



Mitsubishi Industrial Robot

**CR800 Series Controller
CR750/CR751 Series Controller**

Multifunctional Electric Hand Option Instruction Manual



Safety Precautions

Always read the following precautions and the separate "Safety Manual" before starting use of the robot to learn the required measures to be taken.



CAUTION

All teaching work must be carried out by an operator who has received special training. (This also applies to maintenance work with the power source turned ON.)

Enforcement of safety training



CAUTION

For teaching work, prepare a work plan related to the methods and procedures of operating the robot, and to the measures to be taken when an error occurs or when restarting. Carry out work following this plan. (This also applies to maintenance work with the power source turned ON.)

Preparation of work plan



WARNING

Prepare a device that allows operation to be stopped immediately during teaching work. (This also applies to maintenance work with the power source turned ON.)

Setting of emergency stop switch



CAUTION

During teaching work, place a sign indicating that teaching work is in progress on the start switch, etc. (This also applies to maintenance work with the power source turned ON.)

Indication of teaching work in progress



DANGER

Provide a fence or enclosure during operation to prevent contact of the operator and robot.

Installation of safety fence



CAUTION

Establish a set signaling method to the related operators for starting work, and follow this method.

Signaling of operation start



CAUTION

As a principle turn the power OFF during maintenance work. Place a sign indicating that maintenance work is in progress on the start switch, etc.

Indication of maintenance work in progress



CAUTION

Before starting work, inspect the robot, emergency stop switch and other related devices, etc., and confirm that there are no errors.

Inspection before starting work

The points of the precautions given in the separate "Safety Manual" are given below. Refer to the actual "Safety Manual" for details.

 DANGER

When automatic operation of the robot is performed using multiple control devices (GOT, programmable controller, push-button switch), the interlocking of operation rights of the devices, etc. must be designed by the customer.

 CAUTION

Use the robot within the environment given in the specifications. Failure to do so could lead to a drop or reliability or faults. (Temperature, humidity, atmosphere, noise environment, etc.)

 CAUTION

Transport the robot with the designated transportation posture. Transporting the robot in a non-designated posture could lead to personal injuries or faults from dropping.

 CAUTION

Always use the robot installed on a secure table. Use in an instable posture could lead to positional deviation and vibration.

 CAUTION

Wire the cable as far away from noise sources as possible. If placed near a noise source, positional deviation or malfunction could occur.

 CAUTION

Do not apply excessive force on the connector or excessively bend the cable. Failure to observe this could lead to contact defects or wire breakage.

 CAUTION

Make sure that the workpiece weight, including the hand, does not exceed the rated load or tolerable torque. Exceeding these values could lead to errors or faults.

 WARNING

Securely install the hand and tool, and securely grasp the workpiece. Failure to observe this could lead to personal injuries or damage if the object comes off or flies off during operation.

 WARNING

Securely ground the robot and controller. Failure to observe this could lead to malfunctioning by noise or to electric shock accidents.

 CAUTION

Indicate the operation state during robot operation. Failure to indicate the state could lead to operators approaching the robot or to incorrect operation.

 WARNING

When carrying out teaching work in the robot's movement range, always secure the priority right for the robot control. Failure to observe this could lead to personal injuries or damage if the robot is started with external commands.

 CAUTION

Keep the jog speed as low as possible, and always watch the robot. Failure to do so could lead to interference with the workpiece or peripheral devices.

 CAUTION

After editing the program, always confirm the operation with step operation before starting automatic operation. Failure to do so could lead to interference with peripheral devices because of programming mistakes, etc.

 CAUTION

Make sure that if the safety fence entrance door is opened during automatic operation, the door is locked or that the robot will automatically stop. Failure to do so could lead to personal injuries.

 CAUTION

Never carry out modifications based on personal judgments, or use non-designated maintenance parts. Failure to observe this could lead to faults or failures.

WARNING

When the robot arm has to be moved by hand from an external area, do not place hands or fingers in the openings. Failure to observe this could lead to hands or fingers catching depending on the posture.

CAUTION

Do not stop the robot or apply emergency stop by turning the robot controller's main power OFF. If the robot controller main power is turned OFF during automatic operation, the robot accuracy could be adversely affected. Moreover, it may interfere with the peripheral device by drop or move by inertia of the arm.

CAUTION

Do not turn off the main power to the robot controller while rewriting the internal information of the robot controller such as the program or parameters. If the main power to the robot controller is turned off while in automatic operation or rewriting the program or parameters, the internal information of the robot controller may be damaged.

DANGER

Do not connect the Handy GOT when using the GOT direct connection function of this product. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

DANGER

Do not connect the Handy GOT to a programmable controller when using an iQ Platform compatible product with the CR7xx-Q/CR800-R/CR800-Q controller. Failure to observe this may result in property damage or bodily injury because the Handy GOT can automatically operate the robot regardless of whether the operation rights are enabled or not.

DANGER

Do not remove the SSCNET III cable while power is supplied to the multiple CPU system or the servo amplifier. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables of the Motion CPU or the servo amplifier. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

DANGER

Do not remove the SSCNET III cable while power is supplied to the controller. Do not look directly at light emitted from the tip of SSCNET III connectors or SSCNET III cables. Eye discomfort may be felt if exposed to the light. (Reference: SSCNET III employs a Class 1 or equivalent light source as specified in JIS C 6802 and IEC60825-1 (domestic standards in Japan).)

DANGER

Attach the cap to the SSCNET III connector after disconnecting the SSCNET III cable. If the cap is not attached, dirt or dust may adhere to the connector pins, resulting in deterioration connector properties, and leading to malfunction.

CAUTION

Make sure there are no mistakes in the wiring. Connecting differently to the way specified in the manual can result in errors, such as the emergency stop not being released. In order to prevent errors occurring, please be sure to check that all functions (such as the teaching box emergency stop, customer emergency stop, and door switch) are working properly after the wiring setup is completed.

CAUTION

Use the network equipments (personal computer, USB hub, LAN hub, etc) confirmed by manufacturer. The thing unsuitable for the FA environment (related with conformity, temperature or noise) exists in the equipments connected to USB. When using network equipment, measures against the noise, such as measures against EMI and the addition of the ferrite core, may be necessary. Please fully confirm the operation by customer. Guarantee and maintenance of the equipment on the market (usual office automation equipment) cannot be performed.

CAUTION

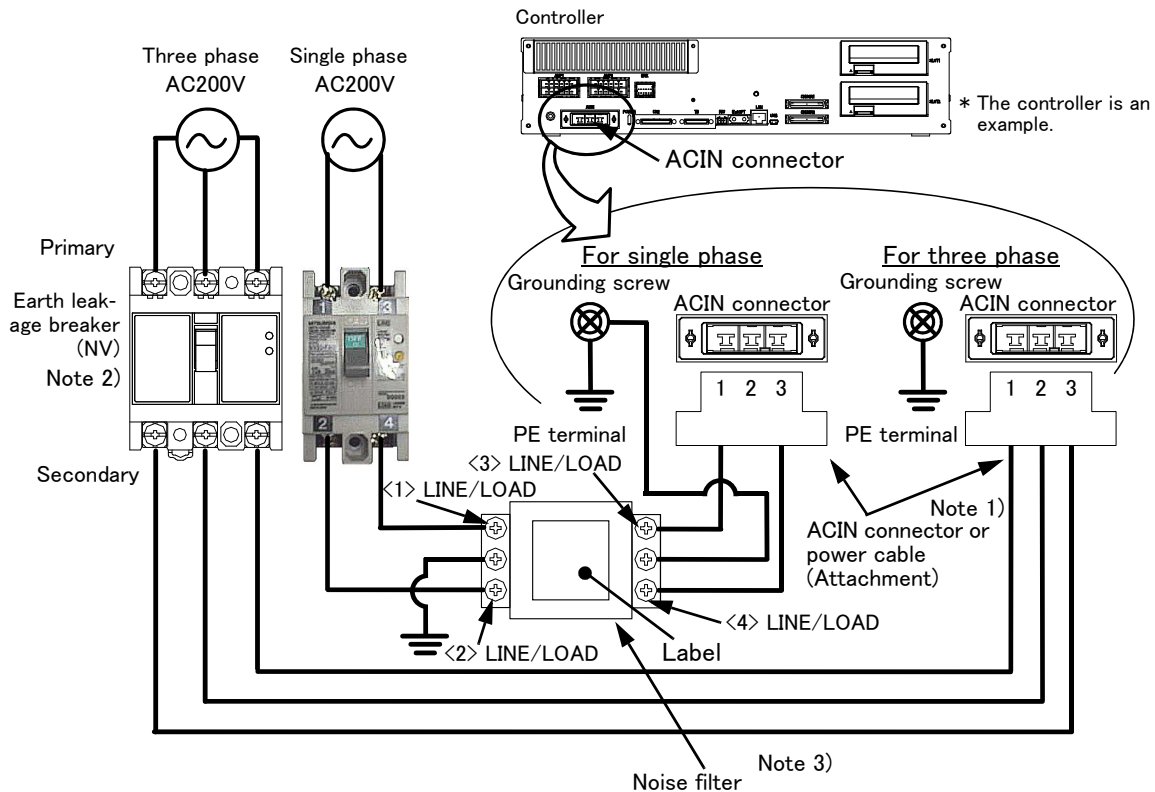
To maintain the safety of the robot system against unauthorized access from external devices via the network, take appropriate measures.
To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

*CR751-D or CR751-Q controller

Notes of the basic component are shown.

⚠ CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller of CR751-D or CR751-Q because of leakage protection.



Note 1) Crimping swage is recommended for connecting the attachment ACIN connector (soldering is also possible)

Recommendation compression tools: 234171-1(Tyco Electronics)

Note 2) The earth leakage breaker is the customer preparation. Always use the cover below.

Recommendation: For single primary power supply NV30FAU-2P-10A-AC100-240V-30mA, (Cover: TCS-05FA2)

For three primary power supply NV30FAU-3P-10A-AC100-240V-30mA, (Cover: TCS-05FA3)

Note 3) If necessary, as shown in the figure, connects the noise filter between ACIN terminal blocks and primary power supply. (Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)

- 1) Please prepare the following: Leakage current breaker (with the terminal cover), cable for connecting the primary power supply (AWG #14 (2mm² or above), cables to ground the primary power supply (AWG #12 (3.5mm² or above).

The secondary power cable (with the ACIN connector) for single phase or three phase power is supplied with the product to match the specifications. When you build a cable suitable for your environment using the ACIN connector and the ACIN terminal supplied, prepare a secondary power cable (AWG #14 (2mm² or above).

- 2) Confirm that the primary power matches the specifications.
- 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
- 4) Connect the secondary power cable.

a) When using the supplied power cable with the ACIN connector

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

b) When building a power cable using the ACIN connector and the ACIN terminals supplied

Connect the ACIN terminals with the secondary power cable (prepared by customers), and insert the ACIN terminals to the ACIN connector pins with the following numbers. Crimping caulking is recommended to connect the ACIN terminals.

For single phase: 1 and 3

For three phase: 1, 2, and 3

Refer to the figure above and connect the cable from the secondary side of the earth leakage breaker.

- 5) Connect this ACIN connector to the ACIN connector on the front of the controller.
- 6) Connect the grounding cable to the PE terminal. (M4 screw)
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

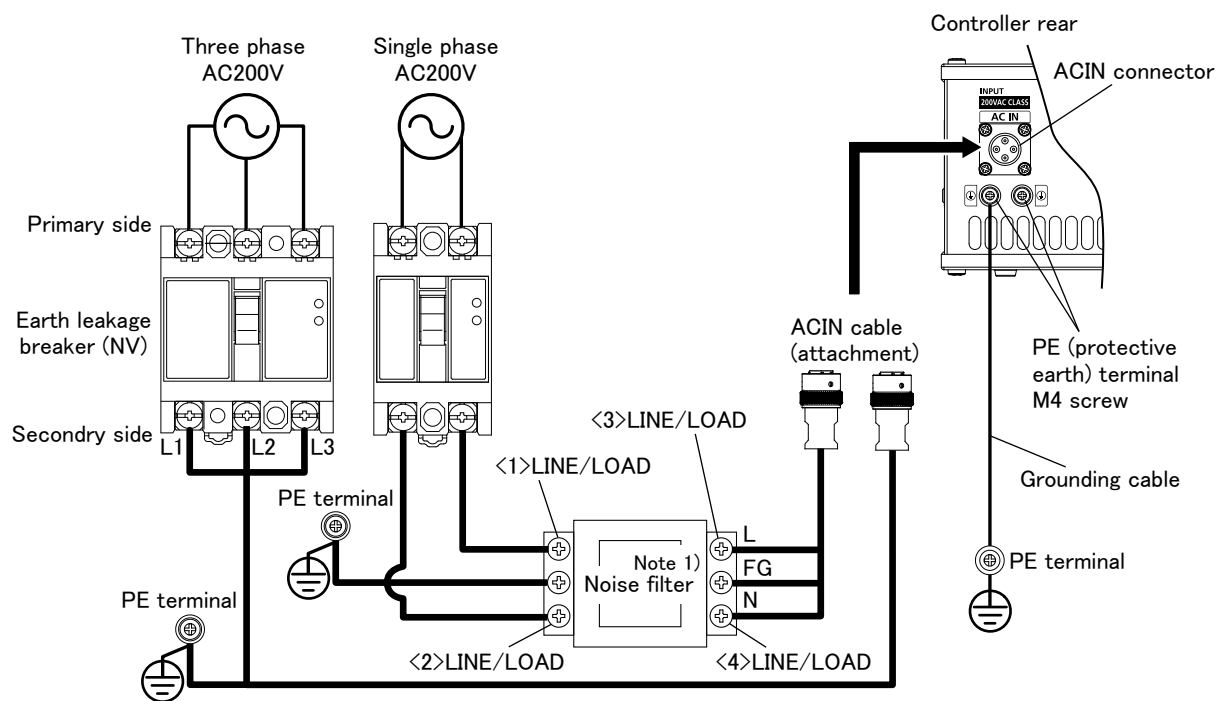
*CR800 controller

Notes of the basic component are shown.



CAUTION

Please install the earth leakage breaker in the primary side supply power supply of the controller of CR800 because of leakage protection.



Note 1) If necessary, as shown in the figure, connects the noise filter between ACIN connector and primary power supply.
(Recommended noise filter: SUP-EL20-ER6 *OKAYA ELECTRIC INDUSTRIES)

1) Prepare the following items.

Part name	Specifications	Remarks
Earth leakage breaker	The following is recommended product. Single phase: NV30FAU-2P-10A-AC100-240V-30mA (Terminal cover: TCS-05FA2) Three phase: NV30FAU-3P-10A-AC100-240V-30mA (Terminal cover: TCS-05FA3)	Prepared by customer.
Cable for primary power supply	AWG14 (2mm ²) or above	Prepared by customer. Tightening torque for terminal fixing screw is 2 ~ 3Nm.
Grounding cable	AWG14 (2mm ²) or above	Prepared by customer. Tightening torque for terminal fixing screw is 2 ~ 3Nm.
ACIN cable	Terminal: M5, cable length: 3m	Supplied with the product.

- 2) Confirm that the primary power matches the specifications.
- 3) Confirm that the primary power is OFF and that the earth leakage breaker power switch is OFF.
- 4) Connect the ACIN cable to the breaker.
Connect the power terminals of the ACIN cable to the secondary side terminals of the earth leakage breaker.
Also, ground the FG terminal of the cable.
- 5) Connect the ACIN cable to the ACIN connector on the rear of the controller.
- 6) Connect one end of the grounding cable to the PE (protective earth) terminal on the controller and ground the other end (2-point grounding) in order to comply with the requirements of EN 61800-5-1 for the touch current of 3.5 mA AC or more.
- 7) Connect the primary power cable to the primary side terminal of the earth leakage breaker.

Revision history

Date	Specifications No.	Details of revisions
2015-10-05	BFP-A3408	• First print
2015-10-23	BFP-A3408-A	• Corrected the errors in the Item column of Table 3-3: hand cable.
2015-11-11	BFP-A3408-B	• “Table 2-5: Specifications of the control unit” was deleted.
2017-07-12	BFP-A3408-C	• Descriptions about the CR800 controller have been added.
2018-02-01	BFP-A3048-D	• Descriptions about the CR800-Q controller have been added.
2026-03-31	BFP-A3048-E	• Changed some sections.

* Introduction

Thank you for purchasing Mitsubishi Electric industrial robot.

This instruction manual explains "Multifunctional Electric Hand" option.

"Highly precise gripping force" "the location" "speed control" is possible, and this product can apply it to the various uses.

Always read over this manual to gain a sufficient understanding of its content before using the "Multifunctional Electric Hand".

Please note that this instruction manual assumes that operators have an understanding of basic Mitsubishi Electric industrial robot operation and functionality. Refer to the separate "Instruction Manual, Detailed Explanations of Functions and Operations" for information on basic operation.

* Notation used in this manual



Danger

Incorrect handling may result in imminent danger, leading to death or serious injury.



Warning

Incorrect handling may lead to death or serious injury.



Caution

Incorrect handling may result in property damage, or danger leading to impairment of the user.

Notice

*ONLY QUALIFIED SERVICE PERSONNEL MAY INSTALL OR SERVICE THE ROBOT SYSTEM.

*ANY PERSON WHO PROGRAM, TEACHES, OPERATE, MAINTENANCE OR REPAIRS THE ROBOT SYSTEM IS TRAINED AND DEMONSTRATES COMPETENCE TO SAFELY PERFORM THE ASSIGNED TASK.

*ENSURE COMPLIANCE WITH ALL LOCAL AND NATIONAL SAFETY AND ELECTRICAL CODES FOR THE INSTALLATION AND OPERATION OF THE ROBOT SYSTEM.

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1 Using This Manual

1.1 Content of This Instruction Manual

This manual is divided up in to the following sections, and describes how to use the electric hand.

Table 1-1:Instruction Manual content

Chapter	Title	Content
1	Using This Manual	Describes the makeup of this manual.
2	Specifications	Describes the electric hand system specifications.
3	Check Before Use	Describes the product configuration and devices to be prepared. Check whether all the required products are present, and check the controller, T/B, and RT-ToolBox2 versions.
4	Installation	Describes how to attach the force sensor to the robot. Pay heed to the precautions when installing the electric hand.
5	Using the Electric Hand (Programming)	Describes how to use (programming method) the electric hand.

2 Specifications

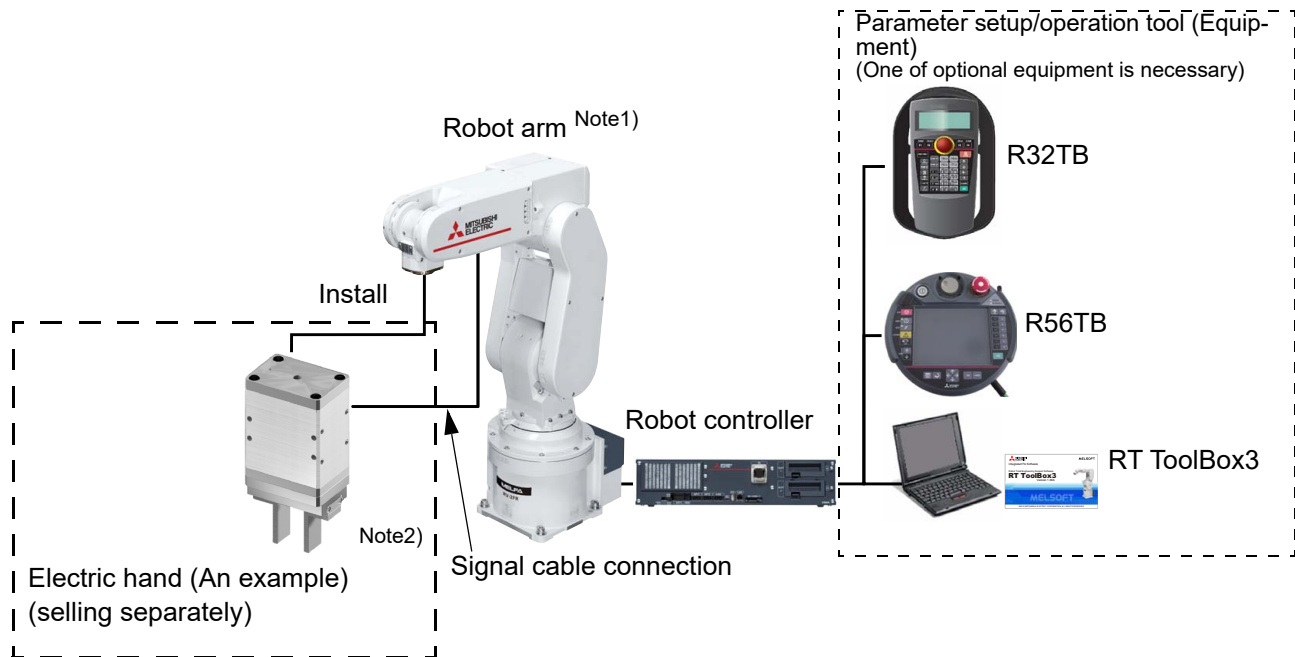
2.1 What is the Electric Hand?

