | Cancels the FFT display.<br>Click the button to close the dialog and delete the linkage cursor.Return to the original time-series data display. |

(a) The scale of slider

The scale which indicates the travel position of the cursor is displayed in the lower part of the slider. The number of divisions on the scale is up to the number of selectable data points.

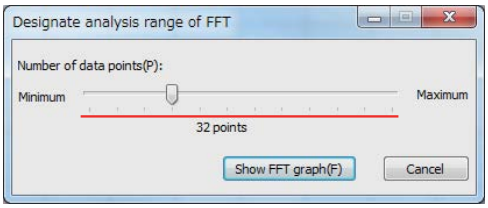
-For the waveform with 10000 data points

The number of selectable data points is $2^2 2^3 \ldots 2^{13}(8192) \leqq 10000 < 2^{14}(16384)$ that is, a total of 12.
So the number of divisions for the slider is 12.




-For the waveform with 100 data points

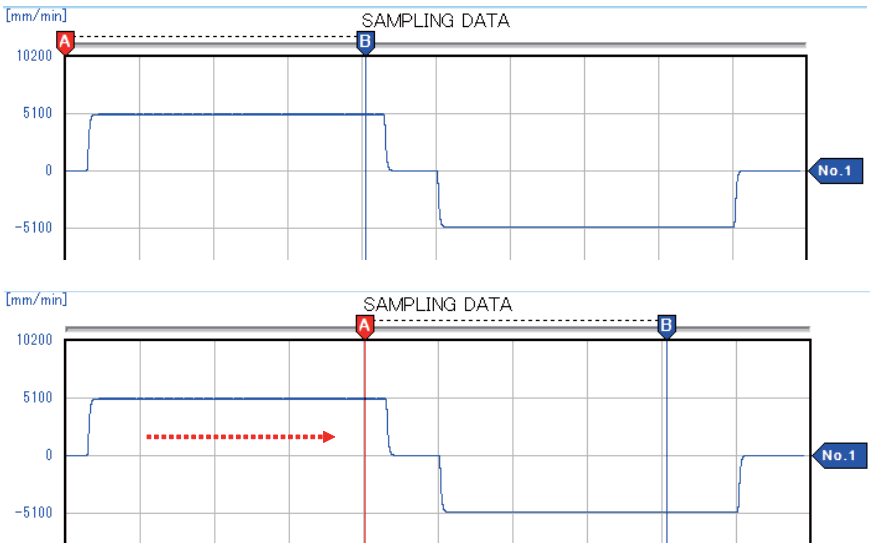
The number of selectable data points is $2^2 2^3 \ldots 2^6(64) \leqq 100 < 2^7(128)$, that is, a total of 5.
So the number of divisions for the slider is 5.



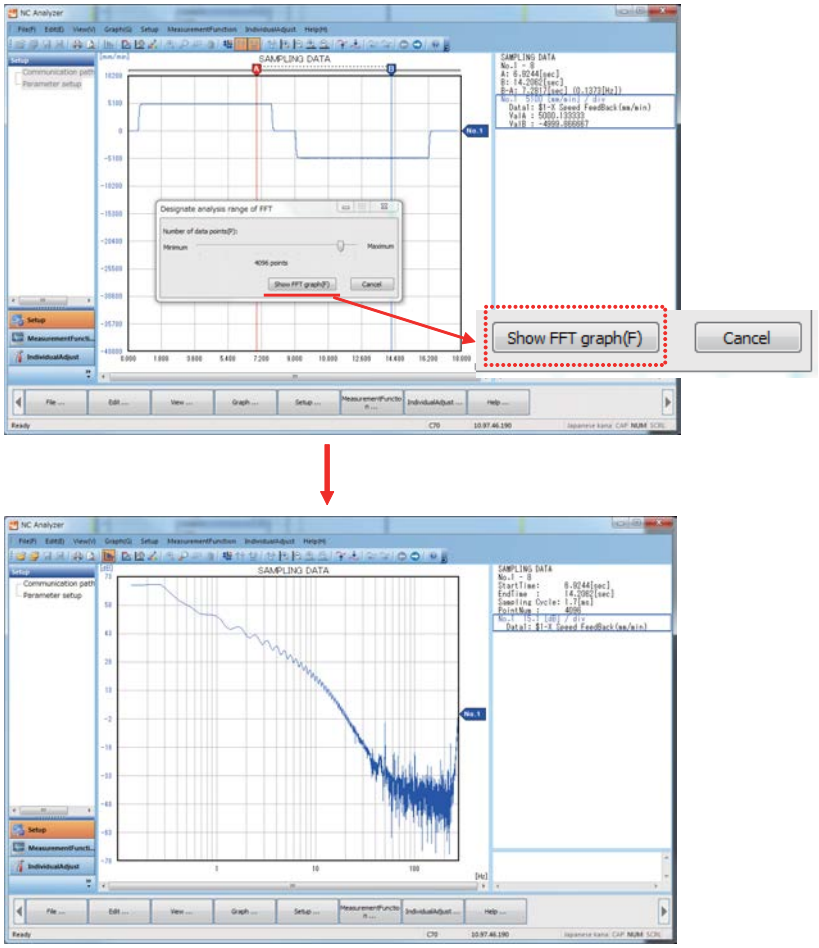

The cursor of the slider moves division by division. The width of the slider itself is fixed regardless of the number of divisions.

(b) Determine the analysis range of FFT

Move the linkage cursor right or left to designate the start time for FFT analysis. The position of cursor A shows the start time for FFT analysis and cursor B shows the end time.



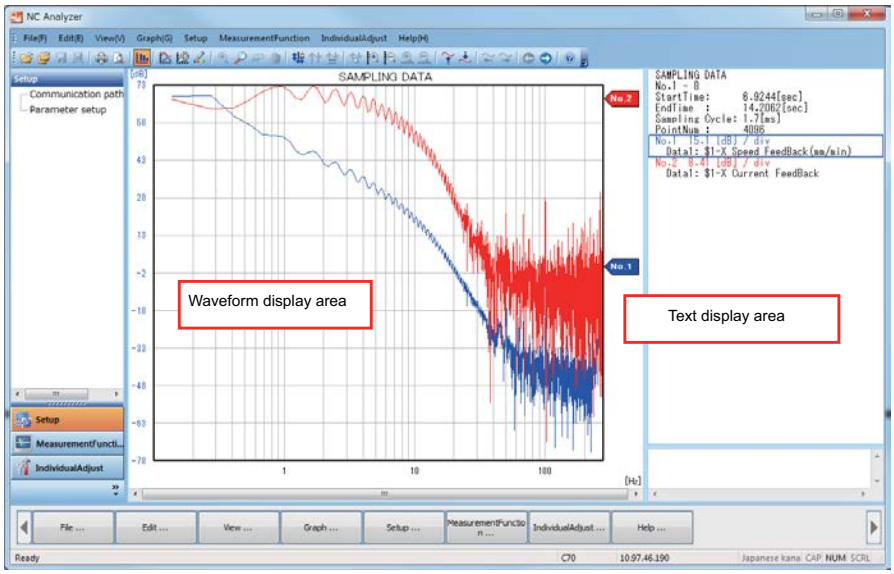

Execute Fourier transform in the range currently defined by the linkage cursor and display FFT graph by clicking the "Show FFT graph (F)" button.




The analysis range cannot be changed during FFT display.

### FFT waveform display

The figure below shows the graph display of FFT.




(1) Waveform display
Maximum of 32 waveforms (8 per screen) can be viewed. Press the display No. changing buttons to change the displayed waveforms.
Waveforms No.1 to 8 are displayed at default. An auto scaling is executed when opening a file.
The graph title will be displayed in the middle of the graph.

(2) Horizontal axis display
The maximum and minimum value labels are not displayed. Only the power-of-ten labels which are present in the middle are displayed.

