

**KOGANEI**



# **ELEWAVE SERIES ELECTRIC HAND**

**Pulse train input type controller**

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**OWNER'S MANUAL Ver. 1.0**

[Main Units]

**EWHA12A**

**EWHA24A**

**EWHA36A**

**EWHA6H**

**EWHA12H**

**EWHA24H**

**EWHA36H**

[Controller]

**EWHC-NH**

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# Contents

## **Chapter 1 Safety Precautions**

1-1 Safety .....	2
1-2 Precautions .....	3

## **Chapter 2 System Configuration**

2-1 Overview .....	4
2-2 Entire system configuration .....	4
2-3 Options and accessories .....	5
2-4 Setting up for operation .....	6

## **Chapter 3 Main Unit**

3-1 Handling the main unit	
3-1-1 Precautions .....	7
3-2 Mounting	
3-2-1 Mounting the main unit .....	7
3-2-2 Mounting a workpiece (fingers) ...	8

## **Chapter 4 Controller**

4-1 Appearance and functions .....	9
4-2 Controller installation	
4-2-1 Installation .....	10
4-2-2 Grounding work .....	10
4-3 Connecting the power supply	
4-3-1 Terminal layout chart .....	10
4-3-2 How to connect the power supply .....	10
4-4 Connecting to the actuator	
4-4-1 Input/output signals chart .....	11
4-5 Connecting to I/O	
4-5-1 Input/output circuits .....	11
4-5-2 Input/output signals chart .....	13
4-5-3 Details of input signals .....	13
4-5-4 Details of output signals .....	15
4-6 Connecting the pulse train input	
4-6-1 Input signals chart .....	17
4-6-2 Details of input circuits .....	17
4-6-3 Definitions of CW and CCW directions .....	19
4-6-4 Input command format .....	19
4-7 Communication with personal computer	
4-7-1 Communication parameter specifications .....	20
4-7-2 Communication cable .....	21
4-7-3 Format of communication commands .....	21

4-7-4 List of communication commands .....	22
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4-7-5 Details of communication commands .....	23
---	----

4-8 Parameters	
4-8-1 Parameter setting method .....	29
4-8-2 List of parameters .....	30
4-8-3 Details of parameters .....	30
4-9 Other functions	
4-9-1 Zone output function .....	32

## **Chapter 5 Operations**

5-1 Setting parameters needed for minimum operations .....	34
5-2 Positioning mode	
5-2-1 Overview of positioning mode	36
5-2-2 Time sequence .....	36
5-2-3 Maximum speed, acceleration/ deceleration maximum value ...	39
5-3 Gripping mode	
5-3-1 Overview of gripping mode .....	40
5-3-2 Time sequence .....	41
5-3-3 Maximum speed, acceleration/ deceleration maximum value ...	45
5-4 Error messages .....	46
5-5 Stop messages .....	47

## **Chapter 6 Troubleshooting**

6-1 If a problem occurs .....	48
6-2 Countermeasures for alarms .....	48
6-3 Alarm specifications	
6-3-1 Alarm message list .....	48

## **Chapter 7 Specifications**

7-1 Basic specifications of main unit .....	49
7-2 Basic specifications of the controller ....	49

## **Chapter 8 Outline Drawings**

8-1 Main unit outline drawings .....	50
8-2 Controller outline drawings .....	52

## **Chapter 9 Technical Data**

9-1 Limits on gripping force at grip points ....	54
9-2 Range of gripping force .....	55
9-3 Allowable load and allowable moment ...	56

# Chapter 1 Safety Precautions

Thank you for purchasing the Elewave Series Electric Hand.

This OWNER'S MANUAL describes the features and how to operate this product.

Please read the manual carefully and use the product in a correct manner.

## 1-1 Safety

Always observe the safety instructions and precautions listed in this manual. Neglect of necessary safety measures or improper handling could result in product breakdown or damage, or in accidents that lead to injury to the users (people who set up, operate, or adjust and check, etc.).

## 1-2 Precautions

- (1) Precaution for automatic operations
  - To prevent injury, install an interlock device to prevent the operator from touching the moving parts of the Electric Hand.
- (2) Precaution against pinched fingers, etc.
  - Be careful to prevent fingers, etc., from being pinched by the Electric Hand's moving parts during transportation, teaching, or during operation.
- (3) Operation not allowed in ambient atmospheres containing flammable gases, etc.
  - The Electric Hand is not built to explosion-proof specifications. Do not use in ambient atmospheres containing flammable gases, flammable dust, or flammable liquids, etc. It could result in ignitions or explosions.
- (4) Operation not allowed in locations subject to electromagnetic interference, etc.
  - Do not use in locations subject to electromagnetic interference, static electric discharge, or radio frequency interference. It could result in erratic operations.
- (5) Safety measures for end effectors (such as fingers, etc.)
  - Design and manufacture the end effectors to prevent the occurrence of dangerous situations (such as workpieces popping out or falling) due to cut-off or fluctuation of the power supply (electrical power, air pressure, etc.).
  - If there is a danger that items gripped by the end effector could pop out or fall, take appropriate safety measures that take into consideration the size, mass, temperature, and chemical properties of the items.
- (6) Precautions for controller checks
  - To prevent electric shock when touching the outside terminal and connector of the controller during controller checks, etc., always switch off the controller power and turn off the power supply.
  - Never touch the inside of the controller.
- (7) Response to a damaged or defective Electric Hand
  - If any of the damage or defects listed below have been found, continuing use of the Electric Hand is dangerous. Immediately stop operation and contact us.

Description of damage or defect	Type of danger
Damage to machine harness or motor wiring	Electric shock, Electric Hand's erratic operation
Damage to outer components of Electric Hand	Damaged parts flying off during Electric Hand's operation
Abnormal operation of Electric Hand (position deviation, vibrations, etc.)	Electric Hand's erratic operation

- (8) Be careful to not touch hot parts of the motor or controller
  - The motor and controller will be very hot in some areas after automatic operations, and touching those areas may cause burns. For checks, etc., first cut the power to the controller, wait for the areas to cool down, confirm the cooled temperature, and then handle those areas.
- (9) Protective grounding
  - Always ground the controller to protect it against electric shock.
- (10) Pulse train input signal line
  - To prevent abnormal operation caused by noise, do not put the main circuit line and signal line in the same duct or the same bundle.
  - Do not put a relay in the cable for the pulse train input. The noise could cause erratic operation.

Remarks: The cable is 1 m long (standard accessory). More than 1 m is a specialized product.

Order model 3 m: EWHK-3W

5m: EWHK-4W

10m: EWHK-5W

# Chapter 2 System Configuration

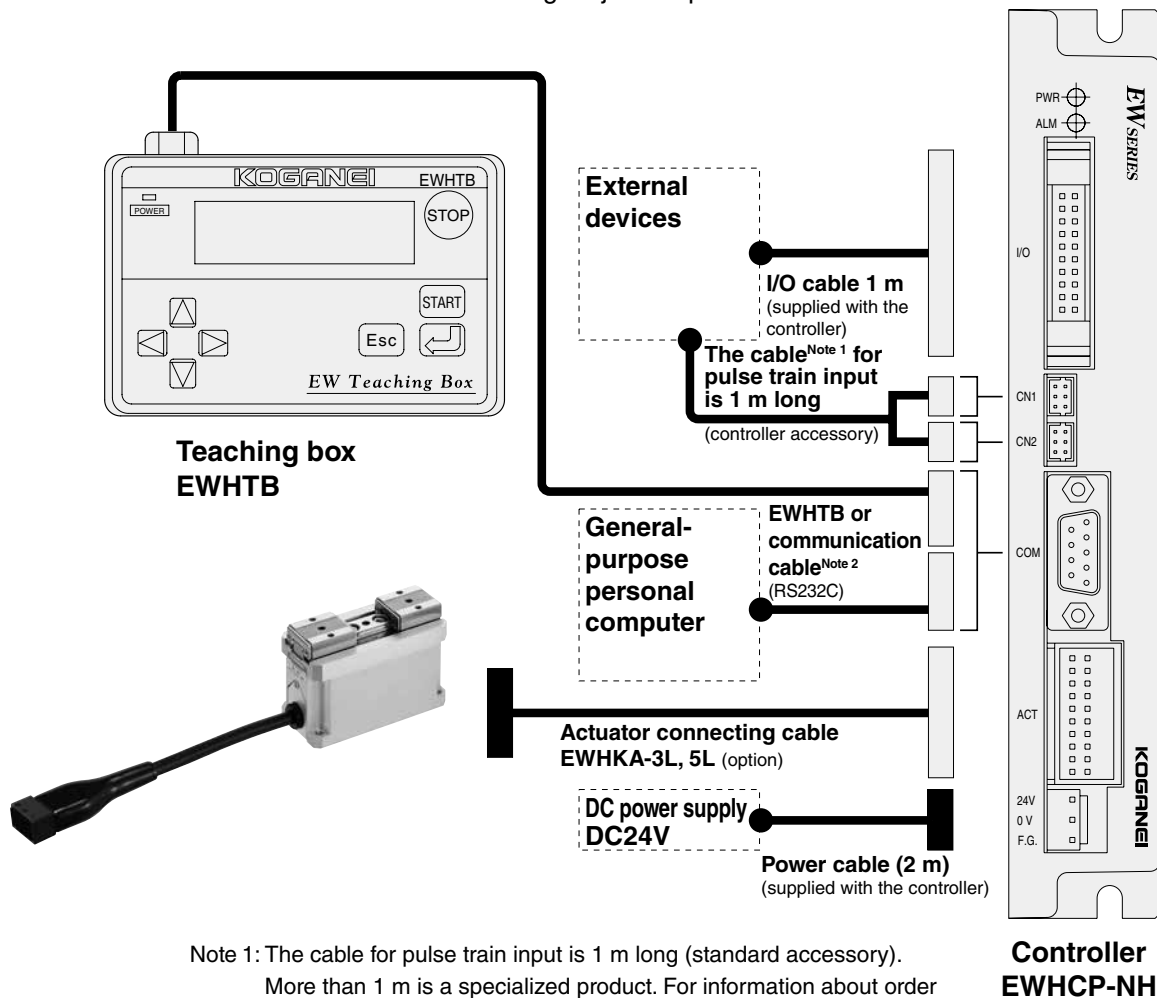
## 2-1 Overview

With the pulse train input type controller, you can control the signals to the actuator (Electric Hand) through the pulse train input from a higher-level device.

Some functions include a zone output function and a pulse train input multiplier function.

## 2-2 Entire system configuration

The Electric Hand consists of the following major components.



Note 1: The cable for pulse train input is 1 m long (standard accessory).  
More than 1 m is a specialized product. For information about order codes, see page 3.

2: RS232C cable (reference)

Specifications: D-sub 9-pin female ↔ D-sub 9-pin female, cross cable

Model: C232R-ECO915 (1.5m) / C232R-ECO930 (3m)

Manufacturer: Elecom

The communication cable must be prepared by the customer.

### [Caution]

- ① If the CN1 and CN2 connectors on the cable for the pulse train input are reversed, the rotation of the motor will reverse. Furthermore, depending on the state of parameter No. 38, it may not operate (refer to page 19). Be sure to connect CN1 to CN1, and CN2 to CN2.
- ② If the pulse train input signal is a differential line driver, then be sure to use the supplied conversion cable for the pulse train input connector. If it is not used, operation may not be possible (blue/white and blue cables connect to CN1 side and green/white and green cables connect to CN2 side).
- ③ If the pulse train input signal is an open collector, then do not use the supplied conversion cable for the pulse train input connector. Using it could reduce the service life or damage the controller.

## 2-3 Options and accessories

1. When Option -CP (with controller EWHCP-NH) is selected, the controller EWHCP-NH and the following accessories are included in the package. Please confirm at time of purchase.

Power cable	(1 pc.)
I/O cable	(1 pc.)
Cable for pulse train input	(1 pc.)
Conversion cable for pulse train input connector	(2 pc.)

2. When Option -3L or -5L (the cable connecting the Electric Hand main unit and the controller) is selected, the cable (-3L: cable length 3 m, -5L: cable length 5 m) is included in the package. Please confirm at time of purchase.

## 2-4 Setting up for operation

	Procedure	Reference section
Installation and connection	Installation	Install the main unit.
		Install the controller.
		3-2 Mounting
		4-2 Controller installation
	Connections	Connect the power supply, controller, actuator, and personal computer, teaching box, and external devices.
		4-3 Connecting the power supply
		4-4 Connecting to the actuator
		4-5 Connecting to I/O
		4-6 Connecting the pulse train input
		4-7 Communication with personal computer
Turning on the power	Turning on the power	Supply 24 VDC.
		4-3 Connecting the power supply
Settings	Setting the actuator number	*Set the actuator number for the connected model of actuator. <sup>Note</sup>
		4-7 Communication with personal computer
		4-7-5 (17)
		5-1 Setting parameters needed for minimum operations
	Changing parameters	Configure parameter data in accordance with your usage conditions.
		4-8 Parameters
		5-1 Setting parameters needed for minimum operations
Operations	Test operations	Check that operations are normal.
		5-2 Positioning mode
		5-3. Gripping mode
	Operations	Input pulse train signal from external device, such as a programmable controller.
		5-2 Positioning mode
		5-3. Gripping mode

Note: When you purchase the actuator and controller as a set, the controller's actuator number is set to the specified actuator number at the time of shipping.

Model	Actuator No.
EWHA12A	84
EWHA24A	85
EWHA36A	86
EWHA6H	87
EWHA12H	88
EWHA24H	89
EWHA36H	90

\*Be sure to set the actuator number for the connected model of actuator.

# Chapter 3 Main Unit

## 3-1 Handling the main unit

### 3-1-1 Precautions

- (1) Do not apply repeated bending or tensile force to the lead wires. Moreover, never carry the main unit by the lead wires. The wires could break.
- (2) Do not apply external force to the workpiece while the workpiece is mounted.  
Applying excessive external force could cause damage to parts.
- (3) Restrictions on operations  
The stepping motor could cause a rise in temperature under certain operating conditions.  
Use the product within the operating temperature range.  
Use of the product in conditions exceeding the operation limits could damage or burn the motor.
- (4) Operating sound  
Operating speed or workpiece conditions could cause the operating sound to be higher, but this is not a malfunction.
- (5) Use the main unit and the controller in locations where there is little dust and dirt.  
Using them in locations where there are large amounts of dirt and dust create the risk of abnormal operation.

## 3-2 Mounting

### 3-2-1 Mounting the main unit

- (1) The mounting surface must be flat. Twisting or bending during the mounting could result in defective operation or degraded performance.
- (2) Avoid scratching or denting the mounting surface of the main unit, because doing so could cause a detrimental effect on mounting accuracy.
- (3) If there is a risk of bolts loosening due to shocks or vibrations, consider taking measures to prevent them from loosening.
- (4) To secure the main unit in place, use tapped holes, or positioning holes, as described below.  
When mounting the main unit, always use screws that are shorter than the thread depth, and tighten to within the allowable torque range.

	Mounting position	Screw size	Thread depth	Maximum tightening torque
			mm	N·m
EWHA12A	Side surface	M4	4	1.50
	Bottom			
EWHA24A	Bottom		6	
EWHA36A				
EWHA6H	Side surface	M3	3	0.63
	Bottom		6	
EWHA12H	Side surface	M4	4	1.50
	Bottom		10	
EWHA24H	Side surface	M5	5	3.00
	Bottom	M4	10	1.50
EWHA36H	Side surface	M5	5	3.00
	Bottom	M4	10	1.50



### 3-2-2 Mounting a workpiece (fingers)

- (1) When mounting the workpiece (fingers), always use screws that are shorter than the thread depth.  
Using screws longer than the thread depth could prevent normal operation.
- (2) Tighten the screws for mounting the workpiece (fingers) within the allowable torque range.

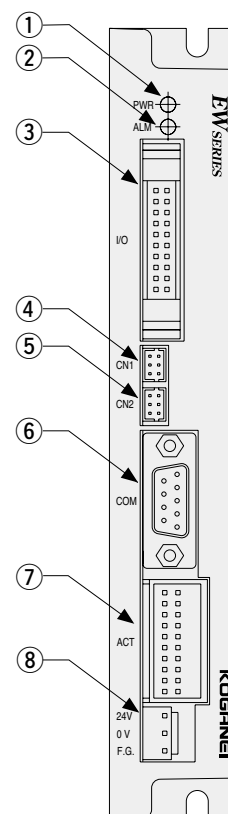
	Screw size	Thread depth	Maximum tightening torque
		mm	N·m
EWHA12A	M2.5	3	0.36
EWHA24A	M3	3	0.63
EWHA36A			
EWHA6H	M2	3	0.176
EWHA12H	M2.5	2.5	0.36
EWHA24H	M3	3.5	0.63
EWHA36H			

- (3) When mounting a workpiece, use a wrench to secure the workpiece or table, and then position the guide so it is not subject to moment.

