KOGANEI

ELEWAVE SERIES
ELECTRIC ROTARY ACTUATOR
EWHRT 3, 5, 10, 20

OWNER'S MANUAL Ver.2.0

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Chapter 1 Safety Precautions

Thank you for purchasing the Elewave Series Electric Rotary Actuator. 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 procedures or improper handling could result in product breakdown or damage, or in accidents that lead to injury to the user (person to set up, operator, or person to adjust or check, etc.).

1-2 Precautions

(1) Precaution for automatic operation
- To prevent injury, install an interlock device to prevent the operator from touching the moving parts of the Electric Rotary Actuator.

(2) Precaution against pinched fingers, etc.
- Be careful to prevent fingers, etc., from being pinched by the Electric Rotary Actuator's moving parts during transportation, teaching, or operation.

(3) Operation not allowed in ambient atmospheres containing flammable gases, etc.
- The Electric Rotary Actuator is not an explosion-proof specification. 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 magnetic interference, etc.
- Do not use in locations subject to magnetic interferences, static electric discharges, or radio frequency interference. It could result in erratic operation.

(5) Precautions for controller check
- To prevent electric shock when touching the outside terminal and connector of the controller during controller checks, etc., always switch off the controller power source and cut off the power supply.
- Never touch the inside of the controller.

(6) Response to a damaged or defective Electric Rotary Actuator
- If any of the damage or defects listed below have been found, continuing use of the Electric Rotary Actuator 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 Rotary Actuator's erratic operation
Damage to outer components of Electric Rotary Actuator	Damaged parts flying off during Electric Rotary Actuator's operation
Abnormal operation of Electric Rotary Actuator (position deviation, vibrations, etc.)	Electric Rotary Actuator's erratic operation

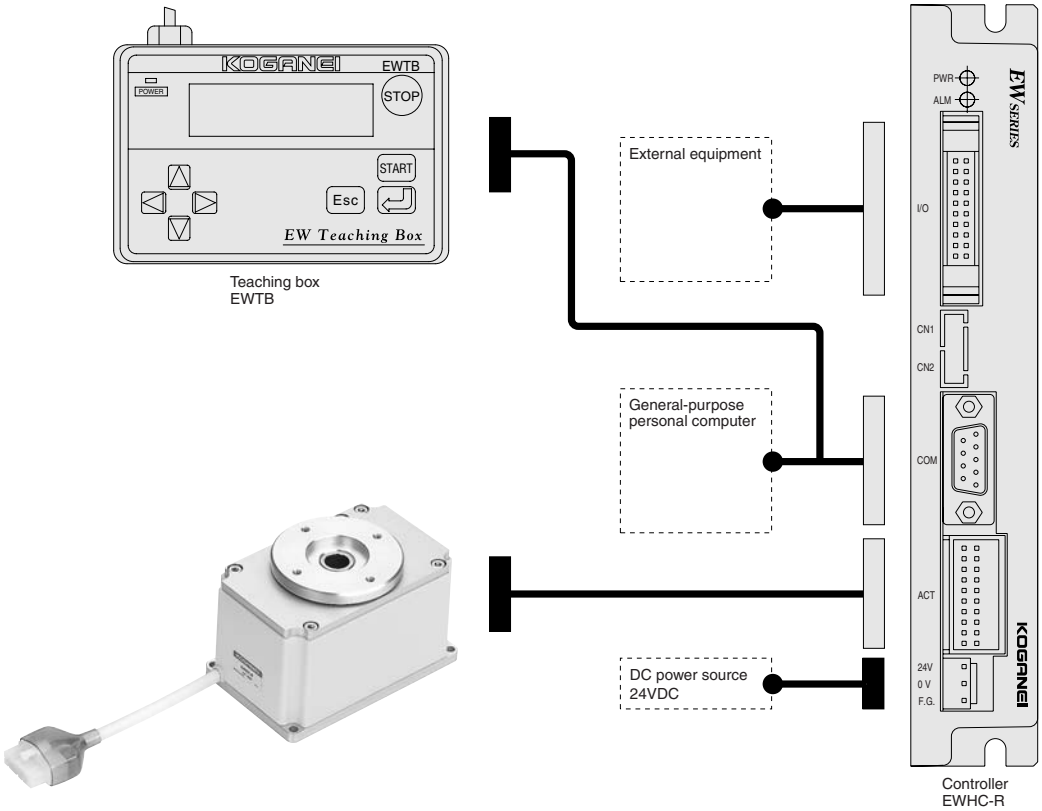
(7) Precaution for contact with high-temperature portions of motor or controller
- The motor and controller will be very hot in some areas after automatic operations, and touching those areas may cause burns. For checks, etc., first cut the power to the controller, wait for the areas to cool down, confirm the cooled temperature, and then handle those areas.

(8) Protective grounding
- Always ground the controller to protect it against electric shocks.

Chapter 2 System Configuration

2-1 Entire system configuration

The Electric Rotary Actuator consists of the following major components.



2-2 Options and accessories

1. When Option -C (with controller EWHC-R) is selected, the controller EWHC-R and the following accessories are packaged together. Please check that they are included with your unit at the time of purchase.

   Power cable (1 piece)
   I/O cable (1 piece)

2. When Options -3L, -5L (relay cable connecting the Electric Rotary Actuator unit and the controller) are selected, the cables (-3L: cable length 3m, -5L: cable length 5m) are included in the package. Please check that they are included with your unit at the time of purchase.

2-3 Setting up for operation

	Sequence		Reference section
Installation and connection	Installation		3-2 4-2
	↓		
	Wiring	Connect the power source, controller, actuator, and personal computer or teaching box.	4-1 4-2
	↓		
	Power supply on		4-2
	↓		
Settings	Actuator number setting	Set the number of the specified actuator type.	4-4
	↓		
	Parameter changes	Set the parameter data in accordance with the operating conditions.	4-7
	↓		
	Point data entry	Enter point data suitable for the operation.	4-5
	↓		
Operations	Test operations	Check that it operates normally.	4-3
	↓		
	Main operations	Use the setting point instructions and the START signal to run the desired operation. For continuous operations, use a programmable controller or other external device to control operations.	4-3

Chapter 3 Main Unit

3-1 Handling main unit

3-1-1 Precautions

(1) Do not apply repeated bending stress or tensile force to the lead wires. Moreover, never grab the lead wire to move the main unit. Applying repeated bending stress or tensile force to the lead wire could cause it to break wire.

(2) Always limit the moment of inertia of the workpiece to less than the maximum load inertia. Exceeding the allowable value could result in defective operation, damage to components, or reduced operating life.

(3) When mounting the table in a vertical direction, design the workpiece so that it will not exert excessive load torque. Limit the load torque to 60% or less of the actuator's maximum torque.

Note: When a load torque exists, limit the speed settings as shown below.

Load ratio (%)	20	40	60
Speed setting (%)	Max. 50	Max. 33	Max. 25

$$\text{Load ratio (\%)} = \frac{\text{Load torque}}{\text{Maximum torque}} \times 100\ (\%)$$

(4) Limit duty to 50% or less.

$$\text{Duty} = \frac{\text{Operating time}}{\text{Operating time} + \text{Down time}} \times 100\ (\%)$$

(5) Do not apply excessive force to the plastic cover on the side of the main unit. It could lead to defective operation or damage to components.

(6) In the without-brake type (standard specification), the table moves freely when the power is shut off. When restraining the table movement is required, either select the with-brake option, or mount an external stopper to secure the table in place.