This product will do "highly precise gripping force" "location control" "speed control" electrically and answer to the various uses by the rich function and line-up.

2.2 System Configuration

2.2.1 CR800 Outline

One of the example of equipment constitution is shown below.



Note1) The figure is the example of constitution of RV-2FR.

Note2) The figure of the electric hand is an example. Refer to the instructions manual attached to the electric hand for attachments and specification, etc. of the electric hand.

CAUTION

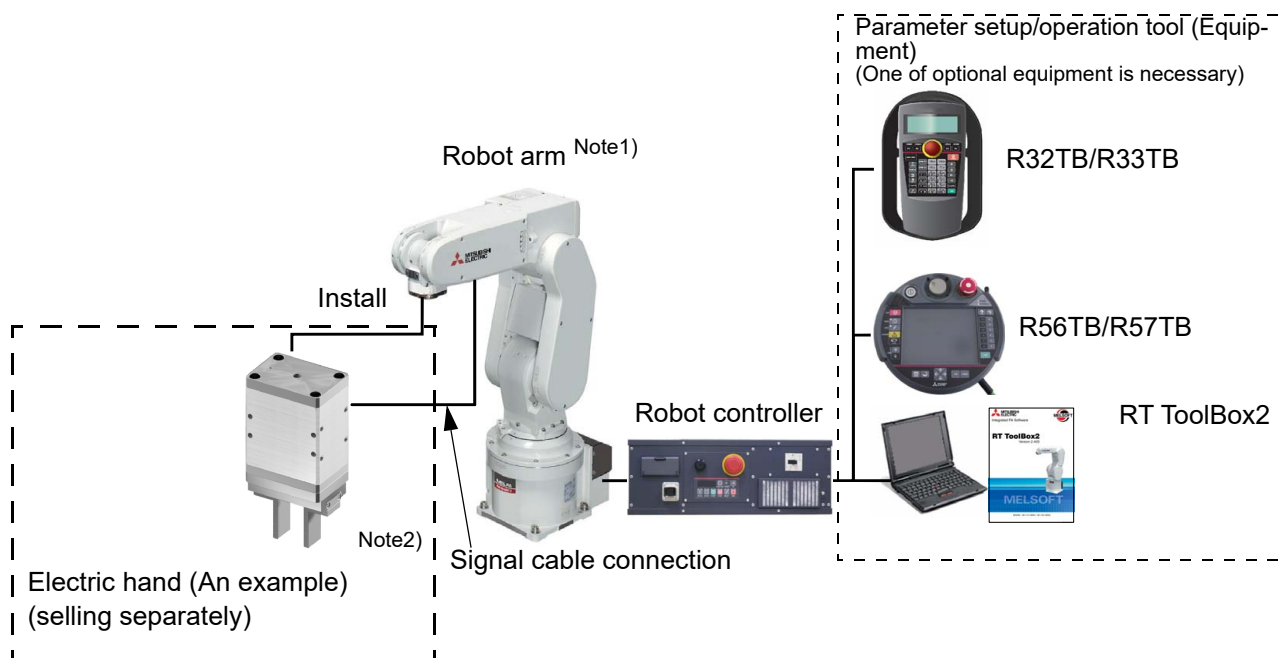
When adjusting the electric hand section, you should turn off the drive power supply of the electric hand sure. Otherwise, there exists the danger that the hand or the finger will be caught. And, even if the servo of the robot arm turns off, the electric hand maintains condition of turning ON the drive power supply. This is the measure for not dropping carelessly the work piece which is doing the grip. Operate safely sure after grasping the drive power supply ON/OFF condition of the electric hand during the teaching or adjustment operations.

The drive power supply of electric hand can be turned off by operation of T/B. The drive power supply of electric hand turn on automatically by operation of the hand open or close etc or execution of the instruction to operate.

Fig.2-1:Example of electric hand use constitution

2.2.2 CR750/CR751 Outline

One of the example of equipment constitution is shown below.



Note1) The figure is the example of constitution of RV-2F.

Note2) The figure of the electric hand is an example. Refer to the instructions manual attached to the electric hand for attachments and specification, etc. of the electric hand.

⚠CAUTION

When adjusting the electric hand section, you should turn off the drive power supply of the electric hand sure. Otherwise, there exists the danger that the hand or the finger will be caught. And, even if the servo of the robot arm turns off, the electric hand maintains condition of turning ON the drive power supply. This is the measure for not dropping carelessly the work piece which is doing the grip. Operate safely sure after grasping the drive power supply ON/OFF condition of the electric hand during the teaching or adjustment operations.

The drive power supply of electric hand can be turned off by operation of T/B. The drive power supply of electric hand turn on automatically by operation of the hand open or close etc or execution of the instruction to operate.

Fig.2-2:Example of electric hand use constitution

2.2.3 Compatible models

Table 2-1:Compatible models

No.	Robot model	Electric hand type	Control unit	Hand cable
1	RV-2F/2FR series ^{Note1)}	2-finger single cam type 2-finger screw type	4F-MEHCU-01 (Arm mount type)	-
2	RV-4F/7F/13F/20F series, RV-4FR/7FR/13FR/20FR series	3-finger single cam type 4F-MEHGR-01 to 05 (any one of the electric hands)	4F-MEHCU-02 (Floor mount type)	4F-MEHCBL-01 to 05
3	RH-3FH/6FH/12FH/20FH series, RH-3FRH/6FRH/12FRH/20FRH series			
4	RH-3FHR/3FRHR series			

Note1) When using a Multifunctional Electric Hand in iQ Platform compatible type, you can't use an extended option of a machine cable.

2.2.4 Limitations

(1) Available equipment, software version

The electric hand can be used with the robot, equipment, tool, and software version shown in [Table 2-2](#).

Table 2-2: Available equipment, software version

Equipment	Controller	R32TB/R33TB	R56TB/R57TB	RT ToolBox2	RT ToolBox3
CR751/750 series	Q type controller: Ver. R2a or later D type controller: Ver. S2a or later	Ver. 1.6 or later	Ver. 2.5 or later	Ver. 2.3 or later	Ver. 1.00A or later
CR800 series	R type controller: Ver. A1 or later D type controller: Ver. A1 or later Q type controller: Ver. A2 or later	Ver. 1.6 or later	Ver. 4.0 or later	-	Ver. 1.00A or later

2.3 Control Unit

2.3.1 Specifications

Table 2-3: Specifications of the control unit

Item	Unit	Specification	Remarks
The number of the maximum connection	Unit	1	" Hand 1", " hand 2", " hand 3" is indicated.
Connection method	-	Remote I/O connection	
Channel number	-	Channel 1	
Station number (input-and-output number)	-	Hand 1: Station number 5 (700 to 731) Hand 2: Station number 6 (732 to 763) Hand 3: Station number 7 (764 to 795)	Set up the station number with the switch of the electric hand body. The hand is distinguishable to the three kinds by setup of the station number. The one unit of the hand can be used simultaneously. * The mentioned input-and-output signal is occupied for electric hands. They are not useful to the signal output in the user program etc.
Teaching point (maximum)	Point	32	The specification value is the maximum teaching point per hand.

Table 2-4: Control unit

No.	Control unit type (Compatible robot models)	Model name in TAIYO	Model name as our products
1	Arm mount type (RV-2F/2FR series)	ESC11-B-11XW 133-5-M	4F-MEHCU-01
2	Floor mount type (RV-4F/7F/13F/20F series, RH-3FH/6FH/12FH/20FH series, RH-3FHR series, RV-4FR/7FR/13FR/20FR series, RH-3FRH/6FRH/12FRH/20FRH series, RH-3FRHR series)	ESC11-B-12XW 111-5-M	4F-MEHCU-02

2.3.2 Outline Drawing

(1) 4F-MEHCU-01

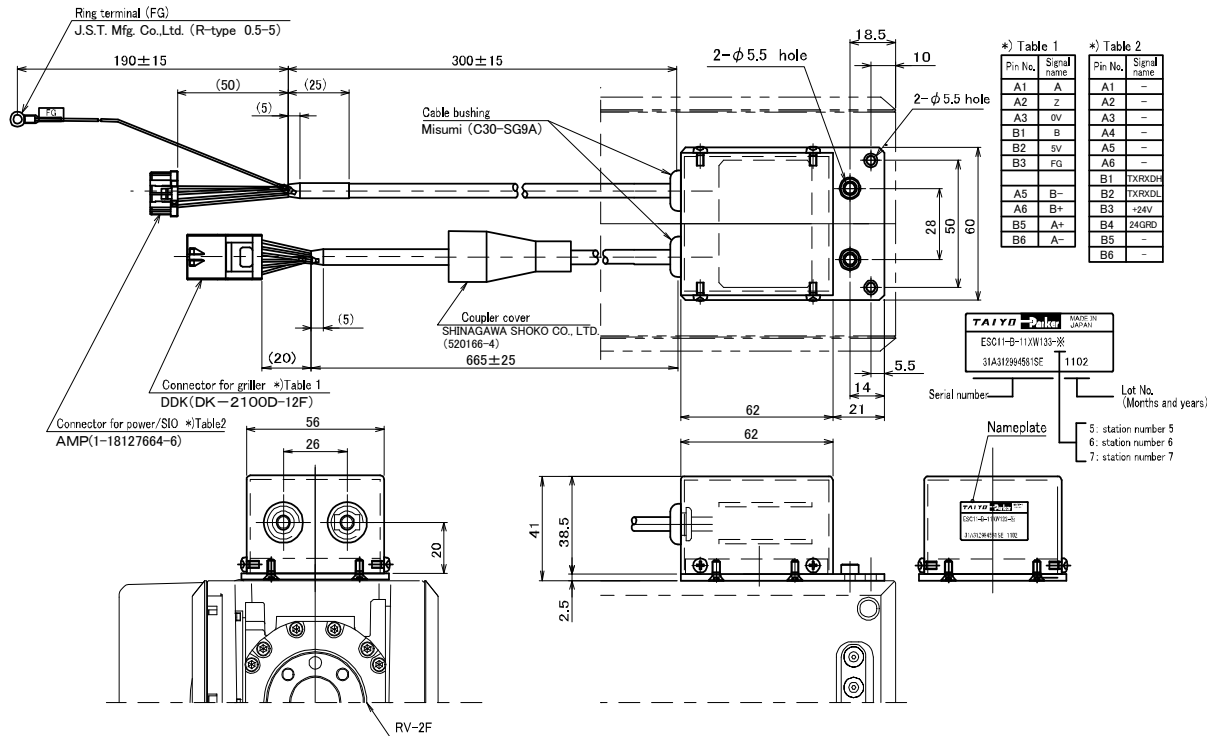


Fig.2-3:Outline drawing of the control unit (4F-MEHCU-01)

(2) 4F-MEHCU-02

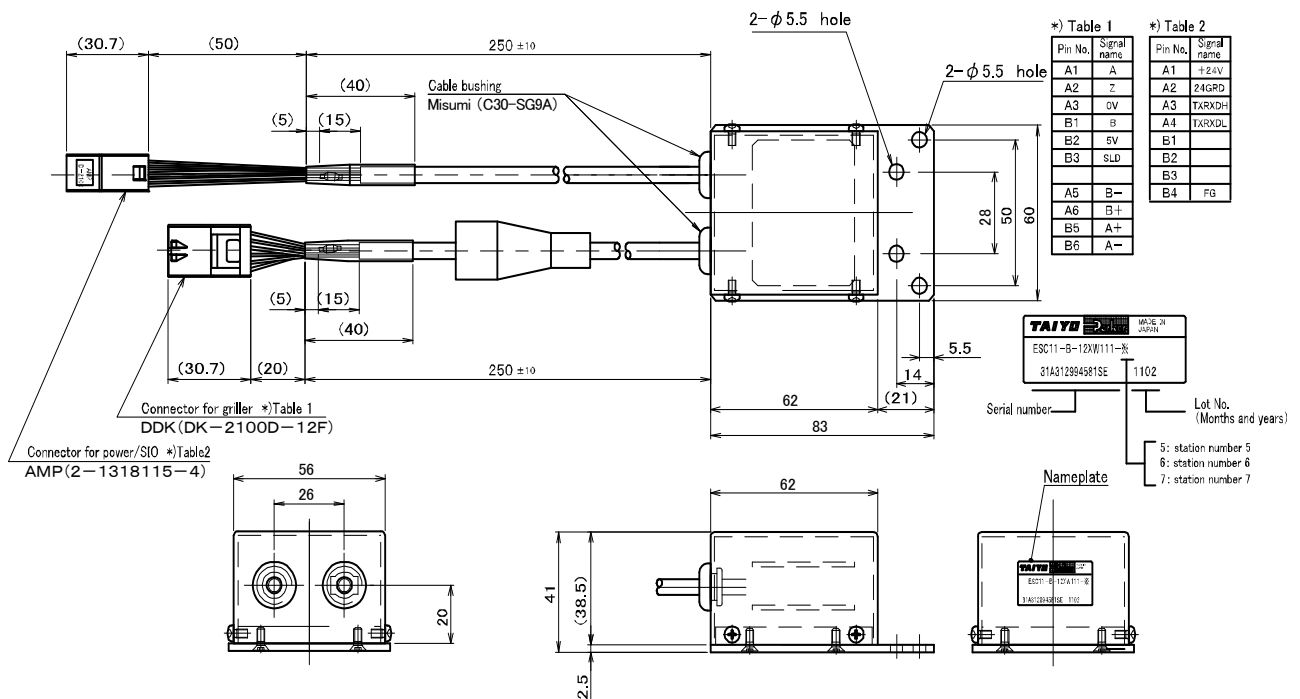


Fig.2-4:Outline drawing of the control unit (4F-MEHCU-02)

2.4 Electric Hand

2.4.1 Models of Electric Hand

Table 2-5:Electric hand

No.	Electric hand type	Model name in TAIYO	Model name as our products
1	2-finger single cam type	ESG1-SS-2005-5N-11XW 107-M	4F-MEHGR-01
		ESG1-SS-2010-11XW 107-M	4F-MEHGR-02
		ESG1-SS-2815-11XW 107-M	4F-MEHGR-03
2	2-finger screw type	ESG1-FT-2840-11XW 109-M	4F-MEHGR-04
3	3-finger single cam type	ESG1-ST-2013-11XW 110-M	4F-MEHGR-05

2.4.2 Outline Drawing

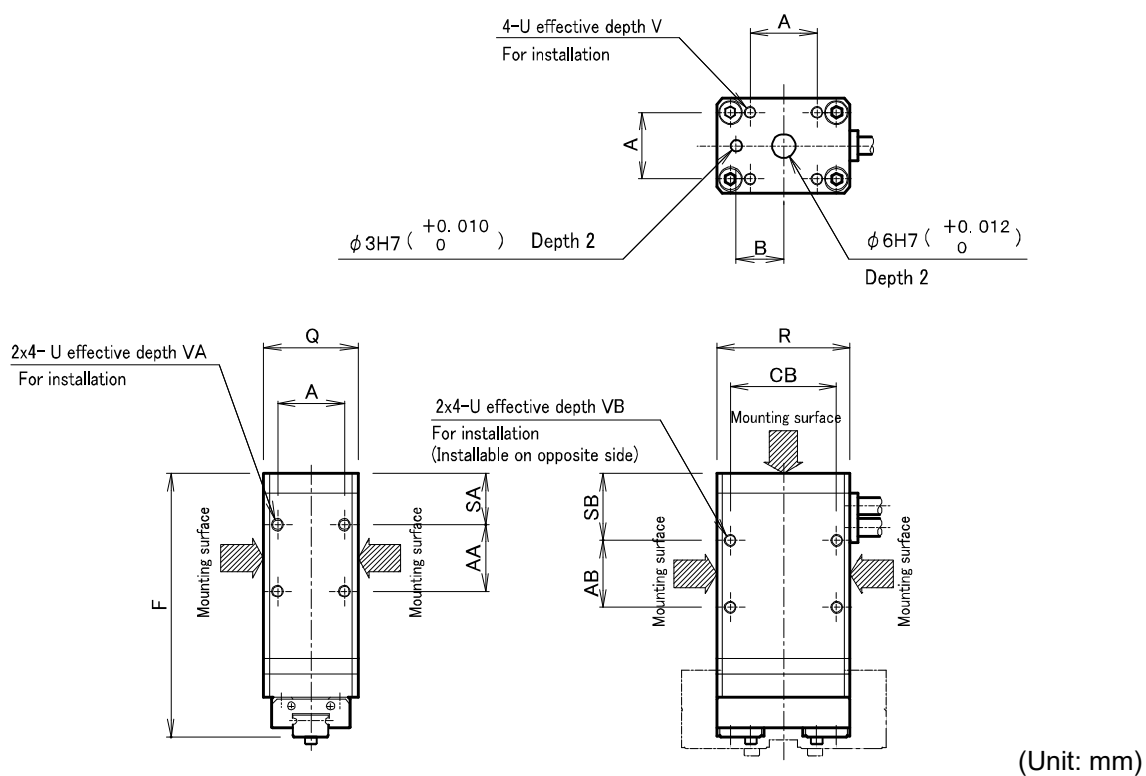
(1) Single cam type

ESG1-SS-2005-5N-11XW 107-M (4F-MEHGR-01): Refer to Fig. 2-6.

ESG1-SS-2010-11XW 107-M (4F-MEHGR-02): Refer to Fig. 2-5.

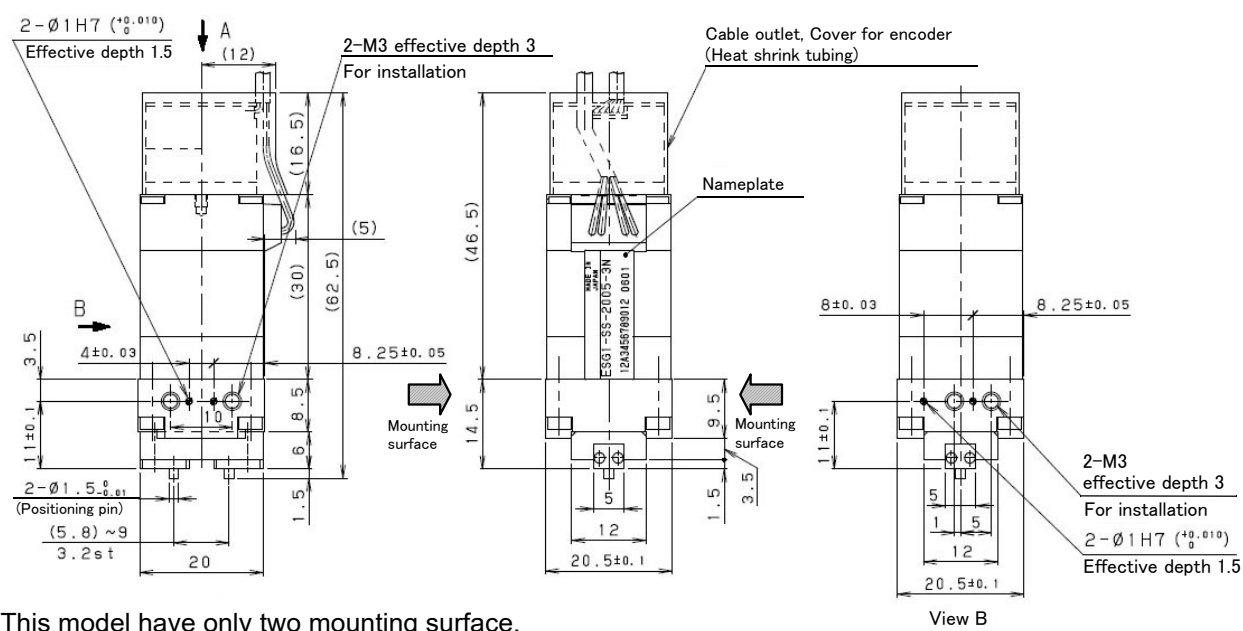
ESG1-SS-2815-11XW 107-M (4F-MEHGR-03): Refer to Fig. 2-5.

ESG1-ST-2013-11XW 110-M (4F-MEHGR-05): Refer to Fig. 2-7.



Model	A	AA	AB	B	CB	F	Q	R	SA	SB	U	V	VA	VB
ESG1-S*-20**	17	17	17	12	27	71	24	34	13	17	M3	5	6	6
ESG1-S*-28**	24	24	14	15	38	78	32	46	16	21	M4	6	8	8

Fig.2-5:Outline drawing of the control unit (Single cam type 1)



* This model have only two mounting surface.