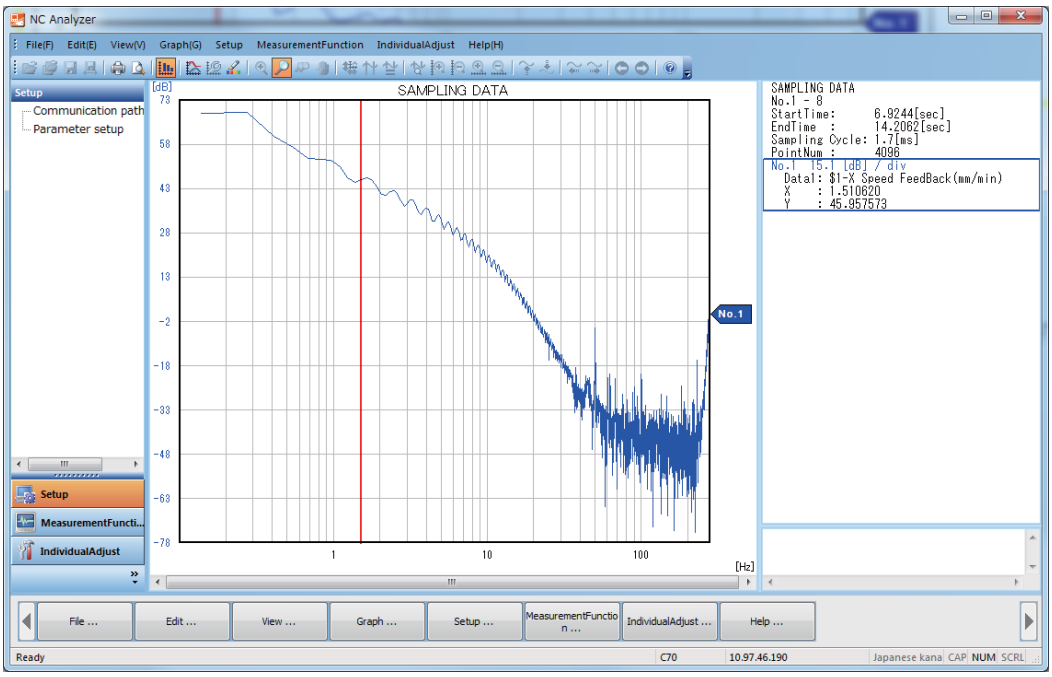
(3) Vertical axis display
The vertical axis labels are those for the currently selected waveform.
The specifications for label's display digits are equivalent to those for time mode. Refer to the section "Vertical axis labels" for time mode.

(4) Text display area
Various informations will be displayed in the text area.
Active waveform can be selected. The selected waveform will be marked with a frame of the same color as the waveform.

(5) Control signal waveform
Control signal waveform is not displayed in FFT graph. The waveform information is not displayed in the text area either.

(6) PLC signal waveform
PLC signal (bit device) waveform is not displayed in FFT graph. The waveform information is not displayed in the text area either.

| Display item | Display contents | Display example | Remarks |
|---|---|---|---|
| Graph title | Equivalent to the specifications for time mode. Refer to the section "Text display area" for time mode. | | |
| Displayedwaveform No. | | | |
| Start time | Start time of the plot data for which FFT display has been executed | StartTime : 0.0000[sec] | |
| End time | End time of the plot data for which FFT display has been executed | EndTime : 3.0523[sec] | |
| Sampling cycle | Sampling cycle | Sampling Cycle : 1.7[ms] | |
| Number of data | Number of the plot data for which FFT display has been executed | PointNum : 512 | |
| Waveform No. andValue for 1Div | Equivalent to the specifications for time mode. Refer to the section "Text display area" for time mode. | | |
| Data1 | | | |
| Conversion | | | |
| Data2 | | | |
| X | The X value of the plot which is indicated by the search line during search mode. | X : 0.978828 | These are displayed only in search mode. |
| Y | The Y value of the plot which is indicated by the search line during search mode. | Y : 275.978498 | |
| Maximum value Minimum value | Equivalent to the specifications for time mode. Refer to the section "Text display area" for time mode. | | |
| P-P | | | |




(7) Zero position marker

The marker which indicates the zero position of waveform is displayed at the right side of the graph area. It is not displayed when zero does not exist in the waveform.

(8) Tool bar

The "FFT display" icon is kept ON during FFT display. When clicking the "FFT display" icon again, return to time-series data display.

### FFT Auto scaling

#### Operation procedure

-Select [Graph(G)] - [AutoScaling] from the menu or function bar.

-Press  from the tool bar.

-Select [AutoScaling] from the selection items to be displayed by right-clicking.
-Check the [AutoScaling] check box on the Axis setting screen and press "OK" or "Apply".

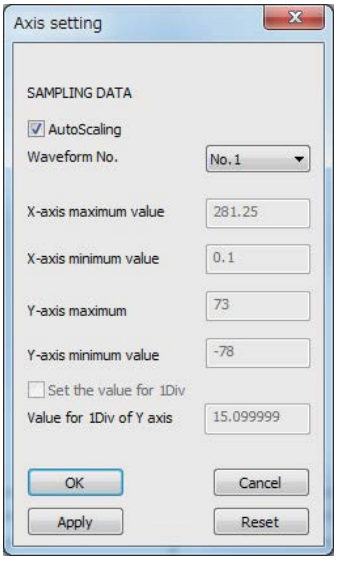
Auto scaling plots a graph with the below-listed the auto scaling values.

| Direction | Value | Auto scaling value |
|---|---|---|
| Horizontal | Minimum value | 0.1 |
| | Maximum value | Maximum value of actual plot data |
| Vertical | Minimum value | 0 or more: 0.95 times of the minimum value rounded down to two significant digits<br>Less than 0: 1.05 times of the minimum value rounded up to two significant digits |
| | Maximum value | 0 or more: 1.05 times of the maximum value rounded up to two significant digits<br>Less than 0: 0.95 times of the maximum value rounded down to two significant digits |

### FFT Drawing setting screen

The drawing setting screen in FFT display is the same as in time-series data display.
When the drawing setting is changed during FFT display, execute Fourier transform again with the new drawing setting and display in FFT. The analysis range of FFT is not changed.
When switching to time-series data display, time-series data is displayed the drawing setting which has been changed during FFT display.

FFT Axis setting screen




| Item | Details | Default value |
|---|---|---|
| Graph title | This displays the graph title. | - |
| AutoScaling Check box | This sets the auto scale ON/OFF.<br>ON: The graph is displayed with auto scale ON.<br>OFF: The graph is displayed with auto scale OFF.<br>When the drag mode and expansion/reduction mode are selected, auto scale OFF is set automatically. | ON |
| Waveform No. | This selects the waveform to carry out axis setting. | No.1 |
| X-axis maximum value | This sets the maximum value of x axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current x axis maximum value<br>Cannot be set |
| X-axis minimum value | This sets the minimum value of x axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current x axis minimum value<br>Cannot be set. |
| Y-axis maximum value | This sets the maximum value of y axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current y axis maximum value<br>Cannot be set. |
| Y-axis minimum value | This sets the minimum value of y axis in the graph.<br>When the auto scale check box is ON, this cannot be set. | Current y axis minimum value<br>Cannot be set. |
| 1Div | This sets 1Div value of the waveform.<br>When the auto scale check box is ON, this cannot be set. | 1Div value of the currently selected waveform<br>Cannot be set. |

Buttons on FFT Axis setting screen

| Button name | Operation |
|---|---|
| OK | Enables the axis range setting made by a user and returns to the NC Analyzer main screen. |
| Cancel | Cancels the process.<br>Returns to the NC Analyzer main screen. |
| Apply | Reflects the axis range setting made by a user to the graph. |
| Reset | Returns the axis range setting made by a user to the original value.<br>Cannot return after pressing "Apply" button. |

