

# MISUMI

## Linear motor actuator

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## E-RAM Series

PA45 Driver User Manual

Ver1.0

Thank you for purchasing our linear motor actuator.

This user manual is a supplement to the manufacturer's catalog, and its purpose is to provide users with more detailed and convenient usage instructions. We have attempted to ensure the accuracy and completeness of the content. Nevertheless, we recommend that users use the manufacturer's catalog as a guide.

Please take the time to read this manual carefully before use. Please keep it well so that you can view it whenever necessary.

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# 1. Driver Overview

## 1.1 Manufacturer Information

Driver Manufacturer: Panasonic

Manufacturer's official website: <https://device.panasonic.cn/>

The manufacturer model number table is as follows.

Misumi model number	Panasonic model number
PA45	MDDLN45SL

## 1.2 Safety precautions

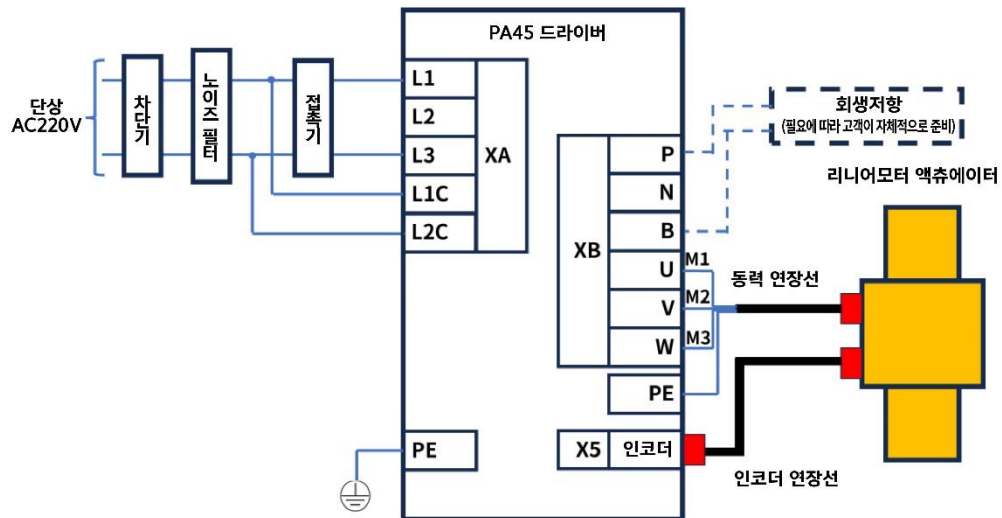
Before installation, please be sure to download and read all relevant materials from the manufacturer's website carefully, and use and operate the product exactly as required to ensure safety and accuracy.

Please use caution as improper handling may result in injury and/or equipment damage.

## 2. final

### 2.1 Main circuit

Driver rated input current 5.2A, maximum current 15.5A



### 2.2 Control circuit

#### ● I/O port definition

Input signal (common) and its function

apply	sign	connector Terminal No.	detail	input/output signal interface
Signal power for control	COM+	7	<ul style="list-style-type: none"> <li>+ pole connecting external direct current power (12~24V)</li> <li>Use 12V±5% to 24V±5% power.</li> <li>It must be insulated from the primary power source. Do not connect to the same power source.</li> <li>Primary power: power for motor brake</li> </ul>	- -
General input 1	SI 1	8	<ul style="list-style-type: none"> <li>Functions can be changed through parameter settings (see below)</li> </ul>	i-1
General input 2	SI 2	9		
General purpose input 3	SI 3	26		
General purpose input 4	SI 4	27		
General-purpose input 5	SI 5	28		
General-purpose input 6	SI 6	29		
General purpose input 7	SI 7	30		
General purpose input 8	SI 8	31		
General-purpose input 9	SI 9	32		

General purpose input 10	SI 10	33		
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## Functions that can be assigned to general-purpose input

apply	sign	detail
Enter Servo Enable On	SRV-ON	<ul style="list-style-type: none"> <li>After on, servo activation changes to on (motor energized)</li> <li>After turning off, servo activation changes to the off state and the motor is de-energized.</li> </ul>
Control mode conversion input	C-MODE	<ul style="list-style-type: none"> <li>Control mode switching</li> </ul>
Forward drive prohibition input	POT	<ul style="list-style-type: none"> <li>Forward drive prohibition input</li> <li>If the moving part of the machine exceeds the forward movement range, disconnect the contact point.</li> <li>When this input is off, there is no forward torque.</li> </ul>
Reverse drive prohibition input	NOT	<ul style="list-style-type: none"> <li>Reverse drive prohibition input</li> <li>If the moving part of the machine exceeds the range of possible movement in the reverse direction, disconnect the contact.</li> <li>When this input is off, there is no reverse torque.</li> </ul>
Deviation counter clear input	CL	<ul style="list-style-type: none"> <li>Clears the position deviation counter</li> </ul>
Command pulse input inhibit input	INH	<ul style="list-style-type: none"> <li>Position command pulse is ignored</li> </ul>
Internal command speed selection 1 input	INTSPD1	<ul style="list-style-type: none"> <li>Internal command speed selection input</li> <li>Internal 8-speed speed can be set by combining INTSPD1, INTSPD2, and INTSPD3</li> </ul>
Internal command speed selection 2 input	INTSPD2	
Internal command speed selection 3 input	INTSPD3	
Speed zero input	ZERPSPD	<ul style="list-style-type: none"> <li>Speed command becomes zero</li> </ul>
Vibration control switching input 1	VS-SEL1	<ul style="list-style-type: none"> <li>Switches the application frequency of vibration suppression control</li> </ul>
Vibration control switching input 2	VS-SEL2	
Gain switching input	GAIN	<ul style="list-style-type: none"> <li>Gain switching input</li> </ul>
Torque limit switching input	TL-SEL	<ul style="list-style-type: none"> <li>Switch torque limit</li> </ul>
Alarm clear input	A-CLR	<ul style="list-style-type: none"> <li>Clear alarm state</li> </ul>
Speed command sign input	VC-SIGN	<ul style="list-style-type: none"> <li>During speed control, the speed command input sign is designated by this input.</li> </ul>
Torque command sign input	TC-SIGN	<ul style="list-style-type: none"> <li>During torque control, the torque command input sign is designated by this input.</li> </ul>
Command frequency division/doubling switching input 1	DIV1	<ul style="list-style-type: none"> <li>Switches the frequency dividing/doubling numerator of the command pulse</li> <li>Combination of DIV1, DIV2 has up to 4 possible transitions</li> </ul>
Command frequency division/doubling switching input 2	DIV2	
Force alarm input	E-STOP	<ul style="list-style-type: none"> <li>When inputting, Err87.0 "Forced alarm input error" occurs.</li> </ul>
Inertia ratio conversion input	J-SEL	<ul style="list-style-type: none"> <li>Inertia ratio conversion</li> </ul>

## Input signal (pulse command) and its functions

The specifications of the command pulse can be selected from two modes.

### A line mode

apply	sign	connector Pin No.	detail	input/output signal interface
Command pulse input 1	PULSH1	44	<ul style="list-style-type: none"> <li>Input terminal for position command pulse. Selectable through parameter settings</li> <li>Speed control, torque control, etc. are invalid in control modes that do not require position commands.</li> <li>The highest allowable input frequency is 8Mpps.</li> </ul>	Di-2
	PULSH2	45		
Command code input 1	SIGNH1	46		
	SIGNH2	47		



## B Open collector mode

apply	sign	connector Pin No.	detail	input/output signal interface
Command pulse input 2	OPC1	One	<ul style="list-style-type: none"> <li>Input terminal for position command pulse. Selectable through parameter settings</li> <li>Speed control, torque control, etc. are invalid in control modes that do not require position commands.</li> <li>The highest allowable input frequency is 500 kpps for line driver input and 200 kpps for open collector input.</li> </ul>	Di-1
	PULS1	3		
	PULS2	4		
Command code input 2	OPC2	2		
	SIGN1	5		
	SIGN2	6		

## Output signal (common) and its function

apply	sign	connector Pin No.	detail	input/output signal interface
General purpose output 1	S01- S01+	10 11	<ul style="list-style-type: none"> <li>Change the function by setting parameters (see below)</li> </ul>	o-1
Universal output 2	S02- S02+	34 35		
Universal output 4	S04- S04+	38 39		
Servo alarm output	ALM- ALM+	36 37	<ul style="list-style-type: none"> <li>Indicates the output signal in an alarm state</li> </ul>	
Universal output 5	S05	12	<ul style="list-style-type: none"> <li>Change functions by setting parameters (see below)</li> </ul>	o-2
Universal output 6	S06	40		
Signal power for control	COM-	41	<ul style="list-style-type: none"> <li>-pole connecting external direct current power (12~24V)</li> <li>Power capacity varies depending on input/output circuit configuration differences</li> <li>Primary power circuits must be isolated, and do not connect power sources such as the circuit shown below.</li> <li>- Power supply for motor brake</li> </ul>	--

## Functions that can be assigned to general-purpose output

apply	sign	detail
Servo alarm output	ALM	<ul style="list-style-type: none"> <li>Indicates the alarm occurrence status output signal.</li> </ul>
Servo standby output	S-RDY	<ul style="list-style-type: none"> <li>Indicates the output signal when the driver is energized.</li> </ul>
External brake release signal	BRK-OFF	<ul style="list-style-type: none"> <li>Outputs a sequence signal that activates the motor's electromagnetic brake.</li> </ul>
0 speed detection signal	ZSP	<ul style="list-style-type: none"> <li>Outputs a 0 speed detection signal.</li> </ul>
Signal output during torque limitation	T.L.C.	<ul style="list-style-type: none"> <li>Outputs a signal during torque limitation.</li> </ul>
Positioning completed	INP	<ul style="list-style-type: none"> <li>Outputs a positioning completion signal.</li> </ul>
Positioning completed 2	INP-2	<ul style="list-style-type: none"> <li>Positioning completion signal 2 is output.</li> </ul>
speed reached output	AT-SPD	<ul style="list-style-type: none"> <li>Outputs a speed attainment signal.</li> </ul>
Speed matching output	V-COIN	<ul style="list-style-type: none"> <li>Outputs a speed match signal.</li> </ul>
warning output 1	WARN1	<ul style="list-style-type: none"> <li>Outputs a warning output signal when Pr4.40 "Warning output selection 1" is set.</li> </ul>
warning output 2	WARN2	<ul style="list-style-type: none"> <li>Outputs a warning output signal when Pr4.41 "Warning output selection 2" is set.</li> </ul>
Position command presence/absence output	P-CMD	<ul style="list-style-type: none"> <li>Output when there is a position command</li> </ul>
Output during speed limiting	V-LIMIT	<ul style="list-style-type: none"> <li>Output when speed is limited during torque control</li> </ul>
Warning removal property output	ALM-ATB	<ul style="list-style-type: none"> <li>Output when a removable warning occurs</li> </ul>
Speed command presence/absence output	V-CMD	<ul style="list-style-type: none"> <li>Speed command present output</li> </ul>
Servo activation on status output	SRV-ST	<ul style="list-style-type: none"> <li>Output when servo activation is on</li> </ul>

## Output signal (pulse train) and its functions

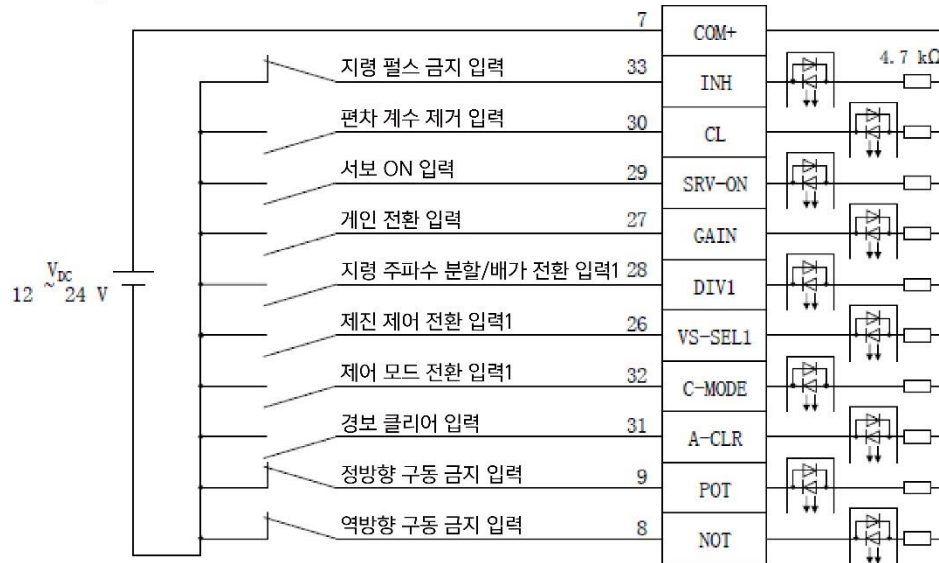
apply	sign	connector Pin No.	detail	input/output signal interface
A-phase output Absolute data output	0A+	21	<ul style="list-style-type: none"> <li>Divided feedback sensor and external sensor signals (A, B, Z phases) differential output (RS422 equivalent)</li> <li>Parameters can be set to division ratio</li> <li>The ground of the line driver of the output circuit must be connected to the signal ground and not isolated.</li> <li>The maximum output frequency is 8 Mpps (after 4 times).</li> </ul>	Do-1
	0A-	22		
B-phase output	0B+	48		
	0B-	49		
Z-phase output	0Z+	23		
	0Z-	24		
Z-phase output	C.Z.	19	<ul style="list-style-type: none"> <li>Open collector output of Z-phase signal</li> <li>The firing electrode side of the transistor in the output circuit is connected to signal ground and is not isolated.</li> </ul>	Do-2

etc

apply	sign	connector Pin No.	detail	input/output signal interface
case ground	F.G.	50, case	<ul style="list-style-type: none"> <li>Connect to ground terminal inside servo driver</li> </ul>	- -
signal ground	GND	13,15, 17, 25	<ul style="list-style-type: none"> <li>signal ground</li> <li>Insulated from control signal power (COM-) and inside the servo driver</li> </ul>	- -
-	-	20	<ul style="list-style-type: none"> <li>Do not connect.</li> </ul>	- -

