Product: 4-axis controller with built-in driver

Model: FMAX-4X-2SD

User's Manual

(Driver version)





Revision History

No.	Date	Contents	Approval	Check	Translation
0	2017.04.07	Initial Release			
1					
2					
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1. [Product warranty]

1.1. In the case of purchase from a supplier other than NPM

If this product is purchased from a supplier other than NPM, please contact the supplier for product warranty information.

1.2. Warranty period

The warranty period is one year from the date of the delivery.

1.3. Warranty scope

If defects are found in the product during the warranty period under normal use following this document, NPM will repair the product without charge. However, the following cases are not covered by the warranty and free repair does not apply to the product even during the warranty period.

- The products are modified or repaired by anyone other than NPM or a person authorized by NPM.
- The defect results from falling of the product after delivery or mishandling in transit.
- Wearing of components, natural deterioration or fatigue (motor axle bearing, gear, grease, cables, etc.)
- The defect results from any use other than original use.
- The product has been subjected to natural disaster or force majeure such as fire, earthquake, lightning strike, wind and flood, salt, and electrical surges.
- The defects or damage results from the cause other than the fault of NPM.
- Note 1) NPM will not provide on-site repair. If the product is defective, the product must be sent to a specified location for repair.
- Note 2) The warranty period of the repaired product is not extended beyond the warranty period of the product before the failure. It is the same as the warranty of the product before the repair.
- Note 3) This warranty covers the product itself. The detriments or damages induced by the product failure etc. will not be covered by the warranty.
- Note 4) A replacement may be provided instead of a repair at the discretion of NPM.
- 1.4. This document

This documents aims to describe the detail of the function of the product and it does not denote fitness for a particular purpose of the customer's.

The examples of application and circuit diagram in this manual are described for your reference. Please confirm the feature and the safety of device or equipment before use.

1.5. Unavailable usages

Please do not use this product for the following use in principle.

If you use the product for the following uses, please contact our sales department.

- Any equipment that may require high reliability or safety, such as nuclear facility, electricity or gas supply system, transportation facilities, vehicle, various safety system, medical equipment, etc.
- Any equipment that may directly affect human survival or property
- Usage under conditions or circumstances that are not specified in the brochure, manual, etc.

When this product is used in any equipment where faults or malfunctions may directly affect human survival or property, please secure high reliability and security with redundancy design, etc.

2. Safety Precautions

Please read this document, manuals and attached documents thoroughly before installation, using product, maintenance and inspection and use the product properly.

Please use the product after mastering about the machine, safety information and precautions. Electrical products may malfunction or have a breakdown. Please use the product with cautions in order to prevent injuries or property damage affecting the people that use this product.

2.1. Symbols

Symbols	Description
	This symbol indicates "Caution". Incorrect handling may cause a hazard that could result in injury, property damage accident or breakdown.
	This symbol indicates "Instruction". Please follow the instruction without fail.
\oslash	This symbol indicates a prohibition. Must not be done.

2.2. Precautions

2.2.1. Precautions for delivery

▲ Caution			
	 This product is accurate equipment. Do not drop or impact it. 	It could cause breakdown.	
	Overloading could cause load collapse.	It could cause breakdown or injury.	

2.2.2. Precautions for installation

🕂 Caution				
	 Do not install the product in place with corrosive gas, oil, dust, vapor or metal powder etc. 	It could cause breakdown or fire.		
	Do not install the product at a site where this product is exposed to severe vibration.	It could cause breakdown.		
	Do not use excessive force when installing the product.	It could cause breakdown.		
\bigcirc	Do not install or remove the product while it is being supplied with electric power.	It could cause an electric shock or breakdown.		
	Do not use in humid place or in place that is always hot.	It could cause breakdown.		
	Do not cover the product with blanket, etc.	It could result in fire.		
	Do not block air/cooling vents.	It could cause breakdown or fire.		

2.2.3. Precautions for wiring

▲ Caution			
	Please wire properly and securely. Failure to do so could cause motor runaway. That could cause injury.	It could cause breakdown or injury.	
	Never wire to wrong terminals.	lt could cause breakdown.	
	 Please fix cables and do not add a tensile stress to cables. 	It could cause breakdown or injury.	
	 Please use end limit signals or emergency signals, etc. as needed for safety. 	It could cause breakdown or injury.	
	Please ground without fail.	It could cause breakdown or an electric shock	
	Please ensure that foreign agents do not enter the body case when wiring.	It could cause breakdown.	

2.2.4. Precautions for operation

Caution				
	If you notice abnormality (smoke), please power off.	It could cause breakdown or fire.		
	If the products get a foreign object in the case, please remove it after powering off.	It could cause breakdown or an electric shock.		
	Please power off before inserting or pulling the plug.	It could cause breakdown		
	Do not touch terminals during being supplied with electric power.	It could cause breakdown or an electric shock.		

