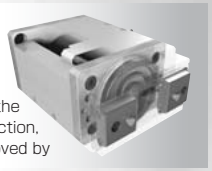
Electric Actuator

Higher accuracy and control of the gripping force, position and speed are realized by use of a closed loop control between stepping motor and rotary encoder. This accuracy is much higher than pneumatic actuators.

The special cam structure provides downsizing. PAT.P

SS /Single cam type
ESG1-SS



Single cam structure
The unique cam structure is simple and compact. Since the self-lock does not function, the fingers can be moved by external force.

SD /Double cam type
ESG1-SD

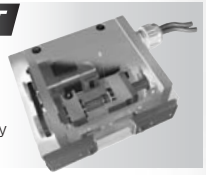
Double cam structure
The double cam structure with special gears provides a simple and compact configuration for high grip force.

Two finger styles

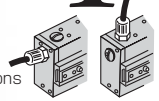
＊One of two finger styles, straight and tee styles, can be selected.

FS /Screw type straight style
ESG1-FS

FT /Screw type tee style
ESG1-FT

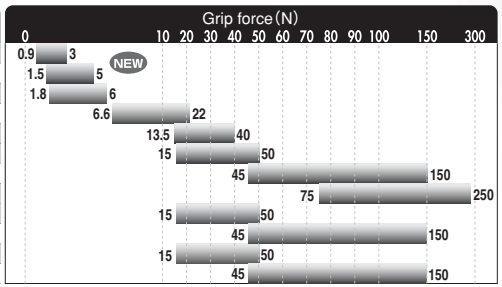


Long stroke
High-efficiency and high-accuracy long stroke is provided by the belt drive of the ground ball screw.



Wiring direction
One of two directions can be selected.

Type	Model/size	Stroke
Single cam type	ESG1-SS-2005-3N	3.2
	ESG1-SS-2005-5N	3.2
	ESG1-SS-2010	7.6
	ESG1-SS-2815	14.3
	ESG1-SS-4225	23.5
Double cam type	ESG1-SD-2005	5
	ESG1-SD-2810	10
	ESG1-SD-4220	19.3
Screw type straight style	ESG1-FS-2020	19
	ESG1-FS-2840	38
Screw type tee style	ESG1-FT-2020	19
	ESG1-FT-2840	38



Gripping force control
The grip force can be set arbitrarily 〈by 1% in the range from 30 to 100%〉.

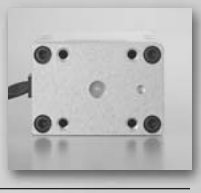
Speed control
The speed and acceleration can be set arbitrarily 〈from 20 to 100 mm/s〉.
＊In the case of the single cam type

Multi-point position control
Positioning points can be set 〈31 points and origin〉.

Measuring by position detection
Position setting and measurement unit 〈0.01 mm〉

Light and compact
The use of the unique cam structure provides light and compact actuators having high grip force.

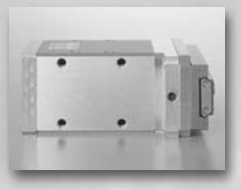
Positioning pin hole
The finger center shaft has a pin hole.



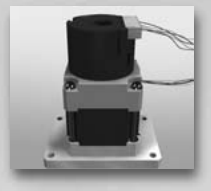
High rigidity and high accuracy
The finger block uses a ball guide.

Motor cable
As the motor cable for connecting the gripper main body and the controller, a robot cable (equivalent product) is used to ensure high flexibility.

Installation in any position
Each of the five surfaces except the finger mounting surface (three surfaces in the case of F type) has four tapped holes for mounting.



Stepping motor and rotary encoder
The closed loop control provides high accuracy position and speed control without loss of synchronism.



ESC11-B/Controller

■Applicable to commercially available PLC and PC

■Support software
Easy point editing and parameter setting with the aid of the support software (supplied free of charge). A serial converter (optional) which can be connected to an RS232C or USB port is available.

■Communication function
Networking through connection with the host controller (up to 16 points)

■Jog switch (optional)
The fingers can be opened and closed without setting of point data or parameters. (For double cam type and screw type)

■Passport size
One model of the small controller can cover all grippers.

■Alarm and monitoring
Easy troubleshooting through various alarm and monitoring functions

The safety precautions stated below are to be followed to use the product safely and correctly and to safeguard both you and other persons and avoid property damage. The precautions are classified into three categories, DANGER, WARNING and CAUTION, to indicate the degree of hazard, damage and imminence. Strictly observe these important safety precautions in addition to the safety requirements specified in JIS B 8433*1) and other standards.