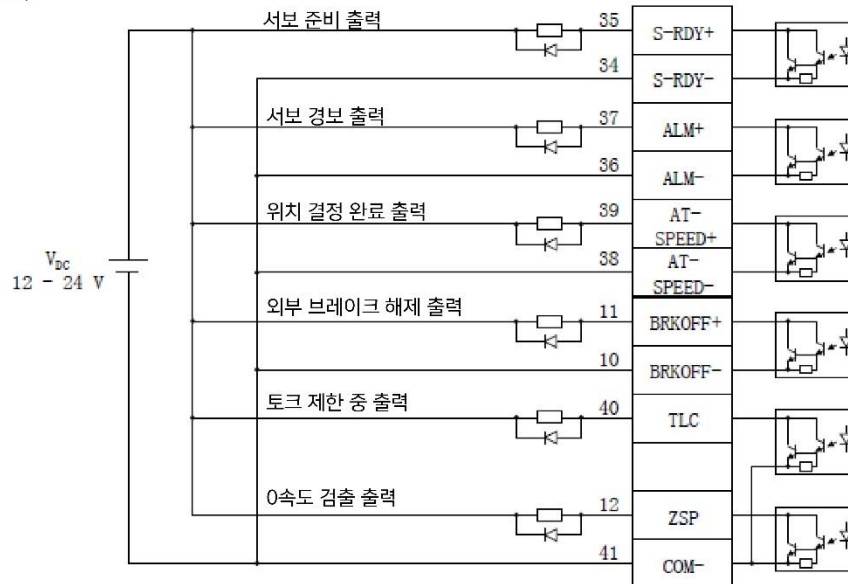
## ● I/O wiring diagram

제어 입력



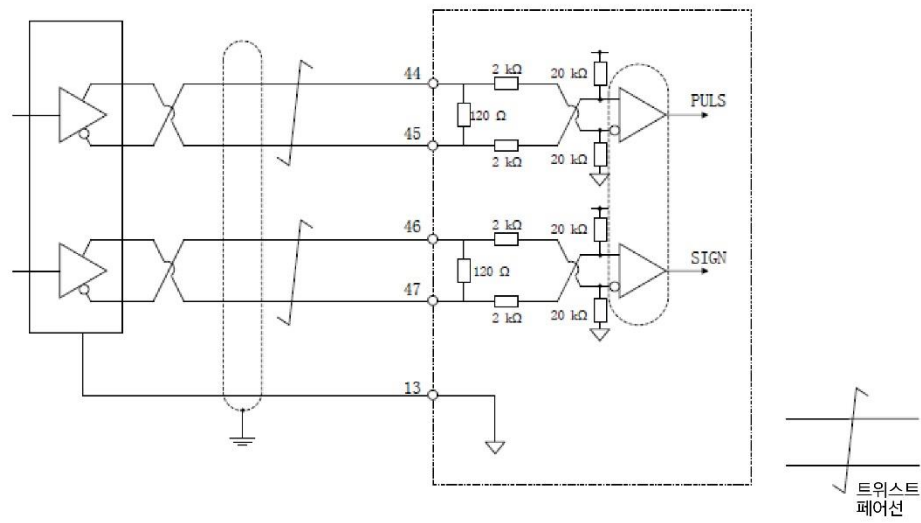
8, 9, 26~33핀의 기능은 파라미터를 통해 설정 가능. 상기 이미지는 표준 공장 파라미터 설정 상황임.

제어 출력

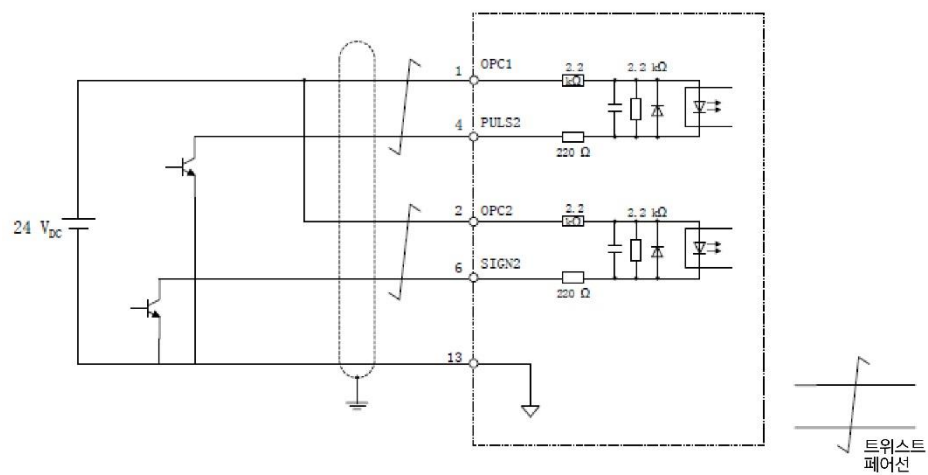


10, 11, 34, 35, 38, 39핀의 기능은 파라미터를 통해 설정 가능. 상기 이미지는 표준 공장 설정 상황임.

Line mode:



Open collector mode:






## 3. Debugging

### 3.1 Software download and installation

#### ● software download



Download the software pack from the MISUMI website.


The software pack includes <PANATERM> and <MotorAuto>.

<input type="checkbox"/> 이름	수정한 날짜	유형	크기
 MotorAutoSetupVer2.0.0.0	2024-05-09 오후 3:46	파일 폴더	
 PANATERM	2024-04-17 오전 9:12	파일 폴더	
 E-RAM시리즈_파나소닉파라미터	2024-05-09 오후 2:15	Microsoft Excel ...	11KB

#### ● Software installation

a. Install <PANATERM>



 PANATERM Open ,  setup.exe Double-click and start the PANATERM installer.

Once installation is complete  PANATERM ver.6.0 Double-click to open the software and it's ready to use.

**! Just select 'Yes' to all notifications that appear during installation.**

**! When you first open the software, file organization will proceed automatically, so please be patient.**

b. Install <Adaptive Debugging Software>

 MotorAutoSetupVer2.0.0.0 open  MotorAutoSetup FOR A6.exe Just double-click and open the software to start using it right away.

**! Precautions before use**

- Make sure your computer and driver are communicating. (If PANATERM can communicate normally, the connection is considered normal)
- Verify that the driver is in a ready state without alarms and external activation.
- Close PANATERM.
- This software cannot be left alone on the desktop and must be opened within a folder.

### 3.2 Communication between computer and driver

## ● final

① Connect the computer and the driver with a communication cable, then turn on the driver.

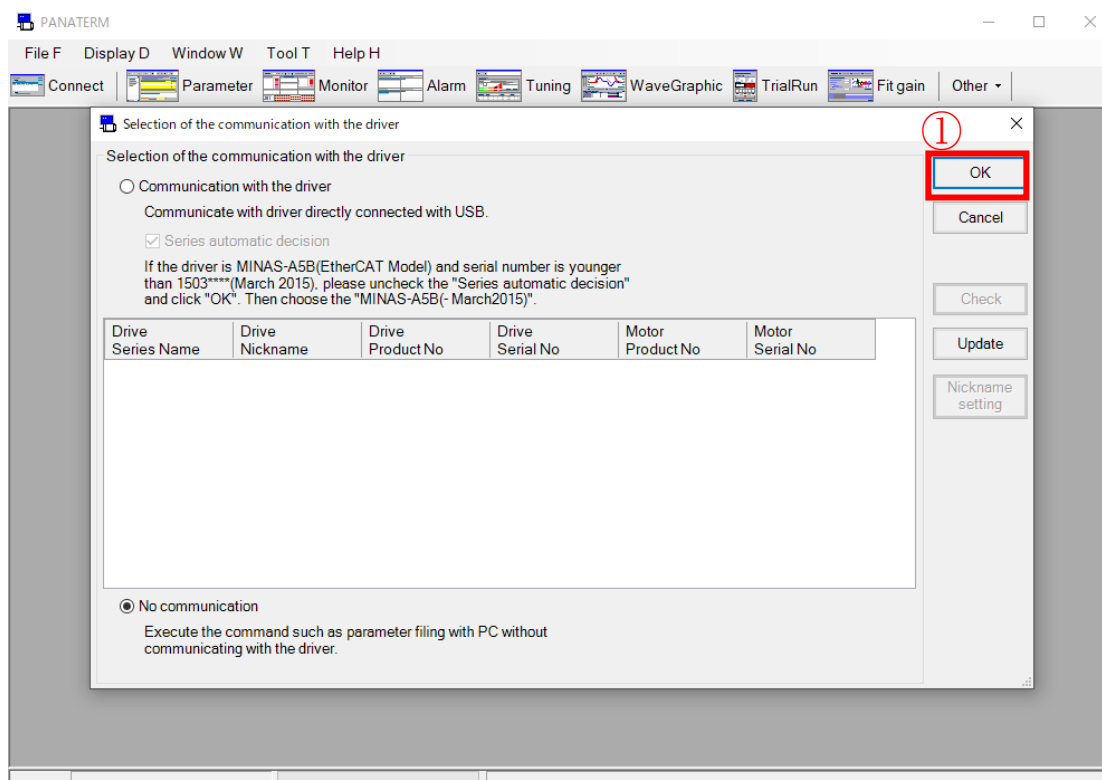
! Before turning on the power, be sure to check that all wiring is correct.

! Communication cables can be purchased from MISUMI, and the model number is USB-AM-MBM-2.

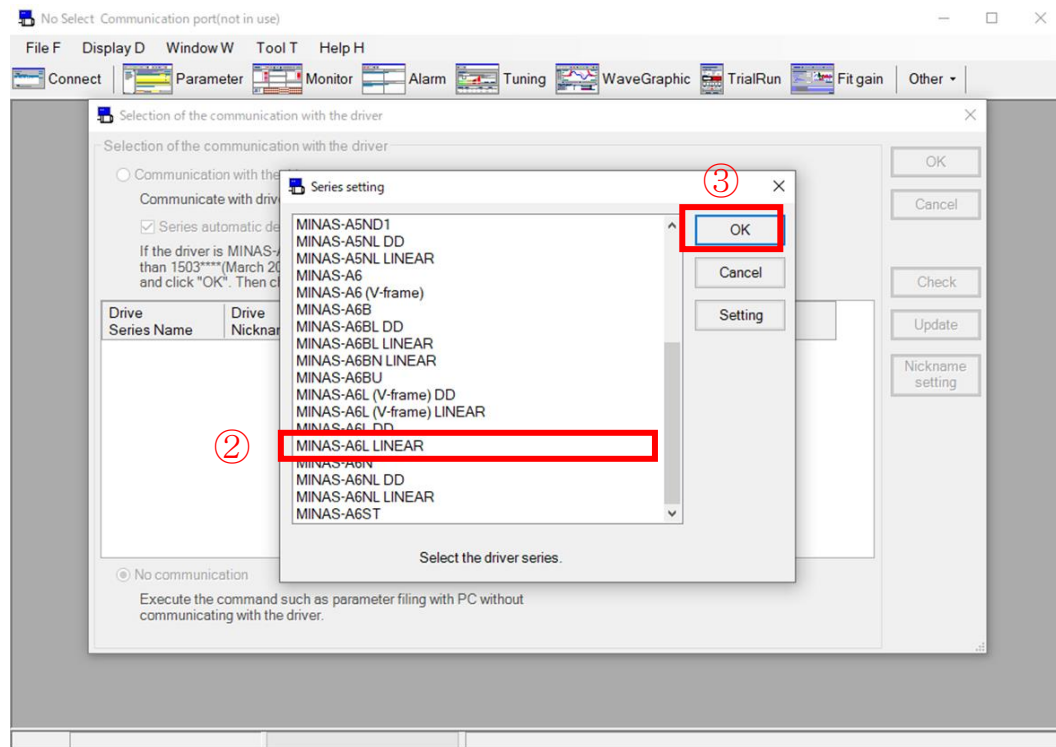


## ● communication

Open PANATERM and click ①<OK>.