# Chapter 4 Controller

## 4-1 Appearance and functions

- ① POWER LED  
Lights when the power supply is turned on.
- ② ALARM LED  
Shows the state of the controller. (See the table below on the right)
- ③ I/O connector  
Use the supplied I/O cable for connecting to sensor switches or an external programmable controller, etc.
- ④ CN1 connector  
Connect the supplied cable for the pulse train input and connector for input of pulse train from external device. (CCW direction pulse or code signal)
- ⑤ CN2 connector  
Connect the supplied cable for the pulse train input and connector for input of pulse train from external device. (CCW direction pulse or drive pulse)
- ⑥ COM connector  
This is the connector for connecting to the RS-232C terminal on a personal computer, or the teaching box, etc.
- ⑦ ACT connector  
This is the connector for connecting to the main unit.
- ⑧ Power connector  
Connects the supplied power cable to supply 24 VDC.



Description	ALARM LED state
Power is on	PRM43 = 0 hr, flashing/PRM43 = 1 hr, off <sup>Note 1</sup>
Origin not complete	Flashing <sup>Note 2</sup>
Normal	Off
Alarm generated	Lit
If alarm is generated or alarm reset is input → State is origin not complete	Flashing

Note 1: The ALARM LED state may change, according to parameter No. 43 (motor energizing method).

2: Flashing time is ON: 0.5 s, OFF: 1.5s.

## 4-2 Controller installation

### 4-2-1 Installation

#### (1) Installation

Use M4 screws in the 5mm U-grooves on the back of the controller to secure it to a rack that has good thermal conductivity.

#### (2) Installation environment

- Install the controller in a location with an ambient temperature of 0 to 40°C, humidity of 35 to 85%, and no condensation.
- Install the controller so there is adequate space around it (20 mm or more) with good ventilation.
- Avoid installations in locations subject to corrosive gases, such as sulfuric acid or hydrochloric acid, as well as ambient atmospheres containing flammable gases or liquids, etc.
- Install the controller where there is little dust or dirt.
- Avoid installations in locations subject to metal chips, oil, or water from other equipment.
- Avoid installations in locations subject to electromagnetic or electrostatic noises.
- Install the controller in a location that is free from large vibrations.

### 4-2-2 Grounding work

- Always ground the equipment to prevent electric shock to people if there is electric leakage and to prevent erratic operation due to electrical noise.
- We strongly recommend type D grounding (grounding resistance of 100  $\Omega$  or less) or better.
- Use the F.G. wire of the power cable, for the ground terminal of the controller.

## 4-3 Connecting the power supply

### 4-3-1 Terminal layout chart

- Connect the power cable to the power supply with a capacity of 24 VDC  $\pm$ 10% and 0.6 A or more.
- Connector: B3PS-VH (JST Mfg. Co., Ltd.)

No.	Signal name	Wire color	Description
1	24 V	Red	Power supply
2	0 V	Blue	
3	F.G.	Green	Ground

#### Caution:

- **Supply of an unstable power voltage to the controller will cause alarm shutdowns or abnormal operation. Use adequate care, therefore, in selecting a 24-V power supply. Ensure as stable a power supply as possible.**

### 4-3-2 How to connect the power supply

- Use the supplied power cable to connect to the power supply. Connect the polarity correctly to prevent mis-wiring. Wrong connections could result in fire or other dangerous conditions.

#### Caution:

- **The EWHCP-NH controller does not have a power switch and an emergency stop function. Always install an appropriate power cut-off (isolator) device for the overall system of equipment.**

#### Caution:

- **Never conduct an insulation resistance test or dielectric strength test on the controller.**

#### Danger:

- **Before wiring to the controller, always turn off the power to the overall system of equipment to avoid the danger of electric shock. There is a risk of electric shock.**

## 4-4 Connecting to the actuator

### 4-4-1 Input/output signals chart

Connect the actuator connecting cable to the ACT connector on the front of the controller. Turn off the power supply before performing the connection. Be sure that the actuator connecting cable is firmly inserted into the connector.

#### ACT

No.	Signal name	Description	No.	Signal name	Description
A1	A+	Motor output A+	B1	B+	Motor output B+
A2	A-	Motor output A-	B2	B-	Motor output B-
A3	F.G.	Frame ground	B3	N.C.	N.C.
A4	COM1 (24V)	COM 24V	B4	COM2 (24V)	COM 24V
A5	N.C.	N.C.	B5	N.C.	N.C.
A6	F.G.	Frame ground	B6	GND 5V	Ground (5V)
A7	DV+	Encoder power supply+	B7	DV-(GND 5V)	Encoder power supply-
A8	EA+	Encoder signal A+	B8	EA-	Encoder signal A-
A9	EB+	Encoder signal B+	B9	EB-	Encoder signal B-
A10	EC+	Encoder signal C+	B10	EC-	Encoder signal C-

## 4-5 Connecting to I/O

### 4-5-1 Input/output circuits

This section provides the specifications for the input/output circuits and example connections. Refer to this example when connecting to the programmable controller or other external equipment.

#### (1) Input/output circuit specifications

##### ○Input power supply

Input voltage: 24 V $\pm$ 10%

##### ○Input circuit

Isolation method: Photocoupler isolation

Input response: 30 ms or less

Input current: 5 mA/24 VDC

Input sensitivity: ON current Min. 3 mA

OFF current Max. 1 mA

##### ○Output circuit

Isolation method: Photocoupler isolation between internal circuits and output transistor

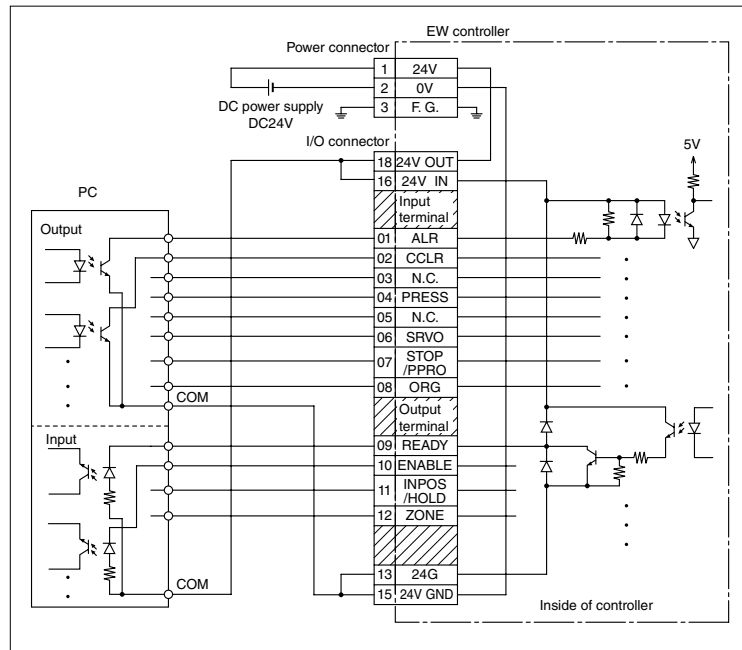
Output terminals: NPN open collector output for all output common terminals (0V side)

Output response: 1 ms or less

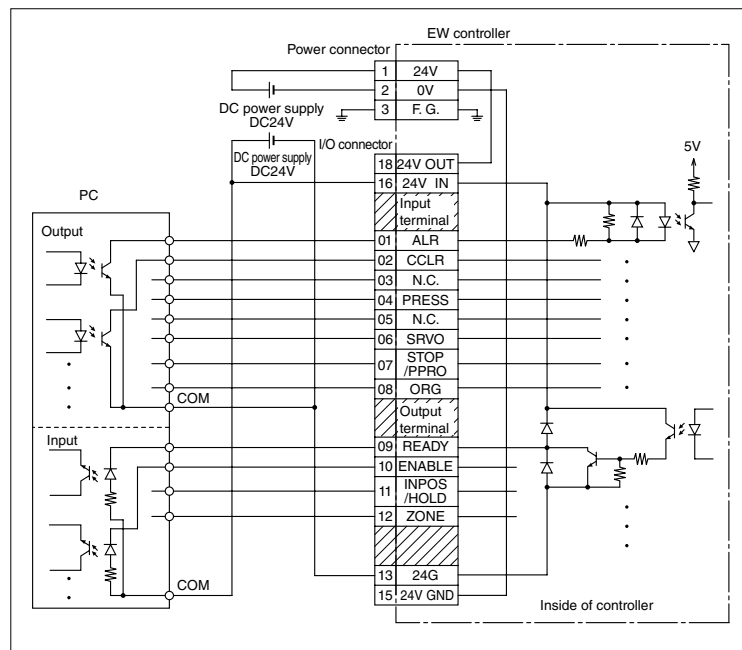
Maximum output current: 30 mA/24 VDC per 1 output

Residual ON voltage: 1.5 V or less

## (2) Wiring system when using the controller's internal power supply



## (3) Wiring method when a separate power supply is used without using the controller's internal power supply



#### 4-5-2 Input/output signals chart

I/O

No.	Color	I/O	Signal name	Description	No.	Color	I/O	Signal name	Description
01	Brown	IN	ALR	Alarm reset	02	Red	IN	CCLR	Clear counter
03	Orange	—	—	N.C.	04	Yellow	IN	PRESS	Gripping mode transition
05	Green	—	—	N.C.	06	Blue	IN	SRVO	Servo ON
07	Purple	IN	STOP/PPRO	Stop return to origin/prohibit pulse train input	08	Gray	IN	ORG	Return to origin start
09	White	OUT	READY	Preparation complete (alarm)	10	Black	OUT	ENABLE	Pulse train input reception possible
11	Brown	OUT	INPOS/HOLD	Positioning complete/ gripping operation complete	12	Red	OUT	ZONE	Zone output
13	Orange		24G	- common	14	Yellow		24G	- common
15	Green		24V GND	Ground	16	Blue	IN	24V IN	24-V input
17	Purple	—	—	N.C.	18	Gray	OUT	24V OUT	24-V output
19	White		F.G.	Frame ground	20	Black		F.G.	Frame ground

Note: Do not connect terminals that are N.C.

#### 4-5-3 Details of input signals

There are 6 dedicated command inputs as input signals. Dedicated command inputs are inputs to control from an external device, such as a programmable controller.

[Input signal details]

Pin No. 1	ALR	Alarm reset
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Explanation

This is input if an alarm occurs (READY is OFF, ALARM LED is lit). When input is received, status changes so READY turns ON and ALARM LED flashes (origin not complete). However, it is disabled if ALR is ON before the alarm occurs. It is only enabled on the rising edge of a signal. Be sure to remove the cause of the alarm before inputting.

Pin No. 2	CCLR	Clear counter
-----------	------	---------------

Explanation

When input is received, the counters (encoder count, energizing count, deviation count) in the controller is reset. However, it is disabled if CCLR is ON when the power is turned on. It is only enabled on the rising edge of a signal.

**[Note] Do not use CCLR during gripping operations (while HOLD output is ON).**

Pin No. 4	PRESS	Gripping mode transition
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**Explanation**

When input is received, the actuator transitions to the gripping mode.

For details, refer to 5-3. "Gripping mode" (page 40).

Pin No. 6	SRVO	Servo ON
-----------	------	----------

**Explanation**

When input is received, the actuator energizes. Turning on the servo turns the ENABLE signal ON and makes receiving pulse train input possible. However, it is disabled if SRVO is ON when the power is turned on. It is only enabled on the rising edge of a signal. Turning on the server clears the energizing counter and encoder counter.

Pin No. 7	STOP/PPRO	Stop return to origin/prohibit pulse train input
-----------	-----------	--

**Explanation**

The input specifications change according to the status.

Status is returning to origin: STOP

Status is something else: PPRO

**STOP**

If input is received while returning to origin, then return to origin is interrupted. The actuator de-energizes and the ALARM LED flashes. However, if ORG is input while STOP is ON, the ORG input is disabled.

**[Note] Other I/O and serial commands cannot be received while STOP is input.**

**PPRO**

When input is received, the controller prohibits pulse train input (while PPRO is ON, ENABLE is OFF and pulse train input is prohibited).

Operation is not possible while the actuator is stopped, even if PPRO is ON and pulses are input.

**[Note] Avoid using this during operations, because synchronization could be lost if PPRO is turned on while the actuator is operating.**

Pin No. 8	ORG	Return to origin start
-----------	-----	------------------------

**Explanation**

When input is received, the actuator starts returning to origin. Executes return to origin in the direction specified in parameter No. 5 Origin return direction. Completing return to origin normally turns the ENABLE signal ON and makes receiving pulse train input possible. However, it is disabled if ORG is ON when the power is turned on. It is only enabled on the rising edge of a signal.

#### 4-5-4 Details of output signals

There are 4 output signals: READY, ENABLE, INPOS/HOLD, and ZONE.

ON and OFF refer to the turning on and off of the output transistor.

[Output signal details]

Pin No. 9	READY	Preparation complete (alarm)
-----------	-------	------------------------------

Explanation

When the controller is operating normally, this output is set to ON. If an alarm is issued, this output is set to OFF and the motor is de-energized.

Pin No. 10	ENABLE	Possible to receive pulse train input
------------	--------	---------------------------------------

Explanation

If the controller can receive pulse train input, this output is turned ON, but when it is OFF the actuator does not move, even if a pulse is input.

Conditions to turn it ON are when the servo is ON or when return to origin is complete.

Conditions to turn it OFF are when returning to origin, stop return to origin/prohibit pulse train input is ON, HOLD output while in gripping mode is ON, stop movement command by Ctrl + C communication command, or an alarm occurs.

Pin No. 11	INPOS/HOLD	Positioning complete/gripping operation complete
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Explanation

The output specifications change according to the status.

Gripping mode transition PRESS input OFF state: INPOS

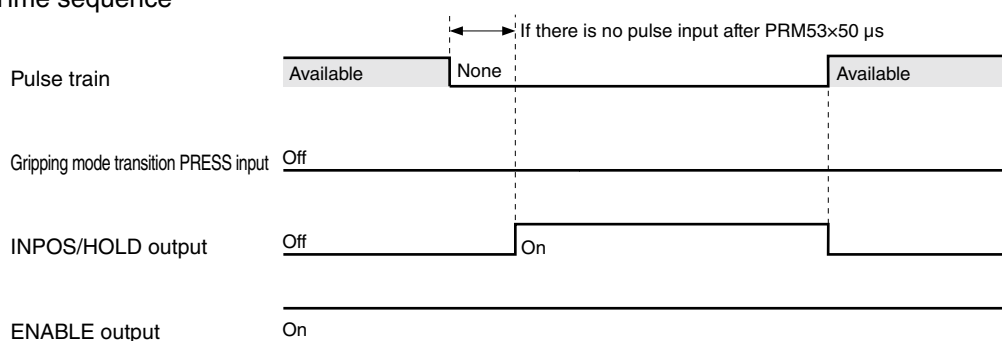
Gripping mode transition PRESS input ON state: HOLD

INPOS

INPOS output is ON if no pulse is input, during the time set for the parameter No. 53 INPOS output time, or when in positioning mode (state is gripping mode transition input OFF). The accuracy for this is  $\pm 2$  ms.

**[Note] This may turn on while moving at low speeds if parameter No. 39 (pulse train input multiplier) was increased.**

Time sequence

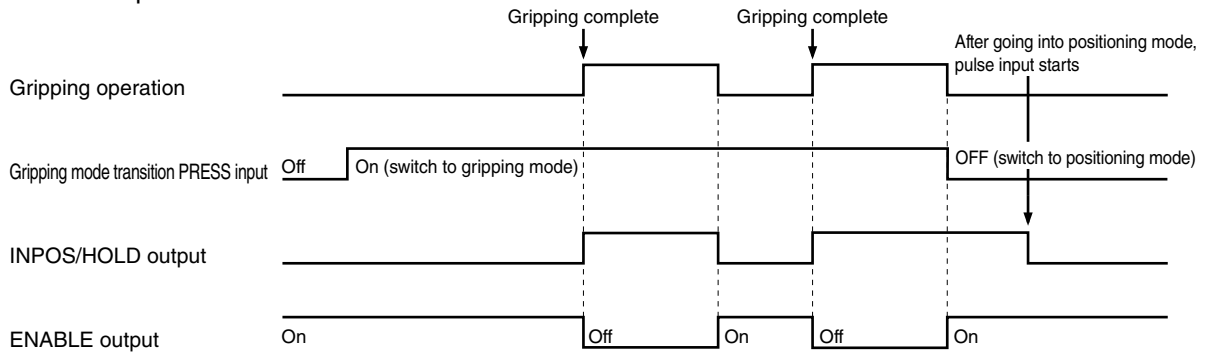




## HOLD

When in gripping mode (state is gripping mode transition input ON), HOLD turns ON according to the difference from the target deviation.