2.2.5. Precautions for maintenance

🕂 Caution			
\bigcirc	Do not install or remove the product or wire while it is being supplied with electric power.	It could cause breakdown or an electric shock.	
	Do not disassemble, convert or repair the product.	lt could cause breakdown.	

3. Outline

3.1. Outline

This controller is a product for 4-axis motion control, and ARCUS PMX-4JX-CR manufactured by ARCUS is adopted as the core part. Two out of the four axes have Elmo driver built-in, and the other two axes are equipped with various signals so that drivers can be connected externally.

This manual is mainly an instruction manual concerning the adjustment of the built-in Elmo driver (TWE3/60). If you would like to learn more about the Elmo driver, please download the manual from Elmo's website and refer to it.

For the details on hardware and software of this controller, please refer to hardware and software version manuals respectively.

3.2. Features

This controller is a 4-axis controller, including two axes of drivers that can drive shaft motors. The two axes can be connected directly to shaft motors, and the remaining two axes can control various motors by connecting with external drivers. Two types of control method can be used: USB communication method with PC and Standalone method which controls by this controller alone. In addition, since analog input terminals are prepared, jog operations by joysticks, etc. is also available. The following are other main functions:

- ◆13 types of Homing mode
- Manual pulsar operation
- On-the-fly speed change
- ♦On-the-fly target position change
- ◆2 to 4-axis linear interpolation
- ◆2-axis circular interpolation
- Circular interpolation with Z-axis synchronization (helical interpolation operation)
- Absolute positioning and incremental positioning can be selected
- ♦Comparator function
- ◆12 inputs and 12 outputs of general-purpose input/output signals
- 3.3. Supported OS
 - Windows 7 and 8

4. Driver specification

4.1. Outline

This manual describes typical specifications of the Elmo drivers built-in this controller. Due to the specifications of the hardware, some specifications are kept lower than the driver ratings. If you would like to learn more detailed specifications, please download "Installation Guide" from Elmo's website.

4.2. Specification

Built-in driver			
Item	Specification	Note	
Driver name	Tweeter		
Model number	TWE 3/60		
Power supply	DC12 to DC48 [V]	*1	
Maximum output current	1 [A]	*1	
Maximum slewing frequency	2 [MHz]		
Serial port for adjustment	RS-232C		
*1. Due to the hardware specification of this controller, they are set lower than the ratings of the Elmo driver.			
	Software for adjustment		
Item	Specification	Note	
Software for adjustment	Composer		
Supported OS	Windows7 , 8		
Language	English / Japanese	Automatic Identification during installation	

Table 4-2-1

5. Installation of Composer

In order to adjust the built-in drivers, Elmo's Composer is required. Please download Composer from Elmo's website and install in your PC before making adjustments. Please refer to "Composer User Manual" for installation.

6. Auto tuning

6.1. Outline

Auto tuning is a method to set complicated parameters automatically.

The explanation here refers to the shaft motor (Motor type: Linear brushless) as the target. Even with other motors, the basic operation flow is the same.

For detailed operation and other adjustment methods, please refer to Elmo's "Composer User Manual".

- 6.2. Operation method
 - 6.2.1. Pre-boot preparation
 - Connect the driver to be adjusted and your PC via RS-232C.
 Connect to CNX 3 when adjusting X axis. When adjusting Y axis, connect to CNY 3
 - 2) Supply power (DC12V to DC48V) to driver (CN11).



Fig. 6-2-1

Connector number	CN11	CNX3, CNY3
Connector part number	MC 1,5/3-STF-3.81	PHR-3
Crimp terminal part number		SPH-002T-P0.5S
Manufacturer	PHOENIX CONTACT	JST

Table 6-2-1

6.2.2. Start-up

- 1) Launch the Elmo's driver adjustment software "Composer".
 - $Start \rightarrow \text{Right click "Composer"} \rightarrow \text{Click "Run as administrator"}.$
 - Elmo's Composer screen (Fig. 6-2-3) will be displayed.

Be sure to click "Run as administrator" to start it. If you start up with "Open", the initial screen will open, but you cannot move to the next tuning screen. Even if you create a shortcut key, please click "Run as administrator" to start.

2) Click 👔 button (Create a New Application)

Communication type setting screen (Fig.6-2-4) will be displayed



Fig. 6-2-2(A)



Ver Einer Compose:	- 0 ×
第2回 Current Mode - 大部 期間的用時未開成配置 * 校 (None)	
Wetche to Composer Application File Create a New Application Open an Existing Application Open Communication Data	
	2017/02/21
2) Click Fig. 6-2-3	

6.2.3. Communication setting

- (1) When there is no change in communication parameters
 - Enter an application file name.
 The application name can be set arbitrarily.
 - 2) Confirm communication parameters.
 - If there is no change in communication parameters, click Next > button.