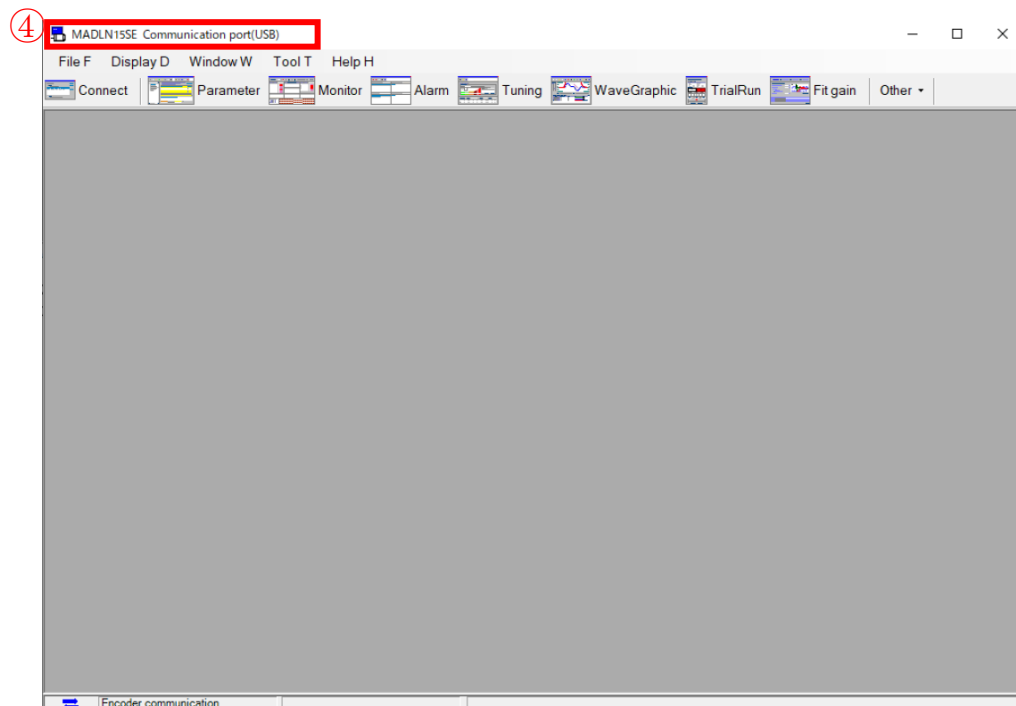


Select ②<MINAS-A6L LINEAR>, and click ③<OK>.



If communication is successful, <Driver model number> is displayed in ④.

! If communication is not possible, reconnect the communication cable, reboot the computer, turn the driver power back on, and replace the communication cable.



### 3.3 Importing motor parameters

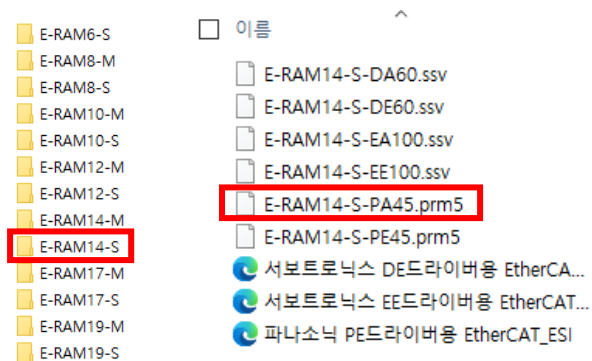
#### ● Download parameter pack

You can download the parameter pack from the following address or request it from a MISUMI customer service representative.

Download address: [https://www.misumi.com.cn/guide/doc/Motor\\_Data.zip](https://www.misumi.com.cn/guide/doc/Motor_Data.zip)

Select the parameter pack according to the model number of the actuator you purchased.

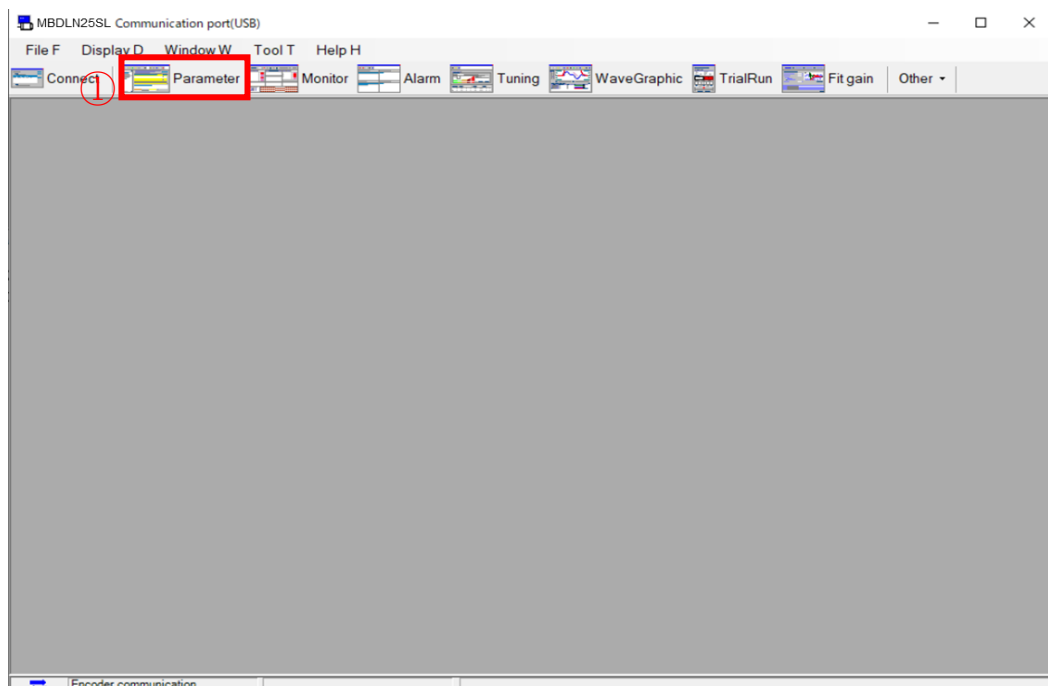
Example) If the model number of the linear motor actuator is E-RAM14-S-600-PA45-C3, the corresponding parameter pack is E-RAM14-S-PA45.



#### ● Importing parameter packs

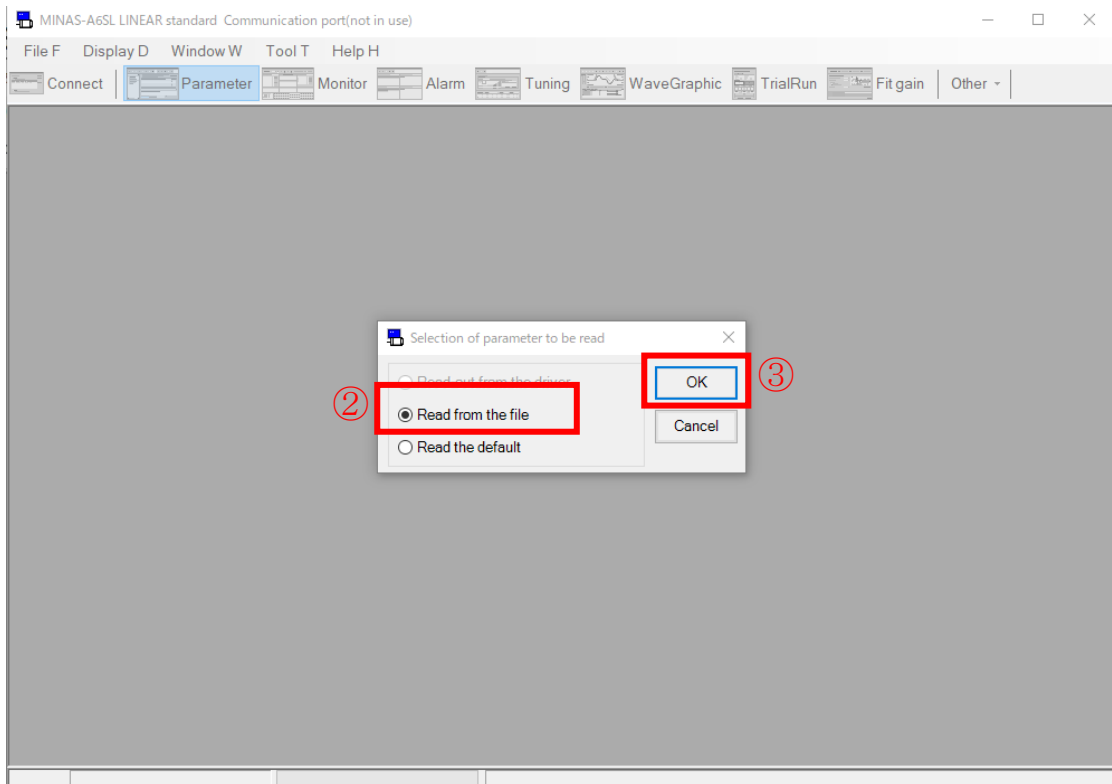
Operate in the following order:

- ① Click <Parameters>.



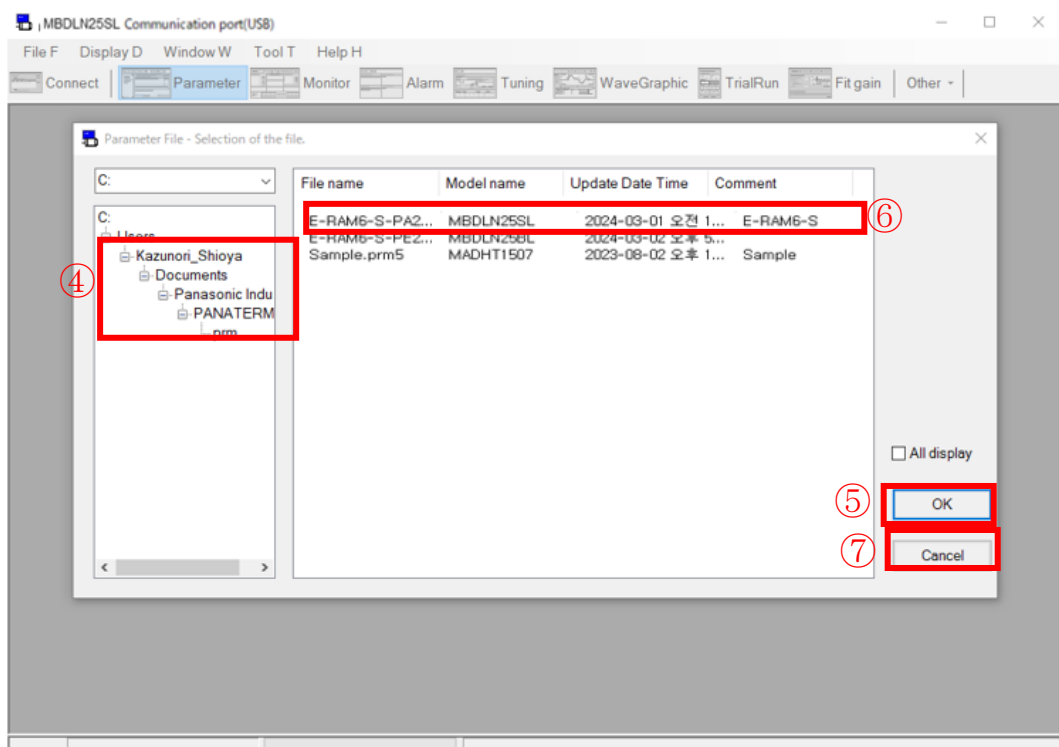


② Select <Read from file>, and click ③<OK>.