### Time sequence



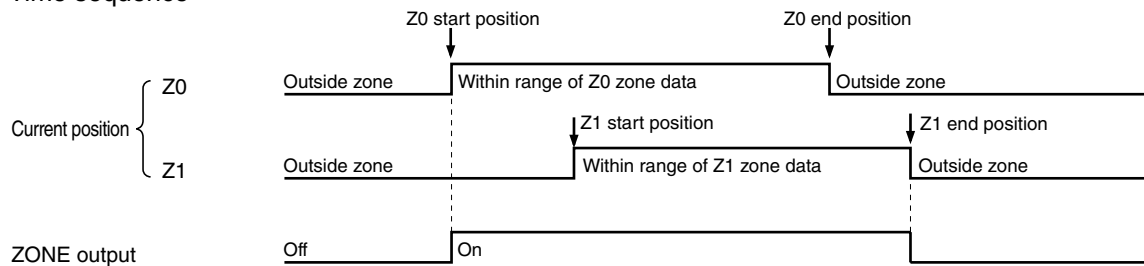
Pin No. 12	ZONE	Zone output
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### Explanation

Two points of position data are registered to the controller, when the actuator moves within the registered position data, the current position of the actuator, it is in the position data range, and ZONE output turns on.

For details, refer to 4-9 "Other functions" (page 32).

### Time sequence



## 4-6 Connecting the pulse train input

### 4-6-1 Input signals chart

CN1

No.	Wire color	Signal name	Description	No.	Wire color	Signal name	Description
1A	Blue/ white	CCW-/ PSGN- <sup>Note 2</sup>	Command pulse input - (CCW pulse/ operating direction)	1B	—	—	N.C.
2A	—	—	N.C.	2B <sup>Note 1</sup>	Blue	CCW+/ PSGN+ <sup>Note 2</sup>	Command pulse input + (CCW pulse/ operating direction)
3A <sup>Note 1</sup>	Blue	CCW+/ PSGN+ <sup>Note 2</sup>	Command pulse input + (CCW pulse/ operating direction)	3B	—	—	N.C.

CN2

No.	Wire color	Signal name	Description	No.	Wire color	Signal name	Description
1A	Green/ white	CW-/PLS- <sup>Note 2</sup>	Command pulse input - (CW pulse/ operating pulse)	1B	—	—	N.C.
2A	—	—	N.C.	2B <sup>Note 1</sup>	Green	CW+/ PLS+ <sup>Note 2</sup>	Command pulse input + (CW pulse/ operating pulse)
3A <sup>Note 1</sup>	Blue	CW+/ PLS+ <sup>Note 2</sup>	Command pulse input + (CW pulse/ operating pulse)	3B	—	—	N.C.

**[Note] Do not connect to N.C.**

Note 1: Use 3A for the differential line driver, and use 2B for the open collector.

Note 2: Signal names change depending on description of parameter No. 38 input command format.

### 4-6-2 Details of input circuits

#### ○ Input power supply

Differential line driver: Input voltage  $\pm 2.4$  to 4 V

Open collector: Input voltage  $\pm 4$  to 5.5 V

#### ○ Input specifications

Isolation method: Photocoupler isolation

Input current: 7.0 mA MAX/5.5 V

#### ○ Input signal specifications

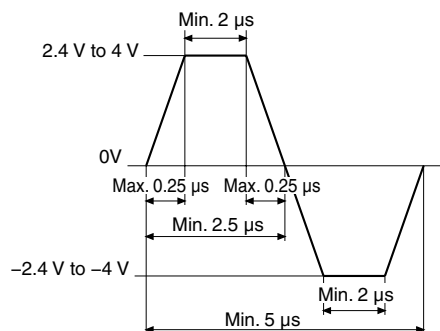
Maximum input frequency: Differential line driver 200 kpps<sup>Note</sup>

Open collector

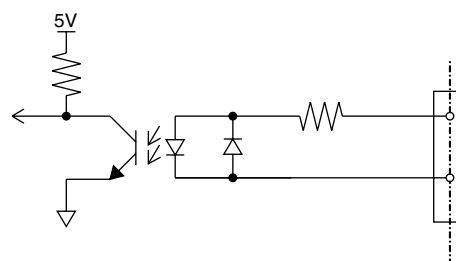
60 kpps<sup>Note</sup>

Pulse duty: 50% or less

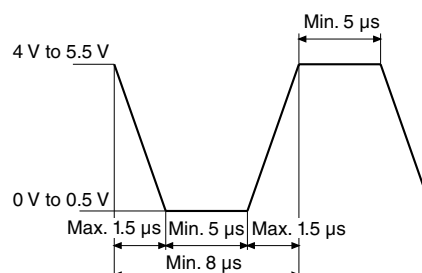
Input signal:



Differential line driver input  
signal specifications

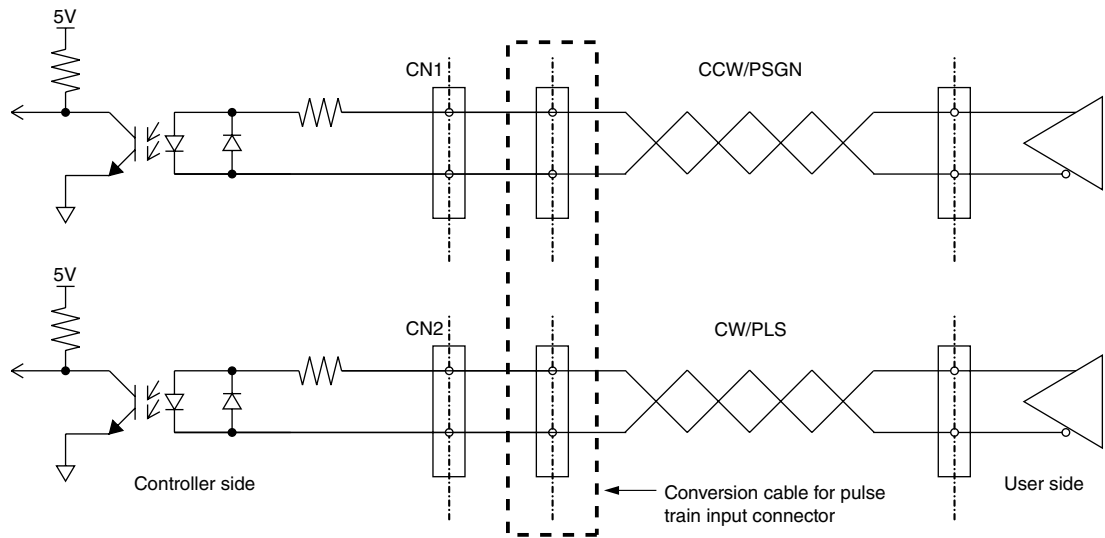


Note: Maximum input frequency is restricted by the maximum speed of the actuator. Keep it below this, according to the main unit specifications.

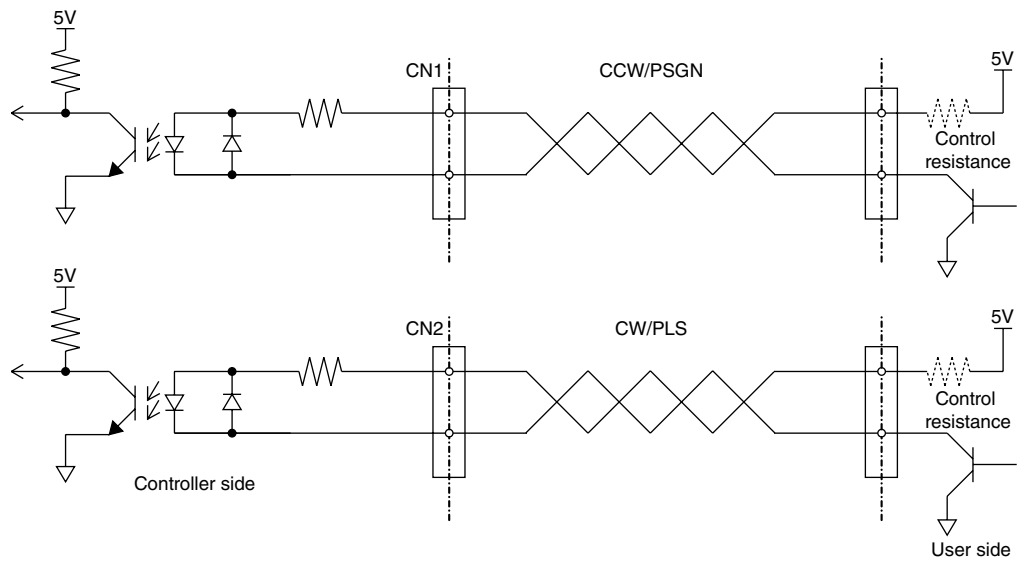


Open collector input signal  
specifications

## ○ Input circuit



Differential line driver input circuit

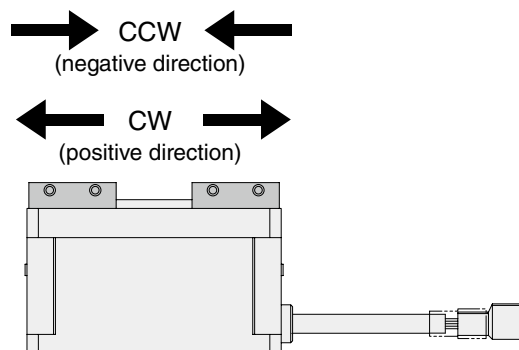


**[Note]** If voltage higher than 5.5 V is input, install a current limit resistor (10 mA or less).

Open collector input circuit

#### 4-6-3 Definitions of CW and CCW directions

The direction in which the actuator moves is defined in relation to the input pulse. Refer to the following diagrams.



#### 4-6-4 Input command format

Command pulse train format/command pulse logic (positive logic or negative logic) is selected according to the setting of parameter No. 38. The initial value is PRM38 = 1.

Command pulse train format	Positive/negative logic	PRM38 settings	Input terminal	Positive direction	Negative direction
CW/CCW method	Positive	1	CW+/CW-		
			CCW+/CCW-		
	Negative	2	CW+/CW-		
			CCW+/CCW-		
Pulse/code method	Positive	3	PLS+/PLS-		
			PSGN+/PSGN-		
	Negative	4	PLS+/PLS-		
			PSGN+/PSGN-		

## 4-7 Communication with personal computer

### 4-7-1 Communication parameter specifications

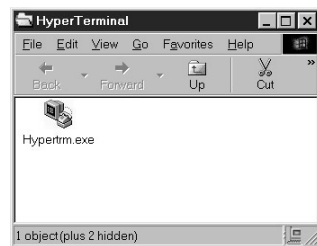
Set the communication parameter settings for a personal computer and other external equipment in the following manner. For the setting methods, see the User's Manual for each machine.

■ Transmission rate	9600 bps
■ Data bit length	8 bits
■ Stop bit length	1 bit
■ Parity check	On
■ Parity setting, Odd parity	(ODD)
■ Control method	XON/XOFF software control method
(X parameter)	(Effective)
■ Communication method	Full duplex
■ Synchronous method	Asynchronous method
■ Return key transmission	CR/LF code
■ CR code reception	For CR/LF reception    Return + line feed CR reception            Return

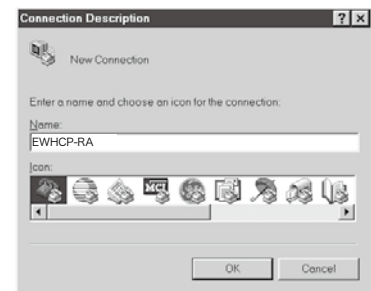
Setting method for Hyperterminal, as standard with Windows 95\* and later

\*Windows is the registered trademark of the U.S. Microsoft Corp.

1. Double-click on Hyperterm.exe.



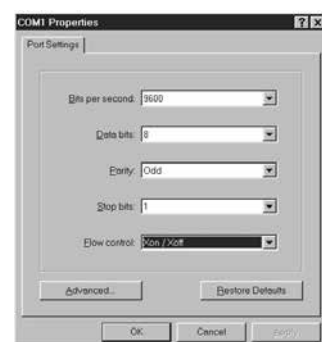
2. Enter name, select icon and click "OK."



3. For the connection method, select "Direct to Com1" and click "OK."



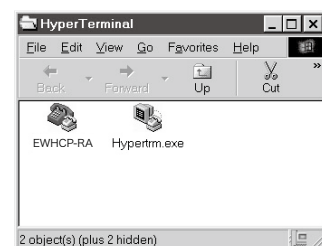
4. Set the port and click "OK."



5. Click the "File," "Properties," and select "ASCII Setup," and then add a check mark as shown in the figure at right, and click "OK."



6. When starting up for the second time or later, double-click on the icon of the newly created file.



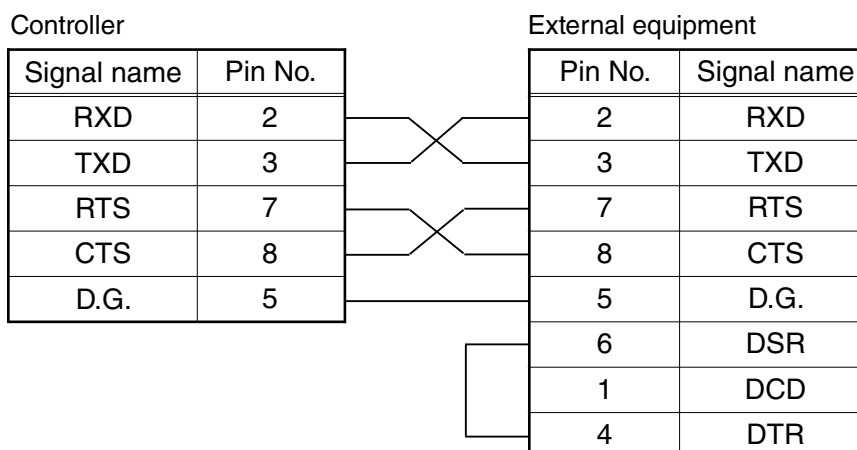
Note: When saving files on Windows XP and later, first shut down Hyperterminal, and then save the file.

### 4-7-2 Communication cable

Applicable connector model

Applicable connector part No. : XM2D-0901 (OMRON-made) or equivalent products

Applicable connector cover part No.: XM2S-0911 (OMRON-made) or equivalent products



### 4-7-3 Format of communication commands

To facilitate easy communication with external equipment, communication commands are as standard.

Communication commands are divided into the following 4 categories.

1. Robot language
2. Data handling
3. Utilities
4. Special codes

With the exception of the special codes, the format for communication commands is as follows.

@<Operation code>[<Operand 1>][,<Operand 2>][,<Operand 3>][,<Operand 4>]c/r l/f

- Basically, communication commands are executed by sending 1 line that begins with the start code '@' (=40H) and ends with the code c/r (=0DH) l/f (=0AH) to the controller. The special codes, however, do not require the start code and c/r l/f.
- Communication commands are composed of operation codes and operands. Depending on the command, either no operand is used or up to a maximum of 4 operands are used.  
The brackets [ ] refer to items that can be omitted.
- The character codes used are the JIS8 level codes (ASCII codes with katakana characters added). Input characters can be either capital letters or lower case letters.
- At least 1 space must be inserted between the operation code and the operand.
- Items with the < > mark (angle brackets) in the operand should be specified by the user. Check the details of each communication command, and enter appropriate data (refer to (4-7-4 "List of communication commands" (page 22)).
- When entering 2 or more operands, insert a comma (,) between them.

## 4-7-4 List of communication commands

Classification	Command	Operand 1	Operand 2	Command description
Actuator operation	@ORG	–	–	Returns to origin
	@SRVO	0: Energizing OFF 1: Energizing ON	–	Motor energizing ON/OFF
	@PRESS	0: Positioning mode 1: Gripping mode	–	Switches positioning/gripping mode
	@?PRS	–	–	Checks positioning/gripping mode
	@ALR	–	–	Alarm reset
	@CCLR	–	–	Counter reset
Data handling	@?PRM	0 to 63 (Parameter No.)	–	Reads parameters
	@?Z	0 to 3 (Zone position data No.)	–	Reads zone position data
	@?POS	–	–	Reads current position
	@?ORG	–	–	Confirms return to origin complete
	@?SRVO	–	–	Confirms motor energized state
	@?VER	–	–	Confirms version
	@?ERR	–	–	Error history display
	@READ	ZON	–	Reads all zone position data
		PRM	–	Reads all parameters
		DIO	–	Reads I/O states
		ERR	–	Reads all error history
	@WRITE	ZON	–	Reads zone position data
		PRM	–	Writes parameters
	@ZDEL	0 to 3 (start No.)	Maximum 4 (number of points)	Deletes zone position data
Utilities	@INIT	ZON	–	Initializes zone position data
		PRM	84 to 90 (Number of actuators being initialized)	Parameter initialization
		ERR	–	Initializes error history
		ORG	–	Initializes origin position data

Classification	Functions	Code	Command description
Special codes	Stop return to origin/ prohibit pulse train input	^C(=03H)	<ul style="list-style-type: none"> <li>•Interrupts return to origin while returning to origin.</li> <li>•In other conditions, pulse train input is prohibited and the actuator does not move. Switches between “Prohibit pulse train input” <math>\longleftrightarrow</math> “Allow pulse train input” for every transmission.</li> </ul>
	End data transmission	^Z(=1AH)	Notifies controller that data transmission of WRITE command has ended.