	1) Enter ar	n application name.
Application Name and Communication Type Please Enter New Application Name Application Name Application Last Successful Communication Properties		
Disconnected : RS 232; COM1; 19200[b Select A Communication Type.	it/sec]; Parity None <	Display the communication parameter
The Connection parameters will be selected automatically when the button <next> is pressed.</next>	© RS 232 ◀ ○ CAN	- Check RS232C.
To change the default Communication parameters press the <properties></properties>	C TCP/IP Gateway Properties	Click here to change the communication parameters.
(戻る(B)) Fig. 6:	\$^(N)> +v>tz/	
1.9.0	2) Click here if the c	communication parameters are not changed.

3) When the excitation of the axis, which will be adjusted, is ON, the following message (Fig.6-2-5) will be displayed.

When it is off, the motor selection screen (Fig.6-2-8) will be displayed.

Click Yes button to turn off the excitation and move to the motor selection screen. If you click No button, you will return to the original screen (Fig.6-2-4) with excitation ON.

Message	X	
		4) Click
	Status : Process : In Motion Do You Want Shut Down Motion and Continue ?	
	【はい(Y) いいえ(N)	

Fig. 6-2-5

(2) When there are changes in communication parameters

- 1) Enter an application name.
 - The application name can be set arbitrarily.
- 2) Click Properties... button. Communication parameter screen (Fig.6-2-6) will be displayed.
- 3) Select Communication parameters from the drop-down list.
- 4) Click Connect button.

If the connection with your PC is established normally, you will return to the communication setting screen (Fig.6-2-4).

RS 232 Properties	×	
		3) Select communication parameters from the list.
Port Setting		
Com Port	COM 2 :	
Bit Per Second	19200 💌	
Parity	None	
Data bits	8	Restore communication parameters to the initial
Stop bits	1	<u>·</u>
Flow Control	None	
	Restore Defaults	
Add to Network	Connect Cancel	
	Fig. 6-2-6 4) Clic	k to check connection

4) If there is a problem in the connection with PC, the following message (Fig.6-2-7) will be displayed.

When you click OK button, you will return to communication parameter screen (Fig.6-2-6), so please check the set parameters. Also, check to ensure the cables in use are not broken, disconnected or connected incorrectly.



6.2.4. Motor selection

(1) List of saved motor

Motor Type	Elmo	Motor Power	My Motor	Nippon Pulse Motor		SEM Controlled
		Company		/ GMC		Motor Technology
Linear Brushless				S040D	S040Q	
				S040T	S040X	
				S080D	S080Q	
				S080T		
				S120D	S120Q	
				S120T		
				S160D	S160Q	
				S160T		
				S200D	S200Q	
				S200T		
				S250D	S250Q	
				S250T	S250X	
				S320D	S320Q	
				S320T	S320X	
				S350D	S350Q	
				S350T		
				S427D	S427Q	
				S427T		
				S435D	S435Q	
				S435T		
				S500D	S500Q	
				S500T		
Rotating Brush						
Rotating Brushless	SAR3ACN	T85SR2.2EH14				HD92C4-64S
	SAR5ACN	T85SR2.2EH15				HD92E4-64S
	SAR3ACN-20	T85SR2.2EH17				HD92G4-64S
	SAR5ACN-20	T85SR2.2EH18				HD92J4-64S
	SB02ADK	T115SR5.2EH14				HD115A6-88S
	SB02ADK-9	T115SR5.2EH15				HD115B6-88S
	SB03ADK-9	T115SR5.2EH16				HD115C6-88S
	SB04ADK	T115SR5.2EH17				HD115E6-88S
	SC05ADK-9	T115SR5.2EH18				
	SC06ADK	T115SR5.2EH19				
	SC06ADK-52					
	SC08ADK-52					
	SE09ADK					
	SE09ADK-52					
	SE15AEK					
	SE22AEK					
	SE30AEK					
Linear, DC, Voice Coil						

(2) When the motor is in the list

- 1) Select the motor manufacturer in the drop-down list.
- 2) Select the motor type
- 3) Select the motor part number in the drop-down list.
- 4) Confirm the rated current value of selected motor is 1A or less, and click Next > button. Feedback pulse setting screen (Fig.6-2-10) will be displayed.

[Caution]

 Please select the motor which does not exceed the maximum current value (1A) as in "4.2. Specification".

1) Select the m	notor manufacturer.
System Data Base Please select the Motor Part Number from the lists below. If you do not find a matching part number, use the Custom button and specify the motor's parameters. ELMO Driver version Wotor Data Base Motor Manufacturer Name Motor Manufacturer Name Motor Manufacturer Station Remove manufacturer Station Remove motor Station Station Motor Type [Amplitude] Ontered (RMS) Inear Brushless 0.45 0.586396 10 Edit	3) Select the motor. Confirm the current value.
Fig. 6-2-8 4) Click afte 2) Select the motor type.	r selecting the motor.