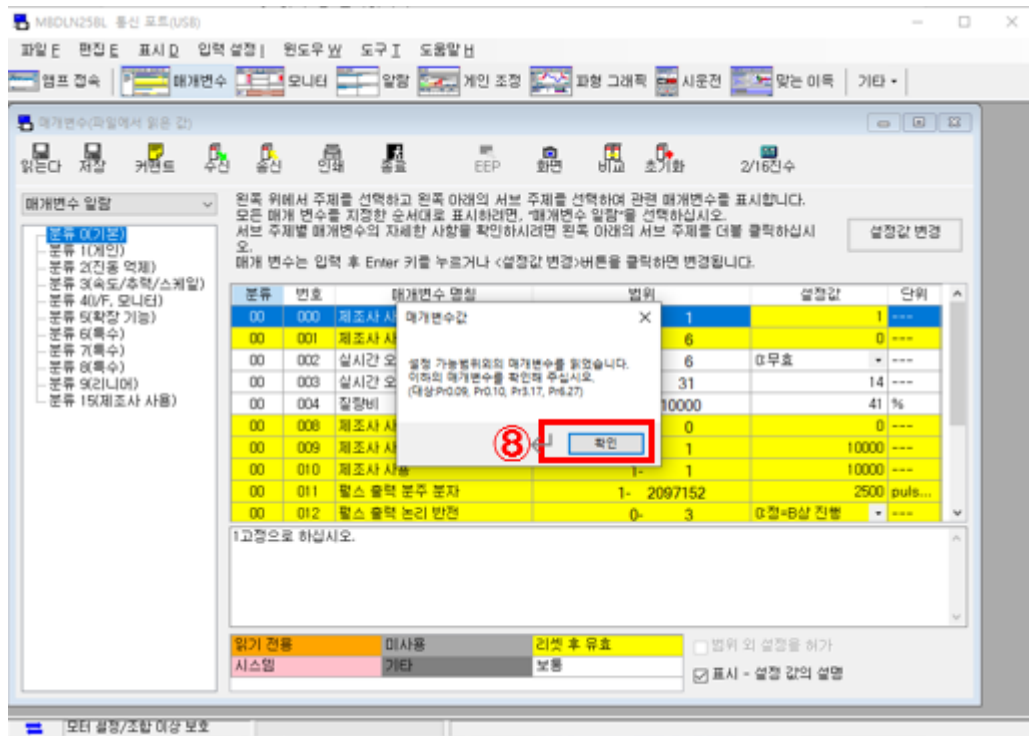


④ Select the address where <Parameter Pack> is saved, and check ⑤<Show All>.


Select ⑥<Parameter Pack> to import, and click ⑦<OK>.



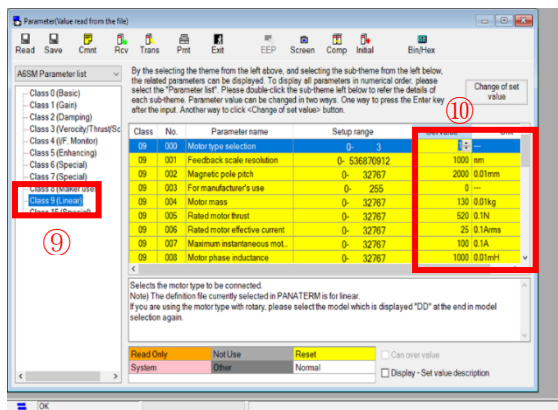
⑧Click <Confirm>.



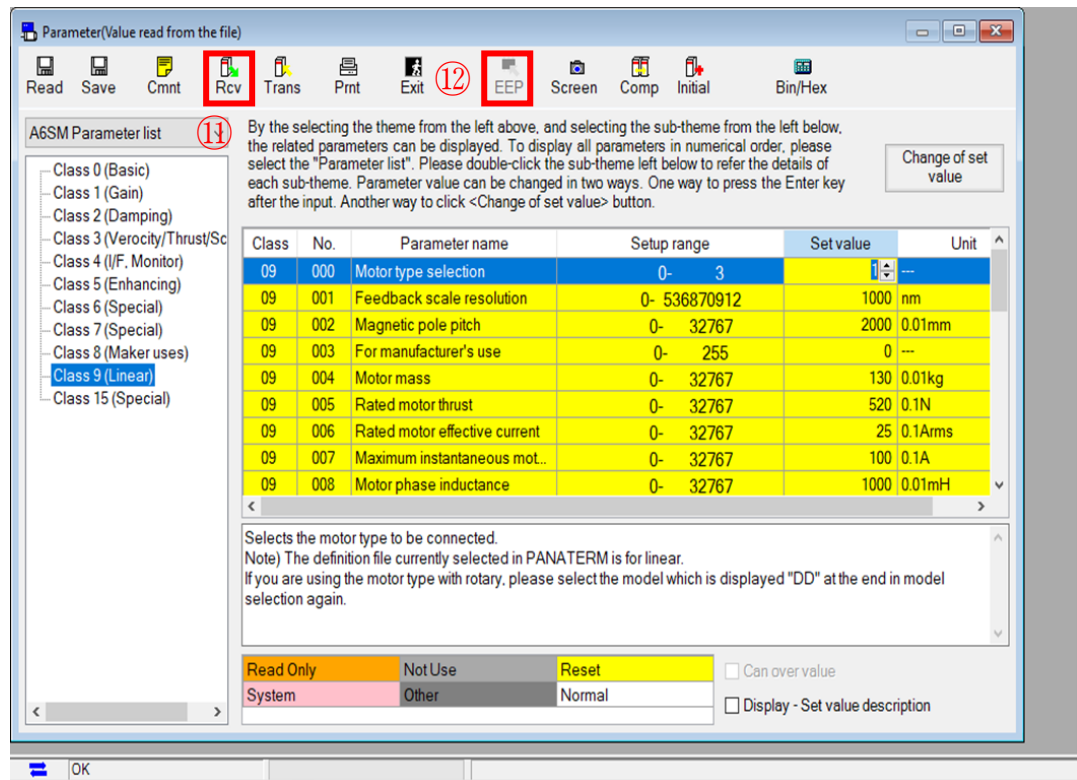
Click ⑨<Category 9 (Linear)> and check whether ⑩<Setting Value> is correct.

!  E-RAM시리즈\_파나소닉파라미터 You must check based on , and pay special attention to whether the units match. If they do not match, please convert to the same units.

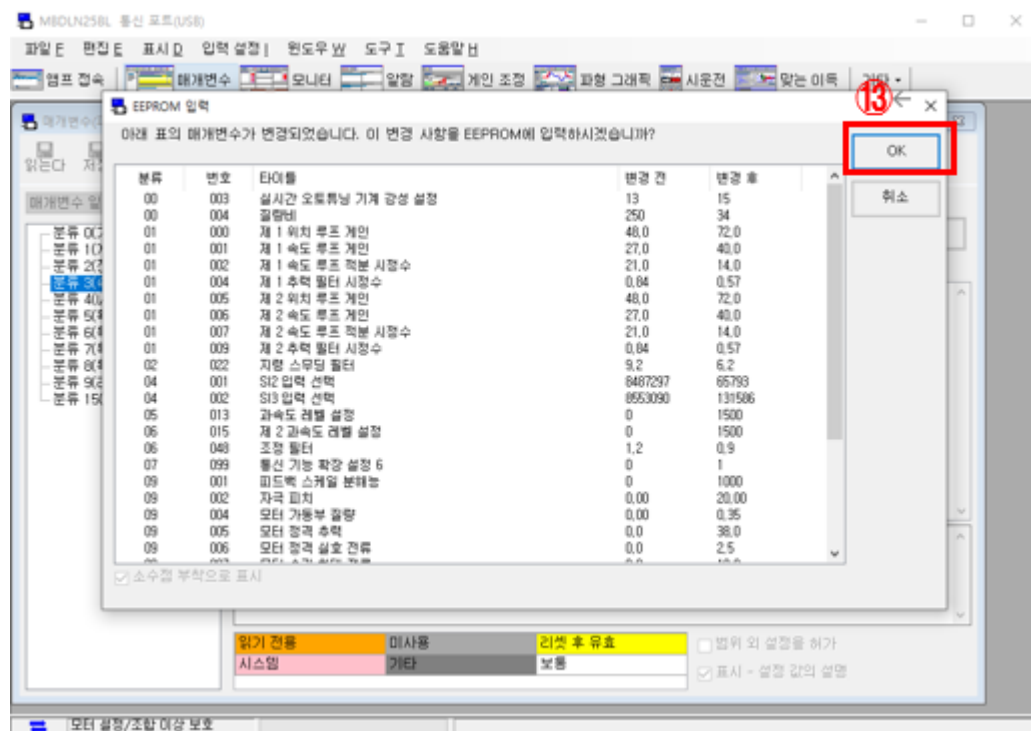
E-RAM6-S			
09	000	-	1
09	001	mm	1000
09	002	mm	20
09	004	kg	0.35
09	005	N	38
09	006	Arms	2.5
09	007	A	10
09	008	mH	9.4
09	009	Ω	3.2
09	010	mm/s	1500
09	020	-	2
09	022	ms	200
09	023	%	80



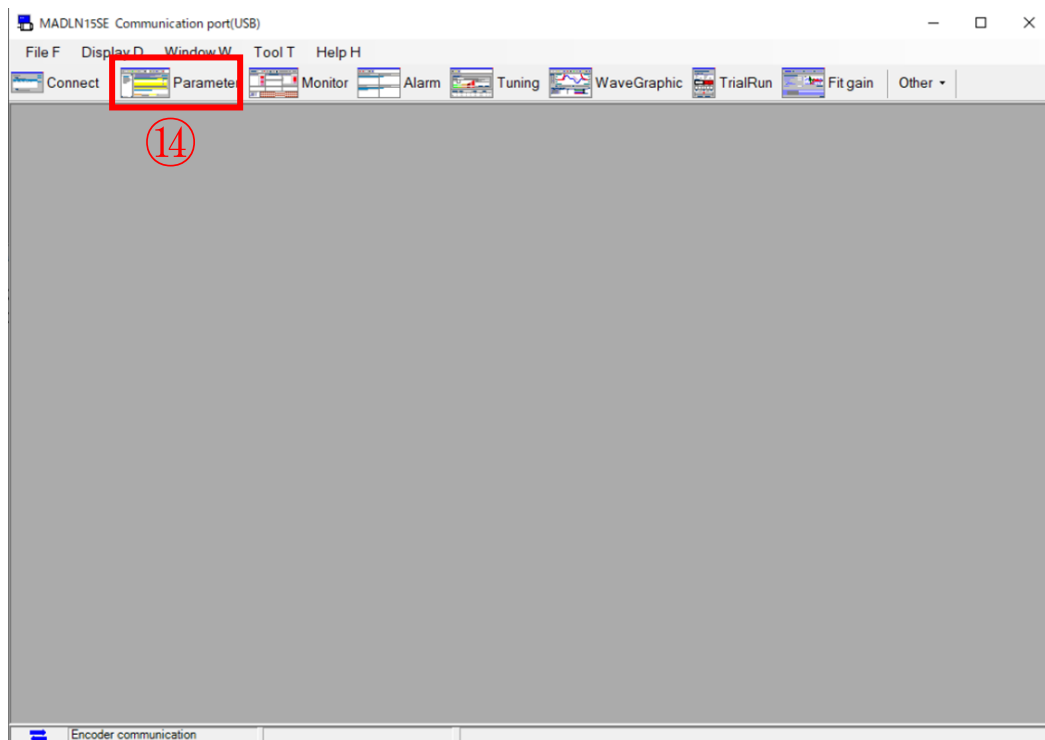
Click ⑪<Send>, then click ⑫<EEP>.



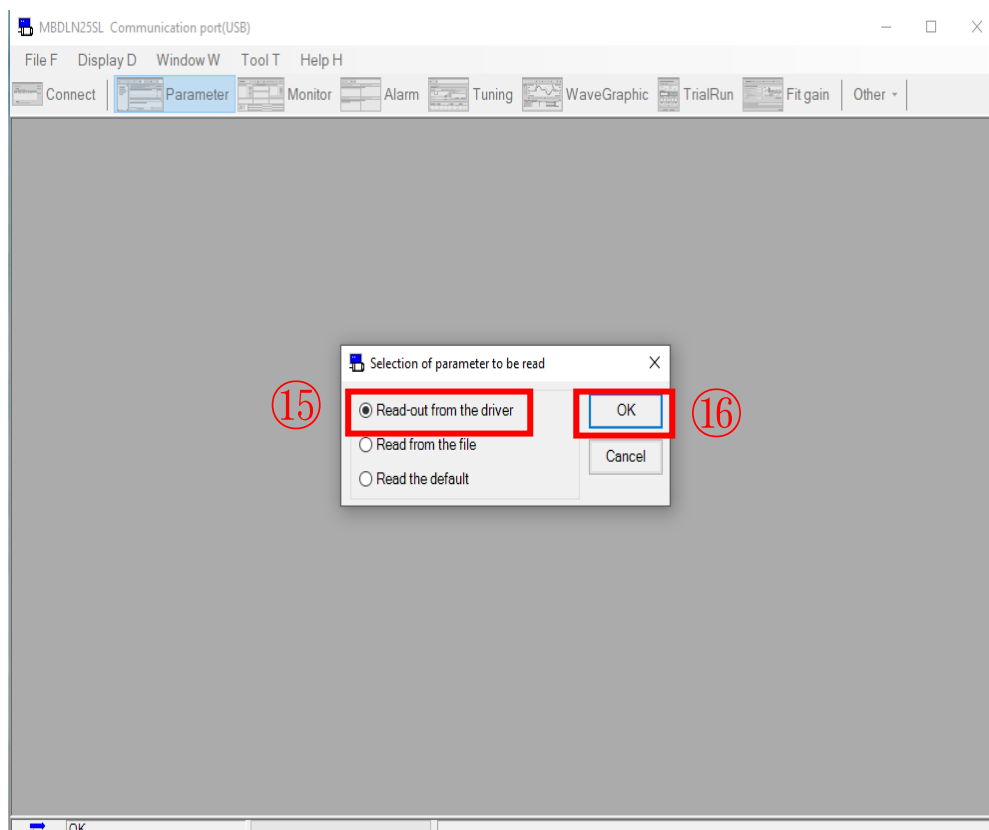
⑬Click <OK>.