Classification	Response	Description
Response from controller	OK	Normal completion of operation
	NG	Error generated Contents of error at next line (within 20 characters)
	STOP	Stop operating Reason for stop at next line (within 20 characters)
	READY	Completion of writing preparation

## 4-7-5 Details of communication commands

(1) **@ORG**

Function	Return to origin.
Format	@ORG c/r l/f
Transmission example	@ORG c/r l/f
Response	OK c/r l/f

(2) **@SRVO**

Function	Specification either for energizing the motor, or for de-energizing the motor.
Format	@SRVO switch c/r l/f

0: Frees the motor.  
 1: Energizes the motor.

Transmission example	@SRVO 1 c/r l/f
Response	OK c/r l/f

(3) **@?VER**

Function	Checks the controller software version number.
Format	@? VER c/r l/f
Transmission example	@? VER c/r l/f
Response	1.00 c/r l/f OK c/r l/f

(4) **@?POS**

Function	Reads the current position.
Format	@? POS c/r l/f
Transmission example	@? POS c/r l/f
Response	5.67 c/r l/f OK c/r l/f

(5) **@?PRM**

Function	Reads the specified parameter.
Format	@? PRM parameter no. c/r l/f
Transmission example	@? PRM 5 c/r l/f
Response	1 c/r l/f OK c/r l/f

(6) **@? Z**

Function	Reads the specified zone position data.
Format	@? Z zone position data No. c/r l/f
Transmission example	@? Z 3 c/r l/f
Response	Z3 = 0.00, 5.00 c/r l/f OK c/r l/f

(7) **@? ORG**

Function	Confirms whether return to origin has been completed or not.
Format	@? ORG c/r l/f
Transmission example	@? ORG c/r l/f
Response 1	0 c/r l/f ···· Return to origin not completed OK c/r l/f
Response 2	1 c/r l/f ···· Return to origin completed OK c/r l/f



**(8) @?SRVO**

Function	Can confirm the motor energized state.
Format	@? SRVO c/r l/f
Transmission example	@? SRVO c/r l/f
Response 1	0 c/r l/f ······De-energized state OK c/r l/f
Response 2	1 c/r l/f ······ Energized state OK c/r l/f

**(9) @READ ZON**

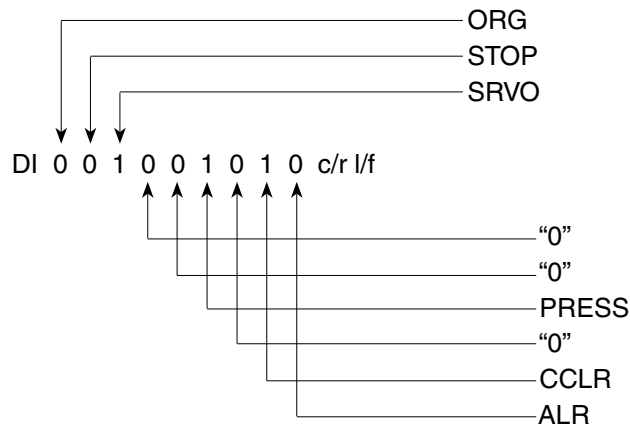
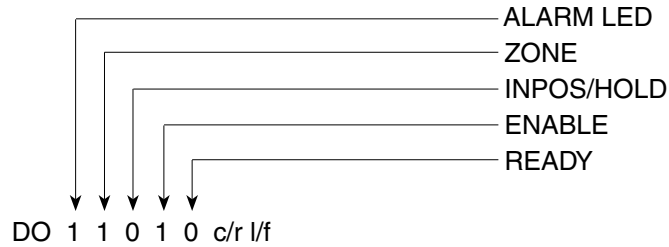
Function	Reads all zone position data.
Format	@READ ZON c/r l/f
Transmission example	@READ ZON c/r l/f
Response	Z0 = 5.00, 7.00 c/r l/f Z3 = -5.00, -7.00 c/r l/f ^Z OK c/r l/f

**(10) @READ PRM**

Function	Reads all parameter data.
Format	@READ PRM c/r l/f
Transmission example	@READ PRM c/r l/f
Response	PRM0 = 84 c/r l/f PRM1 = 0 c/r l/f PRM2 = 0 c/r l/f PRM3 = 14000 c/r l/f : PRM63 = 1 c/r l/f ^Z OK c/r l/f

**(11) @READ DIO**

Function Reads custom input/output status.  
 Format @READ DIO c/r l/f  
 Transmission example @READ DIO c/r l/f  
 Response



OK c/r l/f

**(12) @READ ERR**

Function Reads error history records. (Up to the latest 16 records. The latest record is added to the bottom line.)  
 Format @READ ERR c/r l/f  
 Transmission example @READ ERR c/r l/f  
 Response

32: Origin return not completed c/r l/f  
 01: Overload c/r l/f  
 03: Overheat c/r l/f  
 OK c/r l/f

**(13) @WRITE ZON**

Function Writes zone position data.  
 Format @WRITE ZON c/r l/f  
 Transmission example

Personal computer side	Controller side
@WRITE ZON c/r l/f	
	READY c/r l/f
Z0 = 2, 3 c/r l/f	
Z1=-1.00, -2.00 c/r l/f	
:	
Z3 = 6.50, 7.00 c/r l/f	
^Z	
	OK c/r l/f

**(14) @WRITE PRM**

Function	Writes parameter data.	
Format	@WRITE PRM c/r l/f	
Transmission example	Personal computer side	Controller side
	@WRITE PRM c/r l/f	READY c/r l/f
	PRM5 = 1 c/r l/f	
	PRM10 = 3 c/r l/f	
	:	
	PRM38 = 2 c/r l/f	
	^Z	OK c/r l/f
	Sends only data that requires changes.	

**(15) @ZDEL**

Function	Deletes zone position data.
Format	@ZDEL, start no., number to delete c/r l/f
Transmission example	@ZDEL 0, 2 c/r l/f
Response	OK c/r l/f
Explanation	Zone position data maximum is 3. Specifications cannot exceed this.

**(16) @INIT ZON**

Function	Initializes (deletes) the zone position data.
Format	@INIT ZON c/r l/f
Transmission example	@INIT ZON c/r l/f
Response	OK c/r l/f

**(17) @INIT PRM**

Function	Initializes parameters.
Format	@INIT PRM actuator No. c/r l/f
Transmission example	@INIT PRM 84 c/r l/f
Response	OK c/r l/f
Explanation	Check the actuator No. on the actuator unit, and then initialize the parameters. @When executing INIT PRM, the origin position data is also initialized.

Format	Actuator No.
EWHA12A	84
EWHA24A	85
EWHA36A	86
EWHA6H	87
EWHA12H	88
EWHA24H	89
EWHA36H	90

If the actuator No. changes due to initialization of parameters, then also initialize zone position data (@INIT ZON).

**(18) @INIT ERR**

Function	Deletes all error history.
Format	@INIT ERR c/r l/f
Transmission example	@INIT ERR c/r l/f
Response	OK c/r l/f

**(19) @INIT ORG**

Function	Initializes the origin position data. Execute this command when the actuator unit was replaced during use.
Format	@INIT ORG c/r l/f
Transmission example	@INIT ORG c/r l/f
Response	OK c/r l/f
Explanation	This must be executed if the actuator changes.

**(20) @PRESS**

Function	Turns grip operation ON (executed)/OFF (not executed).
Format	@PRESS command value c/r l/f
	<div style="display: flex; align-items: center;"> <div style="border-top: 1px solid black; width: 100px; margin-right: 10px;"></div> <div style="text-align: center;">↑</div> <div> 0: OFF (Do not execute grip)  1: ON (Execute grip) </div> </div>
Transmission example	@PRESS 1 c/r l/f
Response	OK c/r l/f

**(21) @?PRS**

Function	Confirms pushing state.
Format	@? PRS c/r l/f
Transmission example	@? PRS c/r l/f
Response 1	0 c/r l/f .....I/O PRESS is OFF, when transmitting @PRESS=0 in transmission state, press operation is OFF. (Positioning mode) OK c/r l/f
Response 2	1 c/r l/f .....I/O PRESS is ON, when transmitting @PRESS=0 in transmission state, press operation is ON. (Pushing mode) OK c/r l/f
Response 3	2 c/r l/f .....I/O PRESS is OFF, when transmitting @PRESS=1 in transmission state, press operation is ON. (Pushing mode) OK c/r l/f
Response 4	3 c/r l/f .....I/O PRESS is ON, when transmitting @PRESS=1 in transmission state, press operation is ON. (Pushing mode) OK c/r l/f

**(22) @?ERR**

Function	Reads latest error history records.
Format	@? ERR c/r l/f
Transmission example	@? ERR c/r l/f
Response	32: Origin return not complete c/r l/f OK c/r l/f

**(23) @CCLR**

Function	Clears motor energizing counter and encoder counter, and eliminates deviation.
Format	@CCLR c/r l/f
Transmission example	@CCLR c/r l/f
Response	OK c/r l/f

(24) **@ALR**

Function	Clears alarms.
Format	@ALR c/r l/f
Transmission example	@ALR c/r l/f
Response	OK c/r l/f

## 4-8 Parameters

The controller does not have any potentiometer, dip switches, or any other hardware adjustment mechanism.

Instead, it uses parameters that can easily be set through a personal computer.

The following describes how to change and set the parameters, and gives details of each parameter.

### Safety

Because software is used to detect motor overload and other abnormalities, the controller parameters must be set correctly to match the connected actuator.

When the controller was shipped with the actuator as a set, the controller parameters had already been initialized to match the then shipped actuator, but in any case other than that, first set the actuator No. in accordance with the actuator being used, before operating the controller (See P. 6) If any problem is found, please contact us.

### Caution:

**Do not carelessly change any parameters that have not been explained in this manual. Doing so could cause fatal problems in the actuator or the controller.**

### 4-8-1 Parameter setting method

Parameter editing is performed via the RS232C port on the personal computer. For communication parameters and cable specifications, see section "4-7 Communication with a personal computer" on P. 20. The editing of parameters is carried out by using general-purpose communication software, dedicated support software, or the teaching box.

For how to use the support software, see the separately available support software User's Manual.

For how to use the teaching box, see the separately available teaching box User's Manual.

### Parameter edit commands

#### @WRITE PRM

Function	Writes parameters.	
Format	@WRITE PRM c/r l/f	
Transmission example	Personal computer side	Controller side
	@WRITE PRM c/r l/f	
		READY c/r l/f
	PRM5 = 1 c/r l/f	
	PRM10 = 3 c/r l/f	
	^Z	
		OK c/r l/f
	Sends only data that requires changes.	

After editing, read and check the parameter data.

#### @READ PRM

Function	Reads all parameter data.
Format	@READ PRM c/r l/f
Transmission example	@READ PRM c/r l/f
Response	PRM0 = 84 c/r l/f
	PRM1 = 0 c/r l/f
	PRM2 = 0 c/r l/f
	•
	•
	PRM63 = 1 c/r l/f
	OK c/r l/f

## 4-8-2 List of parameters

No.	Name	Input range	Initial value						
0	Actuator No.	84 to 90	84	85	86	87	88	89	90
5	Origin return direction	0: Opening side, 1: Closing side	0	0	0	0	0	0	0
10	Origin return speed	1 - 15 (mm/s)	5	5	5	5	5	5	5
22	Switch between English and Japanese	0: English, 1: Japanese	1	1	1	1	1	1	1
35	Origin shift distance	-32768 to 32767 ( $\times 0.01$ mm)	0	0	0	0	0	0	0
36	Origin shift speed	1 - 15 (mm/s)	5	5	5	5	5	5	5
37	Gripping force	1 to 10	10	10	10	10	10	10	10
38	Input command format	1: Pulse train CW/CCW (positive logic) 2: Pulse train CW/CCW (negative logic) 3: Pulse/code (positive logic) 4: Pulse/code (negative logic)	1	1	1	1	1	1	1
39	Pulse train input multiplier	1 to 8	1	1	1	1	1	1	1
43	Motor energizing method	0: When the power is turned on, motor energizing is OFF 1: When the power is turned on, motor energizing is ON	0	0	0	0	0	0	0
53	Time to output INPOS	100 - 1999 ( $\times 50\mu\text{s}$ )	1000	1000	1000	1000	1000	1000	1000

## 4-8-3 Details of parameters

- PRM0 : Actuator No.  
Displays the actuator No. This parameter is only for reading.
- PRM5 : Origin return direction  
Sets the origin return direction. Selecting 0 sets the origin return on the opening side, and selecting 1 sets the origin return on the closing side.  
Input range 0, 1  
Meaning 0: Opening side 1: Closing side  
Initial value 0
- PRM10 : Origin return speed  
Sets the speed when returning to origin. The speed is set for one side of the moving part.  
Input range 1 to 15 (mm/s)  
Initial value 5
- PRM22 : Switch between English and Japanese  
Sets the language used for response messages in communications.  
Input range 0, 1  
Meaning 0: English 1: Japanese  
Initial value 1
- PRM35 : Origin shift distance  
Sets the virtual origin. Always execute return to origin after setting it. When executing return to origin, the product temporarily returns to its mechanical origin and then moves the distance set for the origin shift position to complete return to origin. And, that position becomes 0. For example, if an accidental position deviation occurred, it is ordinarily necessary to re-teach all point data. However, by setting the amount of deviation as this parameter, a quick recovery is possible without taking the time to re-teach.  
Input range -32768 to 32767 ( $\times 0.01$  mm)  
Initial value 0

- PRM36 : Origin shift speed  
Sets the speed for origin shift. The speed is set for one side of the moving part.  
Input range 1 to 15 (mm/s)  
Initial value 5
- PRM37 : Gripping force  
Set the gripping force for gripping mode.  
Input range 1 to 10  
Initial value 10
- PRM38 : Input command format(refer to section 4-6-4 (P. 19))  
Set the format of the command pulse train.  
Input range 1 to 4  
Initial value 1
- PRM39 : Pulse train input multiplier  
Set the multiplier of the pulse train input.  
Input range 1 to 8  
Initial value 1
- PRM43 : Motor energizing method  
Set whether to energize motor when power is turned on.  
When "1" is set, the servo is automatically turned ON when the power is turned on.  
Namely, pulse train input can be received.  
Input range 0, 1  
Meaning 0: When the power is turned on, motor energizing is OFF  
1: When the power is turned on, motor energizing is ON  
Initial value 0
- PRM53 : Time to output INPOS  
Set the time to output INPOS for when positioning completed is output.  
INPOS output is output if after pulse train input stops there is no pulse input again after the time set in PRM53.  
Input range 100 to 1999 ( $\times 50\mu\text{s}$ )  
Initial value 1000 (50 ms)  
**[Note] The accuracy is  $\pm 2$  ms.**



## 4-9 Other functions

### 4-9-1 Zone output function

#### Functions

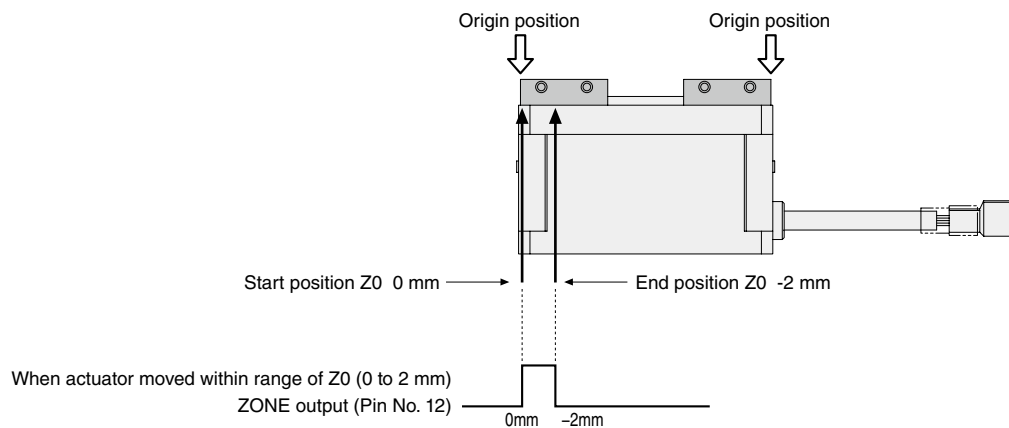
Two points of position data are registered to the controller, when the actuator is moved, the ZONE output is ON while the actuator is within the range of the position data.

You can set a maximum of 4 locations (Z0 to Z3) for zone range.