⚠ DANGER	An imminent hazard which, if not avoided, will result in death or serious injury
⚠ WARNING	A potentially hazardous situation which can result in death or serious injury if the product is improperly handled
⚠ CAUTION	A potentially hazardous situation which may result in personal injury or only property damage if the product is improperly handled

*1) JIS B 8433: Robots for industrial environments – Safety requirements

- This series of products was designed and manufactured as parts for general industrial machines.
- The product shall be selected and installed by a system designer or a person in charge who have sufficient knowledge and experience.
- Before handling the product, read the catalog and instruction manuals. Improper handling of the product can cause accidents. Read the manuals for the gripper main body, controller and support software.
- The applicability of this product to your system shall be verified and judged on your own responsibility.
- After reading the catalog and instruction manuals, keep them in a place accessible to the operators.
- The DANGER, WARNING and CAUTION messages in this "For Safe Use" chapter do not cover all hazardous situations. For the details of each situation, read the product catalog and instruction manuals entirely, and use the product safely and correctly.
- When the gripper is used as a built-in device of a system (machinery, equipment or robot), the system must meet the laws and standards relating to safety measures. After ensuring that the system meets the requirements, handle the gripper in a safe and correct manner conforming to the laws and standards. This gripper is exempted from the application of regulations for miniature robots.
- Do not use the gripper for the following purposes.
  1. Medical devices and machines for sustaining and controlling human life and body, or devices and machines related to them
  2. Mechanisms, machinery and equipment for moving and transferring persons
  3. Critical security parts of machinery and equipment

  These products are not designed for uses requiring high-level safety. They do not support human life.

⚠DANGER

General

Do not use the product out of the specified range. Doing so can cause failure, breakdown and damage of the product and result in significant reduction of the product life.

Design

- If the product is stopped upon occurrence of system failure, such as emergency stop and power interruption, design a safety circuit or device to avoid property damage and personal injury.
- Ground the gripper main body and controller according to the class D grounding work (former class 3 grounding work, grounding resistance of 100 Ω or less). If earth leakage occurs, electric shock and malfunction may be caused.

Use environment

- Do not use the product in a combustible or explosive gas atmosphere. It does not have an explosion-proof structure. Doing so may cause explosion or ignition, resulting in property damage or serious personal injury.
- Do not use it in a place where the main body and controller may be splashed with water or oil.

Installation

When wiring the product, see the wiring procedures stated in the instruction manual, and take care not to wire it incorrectly. Connect the cables and connectors securely so that they will not be disconnected or loosened. Failure to do so may cause product malfunction or fire.

Operation

- When operating or adjusting the system after installing the gripper on the system, strictly observe the safety precautions for the system. Failure to do so can cause serious personal injury.
- Before supplying power to the product and starting it, ensure the safety in the product operating range. If power is supplied to it carelessly, personal injury may be caused by electric shock or contact with moving parts.
- Do not touch any connector while power is on the gripper. Doing so can cause electric shock and malfunction.
- Persons with pacemaker should be at a distance of 1 m or more from the product. The strong magnet in the product may cause malfunction of the pacemaker.
- Do not pour water over the product or wash it. Do not use it in water. Doing so can cause malfunction, resulting in personal injury, electric shock or fire.

Maintenance

- When the gripper is installed in a system (machinery, equipment or robot), maintain the gripper in a safe and correct manner in accordance with the laws and standards relating to the system safety measures.
- Do not disassemble or reassemble any part of the product other than the specified parts. Doing so can cause personal injury, electric shock or fire.
- Do not modify the product. Never cut or reconnect the cable of the product to extend or shorten the cable. Doing so can cause fire.

⚠WARNING

Use environment

- Do not expose the product to direct sunlight or UV light.
- Use it in a place where it will not be exposed to heat radiated from any heat source and the ambient temperature is 0 to +40℃.
- Use it at a humidity of 35 to 90%, taking case that it will not be affected by dew condensation.
- Do not use it in a corrosive gas atmosphere or in a place where it will be affected by corrosive chemicals or solutions. Rusting or excessive deterioration due to corrosion may be caused.
- Do not use it in a place with much dust or iron particles. Particles may enter the inside through gaps, thereby damaging the product.
- Do not use it in a place where it will be splashed with water, cutting oil, cleaning liquid, organic solvent or hydraulic fluid. If there is a possibility that it will be splashed with such a liquid, sufficiently protect it with a cover or a panel. It does not have a drip-proof structure. If water drops enter the inside, it may be damaged.
- Do not use it in a place where it may be exposed to heavy shock or vibration (5 m/s²).
- Do not use it in a place where it may be affected by electromagnetic interference caused by strong electromagnetic wave. The product may malfunction.
- Do not use it in a place where large current or strong magnetic field is generated, in a welding area with arc discharge or in a place where noise is caused by static electricity or it may be exposed to radioactivity. If it is used in such a place, provide sufficient shielding. The product may malfunction.