### Search mode of FFT

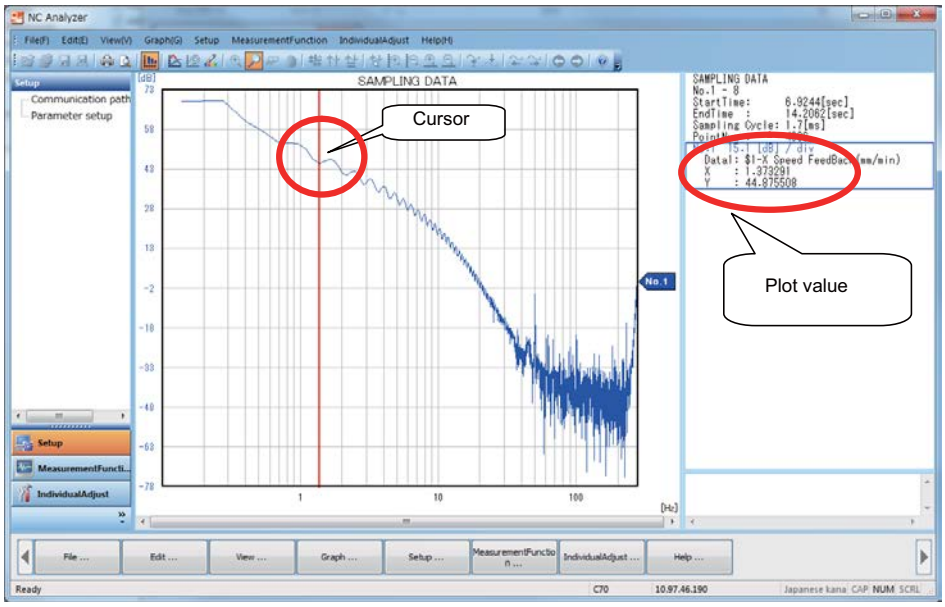
The value of the data point on the graph is read, and displayed in the text area.
When the graph is not displayed, this cannot be selected.

**Execution procedure**

-Select [Graph] - [Search] from the menu.
-Select [Graph] - [Search] from the function bar.
-Select [Search] with right-click.
-Select  button in the tool box.

**Operation procedure**

When the right cursor key is pressed, the red cross is displayed.
Move the red cross with the cursor key, and read the value of the designated point on the graph.
The read value is displayed in the text area.
The cursor can be moved by one plot point at a time with [Left/Right key] on keyboard.
The cursor can be moved by 10 plot points at a time with [Shift key + Left/Right key] or [Up/Down key] on keyboard.




### Multiple search mode of FFT

It is disabled for FFT display.

### Cursor display of FFT

It is disabled for FFT display.

### Enlarging/reducing FFT in time axis direction

It is disabled for FFT display.

### Move offset to right or left of FFT

It is disabled for FFT display.

## 3.6.4 Method of Saving/Displaying the Data

**Save the graph data**

This saves the designated graph data in the file.
When the graph is not displayed, this cannot be selected.
There are three saving methods for the graph data. There are three saving methods for the graph data. Which saving method to use differs depending on the mode.

| How to save | XY mode | Time mode | FFT mode |
|---|---|---|---|
| [Save as] | ○ | ○ | ○ |
| [Save] | - | ○ | ○ |
| [Save data between cursors] | - | ○ | - |

[Save as]

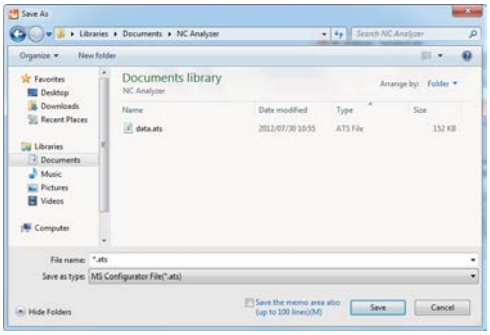
(1) Select the menu [File] - [Save as].
This function can be selected from the function bar, right-click or tool box also.
(2) Shift in the state of the graph selection. Select the target graph with the mouse.
When the graph is selected from the menu displayed by right-clicking or when the graph is drawn in time mode, this operation is not necessary. The screen automatically proceeds to (3).
(3) The file dialog is displayed. After designating the destination, file name, file type, and target, press [Save].
(4) The graph is saved with the designated file name.

[Save data between cursors]

(1) Select the menu [Graph] - [ShowCursor]
This function can be selected from the function bar, right-click or tool box also.
(2) Move the cursors and choose the area to save.
(3) Select the menu [File] - [Save data between cursors]
This function can be selected from the function bar, right-click or tool box also.
(4) The file dialog is displayed. After designating the destination, file name, file type, and target, press [Save].
(5) The graph is saved with the designated file name.

[Save]

(1) Select the menu [File] - [Save]
This function can be selected from the function bar, right-click or tool box also.
(2) The graph is saved with the present file name.



The data saving format is as follows.

| File format | Format | Details | XY mode | Time mode |
|---|---|---|---|---|
| NC Analyzer File(*.ats) | *.ats | The necessary data to reproduce the graph such as the plot data and the axis range of the graph is saved in a batch.<br>The data that the user input to the memo area is saved, however, the data displayed in text area is not saved. | ○ | ○ |
| PlotData(*.csv) | *.csv | Only the plot data with CSV format is saved.<br>The data displayed in text area and memo area are not saved. | ○ | - |
| All(*.ats/*.csv) | *.ats<br>*.csv | Both ats format file and CVS format file are created with the designated name.<br>The file name (previous part from the extension) and the saved place are common. | ○ | - |

| Storage object | Details |
|---|---|
| Graph only | Only the graph data is saved. |
| Graph + Memo<br>(up to 100 line) | The graph data and the memo area data are saved.<br>The memo area data is saved up to 100 lines or less. 100 lines or more are not saved. |

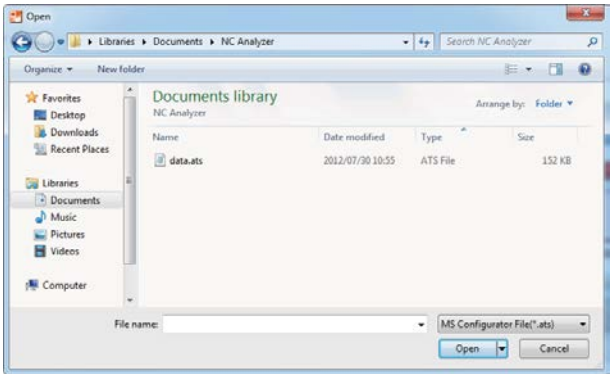
**Display of .ats file**

This displays the graph from .ats file.

(1) Select the menu [File] - [Open].
This function can be selected from the function bar, right-click or tool box also.

(2) Shift in the state of the graph selection when the graph is displayed in the graph area.
When the graph is selected from the menu displayed by right-clicking or when the graph is drawn in time mode, this operation is not necessary. The screen automatically proceeds to (3).
When a graph is not displayed in the designated graph area, the display does not shift in the state of the graph selection.
The place where data is read is designated. Select the target area with the mouse.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.

(3) The file dialog is displayed.
After the displayed file is selected, the designated file is displayed in the graph area when the [Open] button is pressed. At this time, when the graph area where the graph has already been displayed is selected, the graph is overwritten and displayed.




Auto scaling is executed when opening a .ats file written in time mode.
When opening a .ats file written in XY mode, the state of an auto scale is changed by the state of the graph area where the graph is displayed.

| Graph area | Auto scale ON/OFF state | | Supplement |
|---|---|---|---|
| Newly display (Note) | Always display the auto scale ON state. | | Auto scale ON/OFF setting by the user is impossible. |
| Overwrite display | Auto scale ON setting | Display the auto scale ON state. | The display target graph is displayed with auto scale. |
| | Auto scale OFF setting | Display the auto scale OFF state. | The graph is displayed with the scale range set by the graph before being overwritten. |

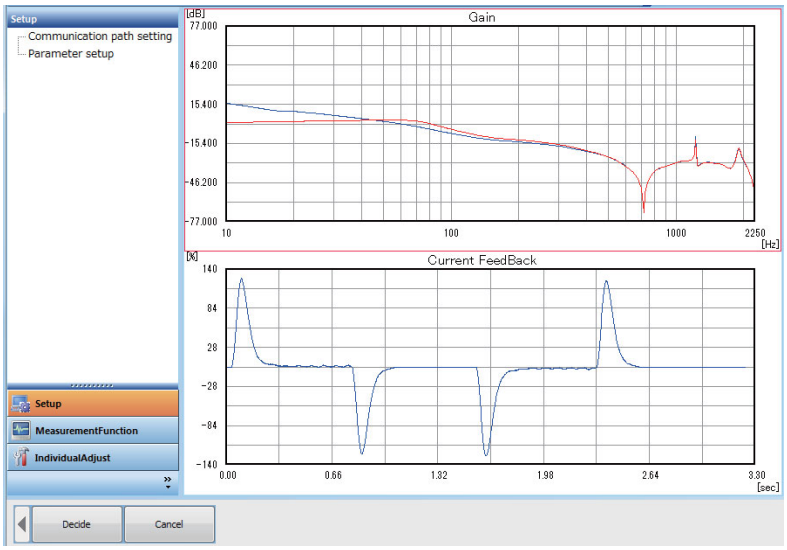
(Note) When the graph is not displayed in the graph area such as initial display, the graph is deleted, etc.