3-2 Mounting

3-2-1 Mounting the main unit

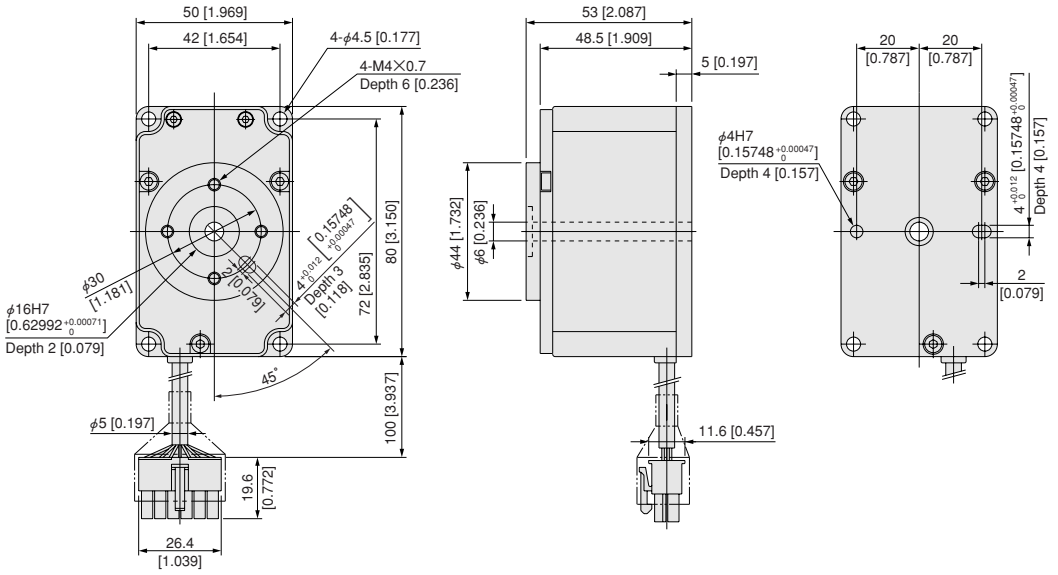
(1) The mounting surface should be flat. Twisting or bending during the mounting could result in defective operation or degraded performance.

(2) Avoid scratching or denting the mounting surface of the main unit, because this also could have a detrimental effect on flatness.

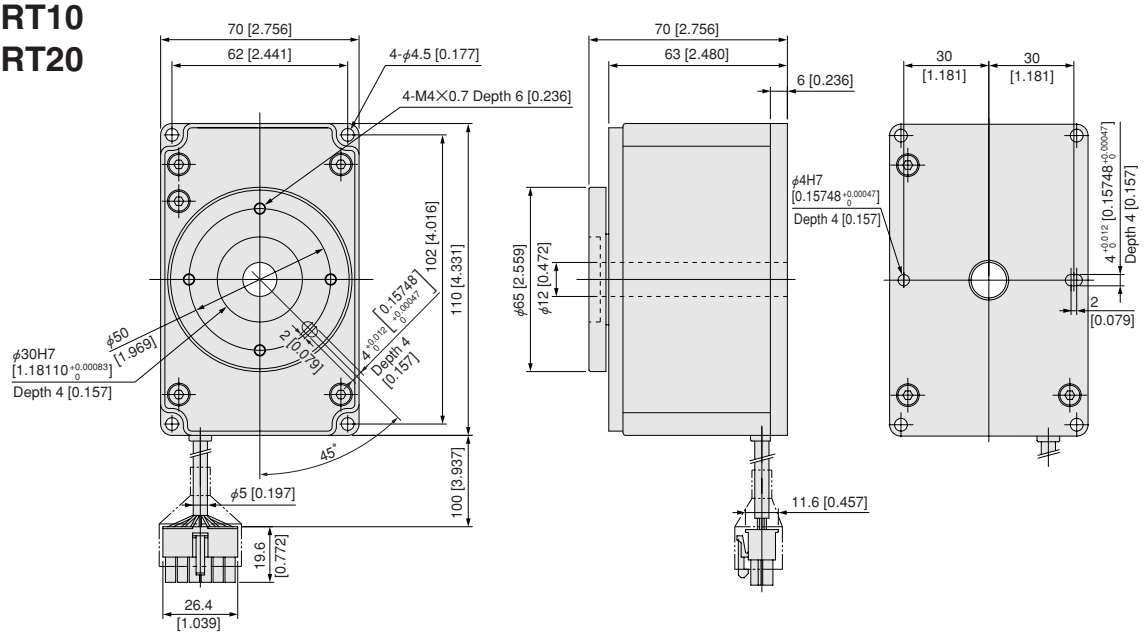
(3) To secure the main unit in place, use the through holes on the bottom.

Unit: mm [in.]

EWHRT3
EWHRT5



EWHRT10
EWHRT20



3-2-2 Mounting a workpiece

(1) When mounting the workpiece, always use screws that are shorter than the thread depth. Using a screw longer than the thread depth will interfere with the main unit, preventing normal operation.
(2) Tighten the screw for mounting the workpiece within the allowable torque range.

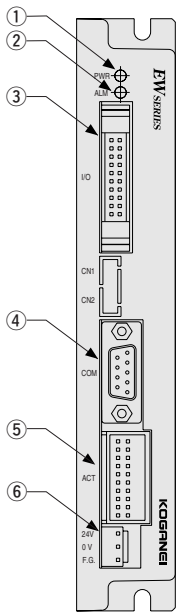
Mounting position	Screw size	Thread depth (mm)	Maximum tightening torque (N・m)
Workpiece	M4	6	1.50

Note: When using screws, etc., to secure the workpiece to the table, hold either the table or the workpiece to perform the operation.

(3) When the table is in the origin position, the marker on the side of the table is in the position shown in the diagram. When mounting the workpiece, first check the marker position to install. Note, however, that the origin position and the mounting hole position are not aligned. Before adjusting the origin position, mount the workpiece and execute origin return.

Chapter 4 Controller

4-1 Appearance and functions



① POWER LED
Lights up when the power supply is turned on.
② ALARM LED
Displays the controller condition.
(See the table at below right.)
③ I/O connector
Use the supplied I/O cable for connecting to sensor switches or an external programmable controller, etc.
④ COM connector
This is the connector for connecting to the RS-232C terminal on a personal computer, Teaching box, etc.
⑤ ACT connector
This is the connector for connecting to the main unit.
⑥ Power connector
Connects the supplied power cable to supply 24VDC.

Description	LED condition
Alarm occurs	Lights up
Error occurs	Quick flashing (ON: 0.25s, OFF: 0.25s)
Origin return not completed	Slow flashing (ON: 0.5s, OFF: 1.5s)
Normal	Not lit

4-2 Installation and connection to external equipment

4-2-1 Controller installation

(1) Installation
Use M4 screws onto the 5mm U-groove on the back of the controller to secure the controller in place against an object with good thermoconductivity.
(2) Installation environment
- Install in locations with an ambient temperature of 0 to 40°C, humidity of 35 to 85%, and no condensation.
- Take adequate space around the controller (20mm or more) with good air flow.
- Avoid locations subject to corrosive gases including sulfuric acid, hydrochloric acid, and in ambient atmospheres containing flammable gases or liquids, etc.
- Install in locations that are almost free of dust and particles.
- Avoid locations subject to metal chips, oil or water from other equipment.
- Avoid locations subject to electromagnetic or electrostatic noises.
- Install in locations that are free from large vibrations.

4-2-2 Connecting the power supply

(1) Power supply
- Connect the power cable to the power source with a capacity of 24VDC ±10% and 1.0A or more.
- Connector: B 3PS-VH (JST Mfg. Co., Ltd.)
The connector pin number table

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

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

(2) Power source connection method

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

Caution:

- **The EWHC-R controller does not have a power switch and an emergency stop function. Always install an appropriate power cut-off (insulation) device for the machinery or equipment as an overall system.**

Danger:

- **Before wiring the controller, always turn off the power to the whole machinery or equipment to avoid the danger of electric shocks.**

(3) Insulation resistance/Dielectric strength test

Never conduct insulation resistance tests or dielectric strength tests on the controller.

4-2-3 Grounding work

- Always perform grounding work to prevent electric shocks to the human body due to electric leakage, and to prevent defective equipment operation due to noise.
- We strongly recommend Type D grounding (ground resistance of 100 Ω or less) or better.
- For the controller's ground terminal, use the power cable's F.G. wire.

4-2-4 Connecting to communication unit

- The EWHC-R can be connected to the equipment with the RS-232C interface used in a personal computer, etc.
- For connection to a personal computer, etc., connect the RS-232C connector (9 pins) of the dedicated cable to the controller connector.

4-2-5 Connecting to the actuator

Connect the robot I/O cable to the robot I/O connector on the front of the controller. Turn off the power supply before performing the connection. Ensure that the robot I/O cable is firmly inserted into the connector.

Using location	Parts name	Model
Connector (main unit side)	Header	1376137-1(AMP-made)
Socket (cable side)	Socket	1-1318118-9(AMP-made)
Housing contact	Contact	1318107-1(AMP-made)

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	FG	Frame ground	B3	BRK	Brake signal
A4	COM1 (24V)	COM 24V	B4	COM2 (24V)	COM 24V
A5	N.C.	N.C.	B5	N.C.	N.C.
A6	FG	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－

4-2-6 Connecting the I/O connector

Connect to programmable controller and other external equipment.