(3) If the motor is not in the list

If the motor is not in the list, please add the motor in the following procedure.

1) Select the motor manufacturer in the drop-down list.

If the manufacturer is not in the list, click New button.

- 2) Select the motor type.
- 3) Click Edit button
- 4) Edit button will change to Cancel button, and Add button will be added over Cancel button.
- 5) Enter the model number in the Motor P/N column.
- 6) Enter the rated current and the max speed values.
- 7) Click Add button to add it to the list.
 - Add button will disappear, and Cancel button will return to Edit button.
- 8) Check the rated current value [RMS] of the selected motor, and click Next button. Feedback pulse setting screen (Fig.6-2-10) will be displayed.

 [Caution]

 Please add a motor which does not exceed the maximum current value (1A) as in "4.2.

 Specification".

1) Select the motor m	nanufacturer
Please select the Motor Part Number from the lists below. If you do not find a matching part number, use the Custom button and specify the motor's parameters. ELMO Driver version Tweeter 2.02.07.21 28 Jan2008	5) Enter the motor model number to be added
Motor Data Base Motor Manufacturer Name Motor Manufacturer Name Motor P/N Remove manufacturer S435D Remove motor S435D New S500D New S500D Continuous Stall Current [A] Maximum Mechanical Motor Type [RMS] [Amplitude] Speed 10 Cancel	7) Confirm the current value and click
< 「戻る(B) 次へ(N)> キャンセル ヘルプ Fig. 6-2-9	3) Click
2) Select the motor type	Enter the rated current and the max speed
8) Click	

6.2.5. Feedback pulse setting

1) Select the encoder type

Either "Encoder" or "Encoder & Digital Hall" would be selected.

- 2) Enter the magnetic pitch of the motor.
- 3) Enter the resolution of the encoder.
- 4) Click Next > button.

The driver output parameter setting screen (Fig.6-2-11) will be displayed.

Commutation Feedback Parameters		
Please select the application parameters.	ble commutation feedback and enter required Current Main Commutation Feedback Main Feedback Sensor Encoder Sensor on load and aided by Digital Halls Encoder Data Magnetic Pitch [mm] 36	 Select the encoder type. 2) Enter the magnetic pitch.
	Pulses per Meter [Line / Meter]	3) Enter the resolution of the encoder.
	Resolution [Count / Meter] 10000000	4) Confirm the input data and click.
	< 戻る(B) 次へ(N) > キャンセル ヘルプ	

Fig. 6-2-10

6.2.6. Driver output parameter setting

- 1) Enter the output current value during constant speed drive.
- 2) Enter the output current value during acceleration (peak time).
- 3) Click Next > button.

Setting screen of the general-purpose input signal (Fig.6-2-12) will be displayed.

System Definitions and Limits		×	
Please review the following system default parameters and change them if persector	Driver Parameters Application Continuous Current Driver Continuous Current	0.45 3.30 [A]	Enter the output current value during a constant speed drive.
These parameters define the system behavior when reaching	Application Peak Current Driver Peak Current	1.8 [A] 6.60 [A]	Enter the output current value during acceleration.
limits.	Application Mechanical Limits		
Wrong parameter(s) will affect the safety of the next step(s)	Speed Stop Deceleration (SD)	0.8 [Meter/sec]	
<u>1</u>	Low Reference for Position High Reference for Position	-999999990 [cnt] 9999999990 [cnt]	
	< 戻る(B) 次へ(N) >	キャンセル ヘルブ	
	Fig. 6-2-11	Confirm the	[≠] e input data and click.

- 6.2.7. Setting of general-purpose input signal
 - Set general-purpose input signal referring to the table below.
 As for functions (Function behaviors), please set as shown in the table below.
 As for logic (Logic level), adjust to the settings in the controller side. Input 3 to Input 6 are not connected.

Signal	Function behaviors	Logic level	Terminal assignment signal name
Input 1	Soft & Hard Stop	Low	Deviation counter clear signal
Input 2	Inhibit (Freewheel)	High	Excitation ON/OFF signal
Input 3	Ignore	Low	Unused
Input 4	Ignore	Low	Unused
Input 5	Ignore	Low	Unused
Input 6	Ignore	Low	Unused

Table 6-2-3

2) Click Next > button.

Setting screen of general-purpose output signal setting screen (Fig.6-2-13) will be displayed.

Logic Input			×	<u> </u>	
Please review the following system default narameters and change	-Select Fur Signal	nction Behaviors and Logic L		1)	Set the contents of Input 1 and Input 2.
them if necessary.	Input 1	Soft & Hard Stop	Low 🔺		
Th	Input 2	Inhibit (Freewheel)	High		
define the system	Input 3	Ignore	Low =		
behavior when reaching	Input 4	Ignore	Low		
limits.	Input 5	Ignore	Low 🚽		
Wrong parameter(s) will affect the safety of the next step(s)		C. ". "			
		Set ugnore for all unp	uts		
<	戻る(B) [🔤 🏸	へ(N)ン キャンセル			
	Fig. 6-	2-12			
			2) Click a	tter setting ge	neral-purpose input signal.