**Display of .csv file**

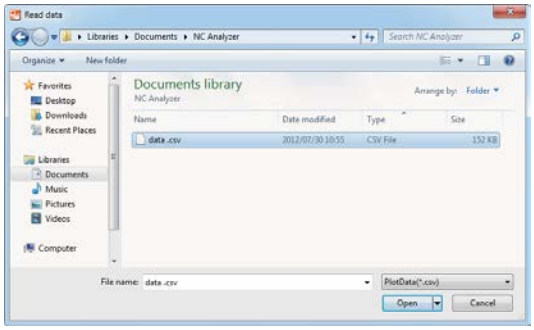
This displays the graph from .csv file.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [File] - [Read data].
This function can be selected from the function bar, right-click or tool box also.

(2) Shift in the state of the graph selection when the graph is displayed in the graph area.
If the graph is selected from the menu displayed by right-clicking, this operation is not needed.
When a graph is not displayed in the designated graph area, this operation is not executed.
The place where data is read is designated. Select the target area with the mouse.
The selected graph is enclosed in a red line. Press the [Decision] button when selecting.




(3) The file dialog is displayed.
Select the displayed file and read method.
The plot addition/overwriting depends on the AutoScalling checkbox selection state of "Axis range settings" dialog.




(4) When the [Open] button is pressed. The file is displayed with the designated method in the graph area.

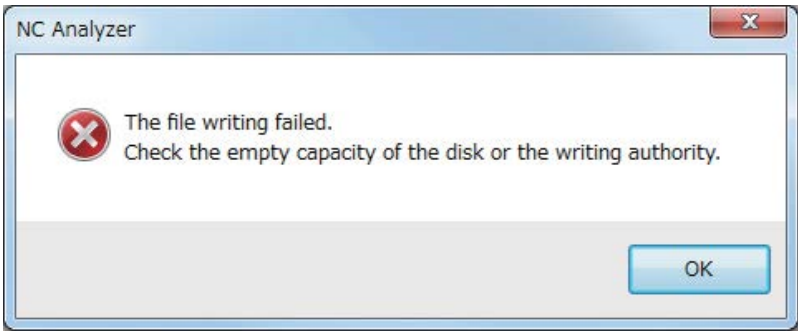
**Save the bitmap**

The data of the graph area, the text area, and the memo area is saved as a bit map file.
When the graph is not displayed, this cannot be selected.

(1) Select the menu [File] - [Save bitmap].
This function can be selected from the function bar, right-click or tool box also.

(2) The file dialog is displayed.
After the saved place, file name are designated, the graph is saved with the designated file name when the [Save] button is pressed.
The bit map is preserved in the state of the text area and the memo area the ratio of 3 to 1.

When failing in "Save bitmap", the following error message will appear.



## 3.6.5 Method of Printing

**Printing**

This prints the contents of the graph area, the text area, and the memo area when connected with the printer.
When the graph is not displayed, this cannot be selected.
When the printer driver is not installed, the error message appears, and the process is finished.

(1) Select the menu [File] - [Print].
This function can be selected from the function bar or tool box also.
(2) When the printer driver is installed, the printing dialog is displayed.
Print according to the print procedure of each printer.
The data is printed in the state of the text area and the memo area the ratio of 3 to 1.

**Print preview**

This displays the print preview when connected with the printer.
When the graph is not displayed, this cannot be selected. Also, cursors for waveform graph will not be displayed.
When the printer driver is not installed, the error message appears, and the process is finished.

(1) Select the menu [File] - [Print preview].
This function can be selected from the function bar or tool box also.
(2) When the printer driver is installed, the print preview screen is displayed.

**Printer setting**

This displays the printer setting screen when connected with the printer.
When the printer driver is not installed, the error message appears, and the process is finished.

(1) Select the menu [File] - [Printer setting].
This function can be selected from the function bar also.
(2) When the printer driver is installed, the printer setting dialog is displayed.

# 4

# Precautions

When using NC Analyzer, pay attention to the followings.

## 4.1 Precautions for Using Automatic Adjustment Function

**Precautions**

(1) When using a program created with the program creation function, confirm an appropriate soft limit.
(2) When using the Speed loop gain adjustment, Frequency response measurement, a minute vibration is added to the motor. In that case, the servomotor might vibrate violently. Input the reset or emergency stop if a danger status is caused because the servomotor vibrates violently. The machine vibration can be controlled by reducing adjustment level. After reducing adjustment level, execute the speed loop gain adjustment.
(3) Confirm the effect stroke of the machine, and execute the Position loop gain adjustment, Time constant adjustment, Lostmotion adjustment, and Lost motion type 3, paying attention to avoid interference.
(4) Cannot execute the automatic adjustment for the axis which uses parallel drive system (tandem). Only parameter setting and initial notch filter setting are available.
(5) Always confirm that the emergency stop and reset are valid when using.
(6) While the automatic tuning function is executed, the display of the servo monitor screen is not updated.
(7) If emergency stop, NC power OFF, alarm occurrence, or input power OFF (instantaneous stop) occurs while performing adjustment with NC Analyzer, make sure to enter the servo in a ready ON after the parameter settings are returned.
(8) Measurement or adjustment is possible even if the vibration value is less than the current limit value. In that case, the measurement or adjustment might not be completed normally. Do not set the current limit value less than 100%.
(9) Do not adjust the axis with a motor unconnected (servo drive unit connected) axis or detached axis. If such an axis is adjusted, the adjustment might not be completed while keeping the status display screen (adjusting screen) displayed. In that case, input the emergency stop or reset to stop the measurement.
(10) Confirm that each parameter described in the section "3.1.2 Parameter Setting" is correctly set to NC. If it is not set correctly, the operation might be incorrect. In that case, input the emergency stop or reset to stop the adjustment.
(11) Each adjustment function confirms the operation mode of all part systems when it is selected from NC Analyzer main screen. If there is even one part system to which the operation mode is not set correctly, an operation mode error message and illegal part system name are displayed. So set the operation mode for subjected part system correctly. In the program creation function, only the operation mode of the part system subjected to the program creation function.
(12) Always execute the speed loop gain adjustment before each adjustment.
(13) If the axis is not moved, the resonance might not be generated.
Confirm the resonance is not generated even if the axis is moved by the pulse sending.
(14) This function does not correspond to inch system. Operate with a metric system.
(15) When the type name of the drive unit cannot be acquired from NC, all drive units are assumed to have not been connected.
(16) When this function is used with other external device connected to PC, the measurement/adjustment might not be correctly completed because of the noise influence.
(17) Input the emergency stop after inputting reset when the emergency stop is input with NC. When only the emergency stop is input, the program forwarded from this function to NC is not deleted.
(18) When the parameters of NC, the servo and spindle parameters are changed and the NC restarts, restart the NC Analyzer also.
When the NC Analyzer is not restarted, the measurement/adjustment is executed by the parameter setting before restarting, therefore, correct results cannot be obtained.
(19) When the emergency stop of NC occurs while executing adjustment function, click the "Cancel" button on the status display screen (measuring screen) and stop the adjustment function.
(20) The tool bar and menu bar is reset to initial settings with the language change.

**Relation with other functions**

(1) NC data sampling
The NC data sampling function cannot be set when the automatic tuning function "#1164 ATS" is set to "1" and "Data protect" is being displayed.
When the adjustment is executed, the NC data sampling parameters are changed.
(2) The servo monitor screen
"ATS Sampling" is displayed and the data is not updated while the automatic tuning function is being executed.
(3) Program display
In the Position loop gain adjustment, Time constant adjustment, Lost motion adjustment, Lost motion type 3 adjustment and Data measurement in program operation, when the program is created and adjusted on NC Analyzer, the machining program No. is allocated automatically. When the machining program in NC memory is used, the machining program No. in which operation search has been executed is displayed.
(4) Search & Start function
Search & Start function will be disabled for safety when the parameter "#1164 ATS" is "1".