Fig.2-6: Outline drawing of the control unit (Single cam type 2)

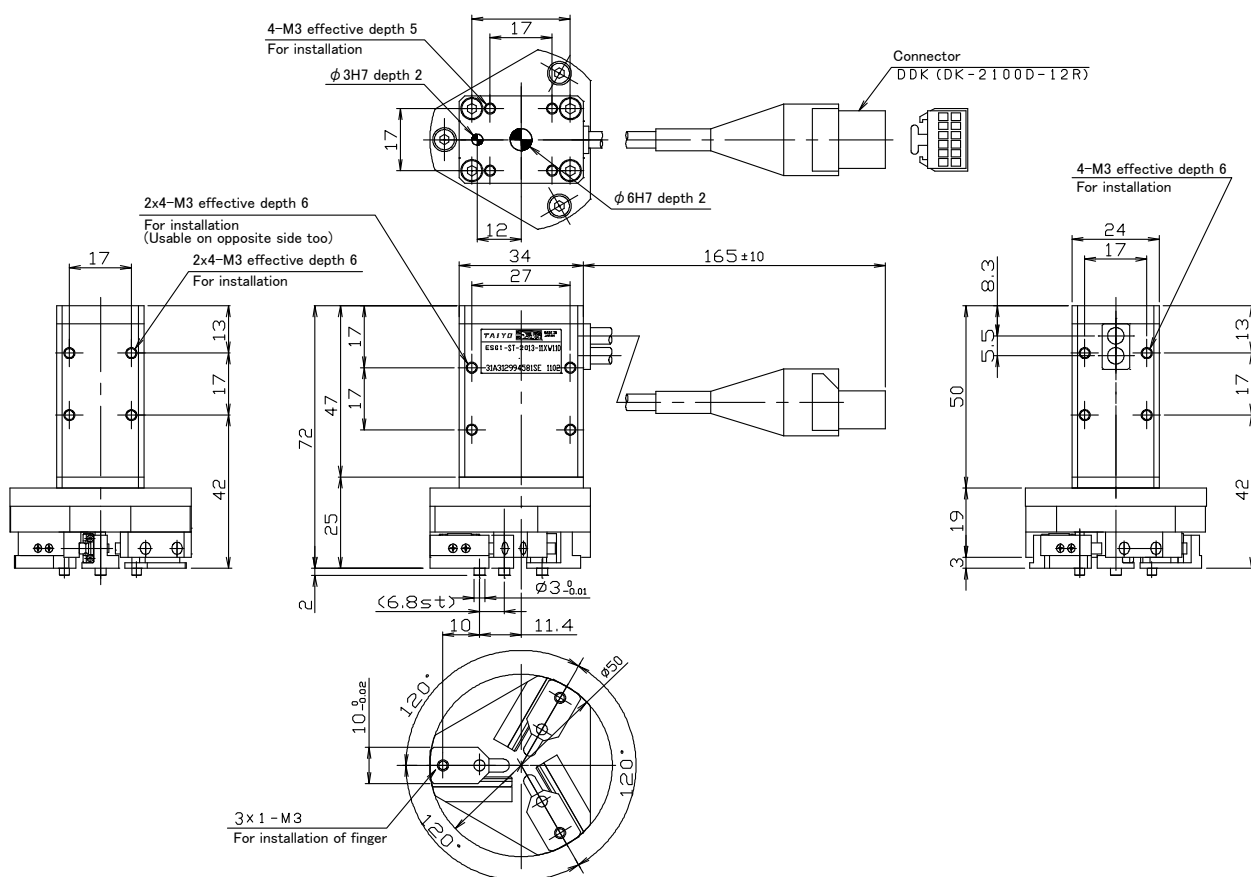


Fig.2-7: Outline drawing of the control unit (Single cam type 3)

(2) Screw type
ESG1-FT-2840-11XW 109-M (4F-MEHGR-04): Refer to Fig. 2-8.

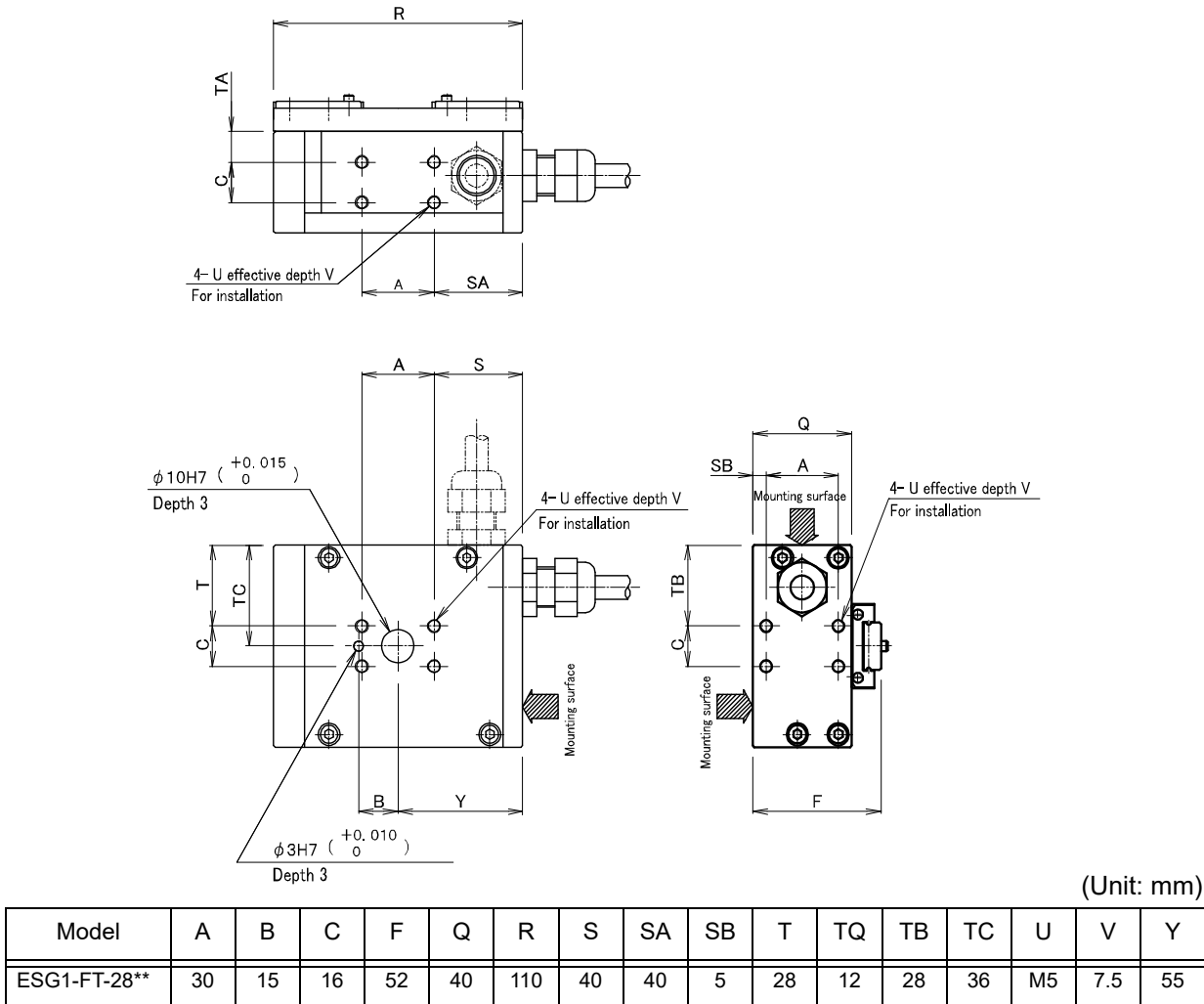


Fig.2-8:Outline drawing of the control unit (Screw type)

2.4.3 Installing the Fingers

⚠ CAUTION

- When installing and uninstalling the fingers, surely support them to prevent applying excessive force to or impacting on the guide block.
- This may cause damage to the parts in the product. The tapped holes used for installing the fingers are through holes. Therefore, never use long screws exceeding the effective thread length. They may damage the product.

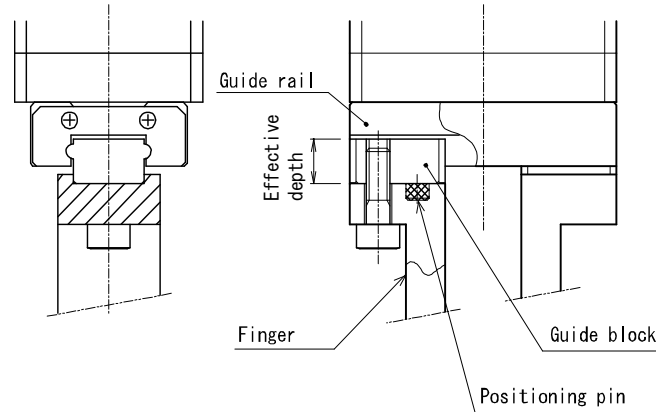


Fig.2-9:Installing the fingers

Using the positioning pin on the guide block may improve installation accuracy and repeatability. For further improvement of installation repeatability, place a guide block between a finger and guide rail as Fig. 2-9.

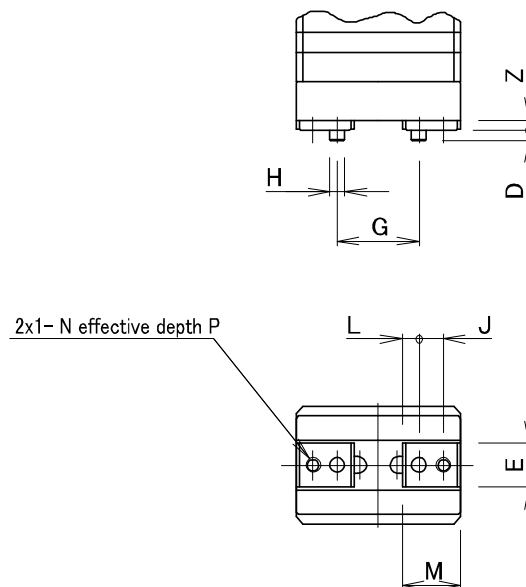
(1) Installing dimensions (Single cam type)

ESG1-SS-2005-5N-11XW 107-M (4F-MEHGR-01): Refer to Fig. 2-10.

ESG1-SS-2010-11XW 107-M (4F-MEHGR-02): Refer to Fig. 2-10.

ESG1-SS-2815-11XW 107-M (4F-MEHGR-03): Refer to Fig. 2-10.

ESG1-ST-2013-11XW 110-M (4F-MEHGR-05): Refer to Fig. 2-7.

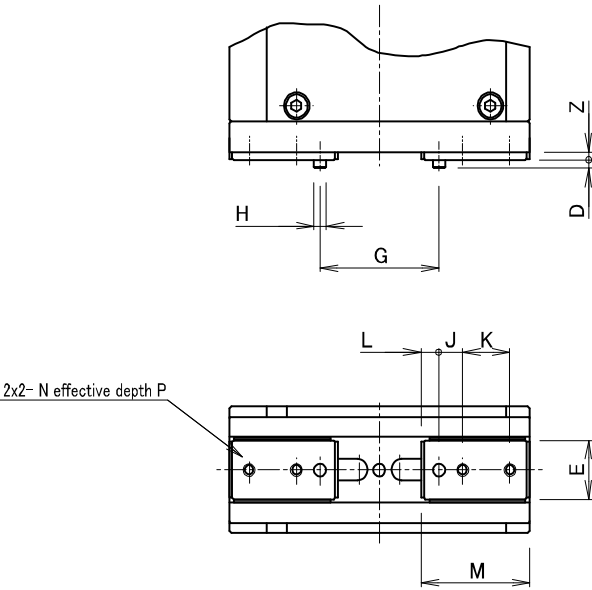


(Unit: mm)

Model	D	E	G	H	J	L	M	N	P	Z
ESG1-SS-20**	2	9 +0/-0.05	8.4 to 16	$\phi 3 +0/-0.01$	5	3.5	12.1	M3	5	2.2
ESG1-SS-2005-*N	1.5	5 ± 0.025	5.8 to 9	$\phi 1.5 +0/-0.01$	3	2.5	8	M2	3.5	1.5
ESG1-SS-28**	2	14 +0/-0.05	9.6 to 23.9	$\phi 3 +0/-0.01$	6	4.3	15	M4	5	2

Fig.2-10:Installing dimensions (Single cam type)

(2) Installing dimensions (Screw type)
ESG1-FT-2840-11XW 109-M (4F-MEHGR-04): Refer to Fig. 2-11.



(Unit: mm)

Model	D	E	G	H	J	K	L	M	N	P	Z
ESG1-F*-28**	2	18 +0/-0.05	13 to 51	φ4 +0/-0.012	8	14	5.5	34.5	M4	7.5	3.7

Fig.2-11:Installing dimensions (Screw type)

2.4.4 Specifications of Electric Hand

(1) Cam type

Table 2-6: Specification

Type		Unit	Single		
			4F-MEHGR-02	4F-MEHGR-03	4F-MEHGR-01
			SS-20	SS-28	SS-2005-5N
Gripping force	Max. continuous rating	[N]	6	22	5
	Minimum setting	[%](N)	30(1.8)	30(6.6)	1.5
	Resolution	[%](N)	1(0.06)	1(0.22)	1(0.05)
Open/close stroke		[mm]	7.6	14.3	3.2
Speed	Max (Rating)	[mm/sec]	100	100	100
	Min. setting	[%](mm/sec)	20(20)	20(20)	20(20)
	Resolution	[%](mm/sec)	1(1)	1(1)	1(1)
	Constant-speed move and grip (max)	[%]	50	50	50
Position	Repeatability	[mm]	±0.02	±0.02	±0.02
Finger	Max. mass (1 pair))	[g]	15	30	10
	Allowable load	[N]	450	350	12
	Allowable pitching moment	[N·m]	0.7	0.5	0.04
	Allowable yawing moment	[N·m]	0.8	0.6	0.04
	Allowable rolling moment	[N·m]	2.3	2.8	0.08
	Max. gripping point	[mm]	20	20	20
	Max. overhang	[mm]	20	25	20
Guide structure			Linear guide		
Max. overhang		(kg)	0.06	0.22	0.05
Operating temperature range		[°C]	0 to 40		
Operating humidity range		[%]	RH35 to 90		
Operating storage temperature		[°C]	-10 to +60		
Mass		[g]	160	300	90

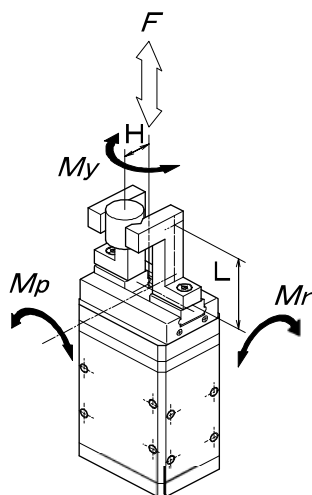


Fig.2-12: Outline drawing of 4F-MEHGR-01 to 03

(2) Screw type

Table 2-7:Specifications

Type		Unit	Screw type
			4F-MEHGR-04
			FT-28
Gripping force	Max. continuous rating	[N]	150
	Minimum setting	[%](N)	30(45)
	Resolution	[%](N)	1(1.5)
Open/close stroke		[mm]	38
Speed	Max (Rating)	[mm/sec]	50
	Min. setting	[%](mm/sec)	20(10)
	Resolution	[%](mm/sec)	1(0.5)
	Low-speed gripping mode (max.)	[%]	50
Position	Repeatability	[mm]	±0.01
Finger	Max. mass (1 pair))	[g]	80
	Allowable load	[N]	1300
	Allowable pitching moment	[N•m]	5
	Allowable yawing moment	[N•m]	6
	Allowable rolling moment	[N•m]	12.7
	Max. gripping point	[mm]	30
	Max. overhang	[mm]	20
Guide structure			Linear guide
Max. gripping mass		(kg)	1.5
Operating temperature range		[°C]	0 to 40
Operating humidity range		[%]	RH35 to 90
Operating storage temperature		[°C]	-10 to +60
Mass		[g]	890

(3) 3-finger single cam type

Table 2-8: Specification

Type		Unit	3-finger single cam type
			4F-MEHGR-05
			2013
Gripping force	Max. continuous rating	[N]	2
	Minimum setting	[%](N)	30(0.6)
	Resolution	[%](N)	1(0.02)
Open/close stroke		[mm]	13
Speed	Max (Rating)	[mm/sec]	100
	Min. setting	[%](mm/sec)	20(20)
	Resolution	[%](mm/sec)	1(1)
	Low-speed gripping mode (max.)	[%]	50
Position	Repeatability	[mm]	±0.03
Finger	Max. mass (1 pair))	[g]	20
	Allowable load	[N]	20
	Allowable moment	[N·m]	0.1
	Max. gripping point	[mm]	20
Guide structure			Linear guide
Max. gripping mass		(kg)	0.02
Operating temperature range		[°C]	0 to 40
Operating humidity range		[%]	RH35 to 90
Operating storage temperature		[°C]	-10 to +60
Mass		[g]	190

$$F = F_a + W \times g$$

$$M = F_b \times L$$

F: Load [N]

M: Moment [N·m]

L: External force action point distance [m]

F_a: External force [N]F_b: External force [N]

W: Mass of workpiece [Kg]

g: Gravitational acceleration [m/s²]

H: Gripping point distance [m]

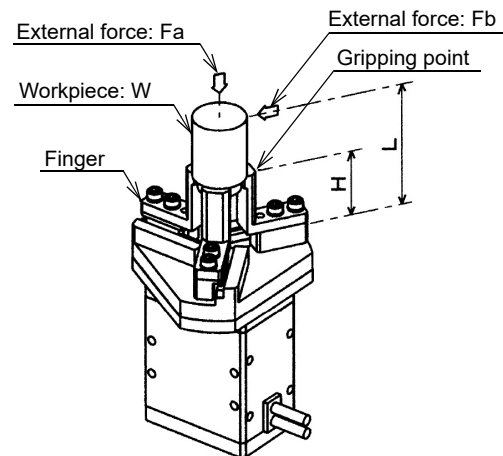


Fig.2-13: Outline drawing of 4F-MEHGR-05

2.5 Hand Cable

2.5.1 Models of hand cable

Table 2-9:Hand cable

No.	Hand cable	Model name in TAIYO	Model name as our products
1	Hand cable (RV-4F/7F/13F/20F series, RV-4FR/7FR/13FR/20FR series)	ESA-C03-12XW113	4F-MEHCBL-01
2	Hand cable (RH-3FH35/45/5515 & clean specification Z=120, RH-6FH(M)(C)35/45/5520, RH-3FRH35/45/5515 & clean specification Z=120, RH-6FRH(M)(C)35/45/5520)	ESA-C13-12XW112	4F-MEHCBL-02
3	Hand cable (RH-6FH(M)(C)35/45/5534, RH-6FRH(M)(C)35/45/5534)	ESA-C16-12XW112	4F-MEHCBL-03
4	Hand cable (RH-12FH(M)(C)55/70/8535, RH-20FH(M)(C)8535, RH-12FRH(M)(C)55/70/8535, RH-20FRH(M)(C)8535)	ESA-C18-12XW112	4F-MEHCBL-04
5	Hand cable (RH-12FH(M)(C)55/70/8545, RH-20FH(M)(C)10035/45, RH-12FRH(M)(C)55/70/8545, RH-20FRH(M)(C)10035/45)	ESA-C21-12XW112	4F-MEHCBL-05

2.5.2 Outline drawing

(1) 4F-MEHCBL-01

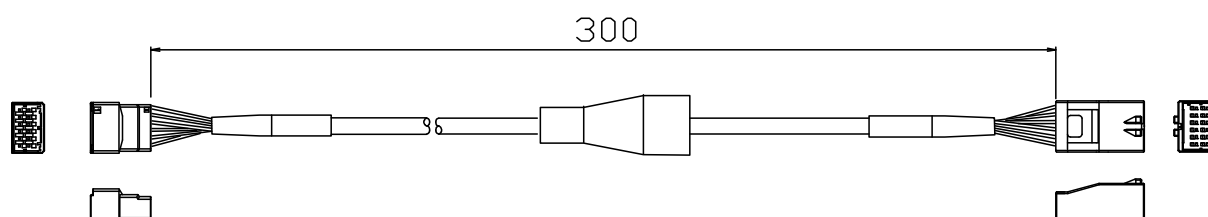
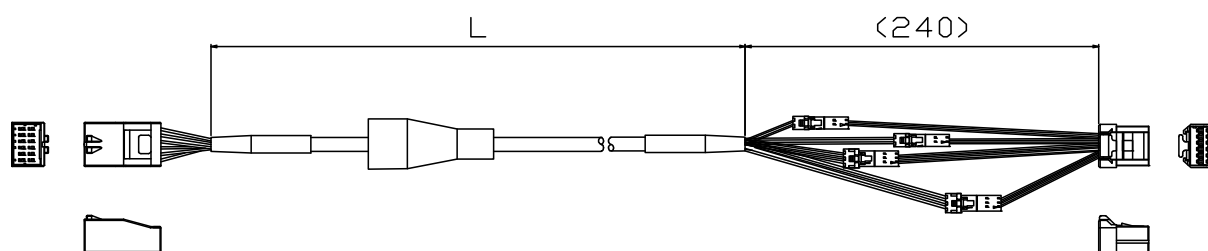


Fig.2-14:Outline drawing of the hand cable (4F-MEHCBL-01)

(2) 4F-MEHCBL-02 to 05



(Unit: mm)

Model	L
4F-MEHCBL-02	1300
4F-MEHCBL-03	1600
4F-MEHCBL-04	1800
4F-MEHCBL-05	2100

Fig.2-15:Outline drawing of the hand cable (4F-MEHCBL-02 to 05)

3 Check Before Use

3.1 Product Checking

Confirm that the parts shown in [Table 3-1](#), [Table 3-2](#), and [Table 3-3](#) are enclosed in the purchased product.