Model	Actuator No.	Zone setting range
EWHA12A	84	$\pm 7$ mm
EWHA24A	85	$\pm 10$ mm
EWHA36A	86	$\pm 10$ mm
EWHA6H	87	$\pm 7$ mm
EWHA12H	88	$\pm 11$ mm
EWHA24H	89	$\pm 13$ mm
EWHA36H	90	$\pm 13$ mm

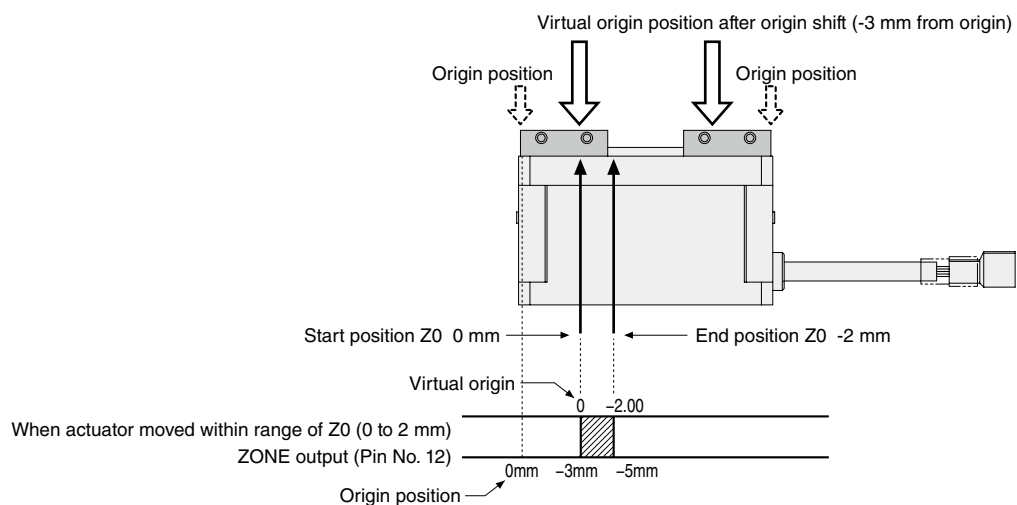
(Example) When Z0 (start position 0 mm, end position -2 mm) are set as the zone range.

Z0 = 0.00, -2.00



The following shows when the origin shift is (-3.00 [mm]).

After origin shift is done the virtual origin position becomes the reference.



## Setting method

### Zone position data

The zone position data is enabled at the point “@WRITE ZON (writing zone position data)” (P.25) is received and “READY” is returned. Disabled when “@” is input.

### Format

Z <zone position data No.> = <start position>, <end position> <c/r l/f>

\* Input ^ (Control-) Z [EOF] to end.

### Regulations

- (1) The zone position data No. continues after ‘Z’ (lowercase letters acceptable) Numbers are 0 to 3.
- (2) Next, continues with ‘=’.
- (3) <Start position>: Start position of zone output. 2 digits after decimal point, after which is ignored.
- (4) The next data is delimited by “(2CH)”.
- (5) <End position>: End position of zone output. 2 digits after decimal point, after which is ignored.
- (6) Finally, continues with <c/r l/f>

**[Note] The input of start position and end position is determined as “Start position < End position (absolute value)”.** Because of this, the position near the origin becomes the start position. Furthermore, to straddle the origin (0.00), you need to set 2 sets of zone data.

**(Example) To turn ZONE output ON for a range from -5.00 mm to 5.00 mm**

**Z0 = 0.00, 5.00**

**Z1 = 0.00, -5.00**

### **[Note] Omission of data**

**The final “0” after the decimal point for the start position and end position can be omitted. Also, if the final digits are 00, then they can be omitted to the decimal point.**

### Transmission example

@WRITE ZON c/r l/f READY after receiving

(Example 1)

Zone position data No. = 0, start position = 1.0 mm, end position = 2.0 mm

Z0 = 1.0, 2.0 c/r l/f

(Example 2)

Zone position data No. = 3, start position = 5.25 mm, end position = 7 mm

Z3 = 5.25, 7 c/r l/f

### Response

^ (Control-) Z [EOF] (write mode ends) after writing,

OK c/r l/f

**[Note] Zone output judgment is by the zone setting values to the absolute pulse count. Note that the pulse count is determined by rounding down the last digit.**

**(Example) For EWHA12A, parameter No.39=1, the number of pulses is for a movement of 1 mm.**

$$\begin{aligned} \text{Pulse count} &= \text{amount of movement} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\ &= 1 [\text{mm}] \div (1.05\pi [\text{mm}]/3072[\text{p}]) \div 1 \\ &\doteq 931.2 \text{ (refer to chapter 5, 5-1 ③ (P. 34) for details on pulse counts)} \end{aligned}$$

**When set so Z0 = 0.00, 1.00, then ZONE output is ON while pulse is 0 to 931.**

# Chapter 5 Operations

## 5-1 Setting parameters needed for minimum operations

Refer to 4-8-1 “Parameter setting method” (P. 29) regarding how to set parameters.

### ① Setting the actuator number

When the controller is turned on for the first time, or when the actuator is replaced, set the actuator No. using the number in the below table in accordance with the actuator model.

Actuator setting method (use either of the following methods for the setting.)

1. Use communication command @ INIT PRM (refer to P. 26).
2. Use the teaching box in the support software to initialize parameters

(For details, see the various owner's manuals).

However, when you purchase the actuator and controller as a set, they are set in advance according to the actuator number when shipped, so settings are not needed.

Model	Actuator No.
EWHA12A	84
EWHA24A	85
EWHA36A	86
EWHA6H	87
EWHA12H	88
EWHA24H	89
EWHA36H	90

**[Note] Be sure to set the actuator number for the connected model of actuator.**

### ② Parameter No. 38: Input command format

Refer to 4-6-4 “Input command format” (P. 19) to set 1 - 4.

The initial value is “1”.

- |                      |                |
|----------------------|----------------|
| 1: CW/CCW method     | Positive logic |
| 2: CW/CCW method     | Negative logic |
| 3: Pulse/code method | Positive logic |
| 4: Pulse/code method | Negative logic |

### ③ Parameter No. 39: Pulse train input multiplier

The number of pulses that are actually input are calculated by the controller, where they can be converted to the amount of movement per pulse according to the multiplier. The initial value is “1”.

- |      |      |
|------|------|
| 1:1x | 5:5x |
| 2:2x | 6:6x |
| 3:3x | 7:7x |
| 4:4x | 8:8x |

Model	Actuator No.	Movement for 1 pulse (PRM39 = 1) [mm]
EWHA12A	84	1.05 $\pi$ mm/3072p
EWHA24A	85	$\frac{27}{56}$ $\pi$ mm/3072p
EWHA36A	86	0.35 $\pi$ mm/3072p
EWHA6H	87	$\frac{15}{7}$ $\pi$ mm/3072p
EWHA12H	88	$\frac{8}{3}$ $\pi$ mm/12800p
EWHA24H	89	$\frac{4}{3}$ $\pi$ mm/12800p
EWHA36H	90	$\frac{7}{8}$ $\pi$ mm/12800p

Remarks:  $1.05 \pi \text{ mm} / \frac{27}{56} \pi \text{ mm} / 0.35 \pi \text{ mm}$  are how much the actuator is moved by 1 rotation of the motor, 3072p means the number of pulses to turn the motor 1 rotation.

(Example) For actuator model EWHA12A, parameter No. 39 = 1,

the number of pulses to move 7 [mm] is:

$$\begin{aligned} \text{Pulse count} &= \text{Amount of movement} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\ &= 7 [\text{mm}] \div (1.05 \pi [\text{mm}] / 3072 [\text{p}]) \div 1 \\ &= 6518.9 [\text{p}] \\ &\div 6519 [\text{p}] \end{aligned}$$

④ Parameter No.43: Motor energizing method

To use only the pulse train input function, without using an external device's I/O input/output, set "1."

0: When the power is turned on, motor energizing is OFF

1: When the power is turned on, motor energizing is ON

If 0 is set, then when the motor is turned on, motor energizing is OFF, READY is ON, ENABLE is OFF, and pulse train input cannot be received. Turning the servo ON or returning to origin makes receiving pulse train input possible. Servo ON and return to origin can be done by I/O input/output.

If 1 is set, when the power is turned on the motor energizes, and pulse train input is possible. When the power is turned on, the position where the actuator is stopped is the origin. Set return to origin, etc., to be done by pulse train input.

(I/O input/output: Input 6 points and output 4 points can be used.)

⑤ Parameter No. 37: Gripping force

Set only when using gripping mode.

Set the gripping force for gripping mode.

Set value: Level 1 - 10

(For the thrust at each gripping level, refer to chapter 9 (P. 55))

Regarding other parameters, see 4-8 "Parameters" (P. 29).

## 5-2 Positioning mode

### 5-2-1 Overview of positioning mode

The actuator moves according to the pulse train input from the higher-level device.

[Movement per 1 pulse]

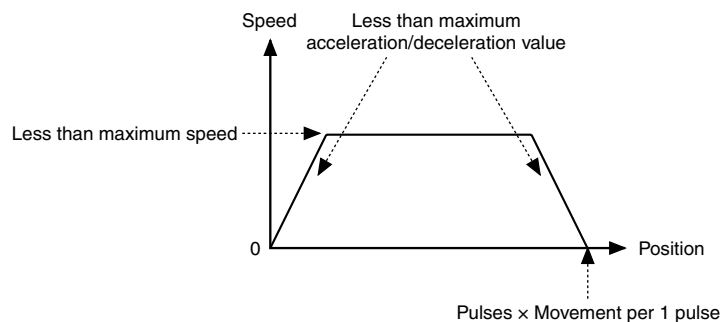
This is “Movement of each actuator per 1 pulse” × “Pulse train input multiplier of parameter No. 39”

[Speed, acceleration/deceleration, startup speed]

For controls, refer to 5-2-3 “Maximum speed, acceleration/deceleration maximum values” (P. 39).

Do operations from a startup speed of 0 [mm/s].

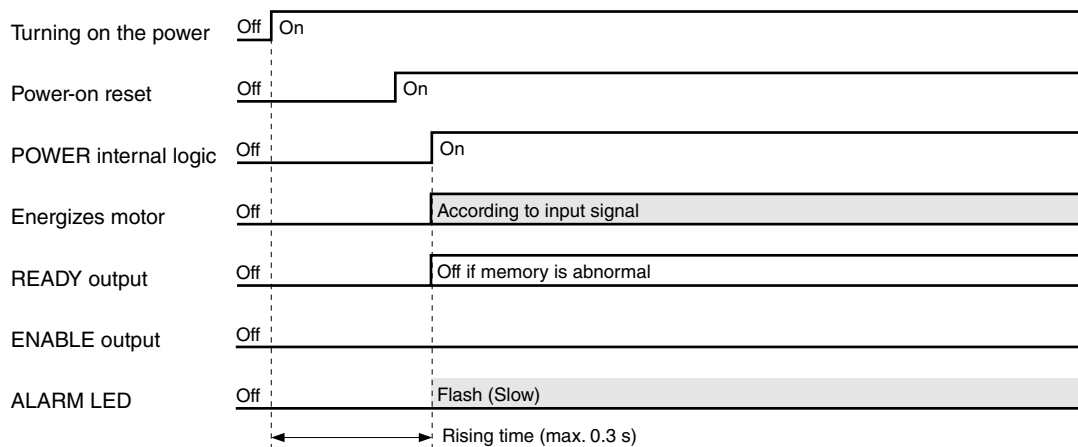
[Operation pattern]



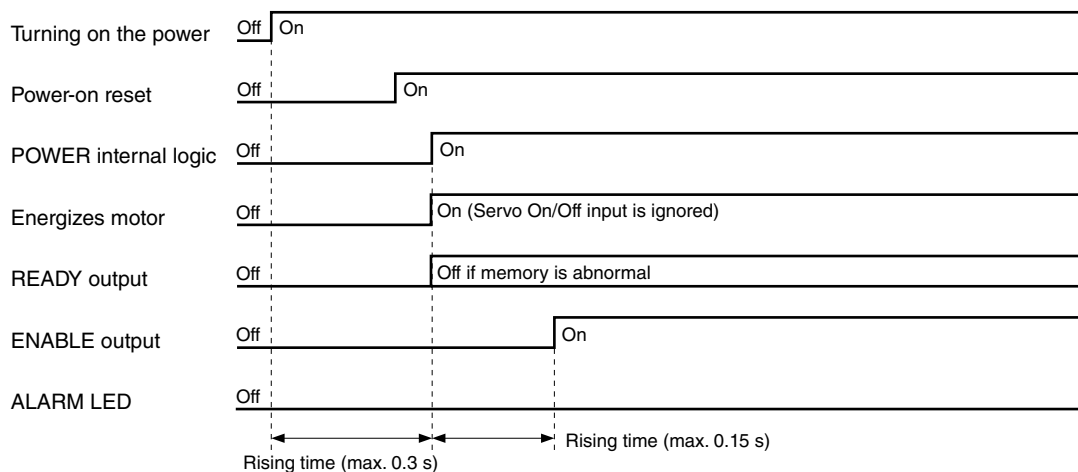
### 5-2-2 Time sequence

(1) When the power is turned on

#### ● When the power is turned on (**PRM43=0**)



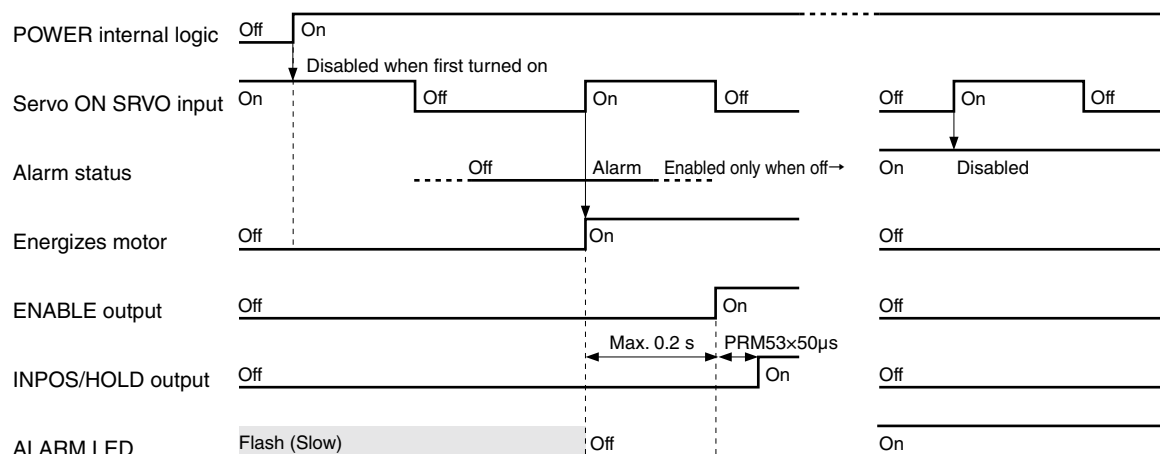
#### ● When the power is turned on (**PRM43=1**)



If parameter NO. 43 (motor energizing method) is 0, before inputting an input command, check that the READY output is turned ON after the power has been supplied.

If parameter No. 43 (motor energizing method) is 1, when the power is turned on the motor energizes, and pulse train input is possible. If READY output is OFF, even after the specified time has elapsed after the power is turned on, it means that an alarm has occurred.

## (2) Servo ON

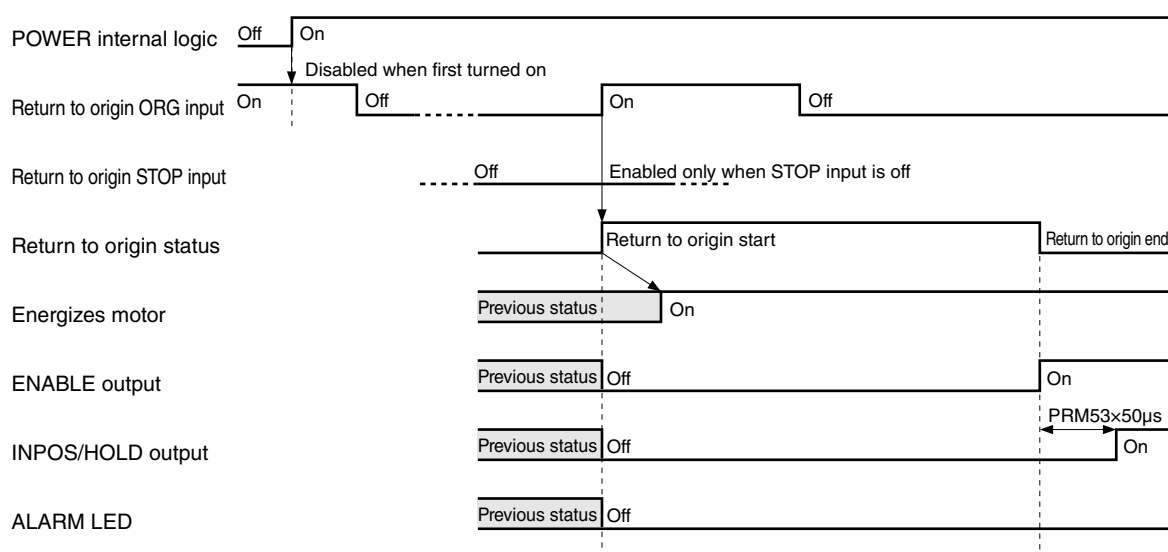


Power is turned on, then after the specified time (0.3 s), SRVO is input. The motor energizes, the ENABLE output turns ON, and receiving pulse train input is possible.

Confirm that ENABLE output is ON, and then input pulses.

SRVO input is disabled in an alarm state. In addition, when the power is turned on, ON is also disabled.