## 4.2 Precautions for Using Measurement Function

**Precautions**

(1) Execute the Vibration signal setup before the Frequency response measurement is executed.
(2) When Frequency response measurement is executed, start measuring from small enough (10 to 20) vibration amount.
However, when the vibration amount is reduced, an error might occur. In that case, set a larger vibration amount on Frequency response measurement Details setting screen, and measure again.
(3) When using the Frequency response measurement, a minute vibration is added to the motor. In that case, the servomotor might vibrate violently. Input the reset (only during vibration) or emergency stop if a danger status is caused because the servomotor vibrates violently. Measure the frequency response by separating about 10mm from the edge of stroke.
The machine vibration can be controlled by reducing vibration amount. Set a smaller amount to vibration amount at measurement on the "Frequency response measurement Details setting" screen, and measure again.
(4) Always confirm that the emergency stop and reset are valid when using.
(5) When the measurement could not be stopped even if the reset is input, input the emergency stop.
(6) Do not measure the axis with a motor unconnected (servo drive unit connected) axis, detached axis or synthetic axis composed of two or more axes (inclination Y axis in lathe system, etc.). If such an axis is measured, the measurement might not be completed while keeping the status display screen (measuring screen) displayed. In that case, input the emergency stop or reset to stop the measurement.
(7) Even if the parameter "#2018 no_srv" is set to "1", the measurement is executed when the servo drive unit and motor are connected.
(8) Measurement or adjustment is possible even if the vibration value is less than the current limit value. In that case, the measurement or adjustment might not be completed normally. Do not set the current limit value less than 100%.
(9) Confirm that each parameter of the axis or axis specification is correctly set to NC. If it is not set correctly, the operation might be incorrect. In that case, input the emergency stop or reset to stop the measurement.
(10) The Frequency response measurement function of machine confirms the operation mode of all part systems when it is selected from the NC Analyzer main screen. If there is even one part system to which the operation mode is not set correctly, an operation mode error message and illegal part system name are displayed. So, correctly set the operation mode for subject part system.

(11) The measurement function confirms the operation mode for all part systems when the [Test] button on the measurement function screen or the [OK] button on each measurement function is pressed.
When the part system to which the operation mode is not correctly set exists, an operation mode error message and an illegal part system name are displayed, and so set the operation mode in the object system correctly.
(12) The value to display waveform for the time-series data measurement and synchronous tapping error measurement applies the inch system ("#1041 I_inch" is set to "1"). The metric system is fixedly used for displaying the circular error measurement, the arbitrary path and others.
(13) Automatic operation startup is valid only for the 1st part system. The gear ratio is not taken into account in the spindle measurement data.
(14) When the type name of the drive unit cannot be acquired from NC, all drive units are assumed to have not been connected.
(15) When this function is used with other external device connected to PC, it might not be able to measure and adjust correctly because of the noise influence.
(16) When the tandem axis is used, use the system in which the gear ratio, motor and detector of the primary axis and secondary axis are the same.
(17) Input the emergency stop after inputting reset when the emergency stop is input with NC. When only the emergency stop is input, the program forwarded from this function to NC is not deleted.
(18) When the parameters of NC, the servo and the spindle parameters are changed and the NC restarts, restart the NC Analyzer also.
When the NC Analyzer is not restarted, the measurement/adjustment is executed by the parameter setting before restarting, therefore, correct results cannot be obtained.
(19) If the internal sampling complete processing fails for time-series data measurement, the warning window "The sampling termination failed. Please stop driving, and push the OK button." will be displayed. Stop the operation and press [OK] button.
(20) Program creation function is not compatible with MITSUBISHI special format.
(21) The tool bar and menu bar is reset to initial settings with the language change.

# 5

# Appendix

# 5.1 Message of Automatic Adjustment

**Error messages**

### E001 Connect NC Failed.

An error occurred in communicating with NC.
Check the connection with NC.

### E002 It was not able to communicate.

An error occurred in communication test with NC.
Check the connection with NC.
Check the port No. and baudrate.

### E003 Reading of a file went wrong.

The reading from the file was failed.
Check the file.

### E004 Preservation of a file went wrong.

The writing to the file was failed.
Check the destination file.

### E005 An input value is inaccurate.

The value of set parameter exceeded the input range.
Check the parameter setting.

### E006 Reading went wrong from NC.

The parameter value could not be read from NC.
Check the connection with NC.

### E007 The writing to NC went wrong.

The parameter value could not be written to NC.
Check the connection with NC.

### E008 The machining program for position loop gain adjustment is not created.

The machining program for adjustment had not been created when the "Execute" of position loop gain adjustment was selected.
Create the machining program for position loop gain adjustment by [IndividualAdjust] - [Program creation].

### E009 The machining program for time constant adjustment is not created.

The machining program for adjustment had not been created when the "Execute" of time constant adjustment was selected.
Create the machining program for time constant adjustment by [IndividualAdjust] - [Program creation].

### E010 The machining program for lostmotion adjustment is not created.

The machining program for adjustment had not been created when the "Execute" of lost motion adjustment was selected.
Create the machining program for lost motion adjustment by [IndividualAdjust] - [Program creation].

### E011 It returned, before adjusting a parameter. Adjustment is stopped.

The adjustment is discontinued because an error occurred while adjusting. Restore the parameter settings before the parameter was adjusted.
Restore the parameter settings before the parameter was adjusted, but the parameter setting might not be restored when communication failure.

Check the connection with NC.

Check the state of NC (alarm, mode) and related parameters.

When other part system is selected or in operation, clear the selection or press the emergency stop button and execute again.

**E012 The machining program of xxx axis is not created.**

The machining program for adjustment of the adjustment target axis had not been created.
(The axis whose machining program has not been created appears in xxx.)
Create the machining program for adjustment of the adjustment target axis.

**E013 The program for adjustment is not created.**

The project not created a machining program for adjustment was selected, and attempted to move to next screen.
Select another project or create the machining program for each adjustment for the selected project.

**E014 It was not able to write in a file.**

The save of machining program for adjustment failed.
Check the destination file.

**E015 The machining program for lostmotion type3 adjustment is not created.**

The machining program for adjustment had not been created when the "Execute" of lost motion type 3 adjustment was selected.
Create the machining program for lost motion type 3 adjustment by [IndividualAdjust] - [Program creation].

**E016 The value of a position is inaccurate. A program was not able to be created.**

This is displayed when the value set to the position in the program creation function is illegal.
Set a correct value.

**E017 The value of speed is inaccurate. Program was not able to be created.**

This is displayed when the value set to the speed in the program creation function is illegal.
Set a correct value.

**E017 The value of speed is inaccurate.**
**Program was not able to be created.**

The value set to the feedrate is illegal.
Set the value within the specified range.

**E018 The value of a dwelling is inaccurate. Program was not able to be created.**

This is displayed when the value set to the dwell in the program creation function is illegal.
Set a correct value.

**E018 The value of a dwelling is inaccurate.**
**Program was not able to be created.**

The value set to the dwell is illegal.
Set the value within the specified range.

**E019 The value of a stroke is inaccurate. Program was not able to be created.**

This is displayed when the value set to the stroke in the program creation function is illegal.
Set a correct value.

**E020 The value of radius is inaccurate. Program was not able to be created.**

This is displayed when the value set to the radius in the program creation function is illegal.
Set a correct value.

**E020 The value of radius is inaccurate.**
**Program was not able to be created.**

The value set to the radius is illegal.
Set the value within the specified range.

**E021 There is no parameter information to save.**

When the data saved in the file or written to NC did not exist, saving or writing in NC was executed.
Set the parameter information for saving.

**The amplitude of output signal obtained by the frequency response measurement is too small.**
**It returns, before adjusting a parameter, and adjustment is stopped.**

The amplitude of output signal that is obtained at the Frequency response measurement is too small.
Check the NC parameters. Check the vibration amount. Check the state (alarm and mode) of NC.