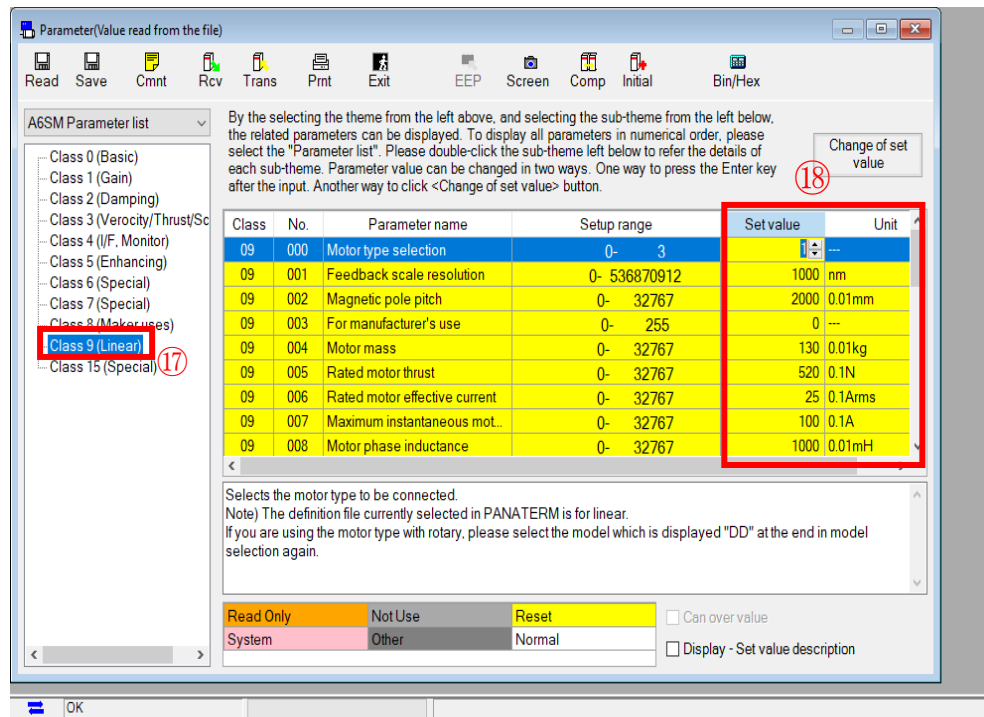
Turn off the driver, then turn it back on after 5 seconds and click ⑭<Parameters>.



Select ⑮<Read from driver>, and click ⑯<OK>.



Click ⑰<Category 9 (Linear)> and check whether ⑱<Settings> are written to the driver.




## 3.4 Adaptive Debugging

### ● Preliminaries

First turn off the driver, slide the actuator's slider to the middle position, then turn it on.




## ● Start debugging

software  MotorAutoSetup FOR A6.exe Open .

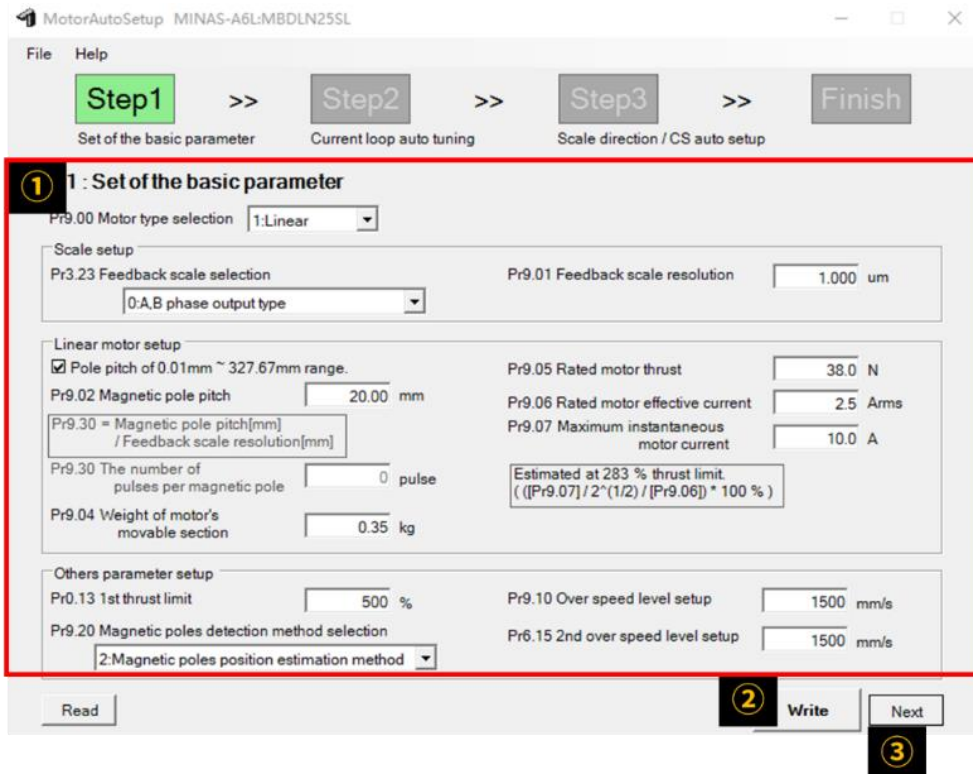
①Check whether the <motor parameters> are correct (especially Pr9.01 and Pr9.02).

Click ②<Write>, and click ③<Next>.

! For precautions, refer to <3.1 Software Download and Installation>, and be sure to close PANATERM first.

!  E-RAM시리즈\_파나소닉파라미터 Please check if the imported parameters are correct based on .

! If there are parameter changes, click ②<Write>, then turn off the driver and turn it on again.



MotorAutoSetup MINAS-A6L:MBDLN25SL

File Help

Step1 >> Step2 >> Step3 >> Finish

Set of the basic parameter Current loop auto tuning Scale direction / CS auto setup

**1: Set of the basic parameter**

Pr9.00 Motor type selection 1:Linear

Scale setup

Pr3.23 Feedback scale selection 0:A,B phase output type

Pr9.01 Feedback scale resolution 1.000 um

Linear motor setup

☒ Pole pitch of 0.01mm ~ 327.67mm range.

Pr9.02 Magnetic pole pitch 20.00 mm

Pr9.03 = Magnetic pole pitch[mm] / Feedback scale resolution[mm]

Pr9.30 The number of pulses per magnetic pole 0 pulse

Pr9.04 Weight of motor's movable section 0.35 kg

Pr9.05 Rated motor thrust 38.0 N

Pr9.06 Rated motor effective current 2.5 Arms

Pr9.07 Maximum instantaneous motor current 10.0 A

Estimated at 283 % thrust limit.  

$$\left( \frac{[Pr9.07]}{2^{1/2}} / [Pr9.06] \right) * 100 \%$$

Others parameter setup

Pr0.13 1st thrust limit 500 %

Pr9.10 Over speed level setup 1500 mm/s

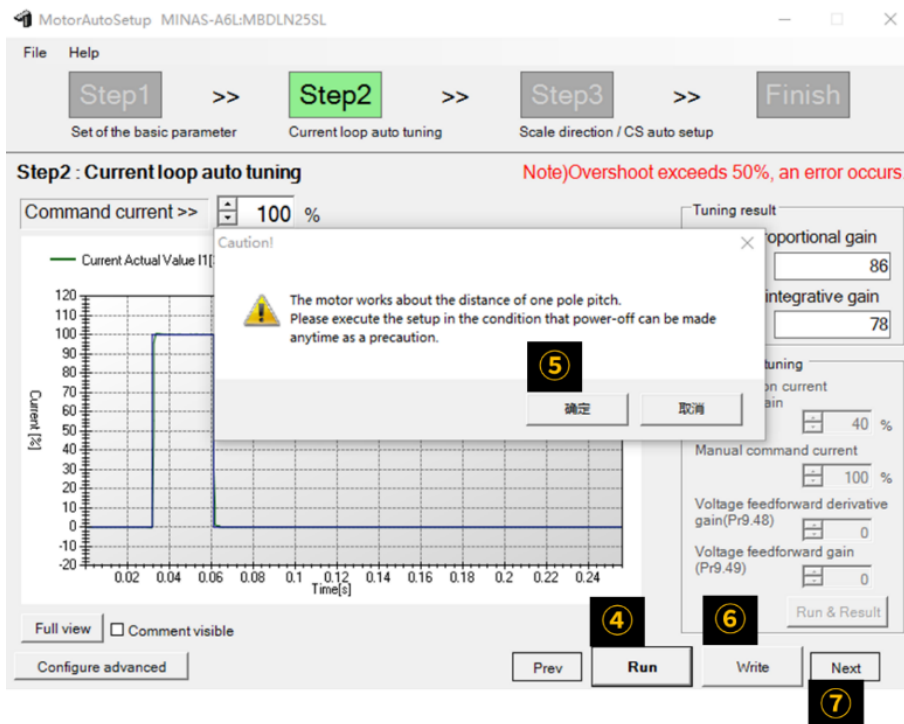
Pr9.20 Magnetic poles detection method selection 2:Magnetic poles position estimation method

Pr6.15 2nd over speed level setup 1500 mm/s

Read Write Next

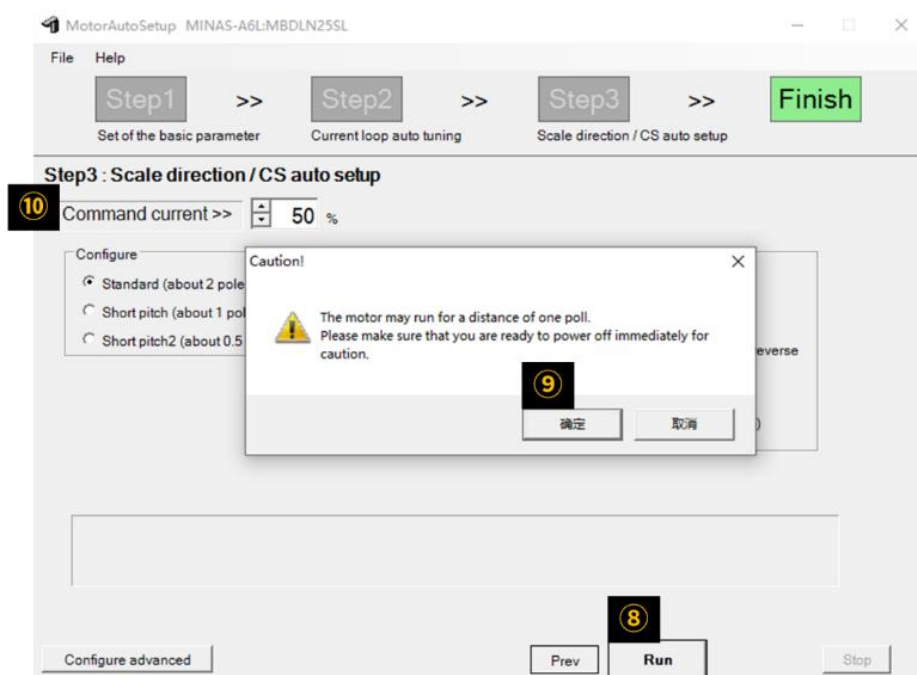
When you click ④<Run> and ⑤<Confirm>, the actuator will run slightly for a while and then stop.

Click ⑥<Write>, and click ⑦<Next>.



When you click ⑧<Run> and ⑨<Confirm>, the actuator will run slightly for a moment and then stop.

! When an alarm occurs, ⑩<Command current> can be increased appropriately.



⑪Click <OK>, then turn off the driver and turn it on again to close this software.