## (3) Return to origin

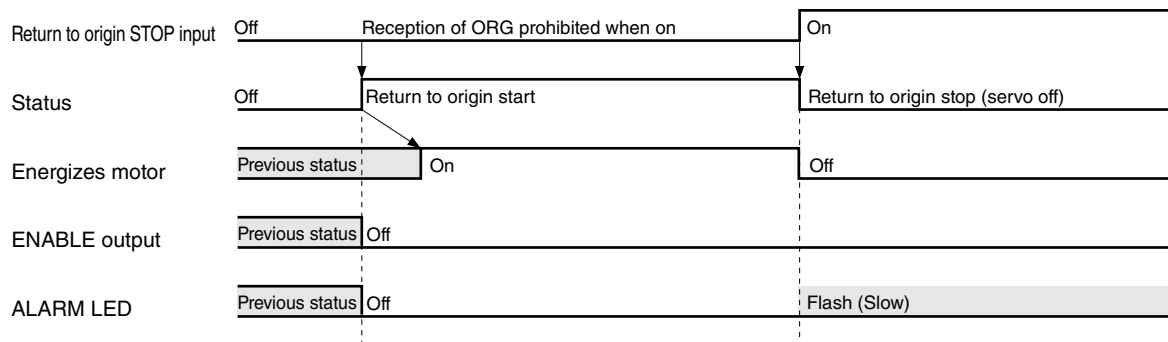


Note: Reception prohibited during 09: Parameter data error and 11: Zone data error alarms.

Power is turned on, then after the specified time, ORG is input. The motor energizes, return to origin ends, the ENABLE output turns ON, and receiving pulse train input is possible.

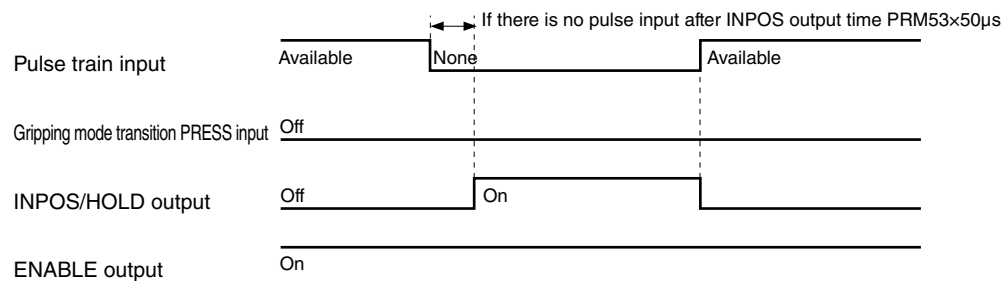
Confirm that ENABLE output is ON, and then input pulses.

## (4) Interrupting return to origin



If STOP is input during return to origin, then return to origin is interrupted, servo turns off, and the ALARM LED flashes.

## (5) Positioning mode

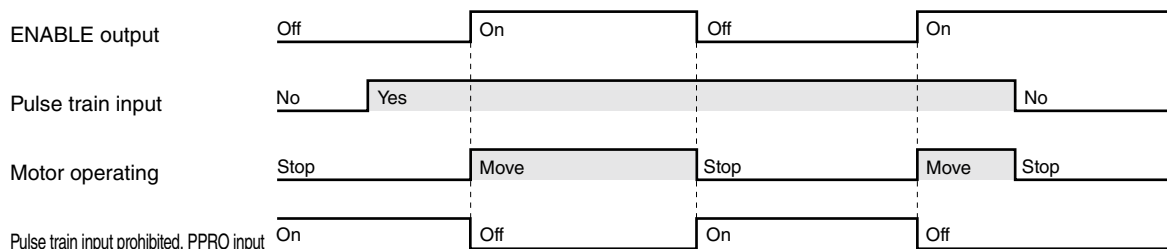


Turn off gripping mode transition input PRESS, and use positioning mode.

INPOS/HOLD output is the INPOS function, and INPOS output is output according to the values set for parameter No. 53 time to output INPOS.

**[Note] The INPOS may be output while moving at low speeds if parameter No. 39 (pulse train input multiplier) was increased.**

## (6) Pulse train input

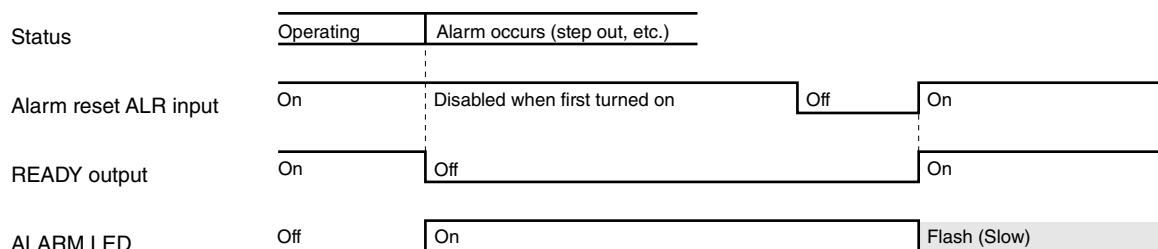


When ENABLE output is ON, the actuator moves if pulses are input.

If pulse train input prohibit PPRO is ON, then ENABLE output turns OFF, and the actuator does not move even if pulses are input.

**[Note] Turning PPRO input ON while the actuator is operating may cause loss of synchronization. Do not do this during operations.**

## (7) Alarm occurs



If an alarm occurs, READY and ENABLE output turn OFF. The ALARM LED lights. Turning ON alarm reset ALR turns ON the READY output and turns off the servos.

## 5-2-3 Maximum speed, acceleration/deceleration maximum value

	EWHA12A	EWHA24A	EWHA36A
Maximum speed mm/s	70	35	24
Maximum acceleration mm/s <sup>2</sup>	14,000	3,500	2,400
Maximum pulse speed p/s	65,190	70,985	67,052
Maximum pulse rate p/s/ms	13,038	7,098	6,705

	EWHA6H	EWHA12H	EWHA24H	EWHA36H
Maximum speed mm/s	140	180	120	100
Maximum acceleration mm/s <sup>2</sup>	14,000	9,000	3,333	3,333
Maximum pulse speed p/s	63,886	275,020	366,693	465,642
Maximum pulse rate p/s/ms	6,389	13,751	10,185	15,520

Note) Overload may occur during the operation after gripping, depending on the load conditions. If this happens, reduce the acceleration and then use it.

## ● How to find pulse speed (p/s)

(Example) For actuator model EWHA12A, parameter No. 39 = 1

For the pulse speed for moving at 70 [mm/s]

$$\begin{aligned}
 \text{Pulse speed} &= \text{speed} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\
 &= 70 [\text{mm/s}] \div (1.05 \pi [\text{mm}]/3072[\text{p}]) \div 1 \\
 &= 65189.8 \\
 &= 65190 [\text{p/s}]
 \end{aligned}$$

## ● How to find pulse rate

(Example) For actuator model EWHA12A, parameter No. 39 = 1

For the pulse rate for moving at 14000 [mm/s<sup>2</sup>]

$$\begin{aligned}
 \text{Pulse rate} &= \text{acceleration} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\
 &= 14000 [\text{mm/s}^2] \div (1.05 \pi [\text{mm}]/3072 [\text{p}]) \div 1 \\
 &= 13037972.9 [\text{p/s}^2] \\
 &= 13038 [\text{p/s/ms}]
 \end{aligned}$$



## 5-3 Gripping mode

### 5-3-1 Overview of gripping mode

The actuator moves according to the pulse train input from the higher-level device, and gripping is done at the force set for the parameter No. 37 gripping force.

When the set gripping force is reached, HOLD output turns ON, ENABLE output turns OFF, and subsequent pulses are disabled.

[Gripping force]

Set by parameter No. 37 gripping force.

[Movement per 1 pulse]

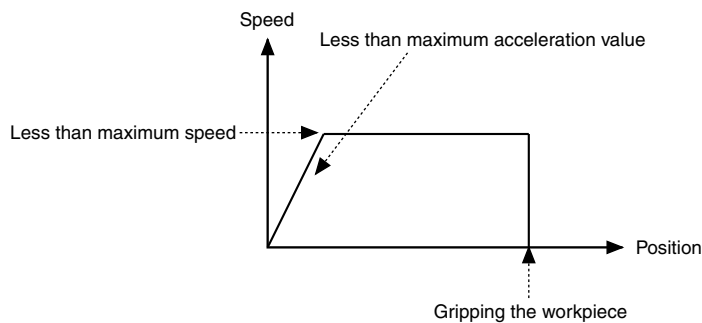
This is "Movement of each actuator per 1 pulse" × "Pulse train input multiplier of parameter No. 39"

[Speed, acceleration/deceleration, startup speed]

For controls, refer to 5-3-3 "Maximum speed, acceleration/deceleration maximum values" (P. 45).

Do operations from a startup speed of 0 [mm/s].

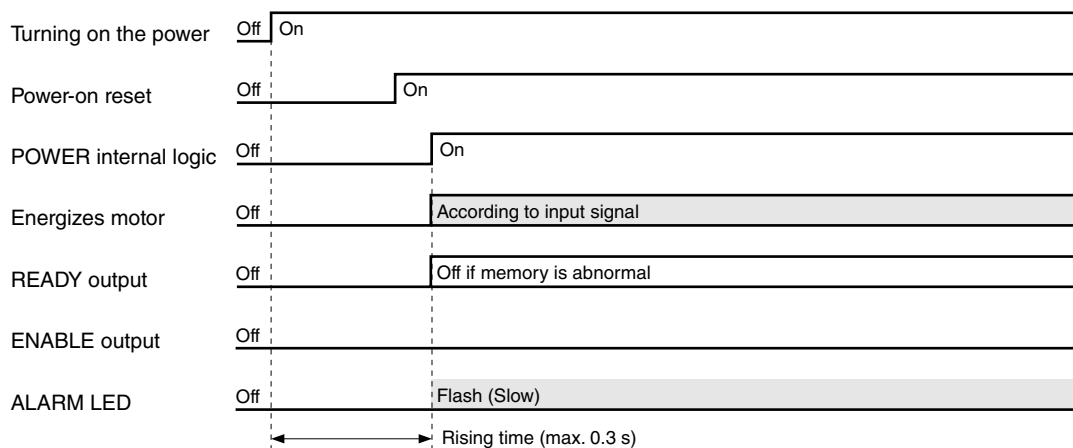
[Operation pattern]



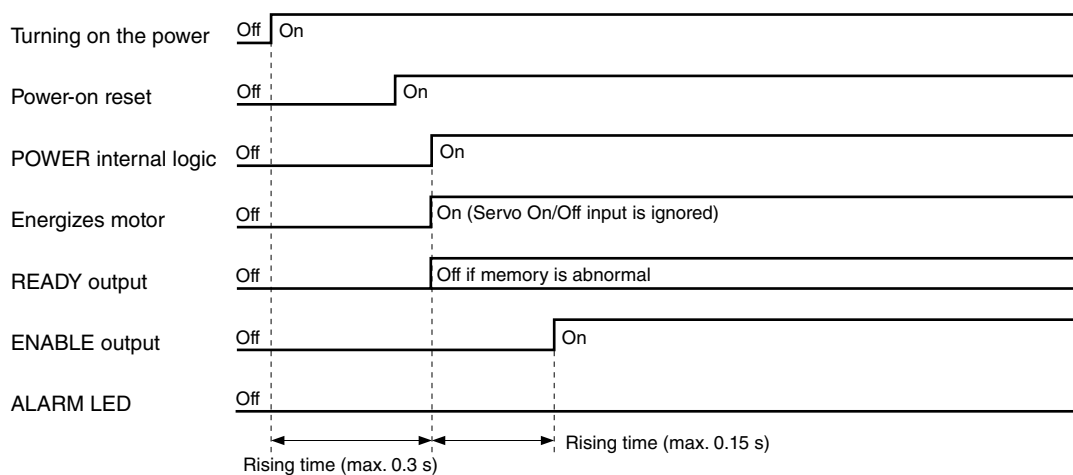
### 5-3-2 Time sequence

#### (1) When the power is turned on

##### ● When the power is turned on (**PRM43=0**)



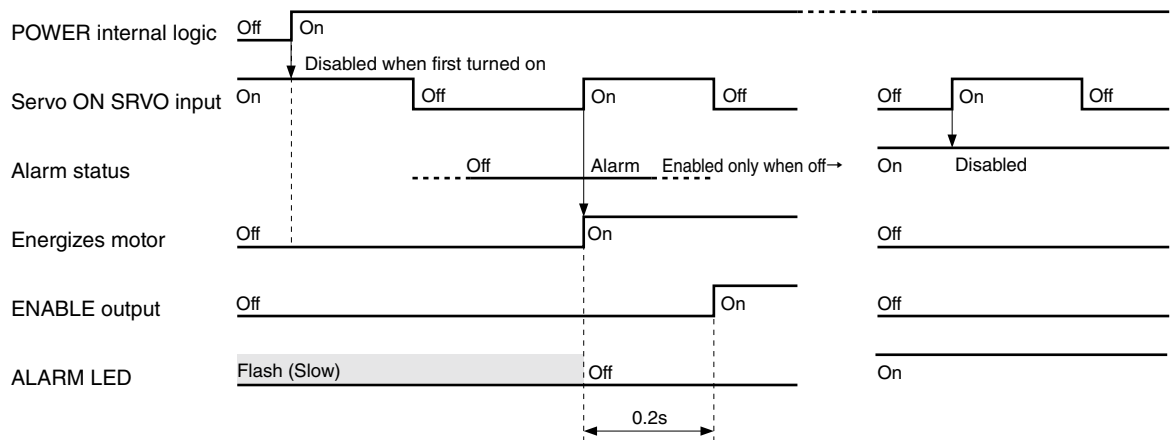
##### ● When the power is turned on (**PRM43=1**)



If parameter NO. 43 (motor energizing method) is 0, before inputting an input command, check that the READY output is turned ON after the power has been supplied.

If READY output is OFF, even after the specified time has elapsed after the power is turned on, it means that an alarm has occurred.

## (2) Servo ON

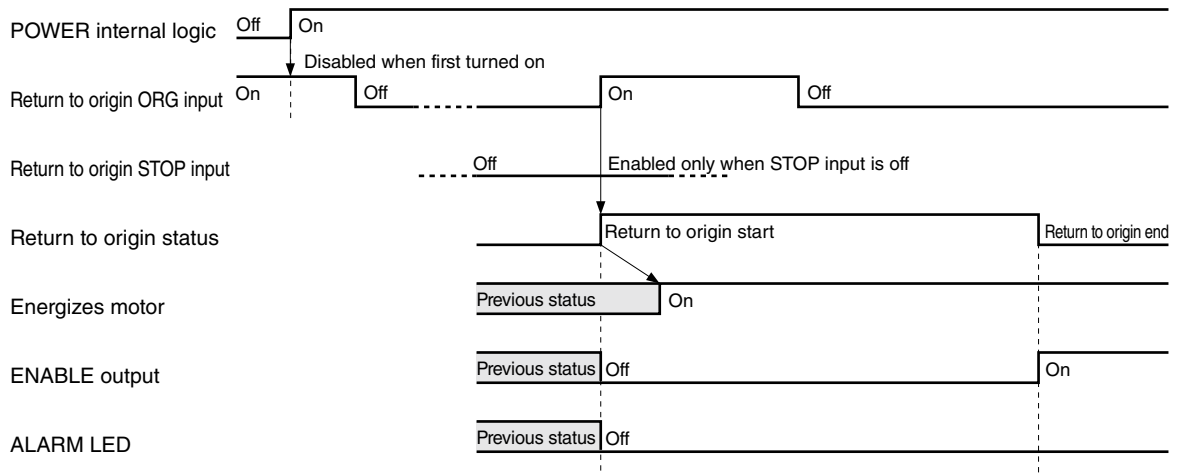


Power is turned on, then after the specified time (0.3 s), SRVO is input. The motor energizes, the ENABLE output turns ON, and receiving pulse train input is possible.

Confirm that ENABLE output is ON, and then input pulses.

When the power is turned on, ON is also disabled.

## (3) Return to origin

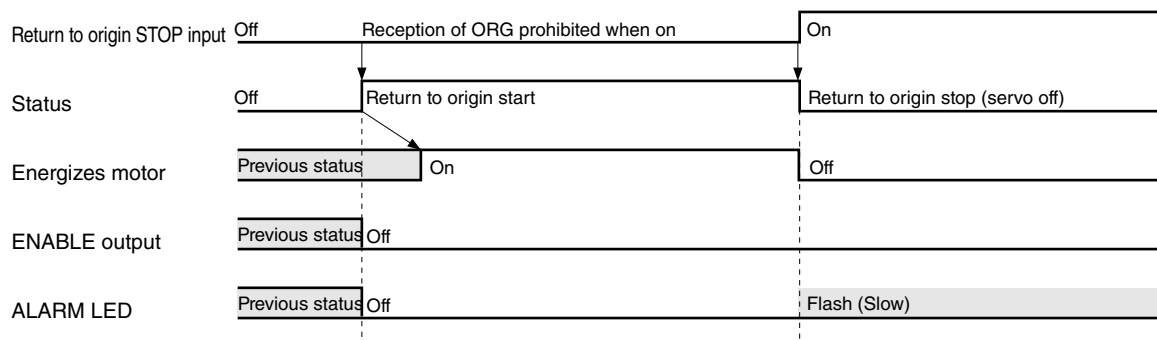


Note: Reception prohibited during 09: Parameter data error and 11: Zone data error alarms.