**You can't select synchronous axis. (Axis name)**

This is displayed when the synchronous axis have been selected in the function which does not correspond to the parallel synchronous control axis.
Change a selected axis.

**You can't select slave axis. (Axis name)**

This is displayed when the secondary axis have been selected in the function which does not correspond to the secondary axis.
Change a selected axis.

**You can't select an axis to which drive unit is not connected. (Axis name)**

This is displayed when the drive unit unconnected axis have been selected.
Change a selected axis.

**NC has no free space for storing programs.**

This is displayed when there is no empty area for the program preservation in NC.
Delete an unnecessary program with NC.

**Initialization of ATSIF.DLL went wrong.**

Failed to initialize ATSIF.DLL.
After reinstalling NC Analyzer, restart the PC again.

**Change to Memory Mode. (System X)**

This is displayed when the adjustment is executed with operation mode of NC other than the memory mode set.
Set the NC operation mode of the part system displayed in the part system X to the memory mode.

**Change to MDI Mode. (System X)**

This is displayed when the program test is executed with operation mode of NC other than the MDI mode set.
Set NC operation mode to the MDI mode.

**The test was interrupted.**

This is displayed when some errors occur during the machining program test.
Check the state of NC.

**There is no consistency between the contents of selected project and the NC parameter.**
**Please confirm the NC parameter (G code system and the setting of AbsInc).**

This is displayed when all the following conditions are met: [Send Program] of the measurement function screen is checked ON. [Lathe] is selected on [Model], and 2, 4 or 6 is selected on [G code system] of the measurement function screen.
AbsInc parameter of NC is illegally set.
Check the NC parameters (G codes and AbsInc setting).

**Emergency stop or reset was input. The measurement is discontinued.**

The emergency stop or reset was input with NC.
Clear the emergency stop or reset with NC.

**The vibration maybe occurred. Decrease the parameter VGN1 and retry adjust.**

The vibration maybe occurred.
Check the NC parameters.

**Adjustment is stopped because CFB_TOO_LOW. Check the motor-lines, or the parameters.**

The vibration signal setup is interrupted as the current feedback is extremely small.
Check the motor power cable and the standard parameters.

**Adjustment is stopped because OVERTIME. Check the motor-lines, or the parameters.**

The vibration signal setup is interrupted as the number of adjustments has reached its limit.
Check the motor power cable and the standard parameters.

**Vibration signal level is not set.**

The vibration signal level is not set.
Check ATS.INI.

**The amplitude of output signal obtained by the frequency response measurement is too small.**

The amplitude of output signal obtained by the frequency response measurement is too small.
Check the NC parameters.
Check the vibration amount.
Check the state of NC (alarm and mode).

**Pop-up messages**

**It succeeded in communication.**

NC Analyzer succeeded in the communication with NC when the communication was tested.

**The parameter after adjustment is changed. Does it end without applying?**

When creating the parameter or machining program, the operation was attempted to be ended without saving.

**Adjustment ended?**

The adjustment was attempted to be ended by pressing the "Cancel" button during the adjustment.

**It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?**

The "Apply" button is pressed on the "Adjustment result" screen.

**It returns, before adjusting a parameter. Is it all right?**

The "Undo" button is pressed on the "Adjustment result" screen.

**The parameter after adjustment is changed. Does it end without applying?**

The adjusted parameters were edited on "Adjustment result" screen, and the adjustment was attempted to be ended without pressing "Apply".

**Creation is interrupted.**

**May I cancel information in preparation?**

The "Cancel" button was pressed while creating the machining program for adjustment.

**May I change a program?**

The "Make" button was pressed while the machining program for adjustment is created.

**Is a program tested?**

The "Test" button was pressed.

**Are No., an axis name, and the number of axes acquired from NC?**

The parameters were read from file while communication with NC is possible.

**Reading is performed from NC. Is it all right?**

Reading from NC was selected.

**It writes in to NC. Is it all right?**

Writing to NC was selected.

**The machining program being displayed is transferred to the NC.**

**It's possible to operate (test) the transferred machining program in Memory mode.**

The machine program is being transferred.

**Adjustment ended?**

The cancel button was pressed while adjusting.

**Cancel the measurement?**

The cancel button was pressed while measuring.

**The parameter after adjustment is changed. Does it end without applying?**

The parameter is changed after the adjustment but not reflected to NC.

**Non-saved data exists. Data is canceled after ending as it is. Is it all right?**

The parameter is changed but not reflected to NC.

**The program has been changed. Do you preserve it?**

Program save confirmation is displayed as the program is changed.

**Preparing the adjustment.**

The preparation for adjustment is executed.

**Preparation of adjustment was completed. Execution of a cycle start starts adjustment.**

**Attention: In case of the system with multiple part systems, confirm that**

**the part system of the selected axis is the same as the part system selected on the NC side.**

NC Analyzer is waiting for the automatic start button to be pressed.

**Data is being sampled.**

Data is being sampled.

**Data is being analyzed. The parameter is changed.**

The data is being analyzed and the parameter is being changed.

**Data is being analyzed.**

The data is being analyzed.

**Adjustment was completed. Please click the next.**

Adjustment completed.

**Measurement completed. Click the "Close" button.**

Adjustment completed.

**The error occurred during adjustment.**

**It returns, before adjusting a parameter, and adjustment is stopped.**

The error occurred during adjustment.

**The error occurred during adjustment.**

**adjustment is stopped.**

The error occurred during adjustment.

**It returns, before adjusting a parameter. Is it all right?**

Return the parameter which is changed for adjustment to the original value.

**It rewrites in the parameter after adjustment while displaying a parameter. Is it all right?**

Set the parameter input from UI to NC.

**VGN1 reached the upper limit.**

**Continue adjustment by setting VGN1 to the upper limit?**

VGN1 has reached the upper limit during the adjustment.

**VGN1 reached the lower limit.**

**Continue adjustment by setting VGN1 to the lower limit?**

VGN1 has reached the lower limit during the adjustment.

**Execute the "Vibration signal setup". The default value is set to the vibration amount.**

The Frequency response measurement/vibration signal setup has never been executed.
Execute the Vibration signal setup.

**Restart the tool to enable the language change.**

Change the display language.

**Re-measurement failed because of incorrect measurement conditions.**

**Please run from the measurement condition setting.**

Re-measurement failed because of incorrect measurement conditions.

**Status display**

**Adjustment is prepared.**

The adjustment is being prepared now.

**Preparation of adjustment was completed.**

The adjustment has been prepared. When the cycle start is input, the adjustment is started.

**Data is sampling.**

The data is being sampled.

**Data is analyzing.**

The data is being analyzed. The parameters are changed.

**Adjustment was completed.**

The adjustment ended. Press the "Next" button.

**The error occurred during adjustment.**

The adjustment is discontinued because an error occurred while adjusting. Restore the parameter settings before the parameter was adjusted.

## 5.2 Message of Measurement Function

**Connection with NC was not completed.**

An error occurred in communicating with NC.
Check the connection with NC.

**Execute the "Vibration signal setup". The default value is set to the vibration amount.**

The Frequency response measurement/vibration signal setup has never been executed.
Execute the Vibration signal setup.

**The vibration amount set by the "Vibration signal setup" is outside the setting range.**

**The default value is set to the vibration amount.**

The vibration amount set by vibration signal setup exceeds the setting range.
Execute the Vibration signal setup again.

**An illegal value is set to the vibration amount. Set an appropriate value (1 to 150 (integer number)).**

The vibration amount setting exceeds the setting range, or value other than the integer value is set.
Set the vibration amount again.

**Execute the "Vibration signal setup".**

The Vibration signal setup has never been executed.
Execute the Vibration signal setup.

**The program end M code is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to program end M code is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The dwell time is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the dwell is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The travel distance is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the travel distance is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The feed rate is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the feed rate is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The radius is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the radius is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The number of repetitions is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the number of repetitions is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The thread pitch is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the thread pitch is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The spindle rotation speed is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the spindle rotation speed is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The square side length is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the square side length is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**R-point is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the R-point is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The thread hole depth is set to an illegal value or is not set.**

**Set an appropriate value (XXXXX to XXXXX).**

The value set to the thread hole depth is illegal.
Set the value within the range specified by (XXXXX to XXXXX).