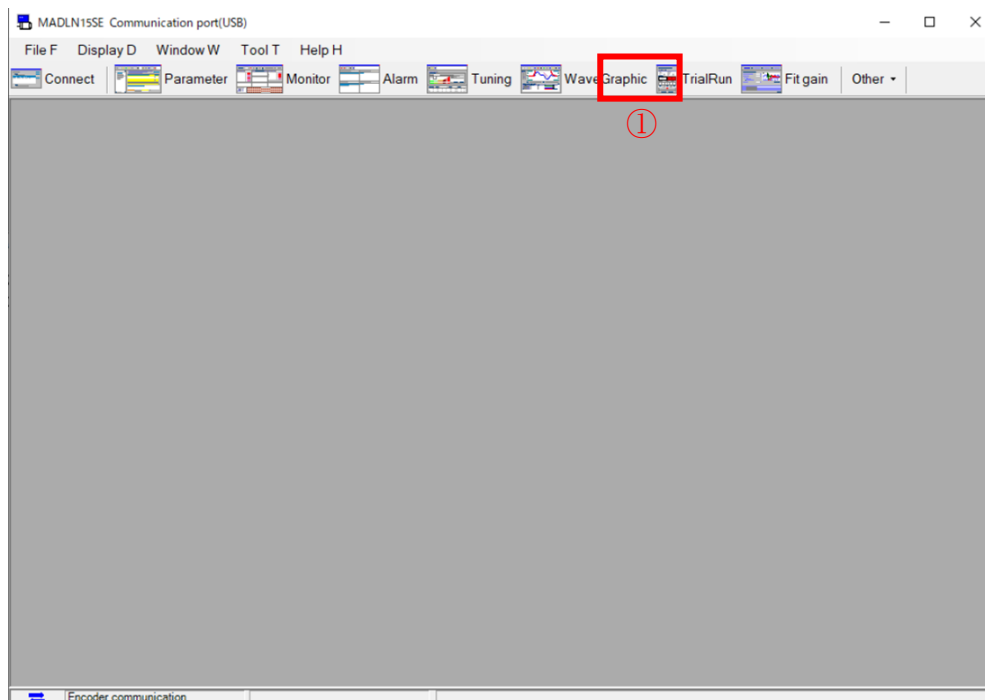
The screenshot shows a 'Result parameters' dialog box with two columns: 'Before parameters' and 'After parameters'. The 'After parameters' column has a red box around the 'TrialRun' button and a yellow circle with the number 11. The 'OK' button is at the bottom right.

Before parameters	After parameters
Pr3.23 Feedback scale selection 0: A, B phase output type	Pr3.23 Feedback scale selection 0: A, B phase output type
Pr9.00 Motor type selection 1: Linear	Pr9.00 Motor type selection 1: Linear
Pr9.01 Feedback scale resolution 1 um	Pr9.01 Feedback scale resolution 1 um
Pr9.02 Magnetic pole pitch 20 mm	Pr9.02 Magnetic pole pitch 20 mm
Pr9.30 The number of pulses per magnetic pole 0 pulse	Pr9.30 The number of pulses per magnetic pole 0 pulse
Pr9.04 Weight of motor's movable section 0.35 kg	Pr9.04 Weight of motor's movable section 0.35 kg
Pr9.05 Rated motor thrust 38 N	Pr9.05 Rated motor thrust 38 N
Pr9.06 Rated motor effective current 2.5 Arms	Pr9.06 Rated motor effective current 2.5 Arms
Pr9.07 Maximum instantaneous motor current 10 A	Pr9.07 Maximum instantaneous motor current 10 A
Pr9.10 Over speed level setup 1500 mm/s	Pr9.10 Over speed level setup 1500 mm/s
Pr6.15 2nd over speed level setup 1500 mm/s	Pr6.15 2nd over speed level setup 1500 mm/s
Pr0.13 1st thrust limit 500 %	Pr0.13 1st thrust limit 500 %
Pr9.20 Magnetic poles detection method selection 2: Magnetic poles position estimation method	Pr9.20 Magnetic poles detection method selection 2: Magnetic poles position estimation method
Pr3.26 Reversal of direction of Feedback scale / CS direction 0	Pr3.26 Reversal of direction of Feedback scale / CS direction 0
Pr9.13 Current proportional gain 88	Pr9.13 Current proportional gain 88
Pr9.14 Current integrative gain 80	Pr9.14 Current integrative gain 78
Pr9.21 CS phase setting 0 degree	Pr9.21 CS phase setting 0 degree

## 3.5 Commissioning

### ● Preliminaries



① Click <Trial Run>.





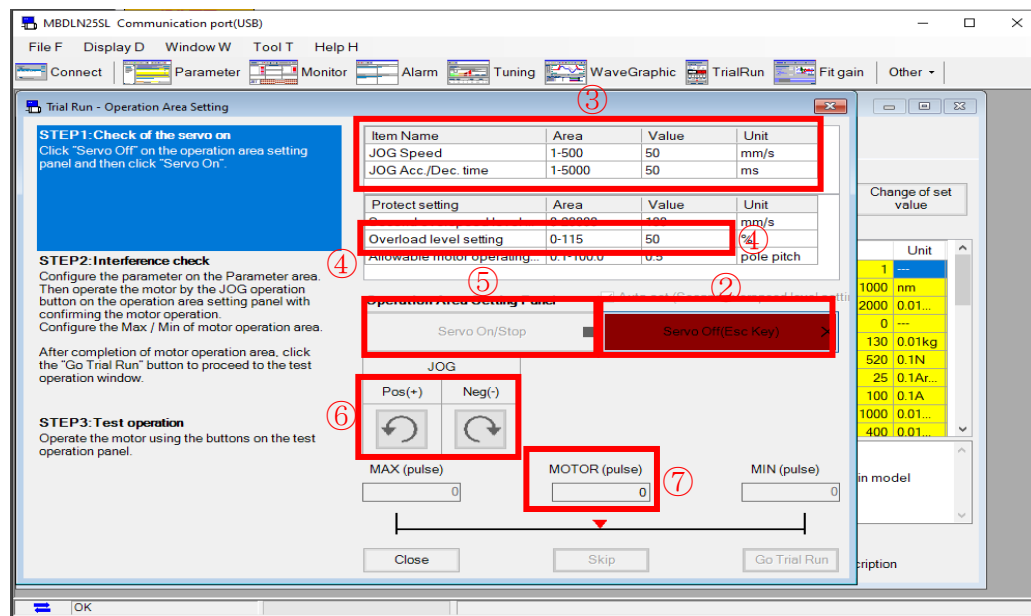
Click ②<Turn off servo activation (Esc key)>, and set ③<JOG speed> and <JOG acceleration/deceleration time>.

④Set <Overload Class Setting> to 115, confirm safety, and then click ⑤<Turn Servo Activation On/Off>.

⑥In <JOG>  or  When you click , the actuator inclines.

⑦Observe <MOTOR(pulse)> to determine the positive and negative directions of the actuator.

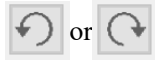
! It is normal for the actuator to emit an electromagnetic sound (tsk tsk) after activation.



## ● Start of test run

① Set <movement amount>, <waiting time>, <speed>, and <acceleration/deceleration time>.

② Check <Continuous JOG> or <Continuous STEP>.



Click to make the actuator continuous JOG or continuous STEP.

! The movement amount is 1STEP=0.001mm, and please set within the range

①<MAX(pulse)>~<MIN(pulse)>.

! Continuous JOG refers to operating once, and continuous STEP refers to operating repeatedly.

! After completing the test run, click ②<Turn off servo activation (Esc key)> to turn off activation.

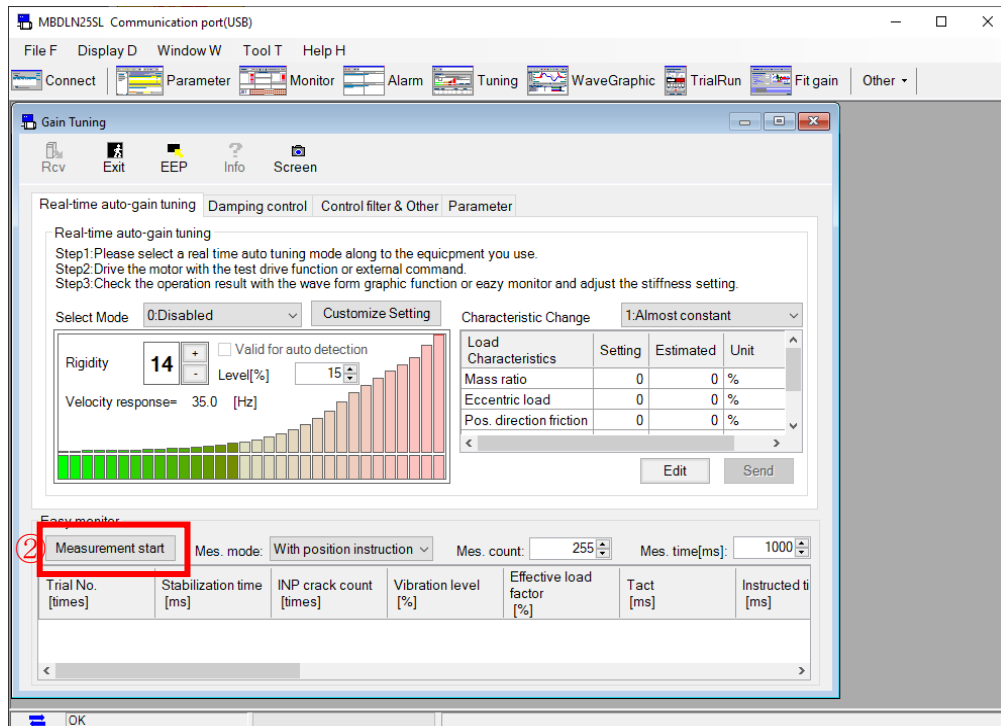


## ● Settlement time analysis

①Click <Gain Adjustment>.



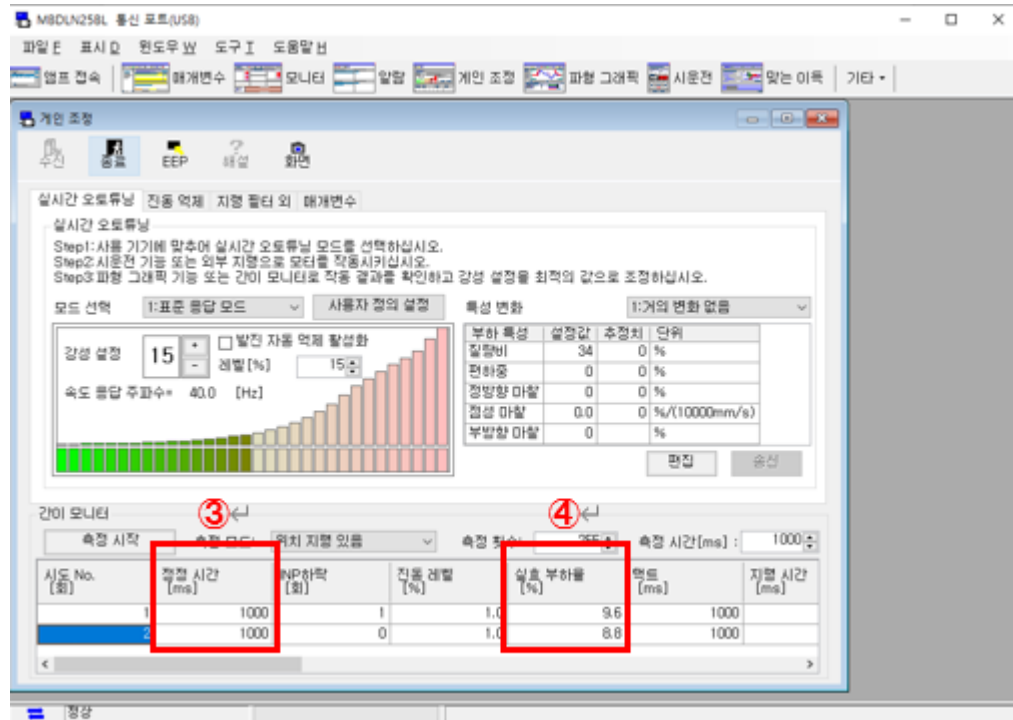
②Click <Start measurement>.



The actuator can be operated through an external PLC command or driver test run command, and check ③<settling time>.