4-3 I/O interface

4-3-1 I/O connector signal table

NO.	Wire color	Signal name	Description	NO.	Wire color	Signal name	Description
01	Brown	POS0	Point setting	02	Red	POS1	Point setting
03	Amber	POS2	Point setting	04	Yellow	POS3	Point setting
05	Green	POS4	Point setting	06	Blue	START	Start signal
07	Purple	STOP	Stop signal	08	Gray	ORG	Origin return signal
09	White	RDY	Preparation completed output	10	Black	BUSY	Command execution in progress output
11	Brown	INPOS	Positioning completed output	12	Red	N.C	No connection
13	Amber	24G	Negative common	14	Yellow	24G	Negative common
15	Green	24V GND	Ground	16	Blue	24V IN	24V input
17	Purple	POS5	Point setting	18	Gray	24V	＋24V
19	White	FG	Frame ground	20	Black	FG	Frame ground

4-3-2 Details of input signals

Input signals include 9 custom command inputs.

○Custom command inputs

Custom command inputs are the inputs to control from the programmable controller or other external equipment. To accept the START and ORG inputs, the READY and BUSY signals must be set as follows.

■ READY output: ON
■ BUSY output: OFF
■ STOP input: OFF

START and ORG inputs are accepted when the OFF state is switched to ON state (the moment when the contact closes). Check the BUSY output on the monitor to confirm whether the controller has accepted the command.

■ START

From the current position, moves by the only point No. data specified in POS0 to POS5.

Note:

To execute START, it is necessary to reconfirm the states of POS0 to POS5.

■ ORG

Returns in the direction of the origin return specified in the parameters.

■ STOP

An input to stop the actuator's movement temporarily.

Setting this input to ON (closing the contact) while the actuator is in operation, or while it is moving back to the origin, will temporarily stop the actuator's movement. While this input is in the ON state (the contact is closed), no custom command can be sent from the I/O, no program from the personal computer can be executed, and the origin return cannot be executed.

■ POS0～POS5

These are inputs for connecting to the output circuits of the programmable controller or other equipment, and for specifying the point No.

Examples of point specification

POS No. / Point No.	POS5 (2^5)	POS4 (2^4)	POS3 (2^3)	POS2 (2^2)	POS1 (2^1)	POS0 (2^0)
P0	OFF	OFF	OFF	OFF	OFF	OFF
P1	OFF	OFF	OFF	OFF	OFF	ON
P3	OFF	OFF	OFF	OFF	ON	ON
P7	OFF	OFF	OFF	ON	ON	ON
P15	OFF	OFF	ON	ON	ON	ON
P31	OFF	ON	ON	ON	ON	ON
P63	ON	ON	ON	ON	ON	ON

4-3-3 Details of output signals

Output signals are 3 signals, READY, BUSY, and INPOS.
ON and OFF refer to the turning on and off of the output transistor.

○Custom output

This output is used for signal interaction with the programmable controller, etc.

■ Preparation completed output (READY)

When the controller system is operating normally, this output is set to ON. If an alarm has issued, this output is at OFF and the motor enters a free state. In this situation, the controller power supply should be switched off before attempting to restart operation.

■ Command execution in progress output (BUSY)

This signal is set to ON when a custom command is being executed or when a command from a personal computer is being executed. This signal goes ON whenever a custom command input is accepted. As a result, when the BUSY signal is ON, the controller cannot accept another custom command input or a command from a personal computer.

Note:

Always turn off custom commands when BUSY is ON. Leaving input ON will prevent BUSY from switching to OFF even after execution of a command is completed.

■ Positioning operation completed output (INPOS)

This signal goes to OFF whenever a custom command input is accepted, and switches to ON when the positioning execution process has been completed normally. If an error occurs during execution, or if STOP has been input, the signal remains unchanged in the OFF state.

4-3-4 Input/output circuits

Here describes the input/output circuit specifications and an example of 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: 24V±10%

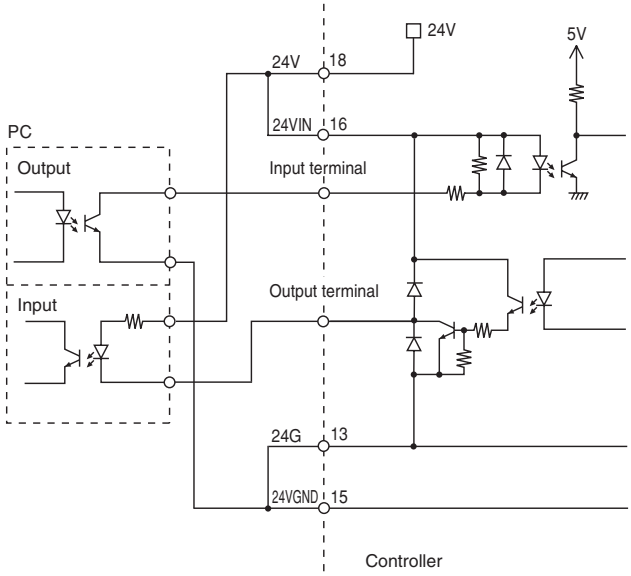
○Input circuits

Insulation method: Photocoupler insulation
Input response: 30ms or less
Input current: 5mA/24VDC
Input sensitivity: ON current Min. 3mA
OFF current Max. 1mA

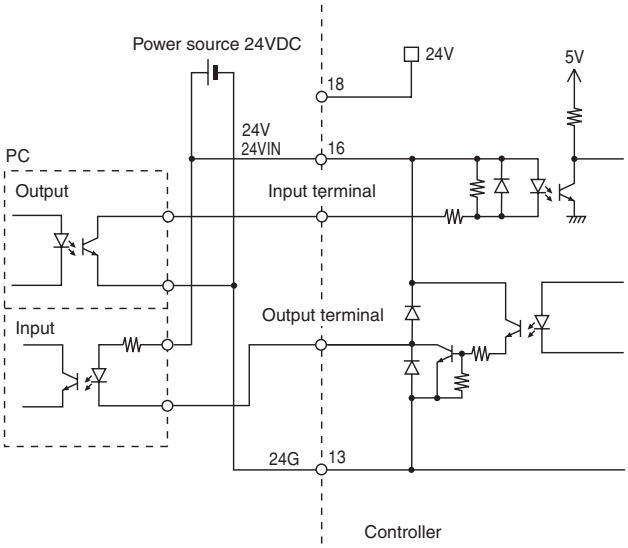
○Output circuits

Insulation method: Photocoupler insulation between internal circuits and output transistor
Output terminals: NPN open collector output for all output common terminals (0V side)
Output response: 1ms or less
Maximum output current: 30mA/24VDC per output
Residual ON voltage: 1.5V or less

(2) Wiring method when using controller's internal power source



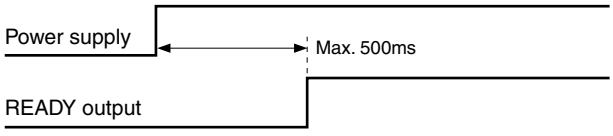
(3) Wiring method when using another power source in place of the controller's internal power source



4-3-5 Timing chart

(1) When the power is turned on

Normal condition



Alarmed condition

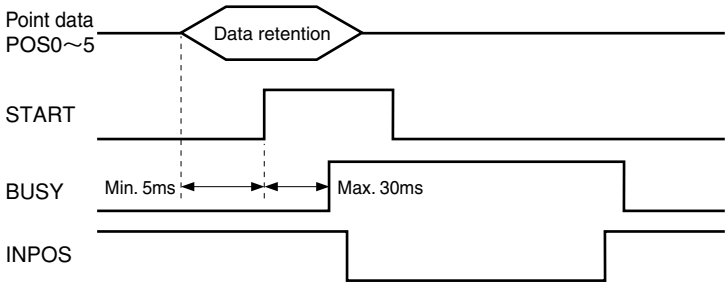
Before attempting to input a custom command, check that READY output is turned ON after the power has been turned on. When the READY output remains OFF after the specified time has elapsed after turning the power on, it means that an alarmed condition has occurred.

(2) Execution of custom command

■ When a custom command is received, BUSY output turns to ON. Whether or not the received command has ended normally can be verified at the point the BUSY output turns to OFF.