- 6.2.8. Setting of general-purpose output signal
 - Set general-purpose output signal referring to the table below.
 As for functions (Function behaviors), please set as shown in the table below.
 As for logic (Logic level), adjust to the settings in the controller side.

Signal	Function behaviors	Logic level	Terminal assignment signal name
Output 1	General-purpose	Low	In position signal
Output 2	General-purpose	High	Alarm signal

Table	6-2-4

1) Click Next > button.

Tuning items confirmation screen (Fig.6-2-14) will be displayed.

Logic Output	— ×	
		1) Set the contents of Input 1
Please review the following system default parameters and change	Select Function Behaviors and Logic Level	and input 2.
them if necessary.	Output 1 General purpose Low	
These parameters define the system		
behavior when reaching limits.		
Wrong parameter(s) will affect the safety of the next step(s)		
<u> </u>	Set "General purpose" for all Outputs	
	< 戻る(B) (ご次へ(N))> キャンセル ヘルブ	
	Fig. 6-2-13 2) Click	after setting general-purpose output signal.
	,	

6.2.9. Confirmation of tuning items

It is automatically selected per the type of motor.
 If there is no change, click Next > button.
 Current loop tuning screen (Fig.6-2-15) will be displayed.

Custom	
	Tuning / skip will be switched each time you click.
There are steps that are mandatory for the achievement of a fully adjusted and tuned servo drive. ✓ Tuning Current Loop If this is not the first run of the wizard, you may de-select any of the steps to meet your specific need. ✓ Tuning Velocity Loop Step 1 ✓ Tuning Velocity Loop Step 3 ✓ Tuning Position Loop Step 5 ✓ Skip Tuning Dual Loop ✓ Skip Tuning Dual Loop	
Fig. 6-2-14 1) Confirm	n contents and Click.

be

6.2.10. Current loop tuning

1) Confirm there would be no danger if motors move.

[Cautio	n]
\wedge	Once a tuning starts, a motor repeatedly moves and stops. To avoid a dangel
	careful not to touch the motor during tuning.

2) Click Run button.

Current loop tuning starts.

At this time, the screen (Fig.6-2-16) is displayed to indicate the tuning is in progress.

To cancel tunings, click Cancel button.

Tuning Current Loop]
Upon clicking the <run> button the servo drive energizes the motor's winding with a high frequency current waveform.</run>	2) Start a current loop tuning.
It is not expected that the motor shaft will move, however, precaution is required for the unlikely event of an undesired movement.	
	Skip the current loop tuning.
(戻る(B) 「次へ(N))」 キャンセル ヘルブ」	

Fig. 6-2-15

3) When a tuning completes, an end screen (Fig.6-2-17) will be displayed.

If you will execute another tuning, click Yes button.

The commutation setting screen (Fig.6-2-18) will be displayed.

If you will execute a current loop tuning again, click No button, and click Run button in the current loop setting screen (Fig.6-2-15).



6.2.11. Commutation setting

1) Confirm there would be no danger if motors move.

[Cautio	n]
\wedge	Once a commutation setting starts, a motor repeatedly moves and stops. To avoid
<u>_!</u> _	injury, be careful not to touch the motor during commutation setting.

2) Click Run button.

The screen (Fig.6-2-19) for confirming the movement in the positive direction in the system will be displayed.

Establishing Commutation	X	
Commutation Feedback Parameters h Motor Commutation May be Wrong ! Please Click <run> button to Establis</run>	ave been Changed !	
	Manually set the number of pole pairs multiplier (Recommended for more than 50 pairs)	
		2) Start a commutation setting
	Run	Skip a commutation setting
< 戻る(B) [XXへ(N)> キャンセル ヘルノブ	

Fig. 6-2-18

 Click OK button if you are ready to start a commutation setting. The commutation setting starts and the movement starts in the positive direction in a system. At this time, the screen (Fig.6-2-20) is displayed to indicate the commutation setting is in progress.

Movement start confirmation screen

Attention	Please Wait
Please notice that after clicking the <ok>, the motor will rotate in what the system defines as Positive direction</ok>	Status : In Progress Please Wait ! Step Number : 2
ок	Cancel
Fig. 6-2-19	Fig. 6-2-20
3) The motor starts moving.	Click to cancel the commutation setting

Commutation setting in progress screen

4) The motor stops after a while, and the confirmation screen of the movement direction (Fig.6-2-21) will be displayed.

Click Yes button if the positive direction in the system and the positive direction in the actual machine are the same, and click No button if they are opposite. The screen (Fig.6-2-22) will be displayed to indicate a commutation setting resumes, and the setting is in progress.