**The corner radius value is larger than the half of the square side length.**

The [Radius] value has been set to 1/2 or more of the [Square side length] value when [Square] program is created.
Set the value of [Radius] and [Square side length] again.

**The previous value of the auto-scale is not held.**

**Set the auto-scale ON.**

This is displayed when an auto scale is turned OFF for the first measurement because a previous value of graph area does not exist.
Check the auto scale check box and press [Measurement] button.

**The test was interrupted.**

This is displayed when NC cannot read the machining program when the machining program is tested.
Check the state of NC.

**It's impossible to select axes other than X and Y and Z axes.**

This is displayed when [Arc] or [Square] is selected on [Kind] of the measurement function screen and excluding [X] axis, [Y] axis, or [Z] axis is selected with [Axis1] of the measurement condition.
Select either X axis, Y axis or Z axis.

**It's impossible to select axes other than X and Z axes.**

This is displayed when [Synchronous tapping] is selected on [Kind] of the measurement function screen and excluding [X] axis or [Z] axis is selected with [Axis1] of the measurement condition.
Select either X axis or Z axis when a synchronous tapping program is created.

**Change to MDI Mode.**

This is displayed when the program test is executed with operation mode of NC other than the MDI mode set.
Set NC operation mode to the MDI mode.

**You haven't set the NC parameters for basic axes that constitute a plane. Set appropriate values.**

This is displayed when the NC parameter "#1026 base_I (Base axis I)", "#1027 base_J (Base axis J)", "#1028 base_K (Base axis K)" are not set when a circular program is created.
Check the plane axis parameter setting of NC.

**It's impossible to select axes to be measured from same axes. Select the axes from different.**

This is displayed when the same axis is set with axis 1 and axis 2 when a circular arc and a square program are created.
Select a different axis of the same part system.

**It's impossible to select axes to be measured from different part systems.**

**Select the axes from one and the same part system.**

This is displayed when the axis in a different part system is set at the measurement which uses two or more axes.
Select an axis of the same part system.

**The setting for the measurement target axis is not appropriate.**

**The default value is set to the measurement target axis.**

The setting for the measurement target axis is not appropriate.
Check the NC parameters.

**It was not able to write in a file.**

This is displayed when failing to write the test program in the file when pressing the test button.
Check whether to write in the Program_Measure\Measurement.eia file and whether the file exists.

**The test was interrupted.**

This is displayed when some errors occur during the machining program test.
Check the state of NC.

**There is no consistency between measurement program and NC parameters.**

**Check the NC parameters (G codes and AbsInc setting).**

This is displayed when all the following requirements are met:
[Send Program] of the measurement function screen is checked ON.
[Lathe] is selected on [Model], and 2, 4 or 6 is selected on [G code system] of the measurement function screen.
AbsInc parameter of NC is illegally set.
Confirm the NC parameter (setting of G code system and AbsInc).

**DLL required for the measurement class is not found.**

When the measurement class is initialized/completed, DLL that is necessary class is not found.
After reinstalling NC Analyzer, restart the PC again.

**Change to Memory Mode. (System X)**

This is displayed when the adjustment is executed with operation mode of NC other than the memory mode set.
Set the NC operation mode of the part system displayed in the part system X to the memory mode.

**You can't select synchronous axis. (Axis name)**

This is displayed when the synchronous axis has been selected in the function which does not support the synchronous axis.
Change a selected axis.

**You can't select slave axis. (Axis name)**

This is displayed when the secondary axis have been selected in the function which does not correspond to the secondary axis.
Change a selected axis.

**You can't select an axis to which drive unit is not connected. (Axis name)**

This is displayed when the servo drive unit unconnected axis or spindle drive unit unconnected axis have been selected.
Change a selected axis.

**NC has no free space for storing programs.**

This is displayed when there is no empty area for the program preservation in NC.
Delete an unnecessary program with NC.

**It's impossible to measure items from different Nos. together if the measurement target axis is the same.**

**Change the measurement items or the axes to be measured. (Axis name)**

**[1] Position command**

**[2] Speed command/Current command**

**[3] Model position/Model error**

**[4] Motor end position**

**[5] Monitor output data**

This is displayed when the measurement target axis and measurement items have been selected by the combination which cannot be measured when the target axis is a servo axis.
Change the measurement target axis or the measurement item to the combination which can be measured.

**It's impossible to measure items from different Nos. together if the measurement target axis is the same.**

**Change the measurement items or the axes to be measured. (Axis name)**

**[1] Position command**

**[2] Speed command/Current command/Current feedback**

**[3] Model position/Model error**

**[4] Motor end position**

**[5] Monitor output data**

This is displayed when the measurement target axis and measurement items have been selected by the combination which cannot be measured when the target axis is a spindle.
Change the measurement target axis or the measurement item to the combination which can be measured.

**A spindle is not connected to the NC.**

This is displayed when the spindle is not connected with NC when the synchronous tapping error accuracy is measured.
Connect the spindle with NC, and start NC Analyzer again.

**Emergency stop or reset was input. The measurement is discontinued.**

The emergency stop or reset was input.

**The setting for the measurement target axis is not appropriate.**

**The default value is set to the measurement target axis.**

The setting for the measurement is not appropriate.
Check the parameter of NC.

**An error occurred while measuring. The measurement is discontinued.**

Some abnormalities occurred while measuring. The measurement is discontinued.
Check the connection with NC. Check the state of NC (alarm and mode).

**The data obtained by the frequency response measurement is abnormal.**

The (sampling) data obtained at the Frequency response measurement is abnormal.
Measure again after check the connection with NC.

**The amplitude of output signal obtained by the frequency response measurement is too small.**

The amplitude of output signal that is obtained at the Frequency response measurement is too small.
Check the NC parameters. Check the vibration amount. Check the state (alarm and mode) of NC.

**The time-series measurement data is incorrect.**

Some abnormalities occurred while the chronological data measuring. The measurement is discontinued.
Check the NC parameters. Check the state (alarm and mode) of NC.

**The measurement data of arc shape error is incorrect.**

Some abnormalities occurred while the arc shape error measuring. The measurement is discontinued.
Check the NC parameters. Check the state (alarm and mode) of NC.

**The synchronous tapping error data is incorrect.**

Some abnormalities occurred while the synchronous tapping accuracy measuring. The measurement is discontinued.
Check the NC parameters. Check the state (alarm and mode) of NC.

**The measurement data of arbitrary path is incorrect.**

Some abnormalities occurred while measuring arbitrary path. The measurement is discontinued.
Check the NC parameters. Check the state (alarm and mode) of NC.

**Enable the automatic tuning function. (NC parameter #1164 ATS)**

The adjustment function or the measurement function was executed without setting the base specification parameter 1164 to "1".
Set the base specification parameter 1164 to "1" and then execute.

**Enable the sampling data output. (NC parameter #1224 aux08 bit0)**

The adjustment function or the measurement function was executed without setting the base specification parameter 1224 bit0 to "1".
Set the base specification parameter 1224 bit0 to "1" and then execute.

**The sampling termination failed. Please stop driving, and push the OK button.**

The sampling completion process failed as it was executed during the operation.
Cancel the operation and then press [OK] button.

**The measurement target illegal. Control input/output signal is not selectable.**

The control input/output signal was selected as a measurement target with NC which does not support the control input/output signal.
Execute with NC which supports to the control input/output signal.

**The measurement target illegal. Spindle is not selectable.**

The spindle was selected as a measurement target with NC which does not support the spindle.
Execute with NC which supports to the spindle.

**The measurement target illegal. PLC axis is not selectable.**

The PLC axis was selected as a measurement target with NC which does not support the PLC axis.
Or NC is in a state where PLC axis cannot be selected as a measurement target.

Execute with NC which supports the PLC axis.

When NC corresponds to the PLC axis, cancel the operation if it is in automatic operation. Close the dialog and then try again.

**The file writing failed. Check the empty capacity of the disk or the writing authority.**

The file writing failed.
Check whether the status is ready to write.

**Adjustment is stopped because CFB_TOO_LOW. Check the motor-lines, or the parameters.**

The vibration signal setup is interrupted as the current feedback is extremely small.
Check the motor power cable and the standard parameters.