Table 3-1:Control unit

No.	Item	Model	Quantity	Remarks
4F-MEHCU-01				
1	Control unit	4F-MEHCU-01	1	
2	Instruction manual	BFP-A3415	1	CD-ROM
4F-MEHCU-02				
1	Control unit	4F-MEHCU-02	1	
2	Instruction manual	BFP-A3415	1	CD-ROM

Table 3-2:Electric hand

No.	Item	Model	Quantity	Remarks
4F-MEHGR-01				
1	Electric hand	4F-MEHGR-01	1	
4F-MEHGR-02				
1	Electric hand	4F-MEHGR-02	1	
4F-MEHGR-03				
1	Electric hand	4F-MEHGR-03	1	
4F-MEHGR-04				
1	Electric hand	4F-MEHGR-04	1	
4F-MEHGR-05				
1	Electric hand	4F-MEHGR-05	1	

Table 3-3:Hand cable

No.	Item	Model	Quantity	Remarks
4F-MEHCBL-01				
1	Hand cable	4F-MEHCBL-01	1	
4F-MEHCBL-02				
1	Hand cable	4F-MEHCBL-02	1	
4F-MEHCBL-03				
1	Hand cable	4F-MEHCBL-03	1	
4F-MEHCBL-04				
1	Hand cable	4F-MEHCBL-04	1	
4F-MEHCBL-05				
1	Hand cable	4F-MEHCBL-05	1	

3.2 Items to be Prepared by Customer

Table 3-4: Customer-prepared items

No.	Item	Quantity			
		RV-2F series RV-2FR series	RV-●F series RV-●FR series Note1)	RH-*FH series RH-*FRH series Note2)	RH-3FHR RH-3FRHR
1	Robot arm	1	1	1	1
2	Cable fixation plate	1 Note3)	-	-	-
3	Cable tie	As required	As required	As required	As required
4	Cable tie mount	As required Note3)	-	-	-
5	Control unit stand	1 Note4)	1	-	-
6	Installation flange for electric hand	1	1	1	1

Note1) In "●" indicates the load (4kg: "04", 7kg: "07", 13kg: "13", 20kg: "20") of the robot arm.

Note2) In "*" indicates the load (3kg: "3", 6kg: "6", 12kg: "12", 20kg: "20") of the robot arm.

Note3) When using ESC11-B-11XW133-5-M control unit.

Note4) When using ESC11-B-12XW111-5-M control unit. (RIO Wiring goes out, the specification.)

4.1.1 RV-2F/2FR Series

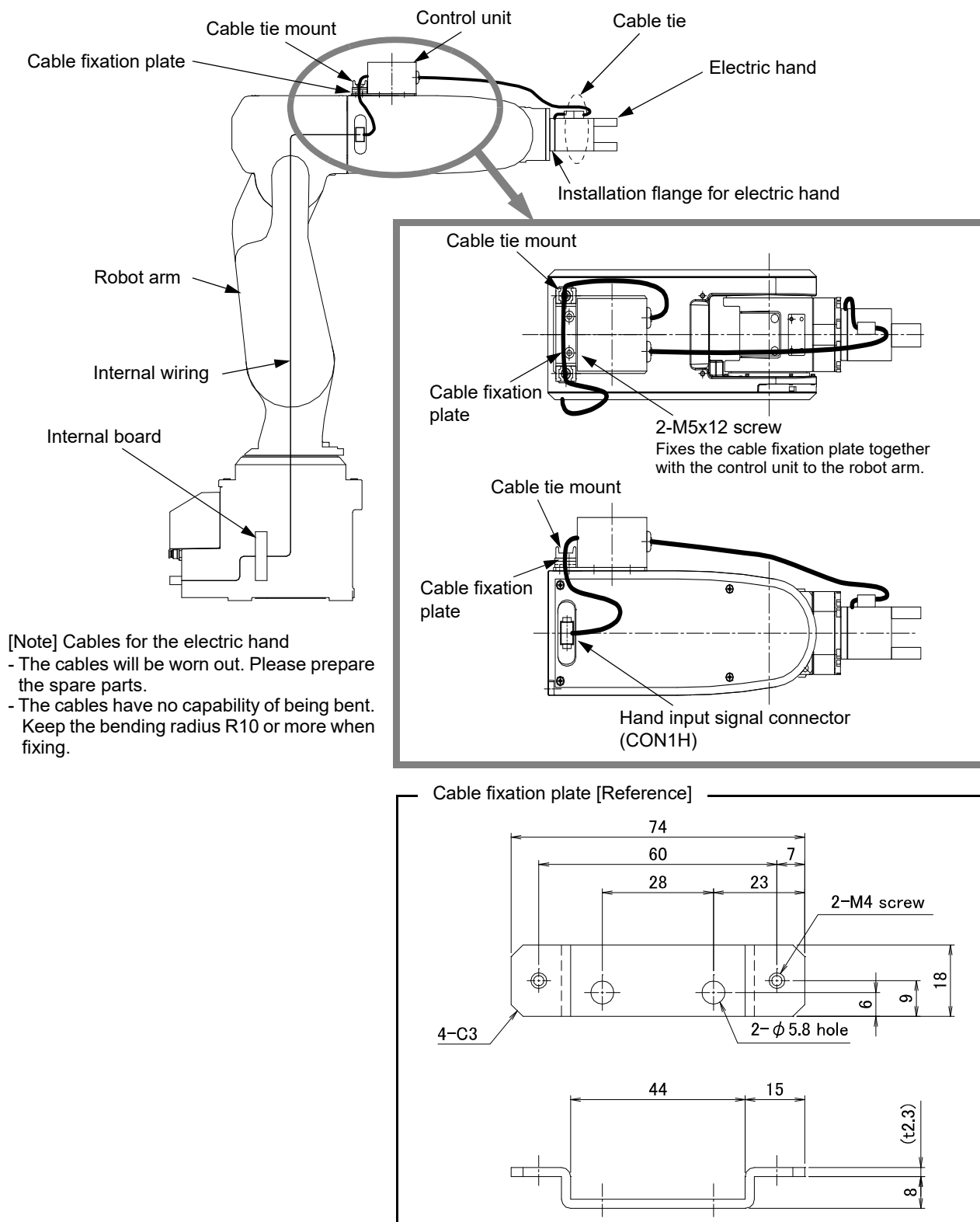
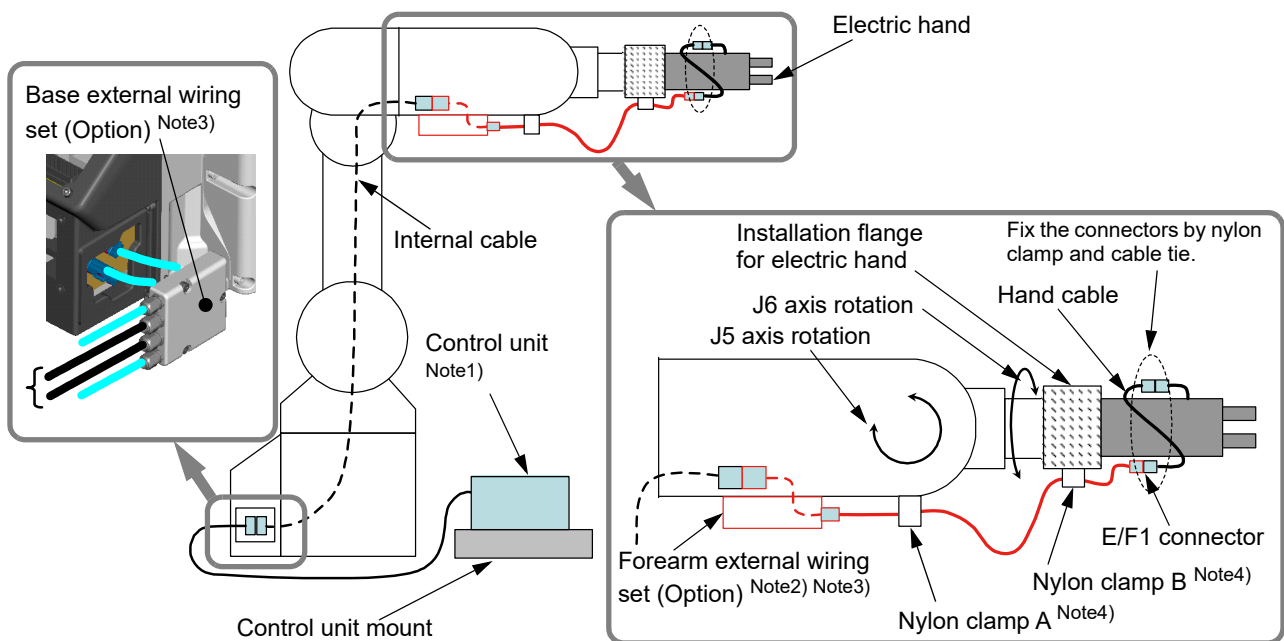


Fig.4-1:Installation and connection

4.1.2 RV-4F/7F/13F/20F Series, RV-4FR/7FR/13FR/20FR Series

(1) Standard specification robot with the optional wiring sets



Note 1) Installation of the control unit

- Do not install the control unit directly on the plant floor.
- Do not install the control unit in the operating range of the robot.

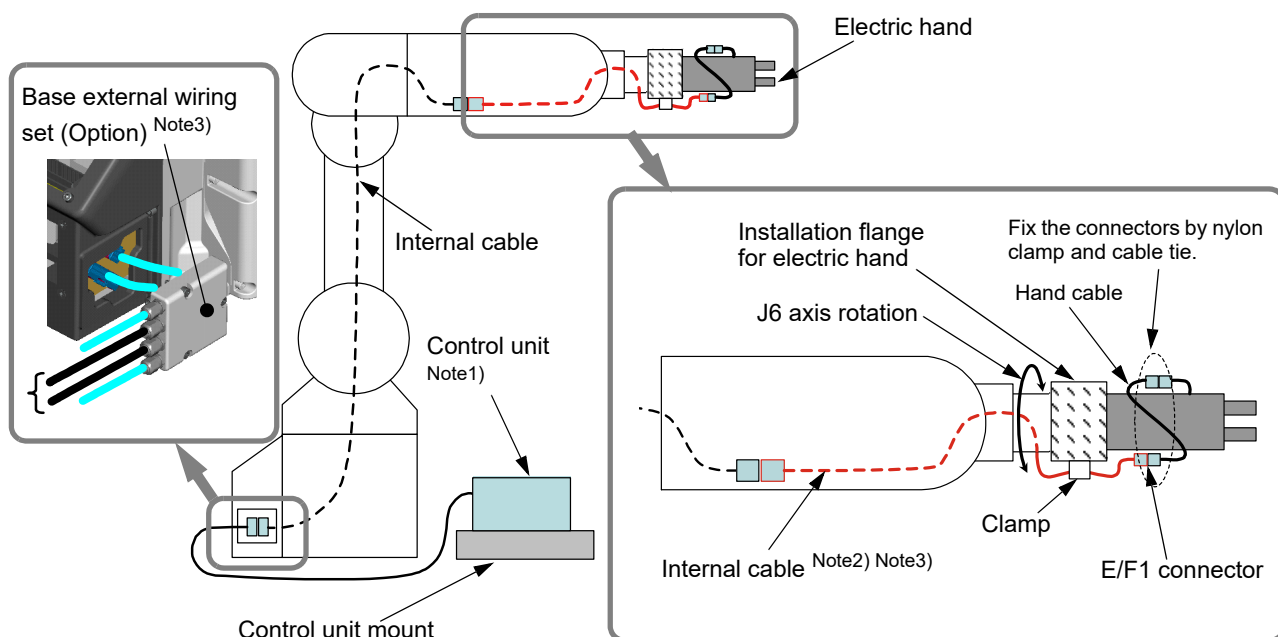
Note 2) The cable will be worn out. Please prepare the spare parts.

Note 3) Refer to separate "Standard Specification Manual" for details of these options.

Note 4) J5 of a robot spindle and J6 when an axis revolved, a cable insist, and please decide the length of the wiring so as not to bend a limited part. A cable confirm breaking and the case after installing it so as not to wear away, I make them move actually, and that you have no intervention with the neighborhood, please.

Fig.4-2:Installation and connection (Standard specification robot with the optional wiring sets)

(2) Special specification (SH02 or SH03) robot



Note 1) Installation of the control unit

- Do not install the control unit directly on the plant floor.
- Do not install the control unit in the operating range of the robot.

Note 2) - The cable will be worn out. When replacing the cable is required, please contact the dealer or service branch of Mitsubishi Electric Co.,.

Note 3) Refer to separate "Standard Specification Manual" for details of these options.

<Electric hand installation example>

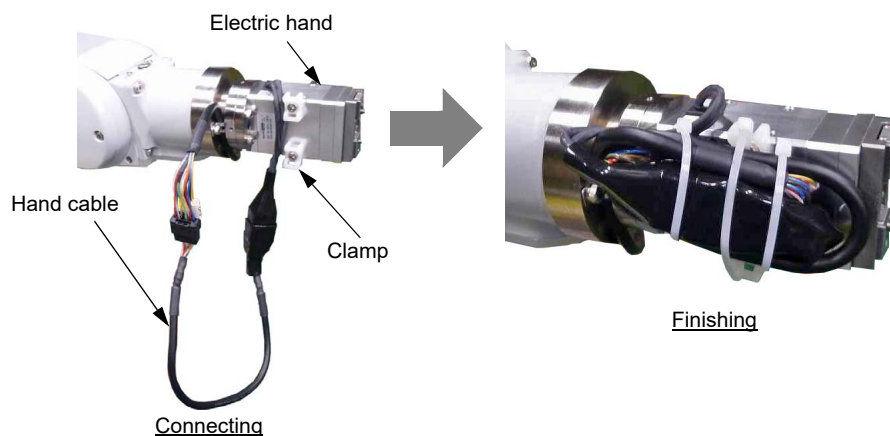
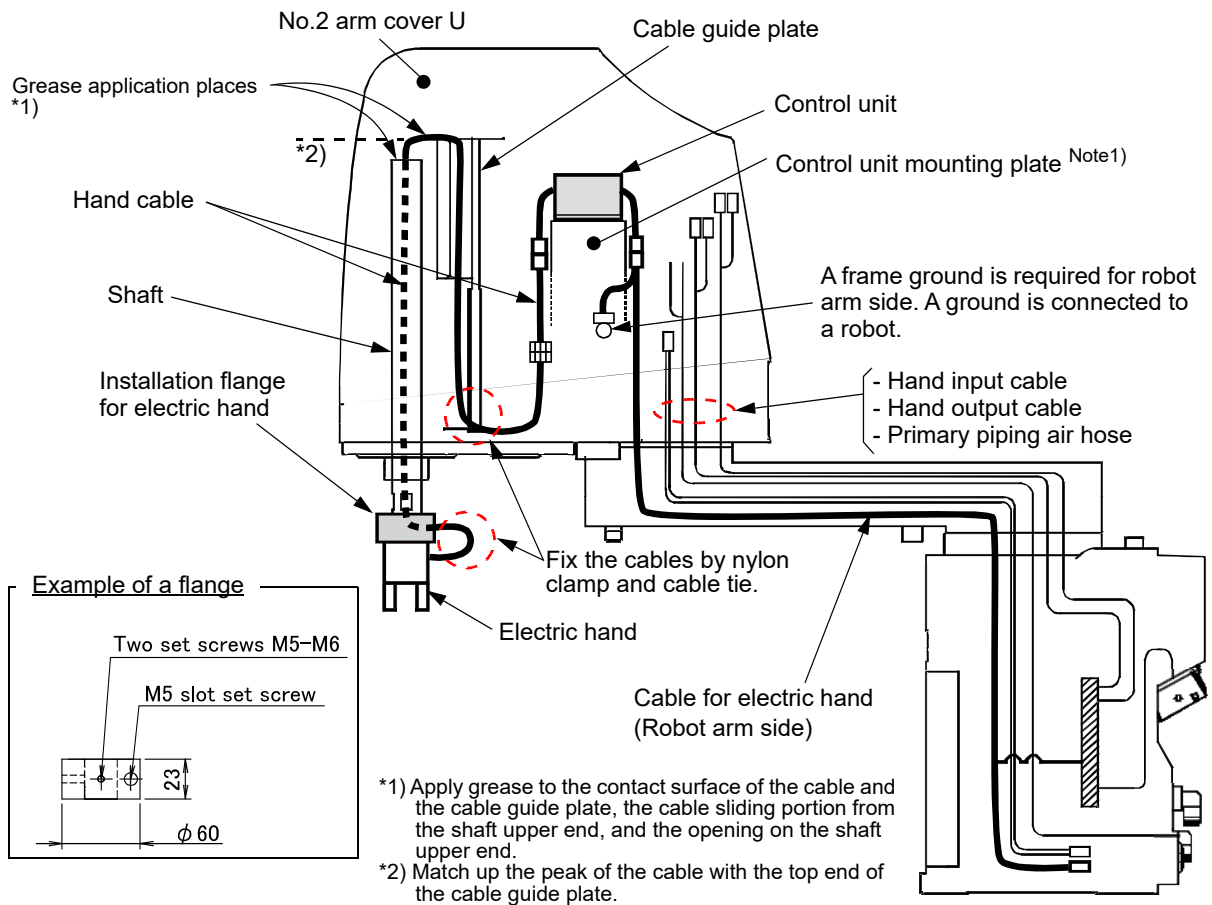


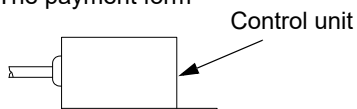
Fig.4-3: Installation and connection (Special specification robot)

4.1.3 RH-3FH/6FH/12FH/20FH Series, RH-3FRH/6FRH/12FRH/20FRH Series

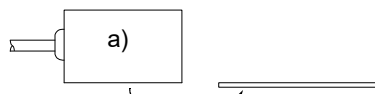


Note 1) Installation method of the control unit is shown below.

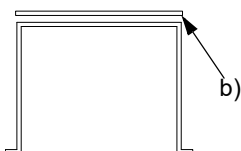
1) The payment form



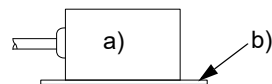
2) Remove the plate from the control unit.



And remove the control unit mounting plate from the robot arm.



3) Install the control unit a) to the mounting plate b).



4) Install the control unit to the robot arm.

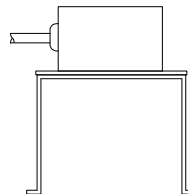


Fig.4-4:Installation and connection (RH-3FH/6FH/12FH/20FH series)

4.1.4 RH-3FHR-S91

S91 model is a wiring special specification of the robot. The electric hand cannot be installed at the standard model of RH-3FHR. Please inform us at the time of your order.