Power is turned on, then after the specified time (0.3 s), ORG is input. The motor energizes, return to origin ends, the ENABLE output turns ON, and receiving pulse train input is possible.

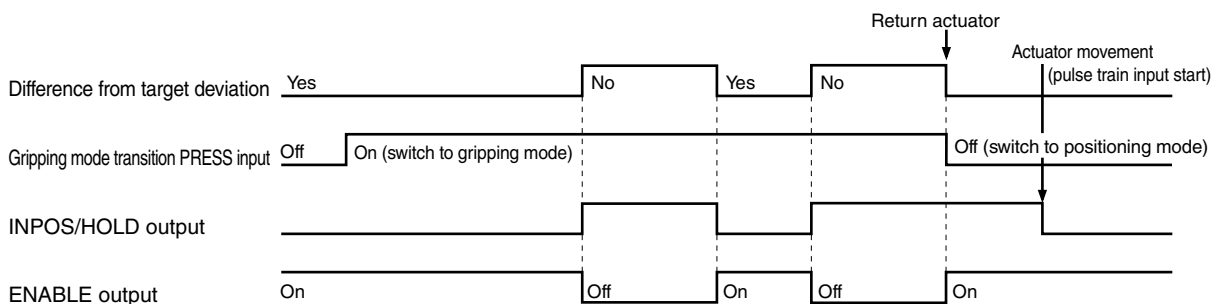
Confirm that ENABLE output is ON, and then input pulses.

## (4) Interrupting return to origin



If STOP is input during return to origin, then return to origin is interrupted, servo turns off, and the ALARM LED flashes.

## (5) Gripping mode



When gripping mode transition input PRESS is ON, the actuator goes into gripping mode. INPOS/HOLD output is the HOLD function, and HOLD output is output after reaching the level (thrust) set in parameter No. 37 gripping force. During HOLD output, ENABLE output is OFF.

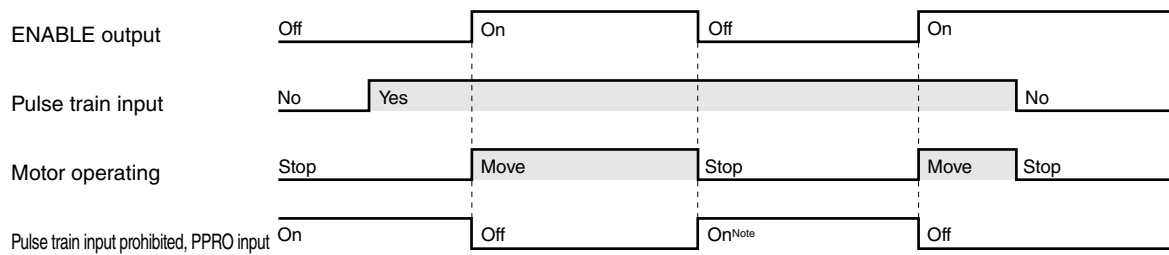
## [How to return actuator after gripping]

To return the actuator during a grip operation, first turn PRESS input to OFF, then go to positioning mode. ENABLE output turns ON. Confirm that ENABLE output is ON, and then input pulses. Operation changes from grip position to incremental operation. Also, amount of return shortens deviation to do gripping. If you want to accurately return to a position, input the amount of return plus the deviation pulse, and then do movements.

[Pulse]

Model	Deviation amount	
	CW direction	CCW direction
EWHA12A	64	80
EWHA24A	64	80
EWHA36A	64	80
EWHA6H	64	80
EWHA12H	64	60
EWHA24H	68	60
EWHA36H	68	60

## (6) Pulse train input

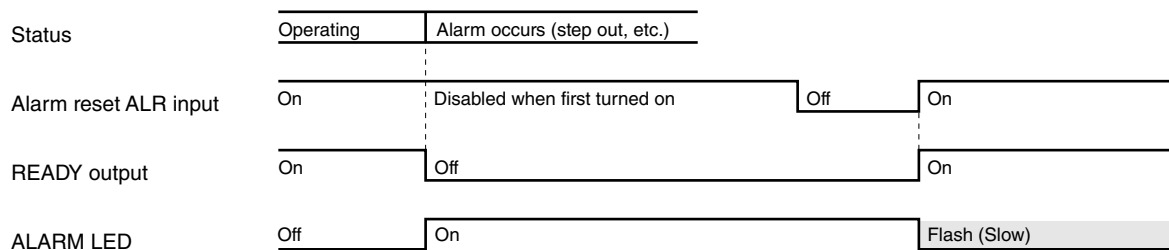


When ENABLE output is ON, the actuator moves if pulses are input.

If pulse train input prohibit PPRO is ON, then ENABLE output turns OFF, and the actuator does not move even if pulses are input.

**[Note] Turning PPRO input ON while the actuator is operating may cause loss of synchronization. Do not do this during operations.**

## (7) Alarm occurs



If an alarm occurs, READY and ENABLE output turn OFF. The ALARM LED lights.

Turning ON alarm reset ALR turns ON the READY output and turns off the servos.

## 5-3-3 Maximum speed, acceleration/deceleration maximum value

	EWHA12A	EWHA24A	EWHA36A
Maximum speed mm/s	35	10	10
Maximum acceleration mm/s <sup>2</sup>	14,000	3,500	2,400
Maximum pulse speed p/s	32,595	20,281	27,939
Maximum pulse rate p/s/ms	13,038	7,098	6,705

	EWHA6H	EWHA12H	EWHA24H	EWHA36H
Maximum speed mm/s	50	35 (10) <sup>Note1</sup>	20	10
Maximum acceleration mm/s <sup>2</sup>	14,000	9,000	3,333	3,333
Maximum pulse speed p/s	22,816	53,476	61,112	46,564
Maximum pulse rate p/s/ms	6,389	13,751	10,185	15,520

Note 1: Gripping level 1 to 5: Max 10 mm/s, gripping level 6 to 10: Max 35 mm/s

Note: Overload may occur during the operation after gripping, depending on the load conditions.  
If this happens, reduce the acceleration and then use it.

● How to find pulse speed (p/s)

(Example) For actuator model EWHA12A, parameter No. 39 = 1

For the pulse speed for moving at 35 [mm/s]

$$\begin{aligned}
 \text{Pulse speed} &= \text{speed} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\
 &= 35 [\text{mm/s}] \div (1.05 \pi [\text{mm}]/3072[\text{p}]) \div 1 \\
 &= 32594.9 \\
 &= 32595 [\text{p/s}]
 \end{aligned}$$

● How to find pulse rate

(Example) For actuator model EWHA12A, parameter No. 39 = 1

For the pulse rate for moving at 14000 [mm/s<sup>2</sup>]

$$\begin{aligned}
 \text{Pulse rate} &= \text{acceleration} \div 1 \text{ pulse per amount of movement} \div \text{PRM39} \\
 &= 14000 [\text{mm/s}^2] \div (1.05 \pi [\text{mm}]/3072 [\text{p}]) \div 1 \\
 &= 13037972.9 [\text{p/s}^2] \\
 &= 13038 [\text{p/s/ms}]
 \end{aligned}$$

## 5-4 Error messages

### (1) Command related

Error No.	Item	Description
21	Message	Typing mistake
	Cause	Command is not correct
	Countermeasure	Input a correct command
23	Message	Data error
	Cause	Error in the numerical data
	Countermeasure	Correct the data
24	Message	Overflow error
	Cause	Error in the transferred data
	Countermeasure	Send the correct command
25	Message	Framing error
	Cause	Error in the transferred data
	Countermeasure	Send the correct command

### (2) Operation related

Error No.	Item	Description
35	Message	Can't execute
	Meaning	Settings make execution impossible.
41	Message	Alarm on
	Meaning	Receiving is prohibited because alarm is on
66	Message	Pulse enabled
	Meaning	Pulse input can be received
67	Message	Pulse disabled
	Meaning	Pulse input cannot be received

### (3) System related

Error No.	Item	Description
53	Message	No actuator type
	Cause	Actuator type number setting is incorrect
	Countermeasure	Redo the initialization using actuator numbers that support the various models
54	Message	No zone data
	Cause	No data has been registered at the specified zone position data number
	Countermeasure	Register the zone position data
56	Message	Data protected
	Cause	Protected parameters have been rewritten
	Countermeasure	Data that is protected cannot be rewritten
57	Message	No parameter
	Cause	Attempted to rewrite parameter numbers that are not registered as parameters
	Countermeasure	Rewrite with numbers that are registered as parameters
58	Message	Saving data
	Cause	Data that was being saved to memory was overwritten
	Countermeasure	Proceed after saving the data in memory

## 5-5 Stop messages

### ● Stop messages

Error No.	Item	Description
61	Message	Stop command
	Meaning	Stopped due to the stop command
63	Message	Stop input
	Cause	Stopped due to a STOP/PPRO input entered from I/O



# Chapter 6 Troubleshooting

## 6-1 If a problem occurs

When informing Koganei of trouble, please provide information that is as detailed as possible about the following items.

Item	Description (Example)
What?	Controller model Actuator model Power supply
When?	Time of purchase (Serial No.) Period of use, conditions of operation When the power is turned on? 1 hour after the power is turned on
Under what conditions?	During operation The position of the Electric Hand when the problem occurred
What happened?	Does not operate Alarm is output
How frequently?	Always occurs Once an hour Cannot be reproduced

## 6-2 Countermeasures for alarms

When READY output is OFF, an alarm is determined to have been issued. In addition, when an alarm is issued, the ALARM LED on the front of the controller lights. When an alarm is issued, turn the power off temporarily, eliminate the cause of the alarm, and then turn on the power again. Doing this cancels the alarm.

## 6-3 Alarm specifications

The transmission format for an alarm message is as follows.

```
<Alarm No.>: <Alarm message> c/r l/f
```

Checking the alarm content

To check the content of the alarm, use a communication cable to connect to a personal computer, and enter the @READ ERR command (see page 25).

### 6-3-1 Alarm message list

Alarm No.	Alarm message	Meaning	Probable cause	Countermeasure
01	Overload	<ul style="list-style-type: none"> <li>Excessive load</li> <li>Cable disconnected</li> </ul>	1) Problem with usage 2) Motor/encoder cable is broken or connection is defective 3) Mechanical lock 4) Too much friction in the actuator unit	1) Reduce the acceleration 2) Inspect the cable continuity 3) Check whether or not the moving part of the actuator is in mechanical lock 4) Check whether or not the friction resistance of the moving part of the actuator is too high, and adjust correctly
03	Overheat	Rise in circuit temperature	1) Overcurrent 2) Shorted cable	Inspect the cables
04	Power supply voltage drop	Input voltage is too low	Power supply	Raise the power supply voltage
05	Power supply voltage high	Input voltage is too high	Power supply	Reduce power supply voltage
06	Cable disconnected	<ul style="list-style-type: none"> <li>Excessive load during return to origin</li> <li>Cable disconnected</li> </ul>	1) Motor/encoder cable is broken or connection is defective 2) Mechanical lock	1) Inspect the cable continuity 2) Check whether or not the moving part of the actuator is in mechanical lock
09	Parameter data error	Parameter data has been corrupted	Power supply was turned off while writing data	Turn on the power supply again, and initialize the parameter data
11	Zone data error	Zone position data has been corrupted	Power supply was turned off while writing data	Turn on the power supply again, and initialize the zone position data

# Chapter 7 Specifications

## 7-1 Basic specifications of main unit

Item \ Model	EWHA12A	EWHA24A	EWHA36A	EWHA6H	EWHA12H	EWHA24H	EWHA36H
Motor	2-phase stepping motor						
Maximum speed (when in one-sided positioning mode) mm/s	70	35	24	140	180	120	100
Maximum speed (when in one-sided gripping mode) mm/s	35	10	10	50	35 (10) <sup>Note 1</sup>	20	10
Minimum speed (one side) mm/s	1						
Maximum gripping force <sup>Note 2</sup> N	12 to 17	22 to 35	33 to 47	5 to 9	11 to 16	22 to 32	34 to 46
Operating temperature range °C	0 to 40						
Open/close stroke mm	14 (One side 7 mm)	20 (One side 10 mm)	14 (One side 7 mm)	22 (One side 11 mm)	26 (One side 13 mm)		
Repeatability mm	±0.03	±0.05	±0.03	±0.05			
Maximum payload (both sides) kg	0.3	0.5	0.2	0.3	0.5		
Mass kg	0.17	0.26	0.15	0.29	0.35	0.36	
Applicable controller	<b>EWHCP-NH</b>						

Note 1: The maximum speed for gripping levels 1 to 5 is 10 mm/sec for EWHA12H only.

2: For details of the gripping force, see the graphs on P. 55.

## 7-2 Basic specifications of the controller

Item \ Model	EWHCP-NH
Axis control	Motor drive method
	Microstep drive
	Control method
	Closed loop control <sup>Note 1</sup>
	Operating method
	Position control and force control by pulse train input
	Origin detection method
	Detection at the stroke end
External input/output	Location detection method
	Encoder A, B phase output
	Pulse train input method
	Differential line driver (max. cable length 10 m)/Open collector (max. cable length 2 m)
	Maximum input pulse frequency <sup>Note 2</sup>
	Max. 200 kpps (differential line driver)/Max. 60 kpps (open collector)
	Pulse train input command format
	CW/CCW, pulse/code (positive and negative logic allowed)
General specifications	Control input
	6 points (alarm reset, clear counter, gripping mode transition, servo ON, pulse train input prohibited/origin return stop, origin return) 5 mA TYP 1 point
	Control output
	4 points (standard end, pulse train input reception possible/positioning complete/gripping operation complete, zone output) 30 mA max./1 point
	Abnormality detection output
	Overload, incorrect data, system abnormality
	External communications
	RS232C 1ch (Communication with personal computer or teaching box)
General specifications	Motor drive output
	Dedicated cable (with F.G.)
	Encoder input
	Dedicated cable (with shielding)
	Pulse train input
	Dedicated cable (twisted pair wires)
	Mass
	0.2 kg
General specifications	Power supply
	24 VDC ±10%, 1.0 A MAX. (Motor and I/O share the same power supply.) <sup>Note 3</sup>
	Operating temperature
	0 to 40°C
	Operating humidity
	35 to 85% RH (no condensation)
	Storage temperature
	-10 to 65°C
General specifications	Back-up
	EEPROM used to maintain setting conditions
	Noise resistance
	IEC61000-4-4 level 3
General specifications	Accessories
	I/O cable, power cable, cable for pulse train input <sup>Note 4</sup> , 2 conversion cables for pulse train input connector <sup>Note 5</sup>

Note 1: Control of the force when gripping and step out detection through a rotary encoder (force control for **EWHCP-NH** only).

2: The actual maximum input pulse count is regulated by the maximum speed of each actuator.

3: Maximum consumed current varies depending on the actuator. See the following table.

4: The cable for pulse train input is 1 meter long.

5: Note that the methods to connect the cables for pulse train input are different for a differential line driver input and for an open collector input.