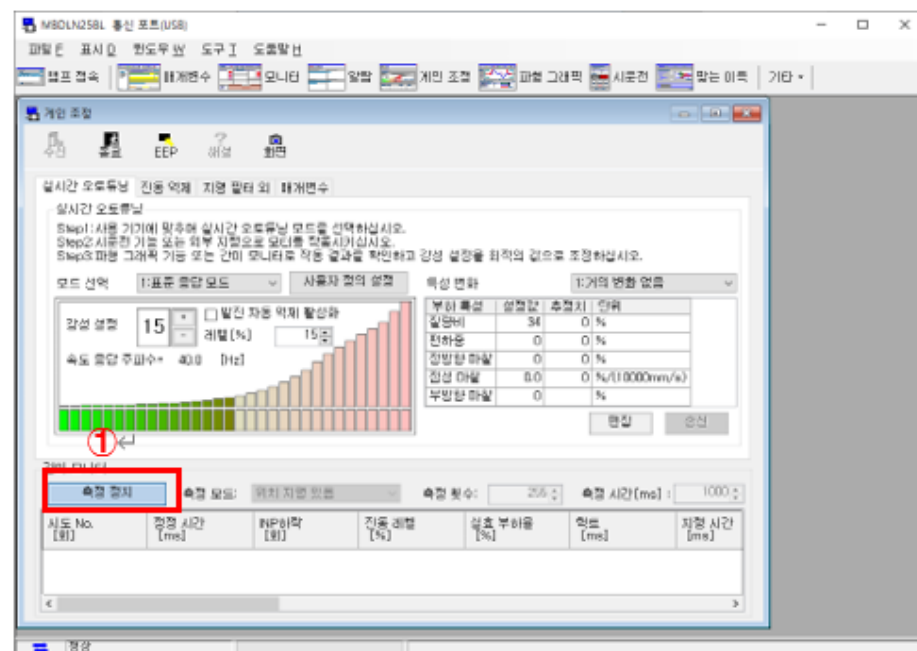
! Excessive settling time indicates poor responsiveness.

! ④<Effective load factor> cannot exceed 100.



## ● Parameter Debugging

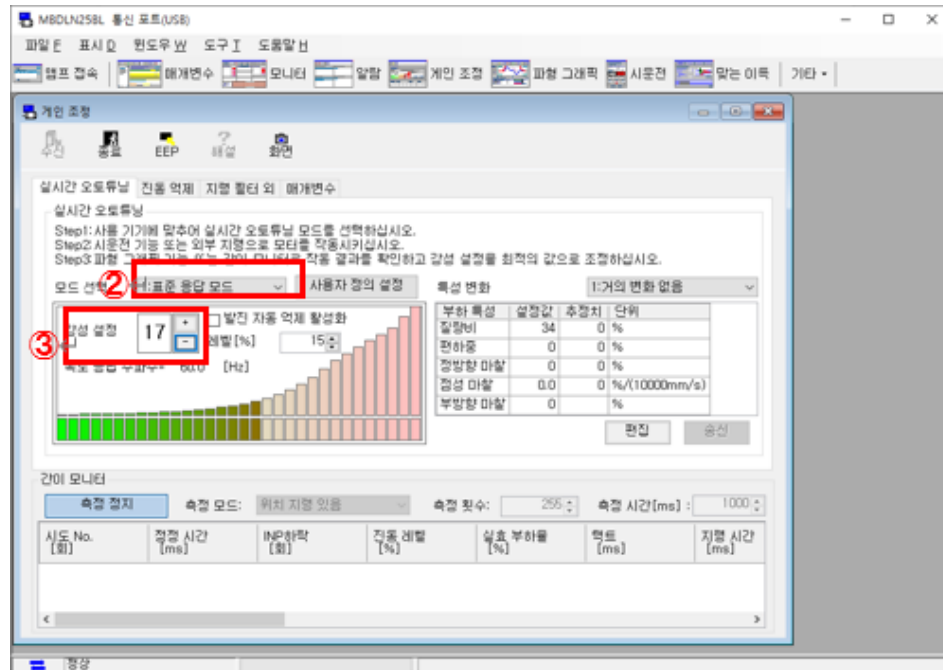
① Click <Stop measurement>.



For the mode, select ②<1: Standard response mode> and set ③<rigidity setting>.

! Increasing it may provide more responsiveness, but may cause noise or vibration in the actuator.

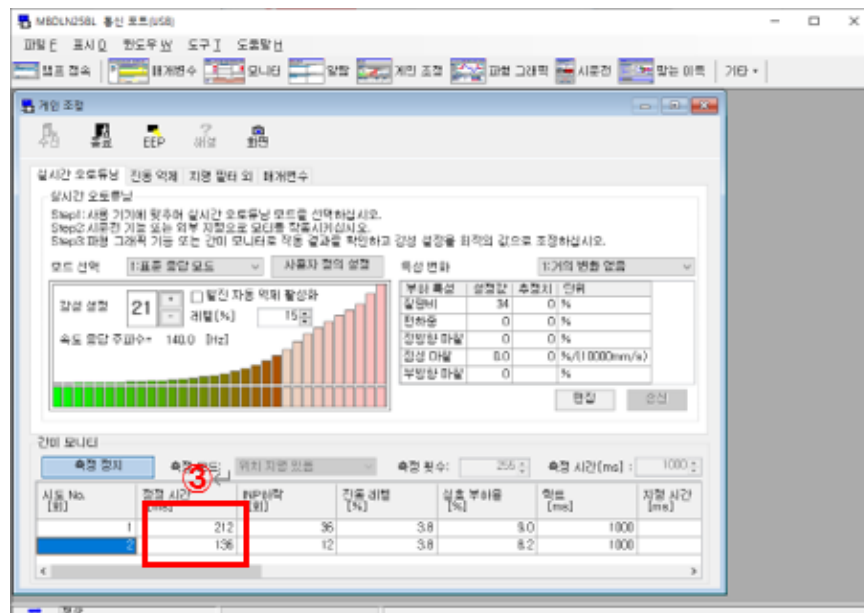
! Lowering it can suppress vibration and noise.



## ● Check debugging results

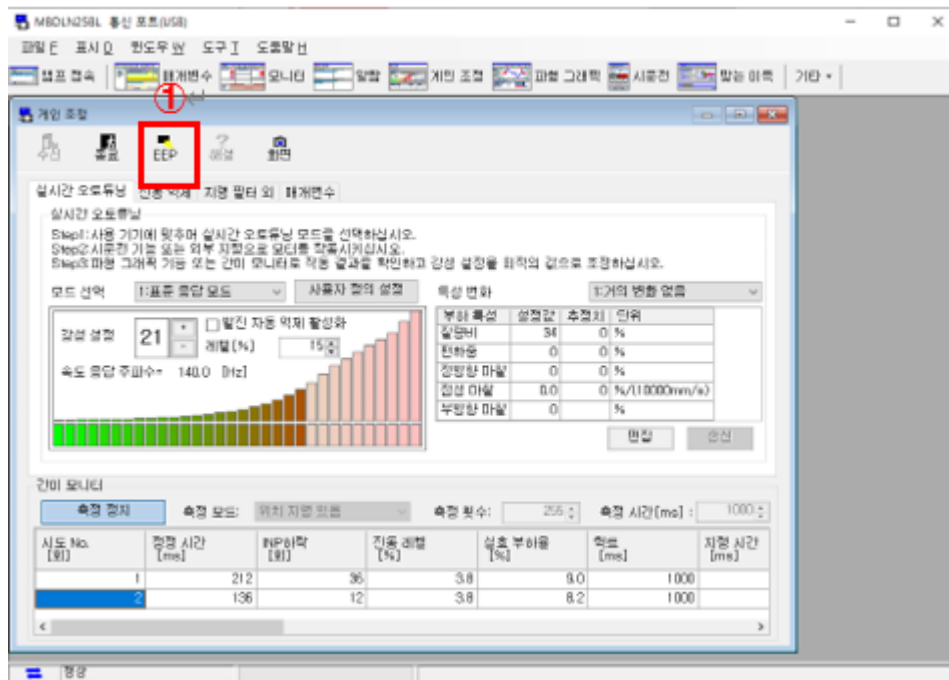
Perform the measurement again, run the actuator, and observe the settling time.

! After increasing the rigidity, the settling time was shortened from the initial 1000ms to 136ms.

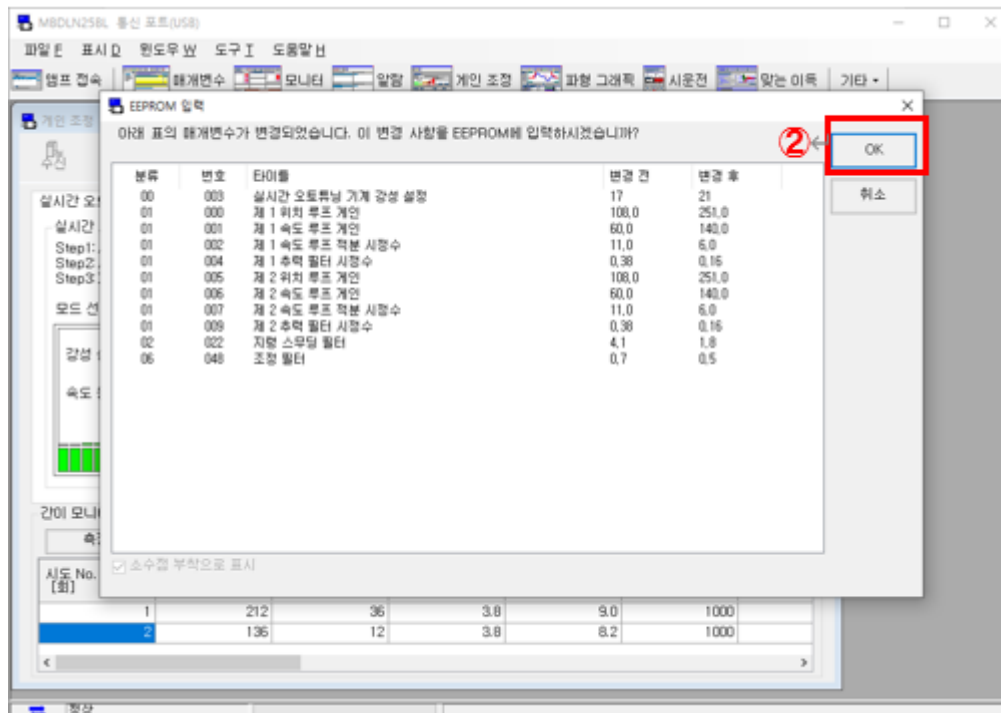


## ● Save parameters

- ① Click <EEP>.



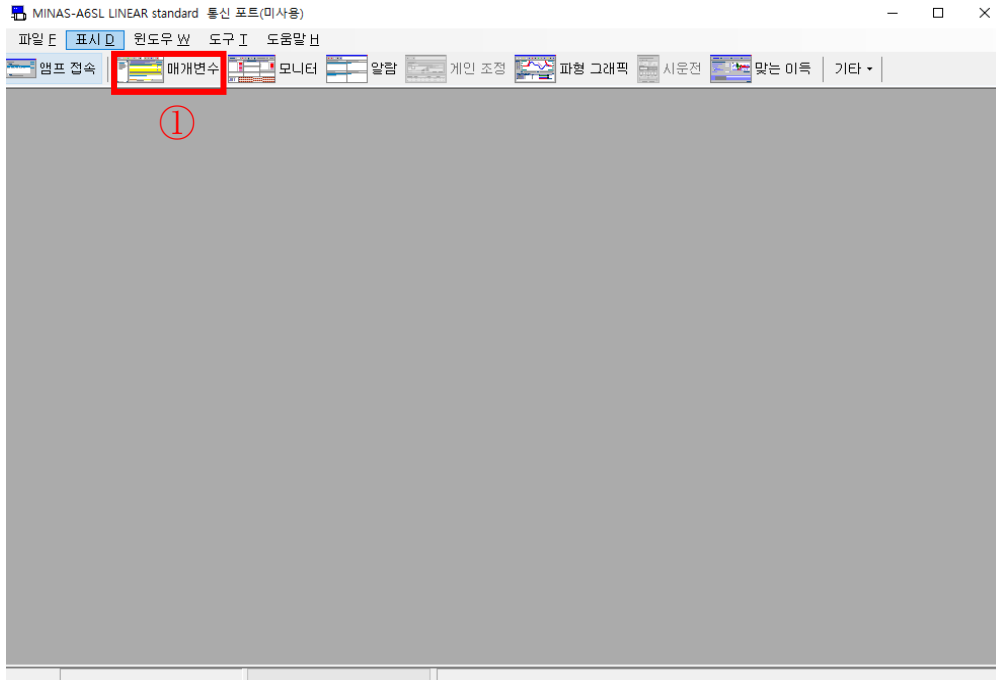
- ② Click <OK>.