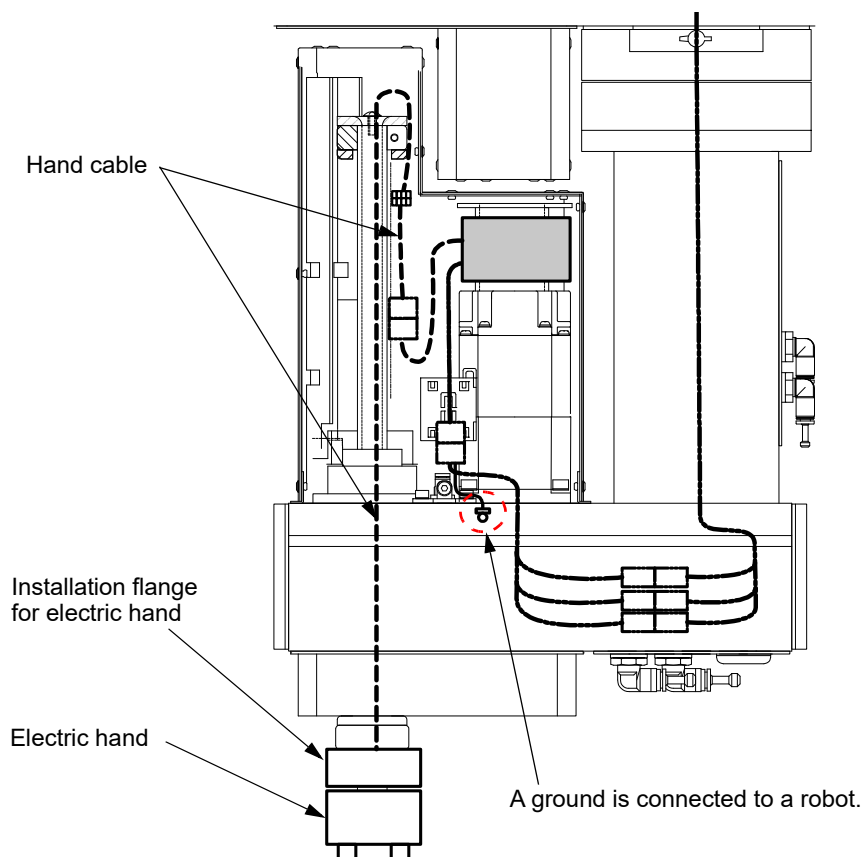


Fig.4-5:Installation and connection (RH-3FHR-S91 series)

4.2 Maintenance and Inspection

Daily and periodic inspections are essential to making sure your gripper will operate safely and efficiently.

4.2.1 Inspection Timings and Items

Table 4-1:Inspection Timings and Items

Inspection	Timing	Items
Daily Inspection	Daily (at start of operation)	Visual inspection Check for correct operations
Periodical Inspection	Every six months after start of operation	Grease supply
Others	As needed	External cleansing

4.2.2 Procedure for Visual Inspection

Check the following for external inspection.

Table 4-2:Visual inspection

Inspection point	What to be inspected	Troubleshooting
Electric hand	Installation bolts are not loose. Fingers are firmly attached.	If you find the loose installation bolts, tighten them by applying the specified torque and take measures to prevent loosening.

Inspection point	What to be inspected	Troubleshooting
Hand cable	Connectors are surely connected. There are no flaws. There are no scratches on the moving parts.	If there are flaws and/or scratches on a cable, replace it and eliminate the cause.

4.2.3 Conducting Operation Check

Check for abnormal noise, vibration, and smooth operation. If any abnormalities are detected, stop the operation immediately.

4.2.4 Reapplication of Grease

⚠ Warning

- Apply proper amount of grease to the prescribed points on the gripper. Electric devices such as a stepping motor or rotary encoder exist in the gripper. Accidental application of grease to the parts may result in unavailability of exhibition of full performance, malfunction, damage of mechanical device and physical accident.
- Do not use spray grease. Flying grease may come in contact with the encoder.
- Never use fluorine grease. If fluorine grease is mixed with lithium grease, the lubricating function of grease will drop and the machine may suffer damage.
- Do not use spray oil, because it may cause grease to wash out, resulting in lubrication failure. It may also travel to the unexpected parts and cause them to malfunction.
- When disassembling and reassembling the gripper to add grease, be sure to observe the specified instructions. Failure to do so may result in product malfunction or damage.

(1) Applicable Grease

Multemp PSNo.2 (KYODO YUSHI) or equivalent product (lithium grease)

(2) Applying Grease to the Guide Part

⚠ Caution

Apply the specified grease to the space between the guide block and guide rail (to four ball screws) with an injection device.
After application of grease, wipe off unnecessary grease around the guide part.

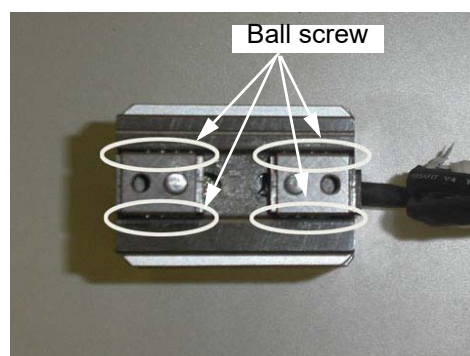
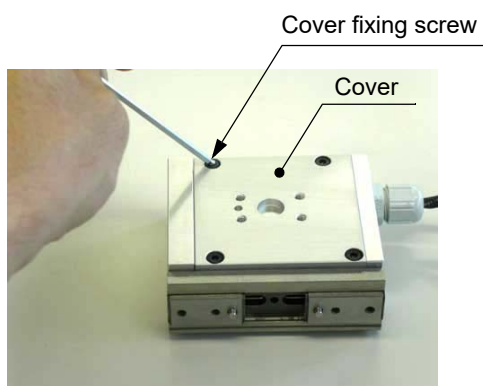


Fig.4-6:Applying grease to the guide part

(3) Applying Grease to the Ball Screws



1) For easier application of grease, open the guide block first.

2) Unscrews and remove the cover.

3) Apply proper amount of grease on the surface of ball screws with fingers.

4) Screw the cover at recommended torque level.

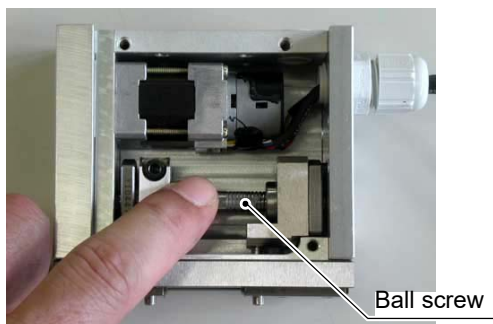


Table 4-3: Cover fixing screw size and recommended fixing torque

Model	Screw size	Recommended fixing torque (N·m)
ESG1-F*-20**	M3x6	0.55 to 0.70
ESG1-F*-28**	M4x10	1.15 to 1.55

(4) Applying Grease to the Liner Guide



Caution

Apply the specified grease to the space between the guide block of the liner guide and guide rail (to ball parts on two surfaces at each three place) with an injection device.

After application of grease, wipe off unnecessary grease around the guide part.

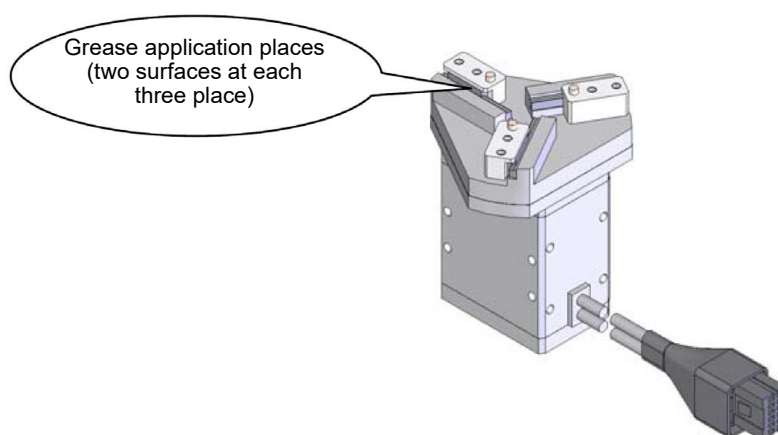


Fig.4-7:Applying grease to the liner guide

4.2.5 Cleaning Outside of the Gripper



Caution

Wipe dirt with soft cloth to prevent dust flying.

To clean stubborn soiling, moisten a soft cloth, etc., with neutral detergent. Care should be taken not to prevent water droplets on the surface of the ball screws from rusting the product.

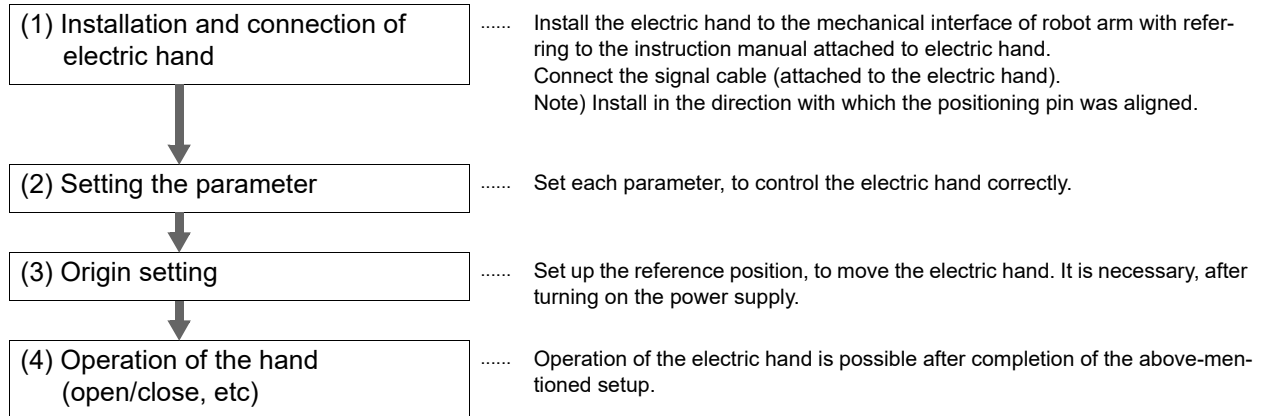
Do not blow compressed air onto the gripper too strongly to prevent dust from entering the electric hand through small openings and gaps.

5 Using the Electric Hand (Programming)

5.1 Operating Procedure

The operating procedure outline of the electric hand is shown below.

<Flow of operation>



5.1.1 Setting the Parameter

Set the parameter necessary for control of the electric hand.

Set up using T/B (R32TB/R33TB, R56TB/R57TB) or RT ToolBox2/RT ToolBox3. Refer to the instruction manual of attachment to each product for details of the parameter change method. R56TB/R57TB or RT ToolBox2 provide a dedicated screen.

- R32TB/R33TB :Refer to "Operation of maintenance screen" in the separate manual "Instruction Manual/ Detailed Explanation of Functions and Operations".
- R56TB/R57TB :R56TB/R57TB Instructions manual (BFP-A8591)
- RT ToolBox2 :RT ToolBox2 / RT ToolBox2 mini Instructions manual (BFP-A8617)

[Caution]

- 1) Specify correctly the parameter name corresponding to the hand number (station number setup by the rotary switch) to be used. In this manual, "n" indicates the place corresponding to the hand number in parameter name.

<Example>

Actuator type: EHnTYPE

If you set up the actuator type of the hand number 1, specify the parameter name as "EH1TYPE."

- 2) A setup of the actuator type will initialize the control parameter. We recommend to back up the parameter changed in preparation for the maintenance of the exchange of the robot etc.
- 3) During data writing, always connect the signal cable of the electric hand.

(1) The Actuator Type Setting

Set up the type of electric hand to be used. Please set up with referring to the instruction manual attached to electric hand.

The contents of the parameters which should be set are shown in [Table 5-1](#).

Table 5-1:Actuator type parameter

Parameter	Parameter name	No. of arrays No. of characters	Details explanation	Factory setting
Actuator type	EHnTYPE	Integer 1	Set up the type (model) of the electric hand. Input range is 0 to 65535. The settings of each Model are shown in Table 5-2 . n: indicates the hand number (1 to 3).	0

Note) When this parameter is set, the control parameter will be read from electric hand body, and it will be automatically set as the parameter of the robot controller. (Initial value) Since the parameter changed by then is overwritten, we recommend to back up the parameter using optional RT ToolBox2.

Table 5-2: Settings of each model

Model	Setting	Model	Setting	Model	Setting	Model	Setting
SS-2010	110	SS-2005-3N	111	SS-2005-5N	112	ST-2013	118
ST-2004	119	SS-2815	120	ST-2820	129	SS-4225	130
ST-4230	139	SD-2005	210	SD-2810	220	SD-4220	230
FS(T)2020	310	FS(T)2840	320				

Caution

If the Multifunctional Electric Hand body is replaced with a new one, clearing the information specific to the hand body is required. Set up the actuator type again. Even if the actuator type does not change, set up the actuator type again. Refer to [Page 24, "\(1\) The Actuator Type Setting"](#) for the actuator type setting.

(2) Setting of the Control Parameter

The parameter for controlling the electric hand is shown in [Table 5-3](#), and each details are shown in [Table 5-7](#). Change if needed.

In addition, refer to the instructions manual of attachment in the electric hand for changing.

Table 5-3: Control parameter list

No	Parameter	Parameter name ^{Note1)}	No. of arrays No. of characters	Contents	Reference page
1	Soft limit (+)	EHnLMTP	Integer 1	This parameter is used for setting a positive movable range. Input range: 0 to 9999 (unit: 0.1mm)	50
2	Soft limit (-)	EHnLMTM	Integer 1	This parameter is used for setting a negative movable range Input range: -9999 to 0 (unit: 0.1mm)	50
3	Stroke	EHnSTRK	Integer 1	This parameter is used for setting actuator stroke length. Input range: 0 to 9999 (unit: 0.1mm)	50
4	Direction of the origin setting	EHnORGD	Integer 1	This parameter is used for specifying the direction in which the fingers return to their origin positions. 0: Opening direction, 1: Closing direction	51
5	Origin-setting speed	EHnORGV	Integer 1	This parameter is used for setting the speed at which the fingers move back to their v positions. Input range: 20 to 50(%)	51
6	Origin position shift	EHnORGSF	Integer 1	This parameter is used for shifting the coordinate position of original data by the parameter value specified as origin position shift. Input range: -9999 to 9999 (unit: 0.01mm)	51
7	Acceleration	EHnACC	Integer 1	This parameter is used for setting actuator acceleration. Input range: 1 to 100(%)	50
8	Maximum program speed	EHnVMAX	Integer 1	This parameter is used for setting maximum speed stored as point data. Input range: 1 to 100(%)	50
9	Gripping Speed	EHnVHLD	Integer 1	Set up the constant speed in effective gripping range at positioning grip movement. Input range: 1 to 100(%)	50
10	Constant-speed movement zone	EHnZNCV	Integer 1	Set up the moving distance by constant speed at positioning grip movement Input range: 1 to 9999 (unit: 0.01mm)	50
11	Limit width	EHnLMTW	Integer 1	Set up the limit width of moving by constant speed at positioning grip movement Input range: 0 to 9999 (unit: 0.01mm)	50
12	Positioning completion distance	EHnPSCD	Integer 1	When moving to the specified point, complete movement in the specified distance (near side). Input range: 1 to 9999 (unit: 0.01mm)	50

No	Parameter	Parameter name ^{Note1)}	No. of arrays No. of characters	Contents	Reference page
13	Origin position return system	EHnORGS	Integer 1	This parameter is used for changing the method in which the fingers return to their origin positions. 0: Stroke end 1: S stroke end + Z phase detection system	51
14	Point data	EHnPOS1 to EHnPOS32	Integer 1	Point data setting of a Multifunctional Electric Hand. Input range: -999.99 to 999.99 (unit: 0.01mm)	51
15	Table data	EHnTBL1 to EHnTBL32	Integer 7	Operating condition table data of a Multifunctional Electric Hand.	51
16	T/B Operation mode.	EHOPEMD	Integer 1	An initial value of operation mode by T/B. 0: Point designation, 1: Table designation	51
17	The present location acquisition mode	EHCURMD	Integer 1	The present location is shown to TB. 0: always indicated 1: MANUAL mode is always indicated. AUTOMATIC mode indicates that movement ends once.	51

Note1) n: Indicates the hand number (1 to 3).

5.1.2 Operation of Electric Hand

Explains the operation method of the electric hand using R32TB. Refer to "R56TB/R57TB Instruction Manual" of the separate volume (BFP-A8684) for the operation by R56TB/R57TB.

The screen related to operation of the electric hand shown in Fig. 5-1

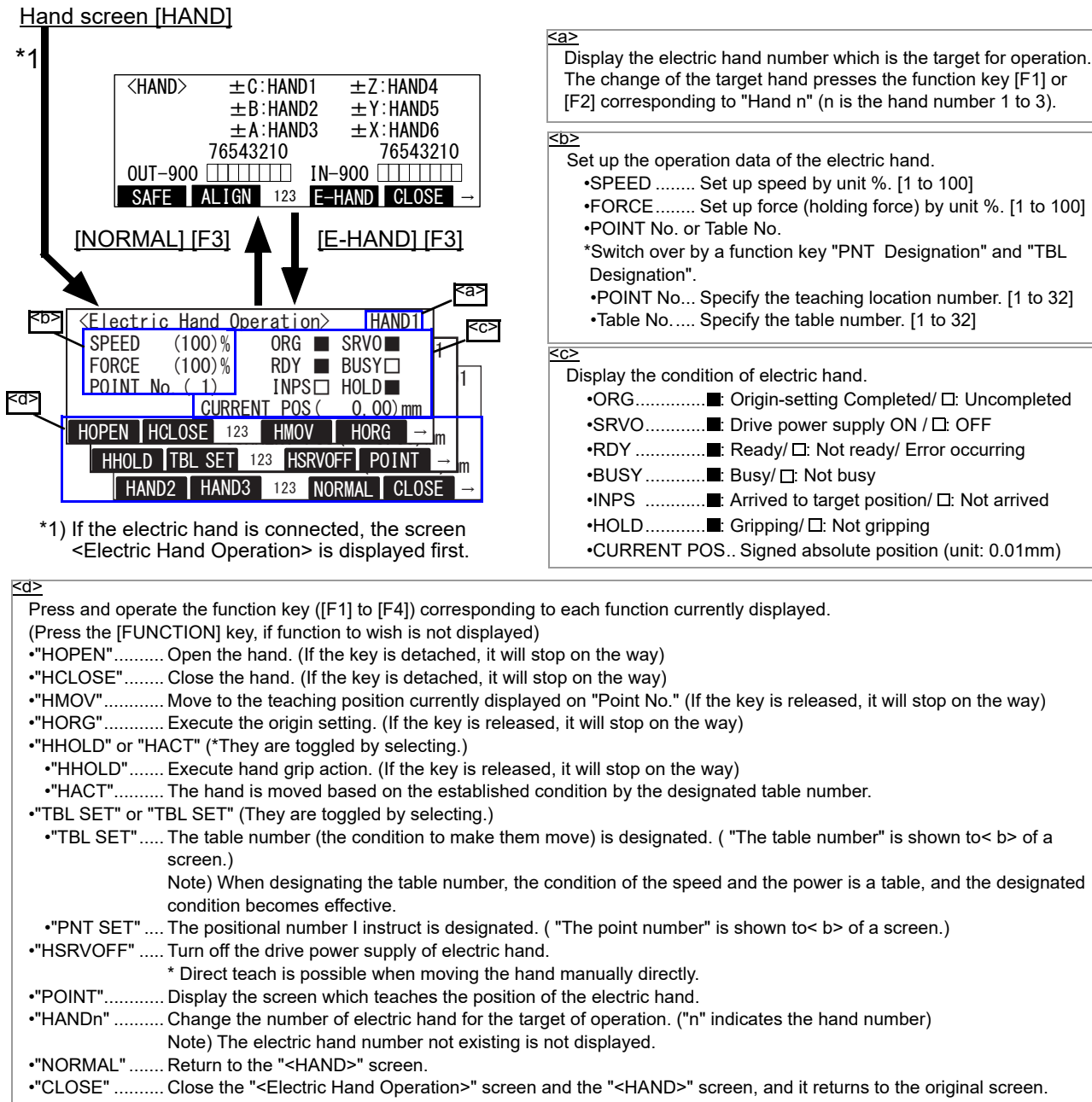


Fig.5-1:Electric hand operation screen

The operation method of each function is shown below. Explain the operation method in the condition of having displayed "<Electric Hand Operation>". Connect the electric hand in advance, TB enabling switch is pushed, and TB is changed into available condition, press the [HAND] key, and display the <Electric Hand Operation> screen.

Display the hand screen:
[HAND]

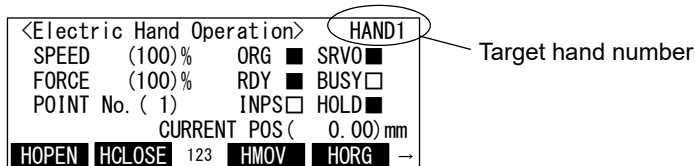


<Electric Hand Operation>				HAND1
SPEED	(100)%	ORG	☒	SRVO ☒
FORCE	(100)%	RDY	☒	BUSY ☐
POINT No.	(1)	INPS	☐	HOLD ☒
CURRENT POS (0.00)mm				
HOPEN	HCLOSE	123	HMOV	HORG →

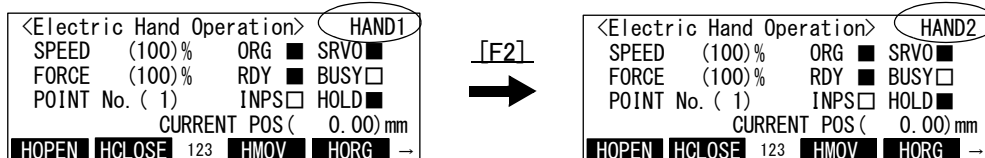
[Note] When stop input of the outside input signal (STOP and STOP2) turns on, a hand doesn't move. As soon as a stop input signal turns on during hand movement, it stops.