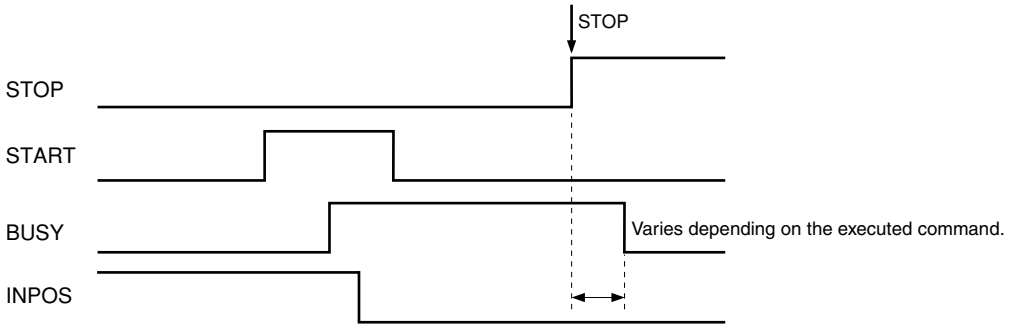
■ Always use pulse inputs for custom commands. Leaving input in the ON state will prevent BUSY from turning to OFF even after execution of a command has been completed.

1. Positioning mode



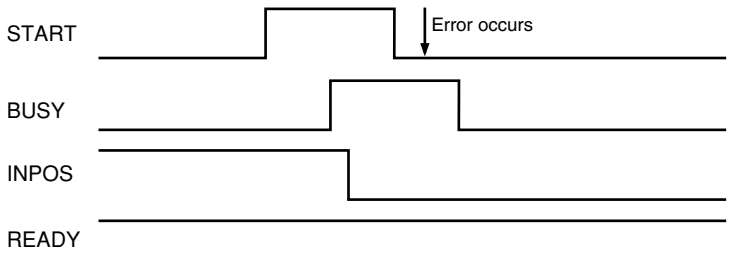
① Input point data in POS0 to POS5. Maintain this input state until BUSY turns to ON. (Changing the input state too early could cause mis-recognition of data.)
② Introduce a delay of at least 5ms, then input START.
③ At the rise of a custom command is input, INPOS turns to OFF and BUSY to ON.
④ Check that BUSY is ON, and then set the custom command input to OFF (open the contact). After this, the point data can be freely changed.
⑤ Wait until BUSY turns to OFF.
⑥ When BUSY turns to OFF, INPOS is ON, this means that the operation has ended normally.

2. When STOP is input



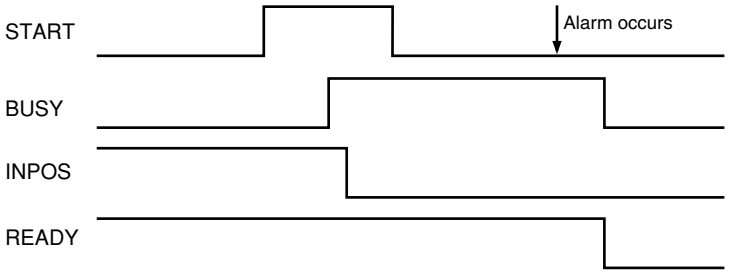
■ When inputting STOP during execution of a command, BUSY turns to OFF. The READY output remains unchanged.

3. When Error is issued



■ With READY output in the ON state, BUSY and INPOS outputs are in the OFF state.

4. When Alarm is issued



■ READY, BUSY, and INPOS outputs all turn to the OFF state.

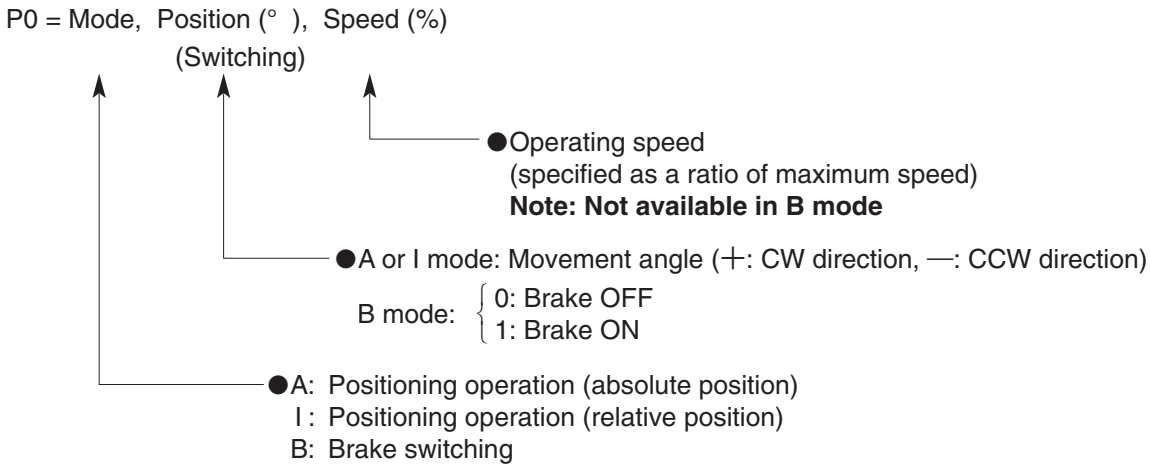
4-4 Actuator number setting

Set the actuator No. using the number in the below table according to the actuator type:

Type	Actuator No.
EWHRT3	61
EWHRT5	62
EWHRT10	63
EWHRT20	64

Actuator number setting method (Use either of the following 2 methods for the settings.)
1. Use the communication command @INIT PRM. (See p.23.)
2. Use the support software initialization command to initialize the parameters.
   (For details, see the support software User's Manual.)

4-5 Point data specifications



Point setting method

Point editing is performed via the RS232C port, on either a personal computer or the teaching box. For the communication parameters and cable specifications, see Section 4-6 “Communication with personal computer” on p.16.

To perform point editing, use either general communication software or the special support software.

For the support software, see the separately available support software User’s Manual.

For the teaching box, see the separately available teaching box User’s Manual.

Use the communication command @WRITE PNT to perform editing.

@WRITE PNT

Personal computer side	Controller side
@WRITE PNT c/r l/f	
	READY c/r l/f
P0 = A, 6.00, 50 c/r l/f	
P1 = I, 3.00, 50 c/r l/f	
P2 = B, 1c/r l/f	
^Z	
	OK c/r l/f

After editing, use the communication command @READ PNT to check the point data.

Transmission example @READ PNT c/r l/f

Response
P0 = A, 20.00, 50 c/r l/f
P1 = I, 30.00, 50 c/r l/f
P2 = A, 60.00, 100 c/r l/f
P5 = I, 20.00, 100 c/r l/f
P6 = B, 0 c/r l/f
OK c/r l/f
All of the data that was input are read.

*1) • Mode B is only possible for with-brake (option) type.
- When the power supply is OFF, the brake is automatically ON, and when the power supply is ON, the brake is automatically OFF.
- If torque is still being applied to the table when the power supply is turned off, the table may move. To maintain the stop position without movement, first activate the brake, then turn off the power. To perform the brake switching, command by the point data and communication command are available (see p.20).
- After the brake is activated, operations cannot be performed. (Error message 36: Brake ON)
To continue operations without turning off the power supply, first off the brake and then operate.

4-6 Communication with personal computer

4-6-1 Communication parameter specifications

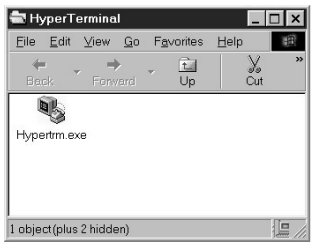
Set the communication parameter settings for a personal computer and other external equipment in the following manner. For the setting methods, see the User's Manual for each machine.

■ Transmission rate	9600bps
■ Data bit length	8 bits
■ Stop bit length	1 bit
■ Parity check	On
■ Parity setting	Odd parity
■ Control method (X parameter)	XON/XOFF software control method (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

Setting method for Hyperterminal, as standard with Windows95* and later.

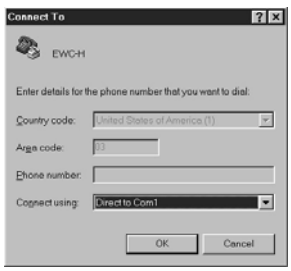
*Windows is the registered trademark of the U.S. Microsoft Corp.