**Adjustment is stopped because OVERTIME. Check the motor-lines, or the parameters.**

The vibration signal setup is interrupted as the number of adjustments has reached its limit.
Check the motor power cable and the standard parameters.

**The common variable value is outside the setting range.**

**Check the input value.**

The value set in "Common variable#" of Time-series data measurement screen is illegal.
Set the value within the specified range.

**The device value is outside the setting range.**

**Check the input value.**

The value set in "Device" of Time-series data measurement screen is illegal.
Set the value within the specified range.

**The measurement target illegal. PLC axis is not selectable. (CH name)**

This is displayed when connected NC does not support the PLC axis measurement.

**The measurement target illegal. Spindle is not selectable. (CH name)**

This is displayed when connected NC does not support the spindle measurement.

**The measurement target illegal. Control signal input/output waveform is not selectable. (CH name)**

This is displayed when connected NC does not support the control input/output signal measurement.

**The setting of the target to measure is inaccurate.**

**Check the setting.(CH name)**

This is displayed when the target axis and waveform type to measure are not set on Time-series data measurement screen, or when the target NC does not support the setting.
Set the axis and waveform type. Or use a compatible NC.

**Designated waveform type cannot be selected during high-speed synchronous tapping enabled.**

**(CH name)**

This is displayed when the waveform type which cannot be measured is set on Time-series data measurement screen during high-speed synchronous tapping enabled.
Set the waveform type which can be measured during high-speed synchronous tapping enabled.

**Model position and model error cannot be selected for the spindle or spindle/C axis.**

This is displayed when model position or model error is set for waveform type while the spindle or spindle/C axis is set on Time-series data measurement screen.

**Monitor output data whose data No. is -1 cannot be measured.(CH name)**

This is displayed when the DA data whose data No. is -1 is set on Time-series data measurement screen.

**Load meter cannot be selected.(Axis name)**

This is displayed when load meter is set for an axis other than the spindle on Time-series data measurement screen.

**Up to two waveform types can be measured for one axis when high-cycle sampling is selected.**

**(Axis name)**

This is displayed when more than three measurement target waveforms are set for one axis on Time-series data measurement screen during high-cycle sampling measurement.

**High-cycle sampling cannot be selected.**

**(Check whether or not the NC supports high-cycle sampling)**

This is displayed when high-cycle sampling measurement is selected on the NC which does not support high-cycle sampling.

**When selecting a High-cycle sampling, please on #1164 ATS = 0**

This is displayed when #1164(ATS) is 1 during high-cycle sampling measurement. Set #1164(ATS) to 0.

**High-speed synchronous tapping setting is enabled(#1281 ext17 bit5=1)**

**Set the spindle parameter #13228(SFNC8) = 0004 (no change for settings of bitF to bit3),**

**and after the measurement, change the setting of #13228(SFNC8) back to the original one.(CH name)**

This is displayed when Bit2 to 0 of #13228 are not 100 with selecting load meter for a measurement target of the spindle while high-speed synchronous tapping is enabled and a synchronous tapping measurement is performed.
Set the parameter following the message.

(Note that it is a warning message and measurement can be performed without changing the parameter settings.)

**Test operation is enabled. (#2018 no_srv = 1)**

**Disable test operation. (#2018 no_srv = 0)(Axis name)**

This is displayed when #2108(no_srv) is 1 while performing frequency response measurement, frequency response measurement of machine, or velocity loop gain adjustment with M700V/M70V/E70 series NC.
Set #2018(no_srv) to 0.

(Note that it is a warning message and measurement or adjustment can be performed without changing the parameter settings, however, a correct result may not be obtained.)

**Attempted to set the value larger than the upper limit to the servo parameter.**

The message "VGN1 reached the upper limit. Continue adjustment by setting VGN1 to the upper limit?" is displayed during Velocity loop gain adjustment and selected "No".
Select "Yes" when the message "VGN1 reached the upper limit. Continue adjustment by setting VGN1 to the upper limit?" is displayed.

**Attempted to set the value smaller than the lower limit to the servo parameter.**

The message "VGN1 reached the lower limit. Continue adjustment by setting VGN1 to the lower limit?" is displayed during Velocity loop gain adjustment and selected "No".
Select "Yes" when the message "VGN1 reached the lower limit. Continue adjustment by setting VGN1 to the lower limit?" is displayed.

**The vibration amount set on previous measurement is out of the range.**

**The default value is set.**

Vibration amount of Frequency response measurement of machine Details setting screen is outside the setting range.
Set the value from 1 to 150 for the vibration amount.

**The amplitude of output signal obtained by the frequency response measurement is too small.**

The amplitude of output signal at the execution of frequency response measurement is smaller than the minimum amplitude.
Increase the key value "BorderValue=" for section [MsigGain] in ATS.ini.

**The amplitude of output signal obtained by the frequency response measurement of Machine is too small.**

The amplitude of output signal at the execution of frequency response measurement of machine is smaller than the minimum amplitude.
Increase the key value "BorderValue=" for section [MsigGain] in ATS.ini.

**The setting of the target to measure is innacurate.**

**Check the setting.(CH name)**

On time-series data measurement screen, "Get" is checked but "Axis" and "Waveform type" are blank.
Uncheck "Get", or specify "Axis" and "Waveform type".

**The device No. of the measurement target is not set. Set the device No.**

The device No. was not set at the PLC signal data measurement.
Set the device No.

**The device No. of the measurement target is outside the setting range. Check the device No.**

The device No. was outside the setting range at the PLC signal data measurement.
Check the device No.

**The odd device No. cannot be set when multiple words are specified. Check the device No.**

The odd device No. was set when multiple words are specified at the PLC signal data measurement.
Check the device No.

**Message of Advance situation screen**

**Preparing the measurement.**

The preparation for measurement is executed.
Wait for a while until the preparation is completed.

**Measurement ready to start.**

**Press the "automatic start" button.**

**Attention: In case of the system with multiple part systems, confirm that the part system of the selected axis is the same as the part system selected on the NC side.**

NC Analyzer is waited that the automatic start button is pressed.
Press the automatic start button.

**Measuring.**

The measurement is executing now.
Wait for a while until the measurement is completed.

**Measurement completed. Click the "Close" button.**

The measurement ended.
Press the "Close" button.

**Cancel the measurement?**

The cancel button was pressed while measuring.
If the measurement is ended, press "Yes" button. If the measurement is not ended, press "Cancel" button.

# 5.3 Message of Graph Function

### Input the integer

This is displayed when an invalid value is input when the graph arrangement is set.
Input the integer from 1 to 10.

### Input value is invalid

This is displayed when an invalid value is input.
Input a normal value.

### The number of plots is exceeding the maximum displayable number (20 plots)

This is displayed when the displayed plot exceeds the MAX value when the data is read.
Display in another graph.

### Reading of a file went wrong. (File name)

This is displayed when opening a file but failed.
Check whether the device is inserted or read/write is prohibited.

### The ATS file of the XY mode is not opened. (File name)

This is displayed when waveform file of XY mode is selected in opening multiple files.
Select a file of time mode.

# Revision History

| Date of revision | Manual No. | Revision details |
|---|---|---|
| Nov. 2012 | IB(NA)1501086-A | First edition created. |
| Feb. 2012 | IB(NA)1501086-B | Corresponded to MTTSUBISHI CNC E70 series<br>Corresponded to the following drive units<br>MDS-D2/DH2 series, MDS-DM2 series and MDS-DJ series<br>"DA output data" and "D/A output data" were changed to "Monitor output data"<br>Corresponded to NC Analyzer S/W version B1 |
| Jan. 2014 | IB(NA)1501086-C | Corresponded to "language change".<br>Added "3.5.3.1.2 PLC Signal Data Measurement".<br>Added "3.5.4 Measure Again".<br>Corresponded to NC Analyzer S/W version B2. |
| | | |

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**Notice**

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible. Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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| | |
|---|---|
| MODEL | NC Analyzer |
| MODEL CODE | 100-329 |
| Manual No. | IB-1501086 |

IB(NA)1501086(ENG)-C(1401)MEE
Made in JAPAN