(1) Changing the Hand Number

- 1) The target hand number to operate is displayed on the upper right of <Electric Hand Operation> screen. When hand numbers differ, change in the following procedure.



- 2) Press the function key corresponding to "Hand n" (n is 1to3), and change the target hand number.



Change the target hand number: [F1], [F2]

Note) The figure is the example which changed the hand number to 2 from 1.

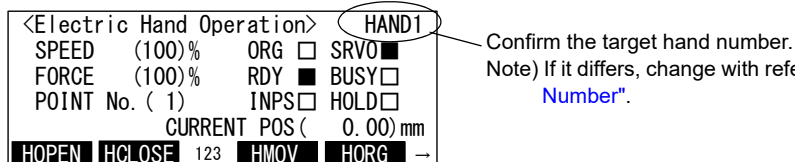
Press the [FUNCTION] key, if "Hand n" is not displayed.

Finish the change of the target hand number.

(2) Origin Setting

The origin setting is action which sets up the reference position of the hand. Before moving the hand, it is necessary to execute sure.

- 1) Confirm the hand number which is the target of the origin setting. (Indication at the upper right of the <Electric Hand Operation> screen)
Change, if it differs.

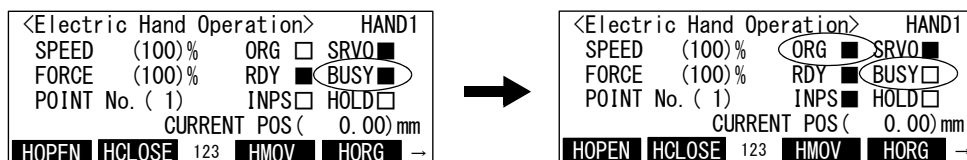


Note) If it differs, change with referring to [Page 28, "\(1\) Changing the Hand Number"](#).

- 2) Pressing the function key corresponding to the "HORG" ([F4]) of the <Electric Hand Operation> screen.

While pressing the key, the electric hand executes origin-setting action. The indication of "BUSY" of TB screen will be "black square" during execution.

If the origin setting is completed, the indication of "BUSY" will be "white square" and the "HORG" indication will shift to "black square".



Origin setting: [F4]

* If the key is released, execution will stop.

Completion of the origin setting.

Origin-setting operation of the electric hand is completion.

(3) Hand Opening and Closing

- 1) Confirm the hand number which is the target of hand opening and closing. (Indication at the upper right of the <Electric Hand Operation> screen)
Change, if it differs.

<Electric Hand Operation>				HAND1
SPEED	(100)%	ORG	☒ SRVO	☒
FORCE	(100)%	RDY	☒ BUSY	☐
POINT No.	(1)	INPS	☐ HOLD	☒
CURRENT POS (		0.00)mm		
HOPEN	HCLOSE	123	HMOV	HORG →

Confirm the target hand number.

Note) If it differs, change with referring to [Page 28, "\(1\) Changing the Hand Number"](#).

- 2) The hand moves while pressing the function key corresponding to "HOPEN" or "HCLOSE". The indication of "BUSY" of TB screen will be "black square" during execution.

<Electric Hand Operation>				HAND1
SPEED	(100)%	ORG	☒ SRVO	☒
FORCE	(100)%	RDY	☒ BUSY	☒
POINT No.	(1)	INPS	☐ HOLD	☒
CURRENT POS (		0.00)mm		
HOPEN	HCLOSE	123	HMOV	HORG →

Open the hand: "HOPEN"([F1])

Close the hand: "HCLOSE"([F2])

* If the key is released, execution will stop.

- 3) When hand has moved to open or close end the "INPS" indication will be "black square". When the hand does the grip on the way, the "HOLD" indication will be "black square".

(4) Teaching the Moving Position

Teach the position of electric hand and it can move by the program (EHMOV instruction) or TB. The maximum of 32 points can be taught to each of electric hands 1-3, and specify by the number. The method of registering the current position of electric hand and inputting the numerical value directly can be used for the teaching method.

- 1) Confirm the hand number to teach. (Indication at the upper right of the <Electric hand operation> screen)
Change, if it differs.

<Electric Hand Operation>				HAND1
SPEED	(100)%	ORG	☒ SRVO	☒
FORCE	(100)%	RDY	☒ BUSY	☐
POINT No.	(1)	INPS	☐ HOLD	☒
CURRENT POS (		0.00)mm		
HOPEN	HCLOSE	123	HMOV	HORG →

Confirm the target hand number.

Note) If it differs, change it with referring to [Page 28, "\(1\) Changing the Hand Number"](#).

- 2) Move the electric hand to the position to teach by operation of the "HOPEN" or the HCLOSE, etc.

<Electric Hand Operation>				HAND1
SPEED	(100)%	ORG	☐ SRVO	☒
FORCE	(100)%	RDY	☒ BUSY	☐
POINT No.	(1)	INPS	☐ HOLD	☒
CURRENT POS (		0.00)mm		
HOPEN	HCLOSE	123	HMOV	HORG →

Movement to the position to teach.

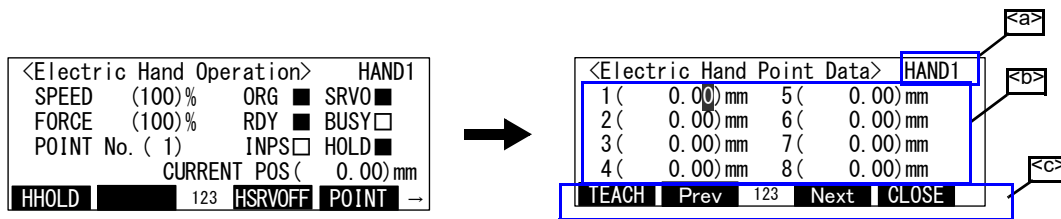
•Open the hand: "HOPEN"([F1])

•Close the hand: "HCLOSE"([F2])

* If the key is released, execution will stop.

•The direct teaching is possible under turning off the drive power supply of hand.

- 3) Press the function key ([F4]) corresponding to the "POINT" in the "<Electric Hand Operation>" screen, and display the "<Electric Hand Point Data>" screen.



Displaying of the
"<Electric Hand Point Data>" screen: [F4]

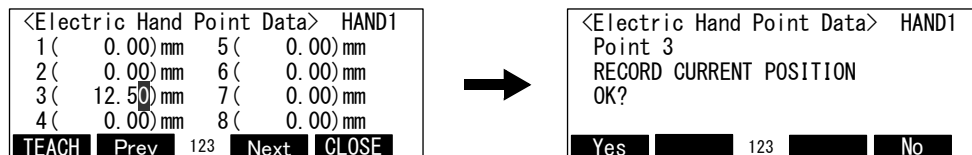
<a>	Display the electric hand number which is the target for teaching.
	Position data is displayed. The cursor can be moved by the arrow key and the numerical value can also be inputted. (fine tuning etc)
<c>	<ul style="list-style-type: none"> •"TEACH"..... Teach the position data at the cursor position. The current position of the hand is set as target position data. •"Prev" Whenever it presses the key, target position data changes to 1-8=>25-32=>17-24=>9-16=>1-8. •"Next" Whenever it presses the key, change target position data to 1-8=>9-16=>17-24=>25-32=>1-8. •"CLOSE"..... Close <Electric Hand Point Data> screen and it returns to the <Electric Hand Operation> screen.

- 4) Teach the position.

As shown below, there exist the "a) Set the current position of electric hand.", and the "b) Setting by the numerical value input." in the teaching method.

- a) Set the current position of electric hand.

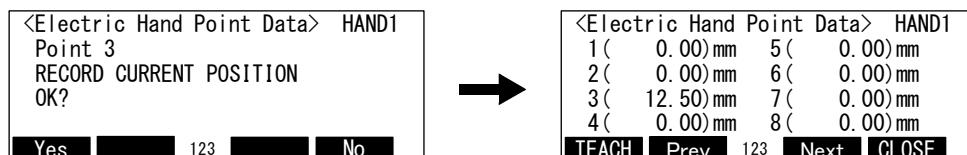
- 1) Press the arrow key and move the cursor to the point number which teaches. If the point number to wish is not displayed, press the function key corresponding to the "Prev" or the "Next". Press the function key corresponding to "TEACH" ([F1]). The confirmation screen is displayed.



Teaching of the current position: [F1]

Note) The figure is the example which teaches the current position to the point 3 of the hand number 1.

- 2) When pressing the function key corresponding to "Yes" ([F1]), the current position will be set up. When pressing the function key corresponding to "No" ([F4]), operation will be canceled.



Execution of the teaching: [F1].
Cancellation is [F4].

The current position of electric hand was taught.

b) Setting by the numerical value input.

- 1) Press the arrow key and move the cursor to the point number which teaches. If the point number to wish is not displayed, press the function key corresponding to the "Prev" or the "Next". Input the numerical value directly and press the [EXE] key.

<Electric Hand Point Data> HAND1			
1 (	0.00)mm	5 (	0.00)mm
2 (	0.00)mm	6 (	0.00)mm
3 (	8.53)mm	7 (	0.00)mm
4 (	0.00)mm	8 (	0.00)mm
TEACH Prev 123 Next CLOSE			

Input the numerical value directly and press the [EXE] key.

<Electric Hand Point Data> HAND1			
1 (	0.00)mm	5 (	0.00)mm
2 (	0.00)mm	6 (	0.00)mm
3 (	8.53)mm	7 (	0.00)mm
4 (	0.00)mm	8 (	0.00)mm
TEACH Prev 123 Next CLOSE			

Note) The figure is the example which sets the point 3 of the hand number 1 as "8.53"mm.

Position data was set up by the numerical input.

5) Finish the screen of point setting.

When the function key corresponding to "CLOSE" ([F4]) is pressed, returns to the screen <Electric Hand Operation>.

<Electric Hand Point Data> HAND1			
1 (	0.00)mm	5 (	0.00)mm
2 (	0.00)mm	6 (	0.00)mm
3 (	8.53)mm	7 (	0.00)mm
4 (	0.00)mm	8 (	0.00)mm
TEACH Prev 123 Next CLOSE			

<Electric Hand Operation> HAND1			
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No. (1)	INPS	HOLD	
CURRENT POS (		0.00)mm	
HOPEN	HCLOSE	123	HMOV HORG →

Finish the "<Electric Hand Point Data>" screen: [F4]

The position teaching of electric hand is finishing.

(5) Moving to the Taught Position

The electric hand can move to the position taught.

- 1) Confirm the hand number to move to. (Indication at the upper right of the <Electric Hand Operation> screen)
Change, if it differs.

<Electric Hand Operation> HAND1			
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No. (1)	INPS	HOLD	
CURRENT POS (		0.00)mm	
HOPEN	HCLOSE	123	HMOV HORG →

Confirm the target hand number.

Note) If it differs, change it with referring to [Page 28, "\(1\) Changing the Hand Number"](#).

- 2) Specify the target point number as "POINT No." on screen.

The cursor is moved into the parenthesis of "POINT No." by the arrow key, input the numeral (1 to 32), and press the [EXE] key.

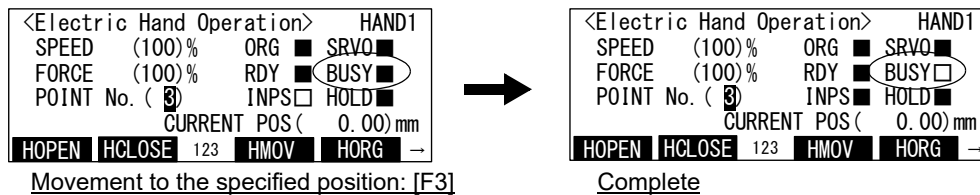
<Electric Hand Operation> HAND1			
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No. (1)	INPS	HOLD	
CURRENT POS (		0.00)mm	
HOPEN	HCLOSE	123	HMOV HORG →

<Electric Hand Operation> HAND1			
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No. (3)	INPS	HOLD	
CURRENT POS (		0.00)mm	
HOPEN	HCLOSE	123	HMOV HORG →

Move the cursor: [Arrow]. Numerical input: [Numeral]

Note) The figure is the example which specified the point 3 of the hand number 1.

- 3) Pressing the function key corresponding to "HMOV" ([F3]). While pressing, the hand moves to the specified position number. The indication of "BUSY" of TB screen will be "black square" during execution. When movement to the target position is completed, the indication of "BUSY" will be "white square" and the "INPS" indication will shift to "black square."

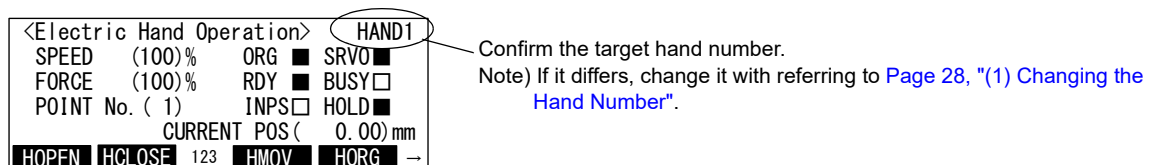


Movement to the teaching position is finishing.

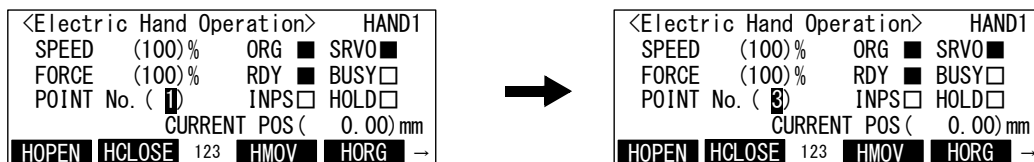
(6) Grip Action

Execute grip action in the taught position. Grip action patterns, such as the trapezoid speed and the distance of moving by constant speed, are based on the set value of parameter. The operation method of grip action is shown below.

- 1) Confirm the hand number to move to. (Indication at the upper right of the <Electric Hand Operation> screen)
Change, if it differs.

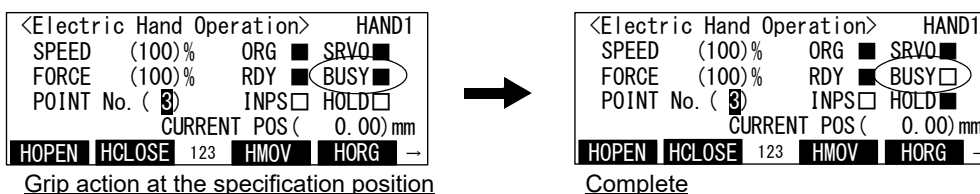


- 2) Specify the point number which does the grip as "POINT No." on the screen. The cursor is moved into the parenthesis of "POINT No." by the arrow key, input the numeral (1 to 32), and press the [EXE] key.



Note) The figure is the example which specified the point 3 of the hand number 1.

- 3) Pressing the function key corresponding to "HHOLD" ([F1]). While pressing, the hand executes gripping action at the specified position number. The indication of "BUSY" of TB screen will be "black square" during moving.



- 4) When the grip of the work piece is done, the indication of "BUSY" will be "white square" and the "HOLD" indication will be "black square". If hand arrive to the target position without doing the grip of the work piece, the indication of "INPS" will be "black square".

Grip action at the teaching position is finishing.

(7) Setting the Moving Speed

The moving speed of electric hand can be set up by T/B. The set value is the rate (%) to top speed. This set value is common between hand numbers.

The method of setting operation is shown below.

- 1) The cursor is moved into the parenthesis of "SPEED" by the arrow key, input the numeral value, and press the [EXE] key.

<Electric Hand Operation>		HAND1	
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No.	(1)	INPS	HOLD
CURRENT POS (0.00)mm			
HHOLD	123	HSRVOFF	POINT →

Setting the speed: [Arrow], [Numeral], [EXE]

<Electric Hand Operation>		HAND1	
SPEED	(50)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No.	(1)	INPS	HOLD
CURRENT POS (0.00)mm			
HHOLD	123	HSRVOFF	POINT →

Complete

Note) The figure is the example which set up speed to 50%.

The setup of moving speed is finishing.

(8) Setting the Force (Holding Force)

The force (holding force) of electric hand can be set up by T/B. The set value is the rate (%) to highest force. This set value is common between hand numbers.

The method of setting operation is shown below.

- 1) The cursor is moved into the parenthesis of "FORCE" by the arrow key, input the numeral value, and press the [EXE] key.

<Electric Hand Operation>		HAND1	
SPEED	(100)%	ORG	SRVO
FORCE	(100)%	RDY	BUSY
POINT No.	(1)	INPS	HOLD
CURRENT POS (0.00)mm			
HHOLD	123	HSRVOFF	POINT →

Setting the force: [Arrow], [Numeral], [EXE]

<Electric Hand Operation>		HAND1	
SPEED	(100)%	ORG	SRVO
FORCE	(30)%	RDY	BUSY
POINT No.	(1)	INPS	HOLD
CURRENT POS (0.00)mm			
HHOLD	123	HSRVOFF	POINT →

Complete

Note) The figure is the example which set up force to 30%.

Note) If setting the small value, the hand may not move due to friction of itself.

Example) The electric hand: "ESG1-SS-2815-11XW107" can move by 10% or more.

The setup of force is finishing.

5.1.3 Specification of the Robot Programming Language

(1) List of Instructions

The list of the instructions which operate the electric hand is shown in [Table 5-4](#).

Table 5-4:Instructions related to electric hand

No	Command	Explanation	Page
1	EHOpen/EHClose (Hand Open/Hand Close)	Open / Close the hand (Move to the open end / close end)	35
2	EHMov (Hand move)	Move and positioning to the specified position	37
3	EHHold (Hand hold)	Positioning and grip operation.	39
4	EHOrg (Hand origin)	Origin setting	41
5	EHServo On/Off (Hand servo)	A power supply of a servomotor is controlled.	42
6	EHStop (Hand stop)	Stop of operation.	43
7	EHTbl (Hand table)	Move by the condition of the designated table number.	44

(2) Status variable list

The list of the status variables related to the electric hand is shown in [Table 5-5](#).

Table 5-5:Status variable of the electric hand

No	Variable name	Array designation ^{Note1)}	Details.	Attribute ^{Note2)}	Data type, Unit	Page
1	M_EHPos1/M_EH-Pos2/M_EHPos3	Point No. (1 to 32)	Point data for each electric hand (1 to 3)	RW	Single-precision real number type, mm	45
2	M_EHCur	Hand No. (1 to 3)	Current position	R	Single-precision real number type, mm	46
3	M_EHBusy	Hand No. (1 to 3)	Operation status (1: Executing /0: Not executing)	R	Integer type	47
4	M_EHInPs	Hand No. (1 to 3)	Arrival condition to target position (1: Arrived /0: Not arrived)	R	Integer type	47
5	M_EHHold	Hand No. (1 to 3)	Hand grip condition (1: Gripping /0: Not gripping)	R	Integer type	47
6	M_EHZone	Hand No. (1 to 3)	Inside of the specified area (1: Inside specified area /0: Outside specified area)	R	Integer type	47
7	M_EHOrg	Hand No. (1 to 3)	Completion condition of hand origin setting (1: Completed /0: Not completed)	R	Integer type	47
8	M_EHTMd1/M_E-HTMd2/M_EHTMd3	Table No. (1 to 32)	Operation mode of designated table data of a Multifunctional Electric Hand	R	Integer type	48
9	M_EHOPos	Hand No. (1 to 3)	Operation completion point number of a multifunctional Electric hand (0: Completed or moving)	R	Integer type	49

Note1) Point No. 1 to 32, Specify point data (teaching No.).

Hand No. 1 to 3, Specify the hand No.

Table number..... 1 to 32, Specify the table number of the hand are designated.

Note2) R..... Only reading is possible.

RW Both reading and writing are possible.

- (3) Detailed explanation of command words
Each instruction is explained below.

EHOpen/EHClose (Hand Open/Hand Close)

[Function]

Commands the electric hand to open or close.