1. Double-click on Hyperterm.exe.



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

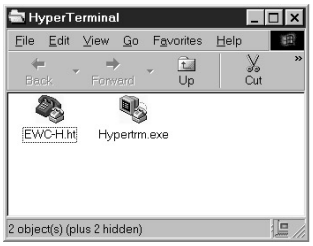
3. For the connection method, select "Direct to Com1" and click "OK."



4. Set the port and click "OK."

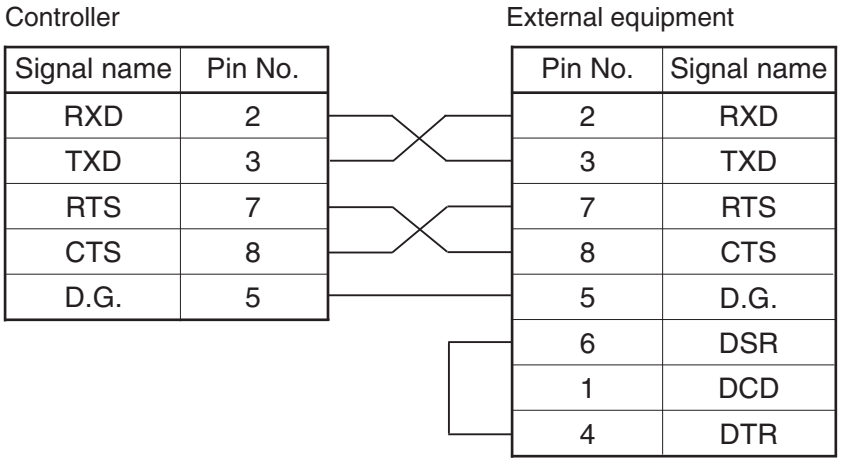
5. Click the "File" "Properties" and select "ASCII Setup" and then add a check mark as shown in the figure at the right, and click "OK."

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



4-6-2 Communication cable

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



Signal name	Pin No.
RXD	2
TXD	3
RTS	7
CTS	8
D.G.	5

Pin No.	Signal name
2	RXD
3	TXD
7	RTS
8	CTS
5	D.G.
6	DSR
1	DCD
4	DTR

4-6-3 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>]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 or 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 3 operands are used. The brackets [ ] refer to items that can be omitted.
- The character codes used are the JIS8 unit-system codes (ASCII codes with katakana characters added).
- 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 the appropriate data. (See sub-section 4-6-4, "List of communication commands" on p.18.)
- When entering 2 or more operands, insert a comma (,) between them.

4-6-4 List of communication commands

Classification	Command	Operand 1	Operand 2	Operand 3	Command description
Actuator operation	ORG				Returns to origin
	MOVD	Coordinate value (°)	Speed (%)		Executes coordinate specified movement
	MOVP	Point No.			Moves to specified point
	X＋				Performs (＋) movement by specified amount
	X－				Performs (－) movement by specified amount
	XINC				Performs (＋) constant speed movement
	XDEC				Performs (－) constant speed movement
	SRVO	Switch			Turns on motor
	BRK	Switch			ON/OFF of brake
Data handling	?POS				Reads current position
	?PNO				Reads current point No.
	?PRM	Parameter No.			Reads specified parameter
	?P	Point No.			Reads specified point data
	?ORG				Confirms state of return to origin
	?SRVO				Confirms state of motor turning on
	?VER				Reads version number
	READ	PNT			Reads all point data
		PRM			Reads all parameters
		DIO			Reads I/O state
		ERR			Reads error history records
	WRITE	PNT			Writes point data
		PRM			Writes parameters
	PDEL	Point No.	Number of points		Deletes point data
Utilities	INIT	PNT			Initializes all point data
		PRM	Actuator No.		Initializes all parameters

Classification	Code	Command description
Special codes	^C (＝03H)	Interrupts ORG, XINC, XDEC
	^Z (＝1AH)	Ends data transmission

Classification	Response	Description
Response from controller	OK	Normal completion of operation
	NG	Occurrence of error Content of error at next line (in 20 characters or less)
	STOP	Stop command Reason for stop at next line (in 20 characters or less)
	READY	Completion of writing preparation
	CAUTION	Caution Contents of error at next line

4-6-5 Details of communication commands

(1) @ORG

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

(2) @MOVD

Function	Performs positioning to the specified location (absolute position from origin) at the specified speed.
Format	@MOVD position, speed c/r l/f
Transmission example 1	@MOVD 30.5,50c/r l/f
Response	OK c/r l/f
Explanation	Moves at 50% of the maximum speed from origin to the 30.5-degree position.
Transmission example 2	@MOVD 380,100 c/r l/f
Response	NG c/r l/f 23: Data error c/r l/f
Explanation	Data beyond the range of operating angle (PRM21) cannot be entered.

(3) @MOVP

Function	Operates by using specified POS No. data.
Format	@MOVP point No. c/r l/f
Transmission example 1	@MOVP 2 c/r l/f
Response	OK c/r l/f
Explanation	Operates as specified at POS2.
Transmission example 2	@MOVP 12 c/r l/f
Response	NG c/r l/f 52: No point data c/r l/f
Explanation	No data at point specified POS12, causing an error.

(4) @X＋(@X－)

Function	Moves at the speed shown below to (＋) side “CW direction” ((－) side “CCW direction”) at the specified amount only. Movement amount = PRM25 [×0.01°] Movement speed = PRM24 [×0.01rps]
Format	@X＋ c/r l/f
Transmission example	@X＋ c/r l/f
Response	OK c/r l/f

(5) @XINC (@XDEC)

Function	Moves continuously at speed shown in the following equation to (＋) side “CW direction” ((－) side “CCW direction”). Stops when ^C is input or movement reaches the software limit. Movement speed = PRM24 [×0.01rps]
Format	@XINC c/r l/f
Transmission example	@XINC c/r l/f
Response 1	STOP c/r l/f 63: Stop command c/r l/f

(6) @SRVO

Function	Commands either for turning on the motor and performing feedback control, or for turning off the motor.
Format	@SRVO switch c/r l/f switch: 0: Frees the motor. 1: Turns on the motor.
Transmission example	@SRVO 1 c/r l/f
Response	OK c/r l/f

(7) @BRK

Function	Switches the brake on and off. (Brake is off during normal operation.)
Format	@BRK switch c/r l/f switch: 0: Brake is OFF 1: Brake is ON
Transmission example	@BRK 1 c/r l/f
Response	OK c/r l/f

(8) @?VER

Function	Checks the controller software version No.
Format	@?VER c/r l/f
Transmission example	@?VER c/r l/f
Response	1.01 c/r l/f OK c/r l/f

(9) @?POS

Function	Reads the current position. (Resolution of 0.45°)
Format	@?POS c/r l/f
Transmission example	@?POS c/r l/f
Response	5.85 c/r l/f ····· Current position is 5.85° from origin. OK c/r l/f

(10) @?PNO

Function	Reads the current point No.
Format	@?PNO c/r l/f
Transmission example	@?PNO c/r l/f
Response	2 c/r l/f ····· Point No. is 2. OK c/r l/f

(11) @?PRM

Function	Reads the specified parameter.
Format	@?PRM parameter No. c/r l/f
Transmission example	@?PRM 25 c/r l/f
Response	100 c/r l/f OK c/r l/f

(12) @?P

Function	Reads the specified point data.
Format	@?P point No. c/r l/f
Transmission example	@?P 10 c/r l/f
Response	P10=A, 50.00, 50 c/r l/f ・・・・・・・ Absolute position of 50°, speed 50%
	OK c/r l/f
Explanation	For the content of response data,
	see Section 4-5, “Point data specifications” on p.15.

(13) @?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

(14) @?SRVO

Function	Can confirm the motor turning on state.
Format	@?SRVO c/r l/f
Transmission example	@?SRVO c/r l/f
Response 1	0 c/r l/f ・・・・・・・ State of motor turning off
	OK c/r l/f
Response 2	1 c/r l/f ・・・・・・・ Motor turned on
	OK c/r l/f

(15) @READ PNT

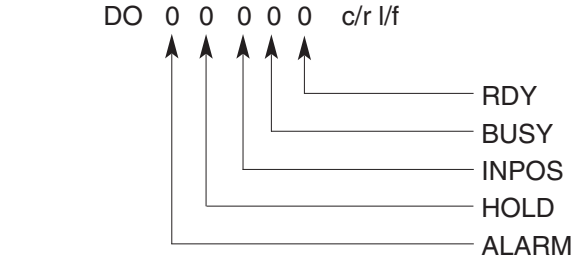
Function	Reads all point data.
Format	@READ PNT c/r l/f
Transmission example	@READ PNT c/r l/f
Response	P0=A, 20.00, 50 c/r l/f
	P1=I, 30.00, 50 c/r l/f
	P2=A, 60.00, 100 c/r l/f
	P5=I, 20.00, 100 c/r l/f
	OK c/r l/f
	Reads all input data.
Explanation	For the content of response data,
	see Section 4-5, “Point data specifications” on p.15.