5) When the commutation setting completes, the end screen (Fig.6-2-23) will be displayed. If you will execute another tuning, click Yes button. The velocity loop tuning screen (Fig.6-2-24) will be displayed. If you will execute a commutation setting again click No button and click Run button.

If you will execute a commutation setting again, click No button, and click Run button in the commutation setting screen (Fig.6-2-18).



Commutation setting end screen

6.2.12. Velocity loop tuning

1) Confirm there would be no danger if motors move.

[Cautio	n]
$\underline{\land}$	Once a tuning starts, a motor repeatedly moves and stops. To avoid injury, be careful not to touch the motor during tuning.

2) Select "Auto Tuning for Speed Design" as a tuning type.

The screen switches to Auto tuning screen (Fig.6-2-25).

Tuning Velocity Loop	
Step 1: Select the Tuning Type Manual Tuning Step 2: Adjust Filter Parameters	
KP KI Advanced Filter 0.0 0.0 0.0 On Osigner	2) Select "Auto Tuning for Speed Design".
Step 3 : Set Test Parameters Displacement [cnt] * Displacement [cnt] * Bisplacement [cnt] * Step 3 : Set Test Parameters * Displacement [cnt] * Displacement [cnt] * Step 3 : Set Test Parameters * Displacement [cnt] * Displacement [cnt] * Step 3 : Set Test Parameters * Displacement [cnt] * Displacement [cnt] * O * Displacement [cnt] * Displacement [cnt] * O * Displacement [cnt] * Displacement [cnt] * O * Displacement [cnt] * Displacement [cnt]	
Step 4 : Set Record Parameters Record Resolution Max. Record Time Slope 180.0 μ sec/point ▼ 0.216 sec ▼	
✓ Run Test	
< 戻る(B) 次へ(N) > キャンセル ヘルプ	
Fig. 6-2-24	Skip Velocity loop tuning.

3) Click Run Auto Tuning button

The screen of the auto tuning start confirmation (Fig.6-2-26) will be displayed.

uning Velocity Loop Step 1 : Select the Tuning Typ Step 2 : Select Auto Tuning Pa	e Auto Tuning for Speed Design		
Auto Tuning Mode Response Slow ar Stable System Noise Rast ar Noisy	d Fast and Fast and Fast and Sensitive d Slow and Quiet Quiet		
Step 3 : Set Test Parameters Displacement [cnt] + 0 Profiler Mode	Velocity Velocity Velo 360000 0 Meter/s Smooth Factor Acceleration [count /sec^2] Dec 0 17308517 173	eity Unit ec v eleration 08517	
Step 4 : Set Record Parameters Record Resolution	Max. Record Time Slop 0.216 sec verset Data Show Transfer Function		3) Start a velocity loop tuning
	xporr Data		
	Fig. 6-2-25		Skip a velocity loop tuning.

4) Click OK button if a motor is ready to move.

A tuning starts.

At this time, the screen (Fig.6-2-27) is displayed to indicate the tuning is in progress.



- 5) When the velocity loop tuning completes, the following graph (Fig.6-2-27) is shown as a tuning result
- 6) Click Next > button in the velocity loop tuning screen (Fig.6-2-29). The screen of position loop tuning screen (Fig.6-2-30) will be displayed.

Stope - scope sol Image: Command diagram 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25 0 0.0625 0.125 0.1875 0.25	Tuning Velocity Loop ▲ Step 1: Select Auto Tuning Type Auto Tuning for Speed Design ▼ Auto Tuning Mode Expert tuning for Speed Design ▼ Auto Tuning Mode Expert tuning for Speed Design ▼ System Noise Stew and Stable Expert tuning for Speed Design ▼ System Noise Stew and Stable Expert tuning for Speed Design ▼ System Noise Stew and Stable Expert tuning for Speed Design ▼ System Noise Stew and Stable Expert tuning for Speed Design ▼ System Noise Test and Customize Test Silow and Customize Test Silow and Customize Test Step 3: Set Test Parameters Smooth Factor Customize Test Noter/sec^2 1 Deseleration Profiler Mode 0 17308517 T308517 T308517 Step 4: Set Record Parameters Max. Record Time Slope Slope Il80.0 gsec/point 0216 sec ▼ Import Data_ Export Data_ Show Transfer Function ✓ Run Auto Tuning <
Fig. 6-2-28	Fig. 6-2-29
	6) Click after the tuning completes

6.2.13. Position loop tuning

1) Click Run Auto Tuning button

A position loop tuning starts.

At this time, the screen (Fig.6-2-31) is displayed to indicate the tuning is in progress.