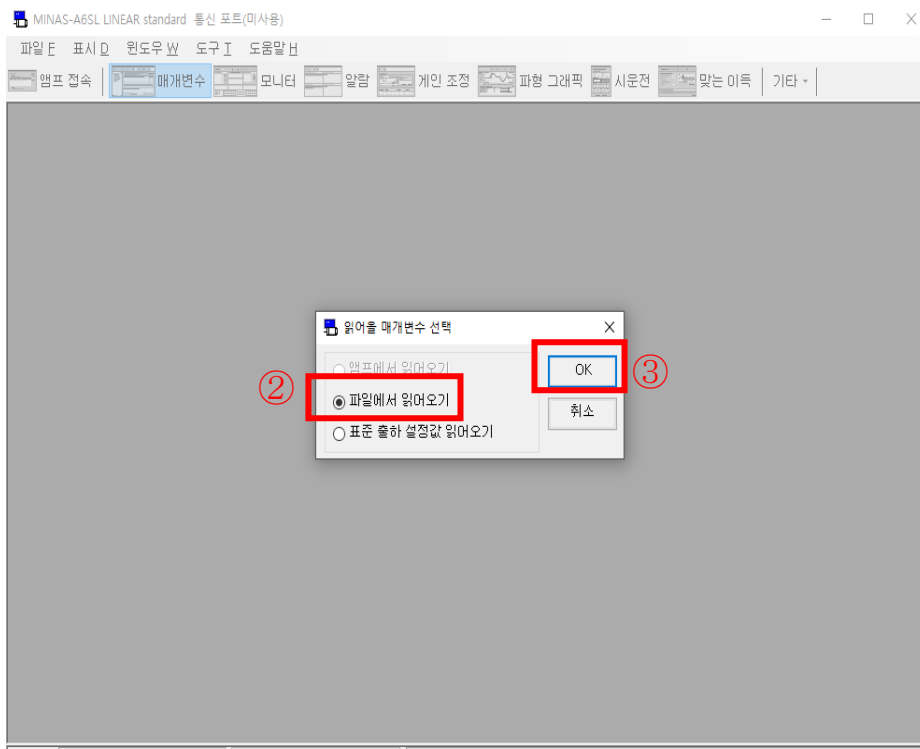
## 3.6 Control

### ● pulse mode


① Click <Parameters>.

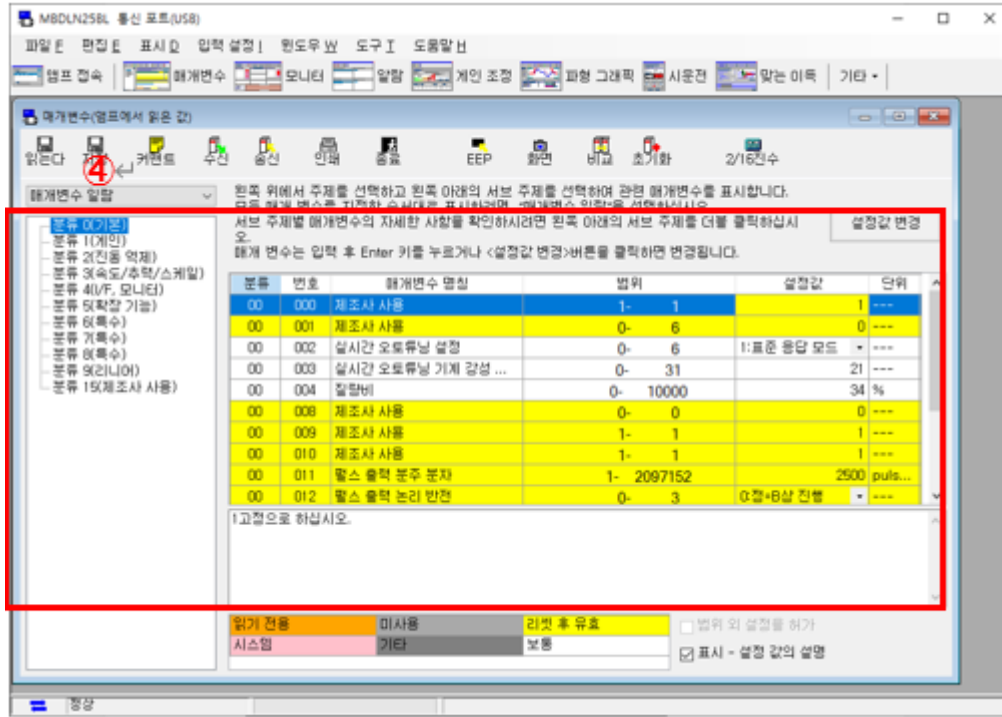


② Click <Read from driver>, and click ③<OK>.



④Set the parameters in <parameter list>.

! After setting the parameters, be sure to  Please click to save.



Line mode:

classification	number	Parameter name	Setting value
00	001	Control mode settings	0: Position control
00	005	Command pulse input selection	1: Line driver dedicated input
00	007	Command pulse input mode setting	1: Forward/Reverse or 3: pulse train + sign

Open collector mode:

classification	number	Parameter name	Setting value
00	001	Control mode settings	0: Position control
00	005	Command pulse input selection	2: Photocoupler input
00	007	Command pulse input mode setting	1: Forward/Reverse or 3: pulse train + sign



## ● Electronic gear ratio settings

The formula is:

Actual moving distance = Number of command pulses x (P 00-009/P 00-010)

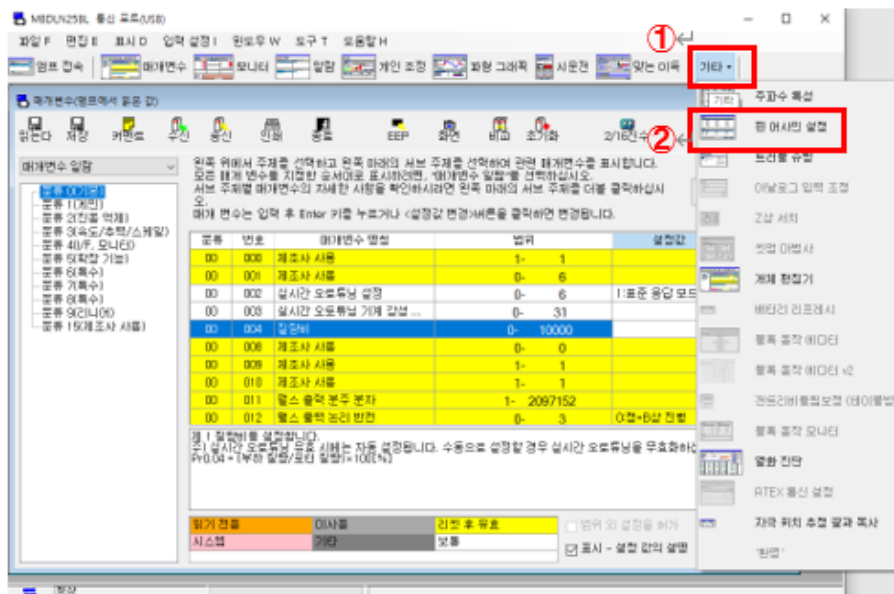
Number of control card feedback pulses = actual moving distance x (P 00-011/P 05-003)/0.001mm

**! To set 1 pulse = 0.001mm, you can set it by referring to the method below.**

classification	number	Parameter name	Setting value
00	009	First command frequency division/doubling numerator	10000
00	010	Command frequency division/doubling denominator	10000
00	011	Number of output pulses per time the motor moves one revolution	2500
05	003	Pulse output frequency division denominator	2500

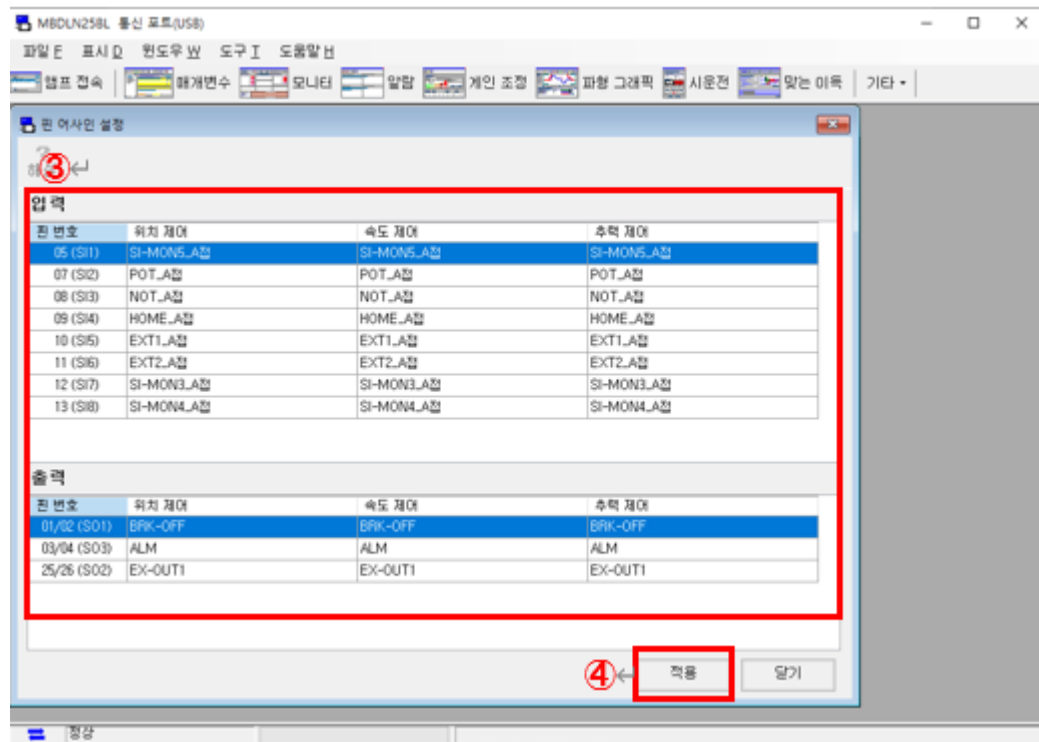
## ● I/O settings

① Click <Other>, and click ②<Pin Definition Settings>.



③Set <input> and <output>, and click ④<Apply>.

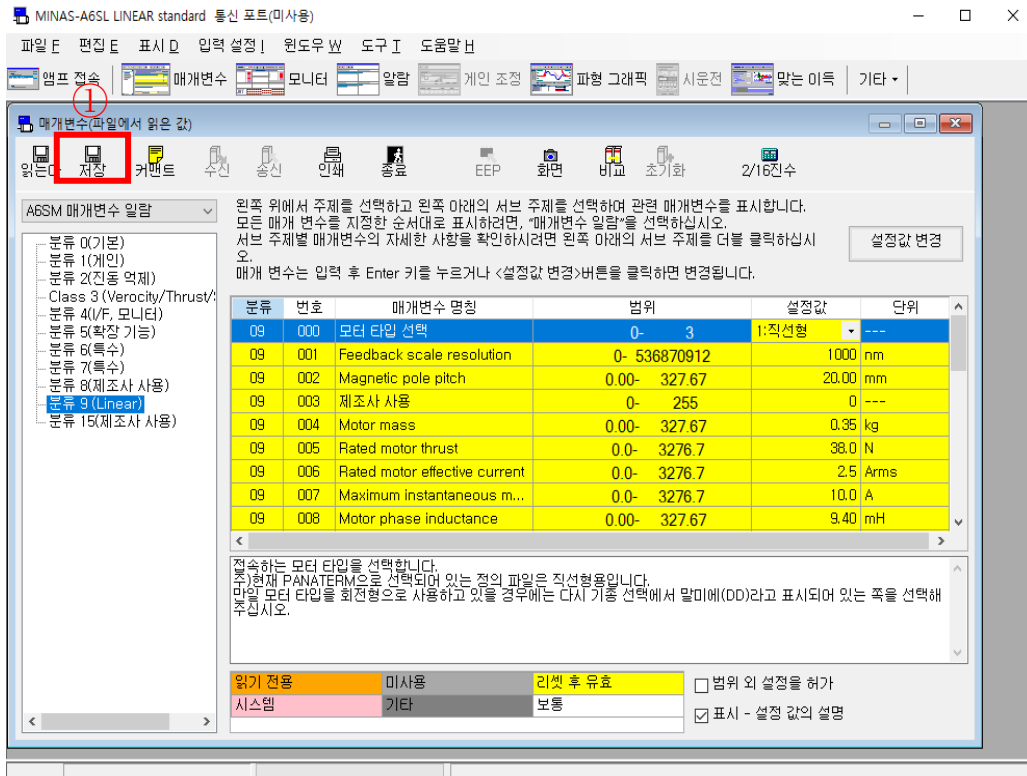
! The polarity of the output cannot be modified.



## 3.7 Parameter backup & parameter recovery

### ● Parameter backup

①Click <Save> and enter the file name as instructed.



### ● Parameter recovery

For recovery methods, please refer to <3.3 Parameter Pack Importing>.

The differences are as follows:

1. The parameter pack is changed to the saved parameter pack.