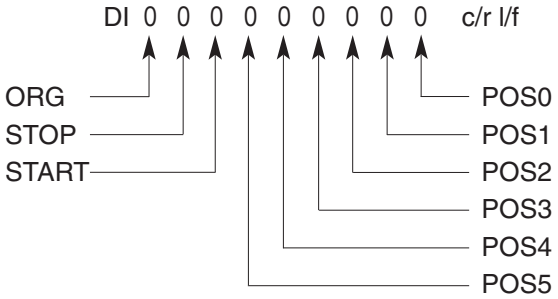
(16) @READ PRM

Function	Reads all parameter data.
Format	@READ PRM c/r l/f
Transmission example	@READ PRM c/r l/f
Response	PRM0=82 c/r l/f
	PRM1=10 c/r l/f
	PRM2=0 c/r l/f
	・
	・
	PRM63=0 c/r l/f
	OK c/r l/f

(17) @READ DIO

Function	Reads custom input/output states.
Format	@READ DIO c/r l/f
Transmission example	@READ DIO c/r l/f
Response	DO 00001 c/r l/f DI 000000000 c/r l/f OK c/r l/f
Explanation	Contents of response data are shown below.





(18) @READ ERR

Function	Reads error history records. (Up to the latest 16 records.)
Format	@READ ERR c/r l/f
Transmission example	@READ ERR c/f 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

(19) @WRITE PNT

Function	Writes point data.	
Format	@WRITE PNT c/r l/f	
Transmission example	Personal computer side	Controller side
	@WRITE PNT c/r l/f	
		READY c/r l/f
	P0=A, 60.00, 50 c/r l/f	
	P1=I, 30.00, 50 c/r l/f	
	^Z	
		OK c/r l/f
Explanation	For data format, see Section 4-5, “Point data specifications” on p.15.	

(20) @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
	PRM1=10 c/r l/f	
	PRM2=0 c/r l/f	
	^Z	
		OK c/r l/f

Sends only data that require changes.

(21) @PDEL

Function	Deletes point data as specified “number of points” from the point specified as the “Point No.”
Format	@PDEL, point No., number of points c/r l/f
Transmission example	@PDEL 10,5 c/r l/f
Response	OK c/r l/f

(22) @INIT PNT

Function	Deletes all point data.
Format	@INIT PNT c/r l/f
Transmission example	@INIT PNT c/r l/f
Response	OK c/r l/f

(23) @INIT PRM

Function	Resets parameters to the initial values. The Electric Rotary Actuator Nos. are as shown below.
Format	@INIT PRM Actuator No. c/r l/f
Transmission example	@INIT PRM 61 c/r l/f
Response	OK c/r l/f

Type	Actuator No.
EWHRT3	61
EWHRT5	62
EWHRT10	63
EWHRT20	64

4-7 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. This section explains 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.
Before using the Electric Rotary Actuator, set the actuator No. according to the actuator model. If any problem is found, please contact us.

Note:

Changing parameters other than those explained in this manual could result in fatal damage or defect in the actuator and controller.

4-7-1 Parameter setting method

Parameter editing is performed via the RS232C port on the personal computer or the teaching box. For communication parameters and cable specifications, see Section 4-6, “Communication with personal computer” on p.16.
Editing parameter is carried out by using general communications software or custom support software.
For handling the support software, see the separately available support software User’s Manual.
For 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
	PRM1=10 c/r l/f	
	PRM2=0 c/r l/f	
	^Z	
		OK c/r l/f
	Sends only data that require 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=60 c/r l/f
	PRM1=10 c/r l/f
	PRM2=0 c/r l/f
	•
	•
	PRM63=0 c/r l/f
	OK c/r l/f

4-7-2 Explanation of parameters

PRM0: Actuator No.
Displays the actuator No. This parameter is only for reading.

PRM1: (＋) software limit
Sets the (＋) side actuator movement range.
For safety, always set to a suitable value.
Input [0] when no limit is set.
Input range 0～9999 (°)
Initial value 0

PRM2: (－) software limit
Sets the (－) side actuator movement range.
For safety, always set to a suitable value.
Input [0] when no limit is set.
Input range －9999～0 (°)
Initial value 0

PRM3: Load inertia
Enters the load inertia attached to the actuator. When the load inertia will change, enter its maximum load inertia.
The controller determines the optimum acceleration for the actuator based on this parameter. Therefore, always set a suitable value. A value that is too small may lead to troubles in the controller and actuator due to abnormal vibrations or heat. On the other hand, setting a value that is larger than the actual load inertia can lead to losses in cycle time and reduced productivity.
Input range 0～20000 ($\times 10^{-6}$ kg･m^2)
Initial value See table below.

Type	EWHRT3	EWHRT5	EWHRT10	EWHRT20
Initial value	1000	3000	2000	20000

PRM4: Acceleration
Sets the acceleration. When lower acceleration is required, change this parameter.
Input range 1～100 (%)
Initial value 100

PRM5: Origin return direction
Sets the origin return direction. Normally, selecting 0 sets the CW movement, and selecting 1 sets the CCW movement when returning to origin.
Input range 0～1
Meaning 0：CW 1：CCW
Initial value 1

PRM10: Origin return speed
Sets the speed for origin return.
Input range 1～50 (×0.01rps)
Initial value 10

PRM21: Operating angle

Enters the effective operating angle for the actuator.
Positioning can be performed in the absolute position within the setting range (±input range).
Input range 1～32400 (in multiples of 360) (°)
Initial value 360

PRM22: Selecting English or Japanese

Sets the language used for response messages in communications.
Input range 0～1
Meaning 0: English 1: Japanese
Initial value 1

PRM24: Teaching movement speed

Parameter for specifying the speed during movement by communication commands @X＋, @X－, @XINC, and @XDEC. This is also used during teaching playback for point.
Input range 1～100 (×0.01rps)
Initial value 20

PRM25: Teaching movement unit

Sets the movement amount during movement by communication commands @X＋ and @X－.
Input range 1～9999 (×0.01°)
Initial value 50

PRM30: Maximum speed

Sets the maximum speed during operations specified by communication command @MOVD, and input of custom command START signal.
Input range 1～100 (%)
Initial value 100

PRM35: Origin shift

The current position when return to origin is completed and which is expressed by coordinate value will be shifted by this amount of parameter value. While the coordinate value of the origin return completed position is normally 0, if for some reason the origin position needs to be shifted to a specific value, change this parameter. For example, if an unwanted position shift occurred, it is ordinarily necessary to perform re-teaching for all point data. However, by setting this parameter to the value of the position shift amount, the operator can quickly correct the point data while eliminating the time required for re-teaching.
Input range －32768～32767 (×0.01°)
Initial value 0

PRM36: Origin shift speed

Sets the speed for origin shift.
Input range 1～100 (×0.01rps)
Initial value 10

Caution

- Under normal conditions, there is no need to change the settings of any parameters other than the ones listed above.

4-8 Error message list

(1) Command error

Error No.	Item	Description
21	Message	illegal type
	Cause	Erroneous command
	Solution	Use the correct command.
23	Message	data error
	Cause	Error in the numerical data
	Solution	Correct the data.

(2) Operation error

Error No.	Item	Description
31	Message	running
	Cause	Another command is already being executed, and the command cannot be accepted.
	Solution	Wait until the current command finishes before inputting the new command.
32	Message	origin incomplete
	Cause	Command cannot be executed because an origin return has not yet been completed.
	Solution	Execute origin return.
34	Message	servo off
	Cause	Command cannot be executed because the motor is in a free state.
	Solution	Reset the motor to normal.
35	Message	can't execute
	Cause	The parameters conflict with the operating instructions.
	Solution	Change either the point data or the parameters.
36	Message	brake on
	Cause	The command cannot be executed because the brake is on.
	Solution	Set the brake to OFF.
37	Message	too long
	Cause	Movement destination position exceeds the software limit.
	Solution	Correct the point data.
39	Message	shifted position
	Cause	Command cannot be executed because the stop position of the table has become misaligned.
	Solution	Execute origin return.