Maximum consumed current

(A)

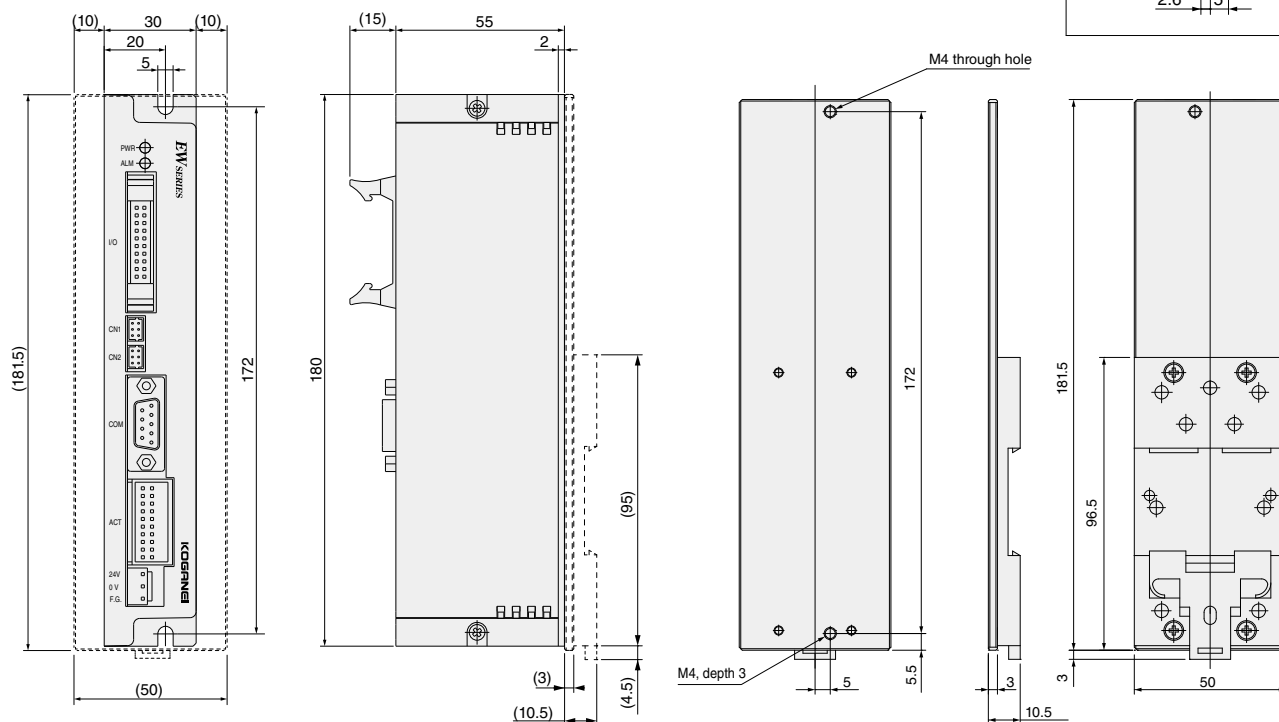
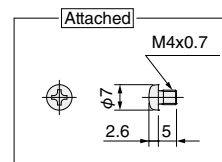
Model	EWHA12A	EWHA24A	EWHA36A	EWHA6H	EWHA12H	EWHA24H	EWHA36H
Maximum consumed current	0.6				1.0		





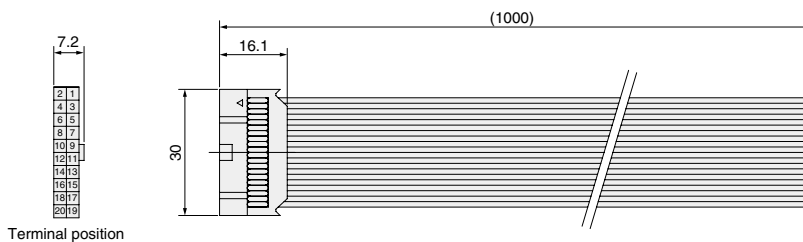
## 8-2 Controller outline drawings

(DIN rail mounting plate)

**EW2DP**

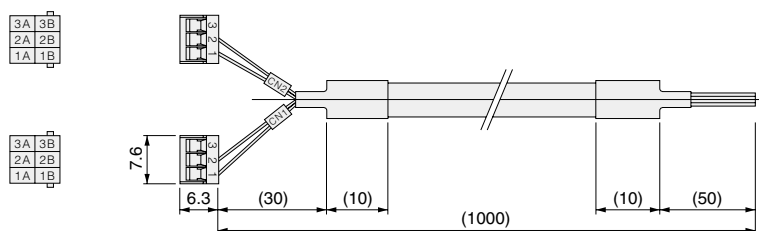
Supplied with the controller

- I/O cable

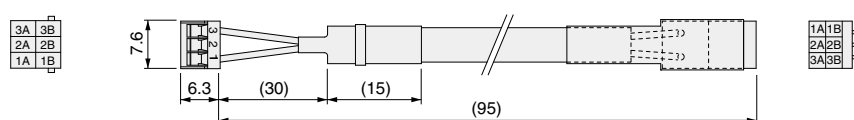
**EW2KI**

Terminal position

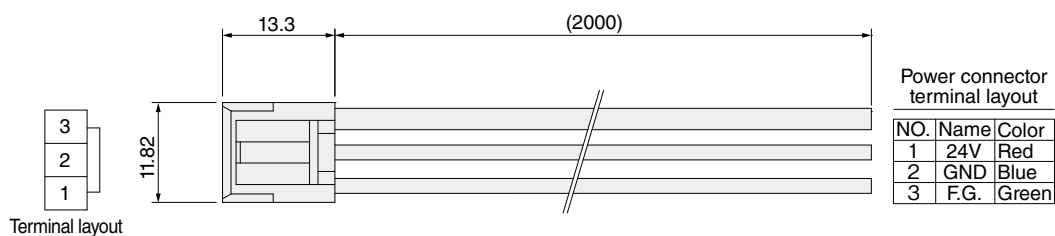
- Cable for pulse train input



- Conversion cable for pulse train input connector



- Power cable

**EW2KP**

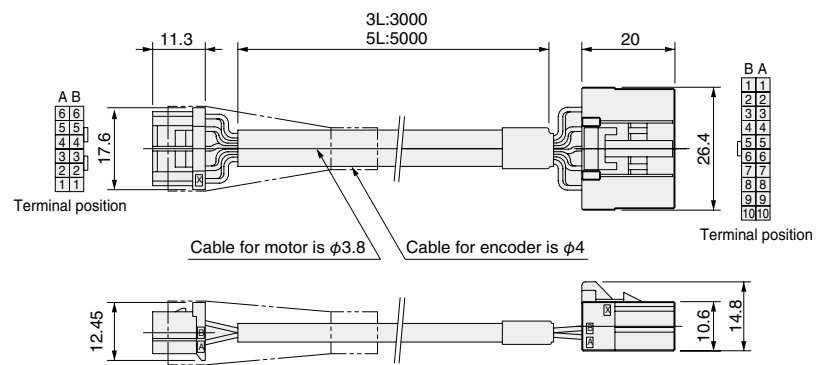
Terminal layout

Power connector terminal layout

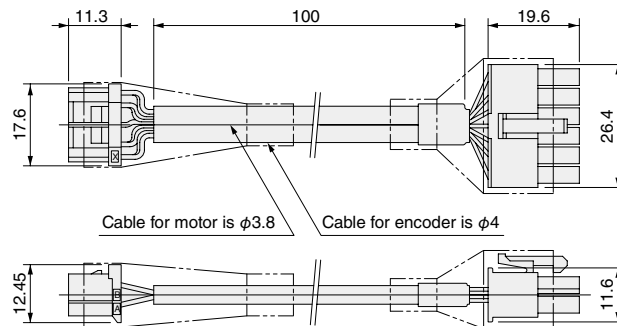
NO.	Name	Color
1	24V	Red
2	GND	Blue
3	F.G.	Green

## Cables (additional parts)

- Connecting cable

**EWHKA-**☐

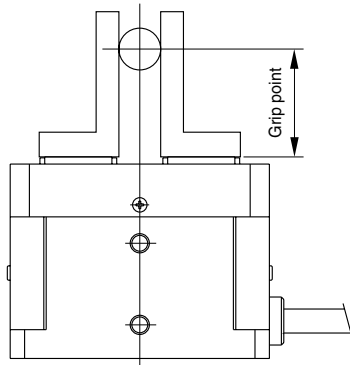
- Conversion cable<sup>Note</sup>

**EWTK**

Note: Conversion cable is to be connected to the EWHKA-☐A, and EWHK-☐ (old cable).

# Chapter 9 Technical Data

## 9-1 Limits on gripping force at grip points



\* Set the gripping force at the grip points within the range shown in the graph at right.

Allowable moment ●EWA12A: 0.51 N·m

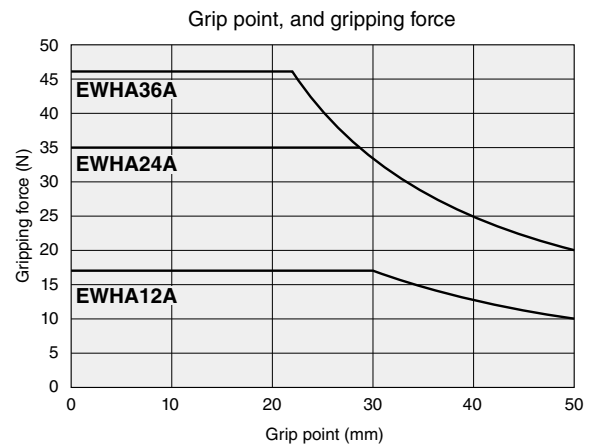
●EWA24A,36A: 1.0 N·m

●EWA6H: 0.26 N·m

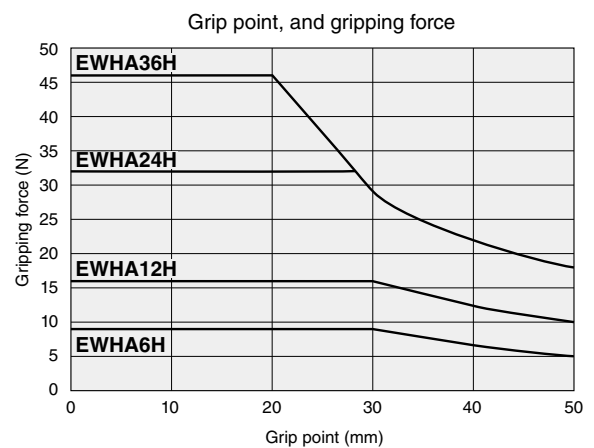
●EWA12H: 0.57 N·m

●EWA24H,36H: 0.9 N·m

[Standard type]



[High-speed type]

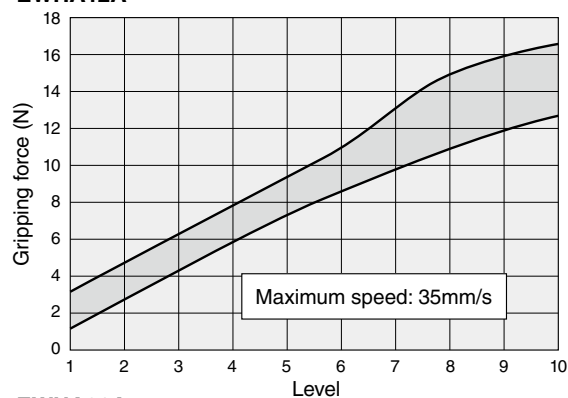


## 9-2 Range of gripping force

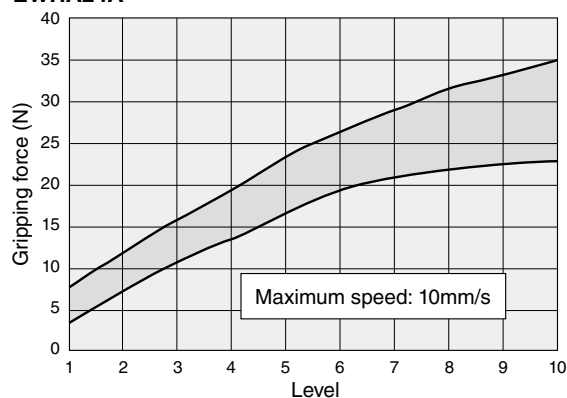
Forces are generated within the range shown in the graphs below at each set level.  
Note that the gripping force repeatability at the same position is within 5%.

[Standard type]

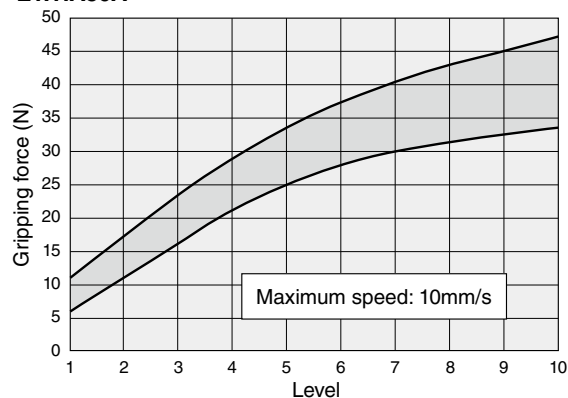
**EWHA12A**



**EWHA24A**

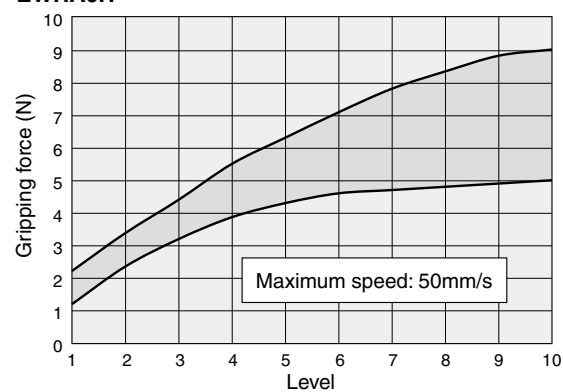


**EWHA36A**

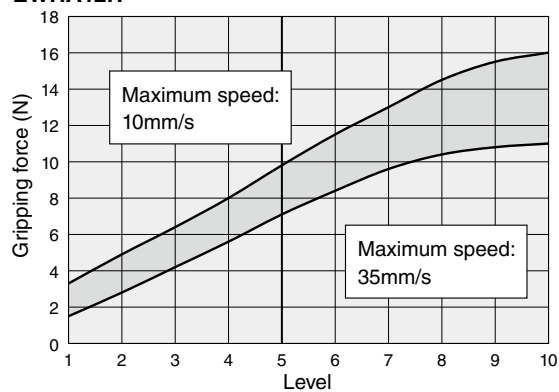


[High-speed type]

**EWHA6H**

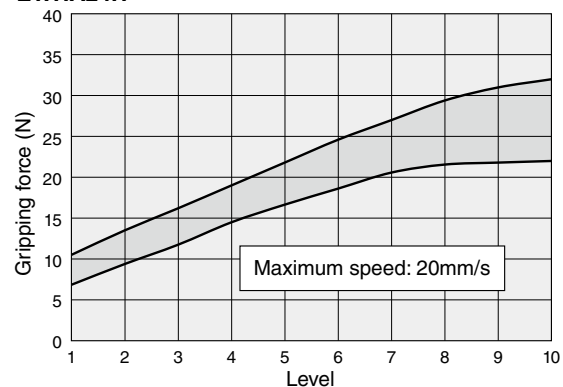


**EWHA12H**

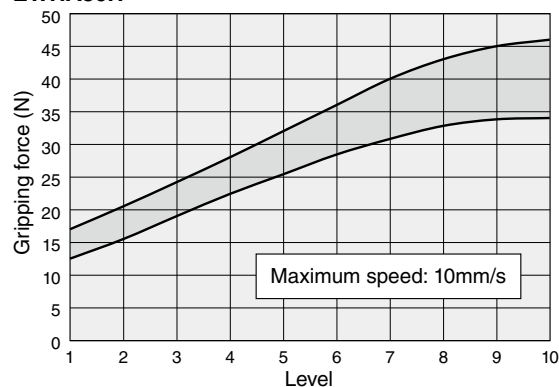


\* The maximum speed up to level 5 is 10 mm/s.

**EWHA24H**

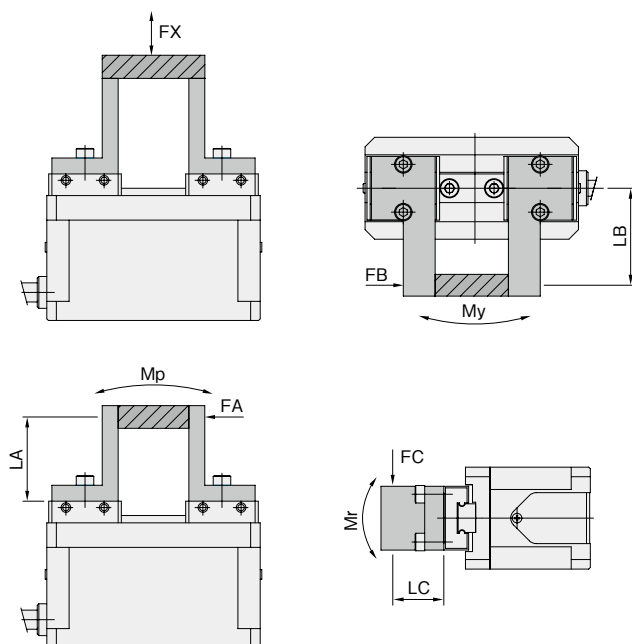


**EWHA36H**





### 9-3 Allowable load and allowable moment



- $M_p = F_A \times L_A$  (N•m)
- $M_y = F_B \times L_B$  (N•m)
- $M_r = F_C \times L_C$  (N•m)

#### [Standard type]

Load and moment Model	FX N	Mp N•m	My N•m	Mr N•m
<b>EWHA12A</b>	40	0.51	0.3	0.6
<b>EWHA24A</b> <b>EWHA36A</b>	120	1.0	1.0	2.0

#### [High-speed type]

Load and moment Model	FX N	Mp N•m	My N•m	Mr N•m
<b>EWHA126HA</b>	59	0.26	0.26	0.46
<b>EWHA12H</b>	118	0.57	0.48	1.29
<b>EWHA24H</b> <b>EWHA36H</b>	154	0.9	0.75	2.16

If you have questions about the contents of this manual, or about other technical issues,  
please consult the OVERSEAS DEPARTMENT at the address and telephone number shown below.

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# ELEWAVE SERIES ELECTRIC HAND

With pulse train input type controller

OWNER'S MANUAL

Aug. 2022 Ver. 1.0 X435058

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