[Format]

```
EHOpen[<Hand No.>, <Speed>, <Force> [, <Zone-on position>, <Zone-off position>]
EHClose[<Hand No.>, <Speed>, <Force> [, <Zone-on position>, <Zone-off position>]
```

[Terminology]

- <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)
- <Speed> Specify the movement speed of the hand by the integer in % unit. Specify with the constant or the numeric variable.
Range of values: 1 to 100 (%) (notes: The real number is rounded off.)
Note) 1. When setting speed is smaller than 20%, a hand vibrates.
2. When setting speed is bigger than 50%, an overload error occurs.
- <Force> Specify the holding force of the hand by the integer in % unit. Specify with the constant or the numeric variable.
Range of values: 1 to 100 (%) (notes: The real number is rounded off.)
Note) If setting the small value (less than 30%), the hand may not move due to friction of itself.
Example) The electric hand: "ESG1-SS-2815-11XW107" can move by 10% or more.
- <Zone on position>/<Zone off position>
When confirming whether the hand exists in the specific area, specify that specific area in the start zone / end zone with a constant or the numeric variable. (Refer to [Fig. 5-2.](#))
Input range: -9999.99 to 9999.99 (mm) (0.01mm unit)

[Reference Program 1] (With no zone specification)

- | | |
|----------------------|--|
| 1 EHOpen 1, 100, 30 | 'Open the hand1 (speed = 100%, force = 30%). |
| 2 Mov PUP | 'Move to higher place of the grip position. |
| 3 Wait M_EHInPs=1 | 'Confirming completion of the move to open end. |
| 4 Mvs PGET | 'Move to the grip position. |
| 5 Fine 0.5, P | 'Waiting the completion of robot's movement. ^{Note1)} |
| 6 EHClose 1, 50, 30 | 'Close the hand1 (speed = 50%, force = 30%). |
| 7 Wait M_EHBusy=0 | 'Waiting the completion of hand's operation. |
| 8 If M_EHHold=1 Then | 'If gripping, the robot will go up. |
| 9 Mvs PUP | |
| 10 EndIf | |

Note 1) By using the Fine command, after movement of robot arm is completed, operation of the hand can be begun. However, the specified value as the pulse in Fine command is the value which requires adjustment. (Refer to "Fine" command in the separate manual "Instruction Manual/Detailed Explanation of Functions and Operations".)
And, the Dly command also has the same effect.

[Reference Program 2] (with zone specification)

1 Mvs PCHK	'Move to the check position of dimensions.
2 Fine 0.5, P	'Waiting the completion of robot's movement. ^{Note 1)}
3 EHClose 1, 50, 30, 20.00 22.00	'Close the hand1 (speed = 50%, force = 30% and zone position = 20 to 22mm).
4 Wait M_EHBusy=0	'Waiting the completion of hand's operation.
5 If M_EHHold=1 AND M_EHZone=1 Then	'"1" will be substituted to the MCHKOK (check flag) if gripping in the zone position.
6 MCHKOK=1	
7 EndIf	
8 EHMov 1, 0, 100, -10.00	'Open the hand1 10mm from the current position (speed = 100%).
9 Wait M_EHInPs=1	'Waiting for the completion of hand movement to the specified position.
10 Mvs PUP	'Move to higher place of the position which checks dimensions.

Note 1) By using the Fine command, after movement of robot arm is completed, operation of the hand can be begun. However, the specified value as the pulse in Fine command is the value which requires adjustment. (Refer to "Fine" command in the separate manual "Instruction Manual/Detailed Explanation of Functions and Operations".)
And, the Dly command also has the same effect.

[Explanation]

- 1) Specify the speed and the force, and open / close the hand.
Move in the open or the closed direction to the stroke end at fixed speed. If the grip is detected on the way, hand stops in that position.
- 2) In automatic operation, if hand movement begins, processing will go to the next instruction (Don't wait for completion of hand movement)
 - a) When operation of the hand needs to be completed before the robot moves, refer to the following status variables. The reference method is shown in the above-mentioned example.
 - M_EHBusy (Operation status)..... = 1: Executing
 - M_EHInPs (Arrival condition to target position).... = 0: Not arrived, = 1: Arrived
 - M_EHHold (hand grip condition) = 0: Start the operation, = 1: Gripped on the way
 - b) During hand movement, if the slot which executed the hand operation command stops, hand movement will also be stopped.
Hand movement will also be resumed if the slot restarted.
However, hand movement cannot be resumed if the target hand is moved by the manual operation of T/B etc. during the slot stop.
 - c) Hand movement can be stopped (end) by the program with executing the EHStop instruction.
- 3) Waits till completion of hand movement by execution of this instruction in step feed or direct execution.
- 4) The stopping position can be confirmed by specifying the zone position.
When the hand position is in the zone, status variable M_EHZone will be set to "1".

Example)

When "EHClose 1, 50, 30, 5, 8" are executed. (The value of M_EHZone is "1" when the positions of the hand are 5mm, to 8mm)

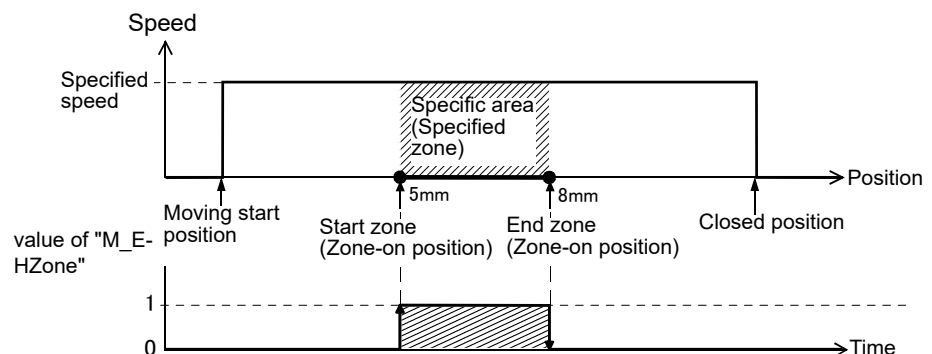


Fig.5-2:Hand movement and the value of status variable (M_EHZone)

- 5) When this instruction is executed during electric hand movement, the error "Electric hand Command double" occurs.

If it may execute overlapping, execute this command after confirming that the hand is not moving with referring to the status variable (M_EHBusy).

- 6) The origin setting must be completed before executing this instruction. If origin setting is not completed, the error will occur.
- 7) It is necessary to initialize the parameter (model selection) for the electric hand of new purchase.

EHMov (Hand move)

[Function]

Positioning movement of the electric hand to the specified position.

[Format]

EHMov[<Hand No.>, <Point No.>, <Speed> [, <Relative position>]

[Terminology]

- <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)
- <Point No> Specify the point number (taught position) of the electric hand. Specify with the constant or the numeric variable.
The range of values is 0 to 32. (notes: The real number is rounded off.)
= 0: Current position
= 1 to 32: Move to the position which set up (taught) as the parameter (EHnPOS1 to EHnPOS32, n: hand number)
- <Speed> Specify the movement speed of the hand by the integer in % unit. Specify with the constant or the numeric variable.
Range of values: 1 to 100 (%) (notes: The real number is rounded off.)
Note) When setting speed is smaller than 20%, a hand sometimes vibrates.
- <Relative position> The target position is shifted by this offset length. Specify per 0.01mm.
Specify with the constant or the numeric variable.
The range of values is -9999.99 to +9999.99mm. (notes: The value below 0.01mm is rounded off.)

[Reference Program 1] (With no zone specification)

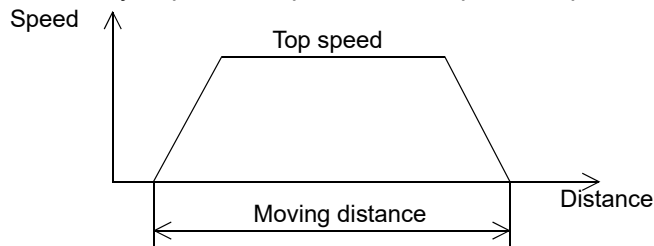
- | | |
|----------------------|---|
| 1 EHMov 1, 5, 100 | 'Move the hand1 (point No. = 5, speed = 100%). |
| 2 Mov PUP | 'Move to higher place of the grip position. |
| 3 Wait M_EHInPs=1 | 'Confirming completion of the move to specified position. |
| 4 Mvs PGET | 'Move to the grip position. |
| 5 Fine 0.5, P | 'Waiting the completion of robot's movement. (Refer to EHOpen/ EHClose (Hand Open/Hand Close)) |
| 6 EHClose 1, 50, 30 | 'Close the hand1 (speed = 50%, force = 30%). |
| 7 Wait M_EHBusy=0 | 'Confirming of movement completion. |
| 8 If M_EHHold=1 Then | 'Confirming of grip completion. |
| 9 Mvs PUP | 'Move to higher place of the grip position. |
| 10 EndIf | |

[Reference Program 2] (with zone specification)

- | | |
|-------------------------------------|---|
| 1 Mvs PCHK | 'Move to the check position of dimensions. |
| 2 EHClose 1, 50, 30, 20.00 22.00 | 'Close the hand1 (speed = 50%, force = 30% and zone position = 20 to 22mm). |
| 3 Wait M_EHBusy=0 | 'Confirming of movement completion. |
| 4 If M_EHHold=1 AND M_EHZone=1 Then | 'Confirming of the grip & zone. |
| 5 MCHKOK=1 | 'Check flag =1. |
| 6 EndIf | |
| 7 EHMov 1, 0, 100, -10.00 | 'Hand1 movement: From the current position to 10mm open. (speed = 100%) |
| 8 Wait M_EHInPs=1 | 'Confirming of movement completion. |
| 9 Mvs PUP | 'Move to higher place of the check position of dimensions. |

[Explanation]

- 1) Specify the point number and the speed and move the electric hand to the specified position.
Move by trapezoidal speed control up to the specified position.



- 2) In automatic operation, if hand movement begins, processing will go to the next instruction (Don't wait for completion of hand movement)
 - a) When operation of the hand needs to be completed before the robot moves, refer to the following status variables. The reference method is shown in the above-mentioned example.
 - `M_EHBusy` (Operation status)..... = 1: Executing
 - `M_EHInPs` (Arrival condition to target position)..... = 0: Not arrived, = 1: Arrived
 - b) During hand movement, if the slot which executed the hand operation command stops, hand movement will also be stopped.
Hand movement will also be resumed if the slot restarted.
However, hand movement cannot be resumed if the target hand is moved by the manual operation of T/B etc. during the slot stop.
 - c) Hand movement can be stopped (end) by the program with executing the EHStop instruction.
- 3) Waits till completion of hand movement by execution of this instruction in step feed or direct execution.
- 4) The target position can shift when the relative position is specified.
- 5) If it stops by external force during operation, the error occurs. (Electric hand Alarm occur (Over load))
- 6) When this instruction is executed during electric hand movement, the error "Electric hand Command double" occurs.
If it may execute overlapping, execute this command after confirming that the hand is not moving with referring to the status variable (`M_EHBusy`).
- 7) The origin setting must be completed before executing this instruction. If origin setting is not completed, the error will occur.
- 8) It is necessary to initialize the parameter (model selection) for the electric hand of new purchase.

EHHold (Hand hold)

[Function]

Positioning and grip operation of the electric hand.

[Format]

EHHold[<Hand No.>, <Point No>, <Speed>, <Force>

[Terminology]

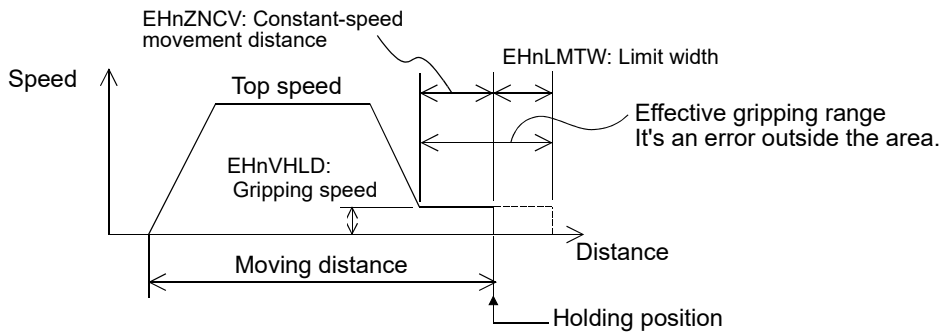
- <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)
- <Point No> Specify the point number (taught position) of the electric hand. Specify with the constant or the numeric variable.
The range of values is 0 to 32. (notes: The real number is rounded off.)
= 0: Current position
= 1 to 32: Move to the position which set up (taught) as the parameter (EHnPOS1 to EHnPOS32, n: hand number)
- <Speed> Specify the movement speed of the hand by the integer in % unit. Specify with the constant or the numeric variable.
Range of values: 1 to 100 (%) (notes: The real number is rounded off.)
Note) When setting speed is smaller than 20%, a hand sometimes vibrates.
- <Force> Specify the holding force of the hand by the integer in % unit. Specify with the constant or the numeric variable.
Range of values: 1 to 100 (%) (notes: The real number is rounded off.)
Note) 1. The real number is rounded off.
2. When setting speed is smaller than 30%, a hand is the frictional influence, and I don't move. If setting the small value, the hand may not move due to friction of itself.
Example) The electric hand: "ESG1-SS-2815-11XW107" can move by 10% or more.

[Reference Program 1]

- | | |
|-------------------------------------|--|
| 1 EHOpe 1, 100, 30 | ' Open the hand1 (speed = 100%, force = 30%). |
| 2 Mov PUP | ' Move to higher place of the grip position. |
| 3 Wait M_EHInPs=1 | ' Confirming completion of the move to open end. |
| 4 Mvs PGET | ' Move to the grip position. |
| 5 Fine 0.5, P | ' Waiting the completion of robot's movement. (Refer to EHOpe/EHClose (Hand Open/Hand Close)) |
| 5 EHHold 1, 5, 100, 30 | ' Grip the hand1 (point No. = 5, speed = 100%, force = 30%). |
| 6 Wait M_EHBusy=0 | ' Confirming of movement completion. |
| 7 If M_EHHold=1 AND M_EHZone=1 Then | ' Confirming of the grip & zone. |
| 8 Mvs PUP | ' Move to higher place of the grip position. |
| 9 EndIf | |

[Explanation]

- 1) Specify the point number, the speed and the force and move and grip the electric hand to the specified position.
Move by trapezoidal speed control up to the specified position near side, and do grip operation by constant speed at just before the grip position.
The control pattern of this function is set up as parameter.
- The Constant-speed movement zone (EHnZNCV)
 - The Gripping Speed (EHnVHLD)
 - The Limit width (EHnLMTW)



- 2) In automatic operation, if hand movement begins, processing will go to the next instruction. (Don't wait for completion of hand movement)
 - a) When operation of the hand needs to be completed before the robot moves, refer to the following status variables. The reference method is shown in the above-mentioned example.
 - **M_EHBusy** (Operation status).....= 1: Executing
 - **M_EHHold** (hand grip condition)= 0: Not gripping, =1: Gripping
 - **M_EHZone** (Halted position)= 1: Inside specified area (Constant-speed movement distance + Limit width)
 - **M_EHInPs** (Arrival condition to target position)= 0: Not arrived, = 1: Arrived
 - b) During hand movement, if the slot which executed the hand operation command stops, hand movement will also be stopped.
Hand movement will also be resumed if the slot restarted.
However, hand movement cannot be resumed if the target hand is moved by the manual operation of T/B etc. during the slot stop.
 - c) Hand movement can be stopped (end) by the program with executing the EHStop instruction.
- 3) Waits till completion of hand movement by execution of this instruction in step feed or direct execution.
- 4) If the grip is done within the constant speed moving distance and the limit width, the status variable M_EHHold and M_EHZone are set to "1".
If the grip is done before the constant speed moving distance, only the status variable M_EHHold is set to "1".
If the grip cannot be done within limit width, the status variable M_EHHold is set to "0", and stop the hand, and M_EHInPs is set to "1".
- 5) Re-starting after stopping on the way does this positioning and grip operation again, after returning to the starting position.
Operation which returns to the starting position is same as the EHMov instruction. (Speed is same as the specified by EHHold command)
- 6) When this instruction is executed during electric hand movement, the error "Electric hand Command double" occurs.
If it may execute overlapping, execute this command after confirming that the hand is not moving with referring to the status variable (M_EHBusy).
- 7) The origin setting must be completed before executing this instruction.
If origin setting is not completed, the error will occur.
- 8) It is necessary to initialize the parameter (model selection) for the electric hand of new purchase.

EHOrg (Hand origin)**[Function]**

Origin setting of electric hand

[Format]

EHOrg[]<Hand No>

[Terminology]

<Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)

[Reference Program 1]

```

1 If M_EHOrg=0 THEN      ' When origin setting is not completed.
2  EHOrg 1                ' Origin setting of the hand1.
3  Wait M_EHOrg=1         ' Waiting to complete the origin setting of hand1.
4 EndIf
5 EHOOpen 1, 100, 30      ' Open the hand1. (speed = 100%, force = 30%)

```

[Explanation]

- 1) Execute the origin setting of the electric hand.
The origin setting of the electric hand is necessary after turning on the controller power.
- 2) In automatic operation, if hand movement begins, processing will go to the next instruction. (Don't wait for completion of hand movement)
 - a) Refer to the following status variables for movement completion confirming of the hand.
 - M_EHBusy (Operation status)..... = 1: Executing
 - M_EHInPs (Arrival condition to target position)..... = 0: Not arrived, =1: Arrived
 - M_EHOrg (completion condition of hand origin setting).... = 1: Completed
 - b) During hand movement, if the slot which executed the hand operation command stops, hand movement will also be stopped.
Hand movement will also be resumed if the slot restarted.
However, hand movement cannot be resumed if the target hand is moved by the manual operation of T/B etc. during the slot stop.
 - c) Hand movement can be stopped (end) by the program with executing the EHStop instruction.
- 3) In the origin setting, if the previous origin position is not reproduced, the error occurs. "Electric hand Alarm occur (Lag of Z phase)".
Please execute the origin setting again after solving the cause of the error.
Initialize the parameter of the electric hand, if the origin position change by replacement of the finger etc.(model selection).
- 4) When this instruction is executed during electric hand movement, the error "Electric hand Command double" occurs.
If it may execute overlapping, execute this command after confirming that the hand is not moving with referring to the status variable (M_EHBusy).
- 5) It is necessary to initialize the parameter (model selection) for the electric hand of new purchase.
- 6) When doing the origin setting by T/B etc. not using this command, it is convenient when you describe the following program at top. The error occur in advance if the origin setting has not been completed
Check the completion of origin setting. (Example: When not having completed the origin setting, the error 9100 will occur)


```

1 If M_EHOrg = 0 THEN
2  Error 9100
3 EndIf

```

Supplement: Set the error which makes occurrence as the parameter. (Refer to the parameter "USR1 to USR20" in the separate manual "Instruction Manual/Detailed Explanation of Functions and Operations".)



CAUTION

Don't move the robot during origin setting of the electric hand.
If the robot is moved, the origin setup may not be correctly completed under the effect of vibration etc.

EHServo On/Off (Hand servo)

[Function]

A servomotor power supply of a Multifunctional Electric Hand is controlled.

[Format]

EHStop[]<Hand No>, <On/Off>

[Terminology]

- <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)
- <On/Off> On: turn on the power of a servomotor of a Multifunctional Electric Hand.
Off: turn off a servomotor of a Multifunctional Electric Hand.

[Reference Program 1]

- | | |
|-------------------|---|
| 1 EHMov 1, 1, 100 | ' Move the hand1 (point No. = 1, speed = 100%). |
| 2 Mov PUP | ' Move to higher place. |
| 3 Wait M_EHBusy=0 | ' Confirming of movement completion. |
| 4 EHServo 1, Off | ' Hand 1 servo off |
| 5 Mvs P1 | ' When a finger of hand 1 or a workpiece were the shape of the cone, and a finger touched a workpiece, a finger of hand 1 follows a workpiece and moves. (Only single cam and three fingers-type) |

[Explanation]

- 1) A servomotor power supply of an electric hand is controlled.
 - When the commands of EHOpen/EHClose/EHMov/EHHold/EHOrg are executed, a servomotor power supply enters automatically, so it isn't necessary to carry out EHServo On.
 - When a servomotor power is turned off, it's possible to move a mobile by the power from the outside. (Only the single cam three fingers type)
- 2) This command shifts to the next command execution after a servomotor power supply on/off is completed.
- 3) When this instruction is executed during electric hand movement, the error "Electric hand Command double" occurs.
If it may execute overlapping, execute this command after confirming that the hand is not moving with referring to the status variable (M_EHBusy).

EHStop (Hand stop)**[Function]**

Stop the electric hand.