(3) System error

Error No.	Item	Description
52	Message	no point data
	Cause	No data has been registered at the specified point No.
	Solution	Register the point data.
53	Message	no actuator type
	Cause	Error in actuator No. setting.
	Solution	Set the actuator No. at the corresponding type, and try the initialization again.

(4) Stop message

Error No.	Item	Description
61	Message	stop command
	Meaning	Due to stop command, execution has stopped.
63	Message	stop on
	Meaning	Due to entry of STOP input from I/O, execution has stopped.
64	Message	limit stop
	Meaning	Stops at the limit position.

Chapter 5 Troubleshooting

5-1 If a problem occurs

When informing Koganei of a trouble, please provide as detailed information 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 (Did it happen when the power was turned on, or 1 hour after the power was turned on?)
Under what conditions?	During operation When the actuator-table reached a specific location
What happened?	Actuator does not move. Alarm is output.
How frequently?	All the time About once an hour Can not be reproduced.

5-2 Countermeasures against alarm

When READY output is OFF, an alarm is presumed to have been issued. In addition, when an alarm is issued, the ALM LED lights up on the front of the controller.
When an alarm has been issued, first fix the trouble causing the alarm and then turn on the power supply. This action turns off the alarm.

5-3 Alarm specifications

The transmission format for an alarm message is as follows.

<Alarm No.>: <Alarm Message> c/r l/f

When canceling the alarm
To cancel the alarm, the power supply must first be switched off. To restart operations, first fix the trouble causing the alarm, and then turn on the power supply.

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 p.22.)

5-3-1 Alarm message list

Alarm No.	Alarm message	Meaning	Probable cause	Countermeasure
01	over load	•Excessive load •Cable disconnected	1) Too large inertia 2) Motor cable's broken wire or defective connection	1) Reduce the acceleration. 2) Check the cable continuity.
03	over heat	Rise in circuit temperature	1) Overcurrent 2) Shorted cable	Inspect the cable.
05	power supply over	Excessively high input voltage	Power supply	Reduce power supply voltage.
06	disconnection	•Excessive load •Cable broken wire	1) Motor cable's broken wire or defective connection 2) Mechanical interference due to an obstacle, etc.	1) Inspect the cable continuity. 2) Check mechanical interference.
08	point data error	Point data has been damaged.	Power supply was turned off while writing data	Turn on the power supply again, and perform initialization for point data.
09	param data error	Parameter data has been damaged.	Power supply was turned off while writing data	Turn on the power supply again, and perform initialization for parameter data.

Chapter 6 Specifications

6-1 Basic specifications of main unit

Item \ Model			EWHRT3	EWHRT5	EWHRT10	EWHRT20
Motor			2-phase stepping motor			
Maximum torque		N·m	0.25	0.5	1.0	2.0
Repeatability[Note1]			±0.02°			
Angle detection			Optical encoder			
Maximum load inertia[Note2]		kg·m²	1.0×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	2.0×10^{-2}
Minimum operating time[Note3]	(90°, at no load)	s	0.1	0.2	0.12	0.2
	(90°, at maximum load)	s	0.25	0.4	0.25	0.5
Operating temperature range		°C	0～40			
Allowable thrust load		N	100		200	
Allowable radial load		N	100		200	
Allowable moment		N·m	2.5		5.5	
Mass[Note4]		kg	0.34（0.4）		0.8（0.9）	
Applicable controller			EWHC-R			

Notes: 1. Repeatability at one-way swing.
2. The workpiece moment of inertia should always be at or below the maximum load inertia.
3. Values are for no load torque.
4. Figures in parentheses show the mass with-brake .

6-2 Basic specifications of controller

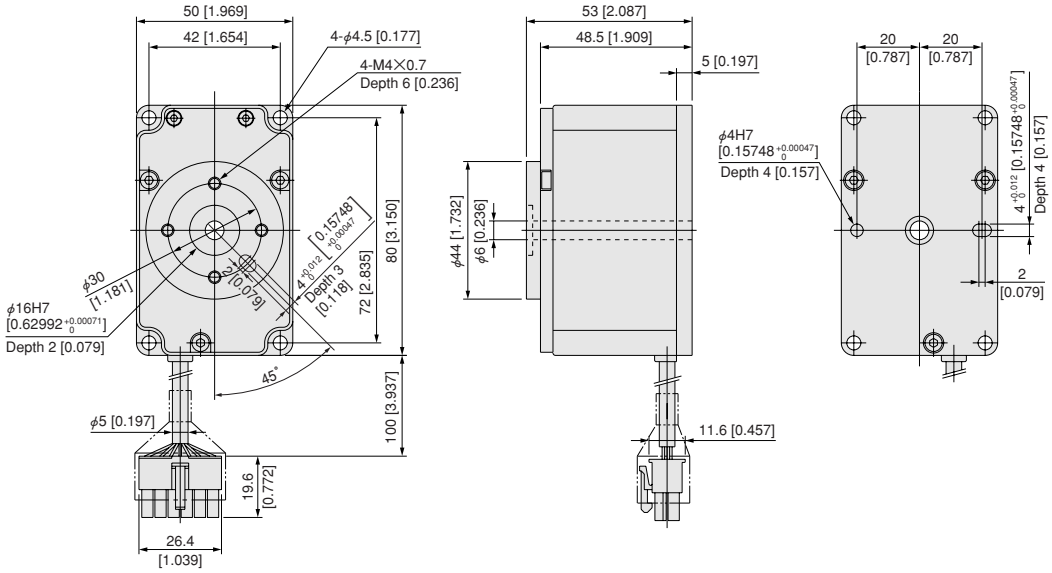
	Item/Model	EWHC-R
Axis control	Motor drive method	Microstep drive
	Control method	Closed loop control
	Operating method	PTP
	Origin detection method	Encoder Z phase
	Position detection method	Encoder A, B phase output
	Minimum setting angle	0.01°
	Speed setting	1～100%
	Acceleration setting	1～100% (Automatic setting based on load inertia)
	Point setting	64 points
	Point input method	Numeric input, teaching input, direct teaching
External input/output	Point setting input	6 inputs photocoupler reception, 5mA TYP/1 input
	Control input	3 inputs (ORG, START, STOP) photocoupler reception, 5mA TYP/1 input
	Control output	3 outputs (READY, BUSY, INPOS), 30mA MAX./1 output
	Abnormality detection output	Overload, disconnection, incorrect data, system abnormality
	External communications	RS232C 1ch (Communication with personal computer and Teaching Box)
	Motor drive output	Dedicated cable (with F.G.)
	Encoder input	Dedicated cable (with shield)
General specifications	Mass	0.2kg
	Power supply	24VDC±10% 1A MAX. (Motor and I/O share the same power supply)
	Operating temperature	0～40°C
	Operating humidity	35～85% RH(no condensation)
	Storage temperature	−10～65°C
	Back-up	EEPROM used to maintain setting conditions
	Noise resistance	IEC61000 – 4-4 level 2
	Accessories	I/O cable, power cable

Chapter 7 Outline Drawings

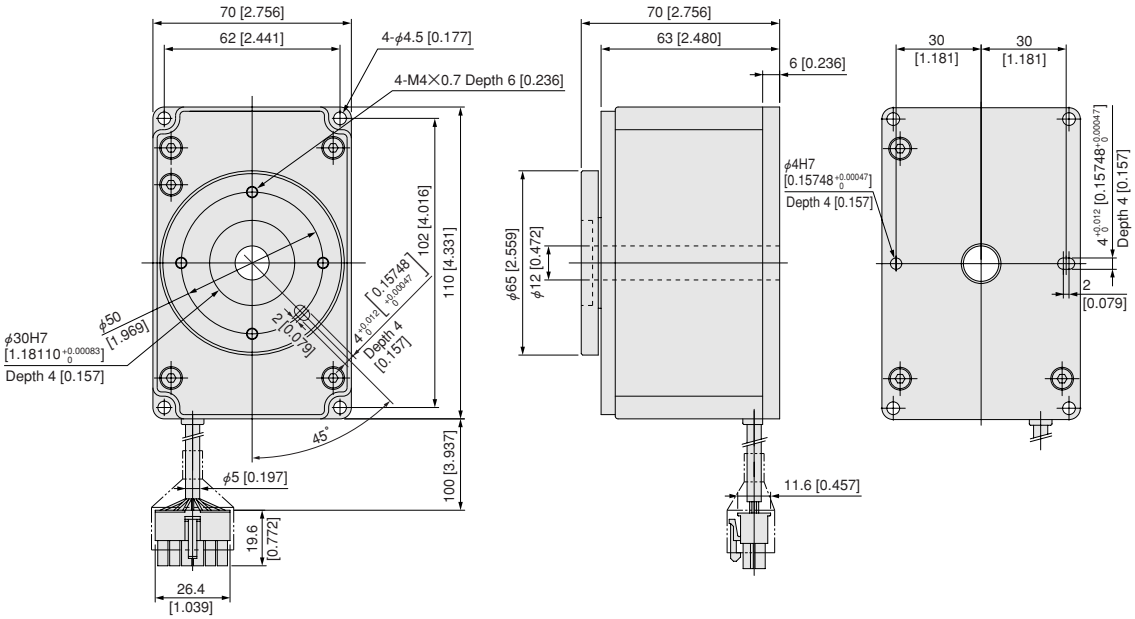
7-1 Main unit

Unit: mm [in.]