Tuning Position Loop	
Step 1: Select the Tuning Type Auto Tuning for Position Design Step 2: Select Auto Tuning Parameters	
Auto Tuning Mode Expert tuning for bounded Response Stable Fast and Stable System Noise Fast and Noisy Customize Test	
Step 3: Set Test Parameters Step 3: Set Test Parameters Step [cnt] Speed Speed Unit 850000 0.200 Meter/sec Smooth Factor Acceleration [count /sec^2] Deceleration 0 17308517 17308517 17308517	
Step 4 : Set Record Parameters Record Resolution 360.0 μsec/point 0.432 sec	1) A position loop tuning starts
Import Data Show Transfer Function ✔ Run Auto Tuning 〈 戻る(B) 〉 次へ(N) > キャンセル へルプ	
Fig. 6-2-30	Skip a position loop tuning
Please Wait	
Status : In Progress Please Wait ! Step Number : 4 Cancel	iton

Fig. 6-2-31

- 2) When the position loop tuning completes, the following graph (Fig.6-2-31) is shown as a tuning result
- 3) Click Next > button in the position loop tuning screen (Fig.6-2-33). The screen of tuning information screen (Fig.6-2-34) will be displayed.

Scope - scope sdv	Tuning Position Loop
File View Window Zoom Objects Analyze Help D D D D D D D D D D D D D D D D D D D	Step 1: Select the Tuning Type Auto Tuning for Position Design Step 2: Select Auto Tuning Parameters Auto Tuning Mode Response Slow and Stable System Noise Fast and Noisy
U 006/3 01/23 01/97 01/23 Tene(tec) Curren Comeand (A) 0.4 0.4 0.4 0.04 0.0525 0.125 0.1875 0.25 Time(tec)	Step 3 : Set Test Parameters Step [cnt] Speed Speed Unit 4687 0.006 Meter/sec * Smooth Factor Acceleration [count /sec'2] Step 4 : Set Record Parameters 19498715 19498715 Record Resolution Max. Record Time 190.0 #sec/point 180.0 #sec/point 0.216 sec *
X=0.0828	< 戻る(B) 次へ(N)> キャンセル ヘルプ
Fig. 6-2-32	Fig. 6-2-33
3) Cl	ick after the tuning completes

- 6.2.14. Display and save the tuning results.
 - 1) Confirm the result information of the tuning.
 - 2) Click Finish button .

Save As request screens (Fig.6-2-35) of the data set by auto tuning will be displayed.

Setup Information				— X		
The follow Wizard. High Position Application N Command SK KP for Currer Profiler Mod Smooth Fact Acceleration Joegeing Vele KI – Velocit KI – Velocit KI – Velocit	ving parameters were Reference Limit=99999999 Peak Current [A]=1.800 Jontinuous Current [A]=0.45 wrce = Software nt Loop =33.156 t Loop =31280 = OFF or=1 =19498715 =1949875 =194987	e changed by 0 0 0 0 0 0 0 0 0 0 0 0 0	Click the <f button to wri parameters FLASH. Click the <b button to rep orevious ste Click the <c button to exi WITHOUT s</c </b </f 	inish> te these to the ack> peat the ens ancel> it aving the Editor		
	< 戻る(E)) 完了	キャンセル	ヘルプ		
	I	-ig. 6-2-34		2) Confir	m the co	intents and click.
			3) Specify	y the folder		
名前を付けて保存						
未1子9 @J易/川(山):	換査治具用ファイ 応			11.77		
AxisX_201612	202.dat 202.dat 2221.dat	2016/11/08 15:20 2016/11/10 17:32 2017/02/21 11:22	TEXA DAT ファイル DAT ファイル DAT ファイル	20 KB 20 KB 20 KB		
						3) After entering the file nar and click
ファイル名(N): ファイルの種類(T):	Test X 20170221.dat Application file(.dat)					7(5) >+2,1
		Fig. 6	6-2-35			
	\	3) Enter a f	ile name]		

6.3. Auto tuning screen transition diagram











7. Setting of pulse input signal and general-purpose I/O signal

7.1. Outline

The contents here are already set before this controller is shipped. Basically, you do not have to operate.

7.2. Operation method

- 7.2.1. Start the Elmo Studio
 - 1) Start the Elmo Studio

Click the button to open the Elmo Studio screen in the Composer screen.