[Format]

EHServo[]<Hand No>

[Terminology]

<Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)

[Reference Program 1]

1 EHCLOSE 1, 100, 30	' Close the hand1. (speed = 100%, force = 30%)
2 *LOOP: If M_In(20)=1 Then EHStop	' If the input signal No. 20 turns on (sensor information etc.), hand operation will be stopped.
3 If M_EHBusy=1 Then Goto *LOOP	' Wait to complete operation of the hand.
4 Mov PUP	' Move to higher place.

[Explanation]

- 1) Operation of the electric hand is stopped.
Operation currently executing by the instruction is stopped.
- 2) It is necessary to initialize the parameter (model selection) for the electric hand of new purchase.
- 3) After this instruction execution, when the hand operation command (EHOpen etc.) is executed immediately, the error may occur. (Hand operation command double execution) In such a case, execute the next instruction after confirming that the hand is not operating by referring to the status variable M_EH-Busy (Operation status).

EHTbl (Hand table)

[Function]

Make a Multifunctional Electric Hand move by the condition of the designated table number.

[Format]

EHTbl[<Hand No>, <Table No>

[Terminology]

- <Hand No>Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
- <Table No>The table number of the Multifunctional Electric Hand of multiple functions is designated. The specified range is 1 to 32.
The table information set as EHnTBL1-32 is set as a parameter.

[Reference Program 1]

```

1  EHTbl 1, 1          ' Move the hand1 (point No. = 5, speed = 100%, Relative amount =-
                        3.0mm).
2  Mov PUP             ' Move to higher place.
3  Wait M_EHInPs=1     ' Confirming of movement completion.
4  Mvs PGET            ' Move to the grip position.
5  Fine 0.5, P         ' Waiting the completion of robot's movement. (Dly command can also
                        be used)
6  EHTbl 1, 2          ' Grip the hand1 (point No. = 5, speed = 100%, force = 30%)
7  Wait M_EHBusy=0     ' Confirming of movement completion.
8  If M_EHHold=1 AND M_EHZone=1 Then 'Confirming of the grip & zone.
9    Mos PUP           ' Move to higher place.
10 EndIf

```

<Parameter setting>

```

EH1TBL1 = 3.00, 5.00, -3.00, 100.00, 0.00, 0.00, 0.00
EH1TBL2 = 4.00, 5.00, 0.00, 100.00, 30.00, 0.00, 0.00

```

[Explanation]

- 1) This command moves a electric hand by table designation.
The Multifunctional Electric Hand is operated following the table information (operation mode, the point number, relative amount, speed, the power, the zone ON location, and the zone OFF location) set as parameter EHnTBL1 - 32.
- 2) In automatic operation, if hand movement begins, processing will go to the next instruction. (Don't wait for completion of hand movement)
Refer to the following status variables for movement completion confirming of the hand.
<Operation mode: "open" or "close">
 - M_EHBusy (Operation status)..... = 1: Executing
 - M_EHInPs (Arrival condition to target position)..... = 0: Not arrived, =1: Arrived
 - M_EHOrg (hand grip condition)..... = 0: Start the operation, = 1: Gripped on the way

- (4) Explanation of Each Robot Status Variable
Each Status Variable is explained below.

M_EHPos1/M_EHPos2/M_EHPos3

[Function]

Reference or setting to the point data of electric hand.

[Format]

<Numerical variable>=M_EHPos1(<Point No>) 'Reference of point data
M_EHPos1(<Point No>)=<Numeric value> 'Setting of point data

[Terminology]

- <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable.
(notes: The real number is rounded off.)
- <Numerical variable>.... Specify the numerical variable which substitutes point data.
Range of values: -9999.99 to 9999.99mm
- <Numeric value> Specify point data. Specify with the constant or the numeric variable.
Specify per 0.01mm.
Range of values: -9999.99 to 9999.99mm (notes: The value below 0.01mm is rounded off.)

[Reference Program]

- | | |
|--------------------|---|
| 1 MPos=M_EHCur | 'Substitute the current position of the hand. |
| 2 MPos=MPos+0.5 | 'Add 0.5mm to the current position. |
| 3 M_EHPos1(5)=MPos | 'Set as the point5. |
| 4 EHMov 1, 5, 100 | 'Move the hand1 to the point5. (point No. = 5, speed = 100%). |
| 5 Wait M_EHInPs=1 | 'Confirm arrival. |

[Explanation]

- 1) Specify the point number, and set up or refer to the point data (The parameters EHnPOS1 to EHnPOS32, n: Hand number) of the electric hand.

M_EHCur

[Function]

Return the current position of the electric hand.

[Format]

<Numerical variable>=M_EHCur [(<Hand No.>)]

[Terminology]

- <Numerical variable> Specify the numerical variable which substitutes current position of the electric hand.
 <Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable. 1 is set as the default value.
 (notes: The real number is rounded off.)

[Reference Program]

1 MPos=M_EHCur	'Substitute the current position of the hand.
2 MPos=MPos+0.5	'Add 0.5mm to the current position.
3 M_EHPos1(5)=MPos	'Set as the point5.
4 EHMov 1, 5, 100	'Move the hand1 to the point5. (point No.=5, speed =100%).
5 Wait M_EHInPs=1	'Confirm arrival to the specified position.
6 EHClose 1, 50, 30	'Close the hand1.
7 Wait M_EHBusy=0	'Wait to complete operation of the hand.
8 Dly 0.1	'Wait for a period of time.
9 Wait M_EHInPs=1	'Confirm arrival.

[Explanation]

- 1) Specify the hand number and return the current position of the electric hand.
- 2) The range of the current position is -9999.99 to +9999.99 mm.
- 3) The value when the target hand is not connected is 0.
- 4) The value when the origin setting of the target hand is not done is indefinite.
- 5) The current position of the Multifunctional Electric Hand being operated may be acquired if the current position is acquired by M_EHCur after the Multifunctional Electric Hand status (M_EHBusy or M_EHInPs) is checked. In this case, wait for a period of time by using Dly (approximately 0.1s).

M_EHBusyM_EHInPsM_EHHoldM_EHZoneM_EHOrg**[Function]**

Return the condition of the electric hand.

M_EHBusy..... Operation status. (1: Executing /0: Not executing)

M_EHInPs Arrival condition to target position. (1: Arrived /0: Not arrived)

M_EHHold Hand grip condition. (1: Gripping /0: Not gripping)

M_EHZone Inside of the specified area. (1: Inside specified area /0: Outside specified area)

M_EHOrg..... Completion condition of hand origin setting. (1: Completed /0: Not completed)

[Format]

<Numerical variable>=M_EHOrg [(<Hand No.>)] *Other status variables are equivalent.

[Terminology]

<Numerical variable>..... Specify the numerical variable which substitutes electric hand condition.

<Hand No> Specify the electric hand numbers 1 to 3 in integer. Specify with the constant or the numeric variable. 1 is set as the default value. (notes: The real number is rounded off.)

[Reference Program]

1 If M_EHOrg=0 THEN	'Condition the origin setting is not completed.
2 EHOrg 1	'Execute the origin setting of the hand1.
3 Wait M_EHOrg=1	'Wait for completion of the origin setting of hand1.
4 EndIf	
5 EHOpen 1, 100, 20	'Open the hand1 (speed =100%, force = 20%).
6 Mov PUP	'Move to higher place of the grip position.
7 Wait M_EHInPs=1	'Confirming completion of the move to open end.
8 Mvs PGET	'Move to the grip position.
9 Fine 0.5, P	'Waiting the completion of robot's movement. (Refet to EHOpen/EHClose (Hand Open/Hand Close))
10 EHClose 1, 50, 20, 20.00 22.00	'Close the hand1 (speed =50%, force = 20%, zone = 20 to 22mm).
11 Wait M_EHBusy=0	'Confirming of movement completion.
12 If M_EHHold=1 AND M_EHZone=1 Then	'Confirming of the grip & zone.
13 Mvs PUP	'Move to higher place of the grip position.
14 EndIf	

[Explanation]

- 1) Specify the hand number and return the various condition of the electric hand.
- 2) The value when the target hand is not connected is 0.
- 3) The description of each status variable is as follows.

Table 5-6: Status variable of the electric hand

No	Status variable	Description
1	M_EHBusy	Operation status (1: Executing /0: Not executing) "1" is set up while the hand operates.
2	M_EHInPs	Arrival condition to target position (1: Arrived /0: Not arrived) "0" is set at starting the operation. When hand arrive to the target position, "1" will be set. (completion range of positioning) "1" is set up while being at the target position.
3	M_EHHold	Hand grip condition (1: Gripping /0: Not gripping) "0" is set at starting the operation. When hand grips by specified force at end of movement, "1" will be set. "1" is set up while hand grips by specified force.
4	M_EHZone	Inside of the specified area (1: Inside specified area /0: Outside specified area) "0" is set at starting the operation. When hand enters into the specified area, "1" will be set "1" is set up while being in the specified area.
5	M_EHOrg	Completion condition of hand origin setting (1: Completed /0: Not completed) "1" will be set up when the origin setting of the hand is completed normally. The origin setting of the electric hand is necessary after turning on the controller power. Confirm the completion condition of the origin setting with this status variable. If not completed, execute the EHOrg command.

M_EHTMd1/M_EHTMd2/M_EHTMd3

[Function]

An operation mode of designated table data of an electric hand is returned.

[Format]

<Numerical variable>=M_EHTMd1(<Table No>) 'Reference of Operation mode of table data data

[Terminology]

<Numerical variable> The variable for which an operation mode of table data (0-5) is substituted is designated.
 0: not set, 1: movement, 2: hold, 3: relative movement, 4: open, 5: close

<Table No> The table number of the Multifunctional Electric Hand is designated.
 A setting area is 1-32. It's established by the fixed number or a variable.

[Reference Program]

M1=M_EHTMd1(1) ' An operation mode of table data 1 of hand 1 is substituted for M1.
 M11=M_EHTMd2(11) ' An operation mode of table data 11 of hand 2 is substituted for M11.
 If M11<>0 Then EHTbl 2, 11 ' Hand 2, move by the contents of table data 11.

[Explanation]

- 1) The hand number is designated, and establishes an operation mode of table data of an Multifunctional Electric Hand (parameter EHnTBL1 - EHnTBL32 and the n : hand number) and refers to it.

M_EHOPos

[Function]

The movement completion point number of the Multifunctional Electric Hand is returned.

[Format]

<Numerical variable>=M_EHOPos [(<Hand No.>)]

[Terminology]

<Numerical variable>.... The variable for which the movement completion point number (1-32) is substituted is designated.

[Reference Program]

M1=MEHOPos(1)

' The completion point number of hand 1 is substituted for M1.

If M_EHOPos(2)=2 Then *L01

' When the completion point number of hand 2 is 2, I jump to *L01.

[Explanation]

- 1) The hand number is designated and the movement completion point number of Multifunctional Electric Hand is returned.
- 2) It will be 0 at the time of order execution starting of EHOrg/EHOpen/EHClose/EHMOV/EHHold.
- 3) The point number is output in M_EHInPs=1 after completion of operation of EHMOV.
- 4) The point number is output by M_EHHold=M_EHZone=1 or M_EHInPs=1 after completion of operation of EHHold.
- 5) output after completion of operation at hold effective area outside in EHHold is a condition of 0. When hold movement was performed in the state from which a held product has been taken, and it was M_EHInPs=1, output is a condition of 0.
- 6) After EHMOV/EHHold command was executed, when an error occurs or operation is interrupted during movement, the output is still 0.
- 7) When a target hand is not connected, it will be 0.

5.1.4 Parameter list

The list of the parameters is shown in [Table 5-7](#).

Table 5-7:Electric hand control parameter list

Parameter	Parameter name ^{Note1)}	No. of arrays No. of characters	Details explanation	Factory setting
Electric hand Actuator Type	EHnTYPE	Integer 1	This parameter is used for setting the type of a gripper currently used. Input range: 0 to 65535 By this parameter setting, the parameter of the connected electric hand is initialized and memorize parameter initial values.	0
Electric hand Soft limit (+)	EHnLMTp	Integer 1	This parameter is used for setting a positive movable range. Input range: 0 to 9999 (unit: 0.1mm) If you set the direction in which the fingers return to their origin positions to OPEN, the closing direction becomes positive direction. If you set the direction in which the fingers return to their origin positions to CLOSE, the opening direction becomes positive direction.	0
Electric hand Soft limit (-)	EHnLMTM	Integer 1	This parameter is used for setting a negative movable range Input range: -9999 to 0 (unit: 0.1mm) If you set the direction in which the fingers return to their origin positions to OPEN, the closing direction becomes positive direction. If you set the direction in which the fingers return to their origin positions to CLOSE, the opening direction becomes positive direction.	0
Electric hand Stroke	EHnSTRK	Integer 1	This parameter is used for setting actuator stroke length. Input range: 0 to 9999 (unit: 0.1mm)	0
Electric hand Positioning completion distance	EHnPSCD	Integer 1	When moving to the specified point, complete movement in the specified distance (near side). Input range: 1 to 9999 (unit: 0.01mm) Increase the parameter to shorten tact time of the system.	0
Electric hand Acceleration	EHnACC	Integer 1	This parameter is used for setting actuator acceleration. Optimum acceleration is automatically set by setting actuator type and mass of moving parts. To decrease acceleration in consideration of the installation place of the actuator and rigidity of fingernails, change the acceleration parameter value. Input range: 1 to 100 (%)	0
Electric hand Maximum program speed	EHnVMAX	Integer 1	This parameter is used for setting maximum speed stored as point data Input range: 1 to 100 (%)	0
Electric hand Gripping Speed	EHnVHLD	Integer 1	Set up the constant speed in effective gripping range at positioning grip movement (movement by EHold instruction). Input range: 1 to 100 (%)	0
Electric hand Constant-speed movement zone	EHnZNCV	Integer 1	Set up the moving distance by constant speed at positioning grip movement (movement by EHold instruction). Move by gripping speed in the moving distance by constant speed (near side) from target position. Input range: 1 to 9999 (unit: 0.01mm)	0
Electric hand Limit width	EHnLMTW	Integer 1	Set up the limit width of moving by constant speed at positioning grip movement (movement by EHold instruction). Move at gripping speed to the position which added limit width from the target position. If the fingers moved beyond the effective gripping range, they stop at the point (movement distance + limit width) Input range: 0 to 9999 (unit: 0.01mm)	0

Parameter	Parameter name ^{Note1)}	No. of arrays No. of characters	Details explanation	Factory setting
Electric hand Direction for returning the fingers to their origin positions	EHnORGD	Integer 1	This parameter is used for specifying the direction in which the fingers return to their origin positions. 0: Opening direction 1: Closing direction If setting the direction in which the fingers return to their origin positions to "0: OPEN", the closing direction will become a positive direction, then the fingers move in the closing direction.	0
Electric hand Speed for returning the fingers to their origin positions	EHnORGV	Integer 1	This parameter is used for setting the speed at which the fingers move back to their v positions. Input range: 20 to 50 (%)	0
Electric hand Origin position shift	EHnORGSF	Integer 1	This parameter is used for shifting the coordinate position of original data by the parameter value specified as origin position shift. Input range: -9999 to 9999 (unit: 0.01mm) If this parameter is specified, there is no need to reentry point data in the case of misalignment of origin positions during product maintenance. Zero point shift should be set within the soft limit.	0
Electric hand Origin position return system	EHnORGS	Integer 1	This parameter is used for changing the method in which the fingers return to their origin positions. 0: Stroke end 1: S stroke end + Z phase detection system After a stroke end is detected, the fingers are reversed until Z phase is detected. If the reversed distance until Z phase is detected is important, change the parameter value of the method for returning to origin positions to "0: stroke end" to adjust the reversed distance to 0.5mm	0
Electric hand Point data	EHnPOS1 to EHnPOS32	Integer 1	Set up the point data of electric hand. (memory) Input range: -999.99 to 999.99 (unit: 0.01mm)	0
Electric hand Table data	EHnTBL1 to EHnTBL32	Integer 7	Table data of an electric hand is established. The 1st element: Operation mode (0: not set, 1: movement, 2: hold, 3:Relative movement, 4:OPEN, 5:CLOSE) The 2nd element: The point number <setting range> operation mode /1: 0 to 32/2: 1 to 32 The 3rd element: Relative amount [mm] <setting range> -9999.99 to 9999.99 The 4th element: Speed [%] <setting range> operation mode /4,5: 1 to 50/1,2,3: 1 to 100 The 5th element: The power [t%] <setting range> 1 to 100 The 6th element: The zone ON location [mm] * An operation mode is Open (EHOOpen) or Close (EHCLOSE), and is effective. <setting range> -9999.99 to 9999.99 The 7th element zone OFF location [mm] * An operation mode is Open (EHOOpen) or Close (EHCLOSE), and is effective. * The 6th or 7th element, when both of them are "0", the zone designation is invalid. <setting range> -9999.99 to 9999.99	0,0,0,0,0,0,0
Electric hand Table comment	EHnTCM1 to EHnTCM32	Character string 1	Set up the comment for the table of the Multifunctional Electric Hand. *When the character string is separated by a one-byte semicolon or space, the subsequent characters are not saved.	""(None)
Electric hand T/B operation mode	EHOPCMD	Integer 1	An initial value of a TB operation mode of an electric hand is established. 0: point designation 1: table designation	0
Electric hand Present location acquisition mode	EHCURMD	Integer 1	The present location acquisition mode of a Multifunctional Electric Hand is established. 0: Always acquires (compatible in the past.) 1: Always acquires in manual mode. And acquires only at once at the time of the end of a movement. Automatic mode is acquired only once at the time of a movement end.	0

Note1) n: Indicates the hand number (1 to 3).

5.1.5 Error list

The error list (the cause and measures) about the electric hand is indicated in [Table 5-8](#).

The target electric hand number is differentiated by the upper 3 digit of the error number.

- H814*: Hand1
- H815*: Hand2
- H816*: Hand3

Table 5-8:Error list

Error No.	Error cause and measures	
H8140 H8150 H8160	Error message	Electric handn Comm.error(RIO)
	Cause	The CRC error or the connection error occurred in electric hand remote I/O communication.
	Measures	Confirm the check of the communication cable, or the power supply of connection equipment.
H8141 H8151 H8161	Error message	Electric handn Alarm occur
	Cause	Either of the alarms shown below has occurred. Motor overload, Motor overcurrent, Z phase deviating, Power supply voltage drop, Position deviation over, Position deviation exceeded, Feedback error 1, 2, and 3, Abnormal voltage, System error 1 and 2.
	Measures	Reset the error of the robot after removing the cause of alarm with referring to the instruction manual of electric hand. If error cannot be canceled by error reset operation, turn off the robot's power supply once and turn on again.
H8142 H8152 H8162	Error message	Electric handn Error occur
	Cause	Either of the alarms shown below has occurred. Soft limit over, The origin setting is not completed, The drive power supply OFF, I/O logic error (system error), The command was inputted during operation, The command was inputted during data writing, Z phase is not found in origin setting, FCS check error, Data input range over, Actuator type mistake, Anomalies in internal communication.
	Measures	Reset the error of the robot after removing the cause of alarm with referring to the instruction manual of electric hand. If error cannot be canceled by error reset operation, turn off the robot's power supply once and turn on again.
H8143 H8153 H8163	Error message	Electric handn not connected
	Cause	The electric hand is not connected.
	Measures	Confirm the communication cable of remote I/O connection, or the setup of the station-number.
H8144 H8154 H8164	Error message	Electric handn type is not set.
	Cause	Type selection of the electric hand is not completed.
	Measures	Set up the actuator type (EHnTYPE) of robot's parameter.
H8145 H8155 H8165	Error message	Electric handn origin is not set.
	Cause	The origin setting of the electric hand is not completed.
	Measures	Execute the origin setting.
H8146 H8156 H8166	Error message	Electric handn Response timeout.
	Cause	There exists no response from the electric hand.
	Measures	Confirm the connection condition of the cable, and electric hand condition, and turn on the power supply of the robot controller once again.
H8147 H8157 H8167	Error message	Electric handn Command double.
	Cause	The operation commands of the electric hand was executed in duplicate.
	Measures	Correct the program so that the operation command may not be executed in duplicate.
H8148 H8158 H8168	Error message	Electric handn Point setting err.
	Cause	Point data registration overlapped in operation of the setup by the multitasking program, T/B, RT ToolBox2, etc., etc.
	Measures	Correct the program, or the operating procedure.
H8149 H8159 H8169	Error message	Electric hand system fault3
	Cause	The system fault occurred in electric hand.
	Measures	Execute the origin setting after resetting the error. If the alarm cannot be reset, turn the power OFF and ON. If it comes back, contact your service provider.
L0092	Error message	Can't use Electric hand signal.
	Cause	The output signal for the electric hand cannot be used.
	Measures	When the electric hand is connected, the output signal used by electric hand cannot be outputted by the program. Change the output signal number used by the program.

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