EWHRT3
EWHRT5

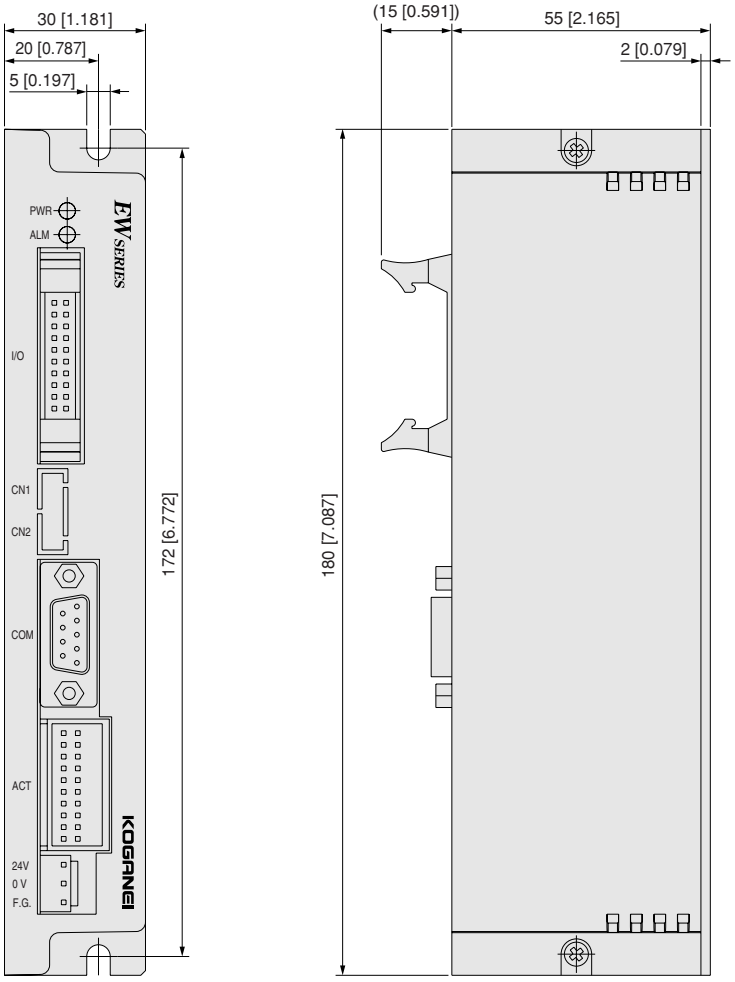


EWHRT10
EWHRT20



7-2 Controller

Unit: mm [in.]



Chapter 8 Technical Data

8-1 Calculation examples for moment of inertia

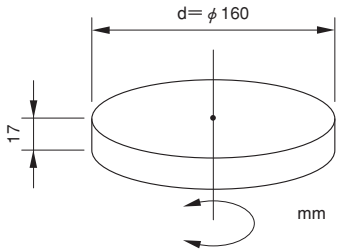
Note: Moment of inertia of the workpiece should always be at or below the maximum load inertia.

1. Disk-shaped load around rotating axis

Load material: Aluminum alloy (density 2.7×10^3kg/m^3)

$$I = \frac{md^2}{8}$$

I : Moment of inertia around rotating axis (kg·m^2)
d : Disk diameter (m)
m : Mass (kg)
d = 0.16 (m)



$$m = \frac{\pi \times 0.16^2}{4} \times 0.017\times2.7\times10^3$$
$$= 0.92\ (kg)$$

$$I = \frac{0.92\times0.16^2}{8}$$

$$= \boxed{3.0\times10^{-3}\ (kg\cdot m^2)}$$

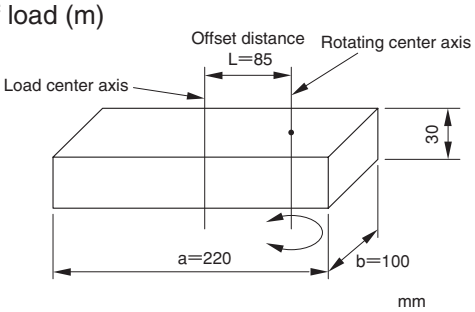
This is the maximum load inertia for **EWHRT5**.

2. Rectangular load offset from rotating axis

Load material: Aluminum alloy (density 2.7×10^3kg/m^3)

$$I = \frac{m}{12}\ (a^2+b^2)+mL^2$$

I : Moment of inertia around rotating axis (kg·m^2)
a, b : Length of side (m)
L : Offset distance from rotating axis to the center of load (m)
m : Mass (kg)



$$m = 0.22\times0.1\times0.03\times2.7\times10^3$$
$$= 1.78\ (kg)$$

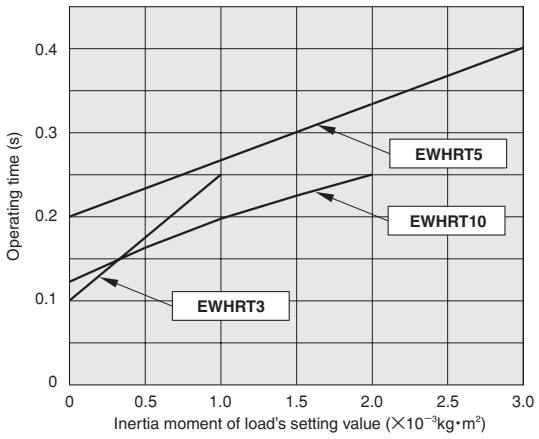
$$I = \frac{m}{12}\ (a^2+b^2)+mL^2$$
$$= \frac{1.78}{12}\ (0.22^2+0.1^2)+(1.78\times0.08^2)$$

$$= \boxed{2.0\times10^{-2}\ (kg\cdot m^2)}$$

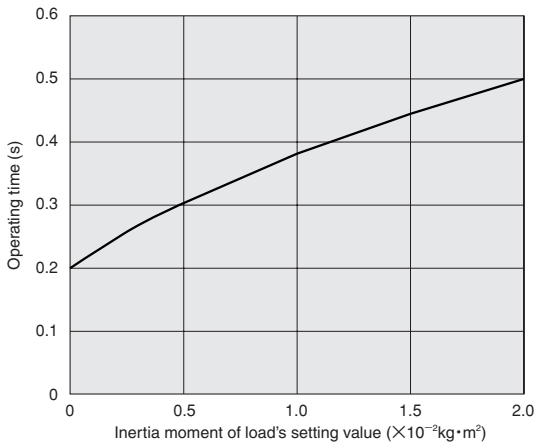
This is the maximum load inertia for **EWHRT20**.

8-2 Operating time (operating angle 90°)

EWHRT3, EWHRT5, EWHRT10



EWHRT20



Revision History
Ver 2.0

P.6 Locating pin holes added to the EWHRT3, 5, 10, and 20 dimension diagrams.
P25 PRM10 input range changed from “1 to 100” to “1 to 50.”
P26 PRM36 input range changed from “1 to 200” to “1 to 100.”
Caution added.
P27 Error numbers 35 and 36 added to “(2) Operation error.”
P31 Locating pin holes added to the EWHRT3, 5, 10, and 20 dimension diagrams.

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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OWNER’S MANUAL

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