Elmo Composer			
File Edit View Communication	Tools Window Help		
🖹 🎮 🖤 Position Moc 🛛 츠 🏧 💆		3_Y_2016052 • 📴 📆	Click here to open the
Smart_Terminal			
Enter Command : Send	Profile Noise Filter Protection	ns Limits Digital Filters Custom Analog Input Input Lo	Elmo Studio
	Criscle Profile Smoot	h factor MSec. Apply	
	Acceleration - Deceleration (Deceleration 207/1999	
	Test Mation	2 100	
	Jogging mode		
	- Position : 0	Counts Relative Z Halo	
<	• • • • • • • • • • • • • • • • • • •		
			$Fig = 7 \cdot 2 \cdot 1/\Lambda$
			Fig. 7-2-1(A)
Or, click Tools	⇒ Elmo Studio		
			Click here to open the
Elmo Composer	Tools Window Holp		Elmo Studio
	Smart Torminal		
	Motion Monitor	2010052 • •	
Smart_lerminal	Elmo Studio		
Send	Table Editor	, Custom Analog Input Input Logic Output Logic	
	Sync Management	ind Logic Level	
	Wizard	rpose Low	
	Simple Wizard	rpose High	
	Advanced Manual Tuning		
	Firmware Download		
4	Scope		
			Fia. 7-2-1(B)
			5 ()
	_		
	•		
Elmo Studio			
· · · · · · · · · · · · · · · · · · ·	1111 1111 日		
86			
() Build (Datug), End in Riss 1.), Find in Riss 2.), Communication Log /	1		
Variable Value Description			
() March 1 (March 2) (March 2) (March 4)/ or Helo, press F1		S OVR Read	
9 é 🗎 0 🗘 💵 📭		● 人役 学 学 二二 ● 3 ○ ● 8 ☆ 10 ● 7 ● 1 → 6 1530	

Fig. 7-2-2

7.2.2. Write program codes

 Open the screen to write program codes. Click New creation button in the Elmo Studio.



2) Select a file format and enter the file name.

Select EHL Program for file format. File name does not require an extension. An extension will be automatically added per the selected file format.

Also, the first letter of the file name is limited to alphabet. If there is an error in the file name, OK button will be invalid.

New Set	Select a file format
Multi Axes Program (Maestro) ELL Program (Sim EHL Program (Sim EHL Program Files (x86)¥ELMO Mo tion Control/Composer¥TestPrg¥ TestPrg_20170307ehl File name: TestPrg_20170307 Logation: [Ci#Program Files (x86)¥ELMO Motion]	Enter a file name
Add file to current Workspace	After entering a file name, click here.
OK Cancel	

Fig. 7-2-4

3) Write a program code.

Enter a code described in "7.3 Program code"



Fig. 7-2-5

4) Build the described program



7.2.3. Program transfer and start/stop



2) Stop the program after confirming the program to start up.

☞ [] 한 위 전 년 (※ 한) 전] 월 [] 章 [] 章 []	Click here	to stop the running program
	Fig. 7-2-8(A)	
₽		When it stops, it becomes valid status.
at> ≰ ◎ 置 置 ② ! 単 両 逐 ④ 勉 円 円 円 1 原際		
COM2.dat>	Fig. 7-2-8(B)	

7.2.4. Close the Elmo Studio

1) To exit the Elmo Studio

Click \mathbf{x} at the upper right corner in the screen or File \rightarrow Exit and exit the Elmo Studio.



7.3. Program code

///////////////////////////////////////	///////////////////////////////////////		
//	//		
// Elmo Driver Setting Pro	ogram //		
//	//		
///////////////////////////////////////	///////////////////////////////////////		
/******		****	
#@AUTOEXEC //1	Power On routine	~~~~~/	
#@AUTOEXEC //1			
/* Set Renve		*/	
YA[4] = 0 //	Pulse & Direction		
UM = 5 //	Position mode		
RM = 1 //	Set reference mod	e	
FF[2] = 1 //	Should be set acco	ording to the Pulse du	ration
ER[3] – 1 //	Set the following ra	itio. Can be any value	
wait 2000	Oct the following re		,
wall 2000			
/* Set General-Purpos	se Input Pin	*/	
// InPort1 ERC	Clear		
IL[1] = 20 //	Soft & Hard Stop	Active Low	
// InPort2 Motor	On/Off		
IL[2] = 1 //	Motor On/Off	Active High	

```
/* Set General Purpose Output Pin
                                                  */
// OutPort1 Alarm
   ER[3] = 100000 // Max. ERC Error Counter
                // General Purpose Active Low
   OL[1] = 0
// OutPort2 Inposition
  TR[1] = 100 // Inposition range
                                      Count (pulse)
   TR[2] = 30
                 // Inposition range
                                      Time (ms)
   OL[2] = 0
                 // General Purpose Active Low
                                            */
/* Eternal loop
   while 1
      if MO == 1 // Motor On/Off Check
         OB[1] = 0 // Alarm Off
      end
      if MS == 0 && DV[2] == 0 // Motor Status Check
         OB[2] = 1 // Inp On
      else
         OB[2] = 0 // Inp Off
      end
   end
return
```

/***********************	****	****************************/
#@AUTO_ER	//	Driver error routine
MI=0xFFFF		Disable all auto routines
OB[1] = 1	//	Alarm On
MI=0	//	Enable all auto routines

return

CALITION	The descriptions in this specification may be changed without prior notice to
	improve performance or quality.



Impress, not just satisfy Nippon Pulse Motor Co., Ltd.

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