Installation

- Provide an emergency stop device in a readily accessible position so that the gripper can be stopped immediately upon occurrence of a hazardous situation during operation. Failure to do so may cause personal injury.
- Secure the product and the attachment tightly using the specified bolts. If they are secured insufficiently, the product or work may become loose or drop, thereby resulting in damage to the equipment or personal injury during operation.
- When installing the product, keep maintenance space. If the space is not kept, daily inspection and maintenance cannot be performed, and the equipment may stop, or the product may be damaged.
- When installing or adjusting the product, put up a signboard "UNDER WORK. DO NOT TURN ON POWER". If power is turned on accidentally, personal injury may be caused by electric shock or sudden operation of the product.
- When installing, do not hold any moving part or cable of the product. Doing so may damage the product.

Operation

- During operation, do not touch the product. Fingers may be caught in it or involved in other equipment, thereby causing personal injury.
- Do not touch any connector or exposed terminal of the controller. Doing so may cause electric shock.
- If power interruption occurs during operation, turn off power. Otherwise, when power is restored, the product may suddenly start moving, thereby damaging the equipment or causing personal injury.
- Before moving any moving part of the product for manual positioning, etc., make sure that the servo has been turned off (by the support software). Failure to do so may cause personal injury.
- If the product causes abnormal heat generation, smoking or abnormal odor, immediately turn off power. Failure to do so may damage the product or cause fire.
- When the protective device (alarm) of the product functions, immediately turn off power. The product may malfunction, resulting in personal injury and property damage. After turning off power, reveal the causes. Do not reapply power until the causes are removed.

Maintenance

- Before maintaining or servicing the product or replacing any part of the product, completely disconnect power from it. Observe the following instructions.
  1. Put up a signboard "UNDER WORK. DO NOT TURN ON POWER". in a prominent place to prevent any third party from turning on power carelessly.
  2. When more than one worker performs maintenance work, the workers shall ensure their safety calling out to one another before turning on or off power or moving any moving part.
- If you have not sufficiently understood the details of the inspection, never perform any operation. Do not fail to inspect the product. The life of the driving parts may be reduced, and the parts may malfunction. If any abnormality is found during inspection, do not use the product without correcting it. Immediately stop using it.

Disposal

Do not throw the product into fire. It may rupture or generate toxic gas.

⚠CAUTION

General

- If the product is used under conditions or in an environment not stated in the catalog or instruction manual or if you intend to use it for any purpose requiring safety, e.g. abiation facilities, combustion equipment, amusement facilities, game equipment, clean room, safety device or other equipment which may have significant influence on human life or property, use it with allowance for rating and performance, and take sufficient safety measures, such as failsafe devices. In such a case, be sure to consult us.
- To connect the gripper main body and the controller, use the special cable supplied by us.
- The component parts including the gripper main body, controller, motor cable, serial converter and jog switch shall be selected from our special parts.

Use environment

- Keep the space for conducting maintenance safely.
- Do not put a floppy disk or any magnetic medium in a range of less than 1 m from the product. The magnetism of the magnet may destroy the data in the medium.

Installation

- When handling the product, ensure the safety using protectors as needed.
- Even when the product is in a packaged state, handle it taking care not to throw it or apply excessive impact to it.
- Do not step on the package. Do not put a heavy article on it. Take care not to apply excessive force to it.
- After opening the package, hold the gripper main body. Do not hold any cable or connector to bring it.
- Although the motor cable is highly flexible, do not house the cable in a movable wiring duct (Cable Bear) having a radius less than the specified radius.
- Take care not to damage the motor cable. If the cable is scratched, forcibly bent, pulled, wound or pinched, earth leakage or conduction failure may occur and result in fire, electric shock or malfunction.
- Do not put obstacles to ventilation around the controller. The controller may be damaged.
- Do not configure such a control that the work will drop upon occurrence of power interruption. Configure a control to prevent drop of work upon power interruption or emergency stop of the equipment.

Operation

- Turn on power to the devices starting from the highest-order one. Otherwise, the product may suddenly start and cause personal injury or damage the equipment.
- Do not put fingers or articles into any opening in the product. Doing so can cause fire, electric shock or personal injury.
- The running motor is generating heat, and the product surfaces are hot. Avoid adverse influence on the work or parts around the product.

Maintenance

When testing the insulation resistance, do not touch any terminal. Doing so can cause electric shock. (Since the product uses a DC power supply, do not perform withstand voltage test.)

Storage

- Store the product in a cold and dark place away from direct sunlight and moisture avoiding dew condensation at a height of 30 cm or more from the floor.
- Do not apply vibration or shock to the product during storage.

Disposal

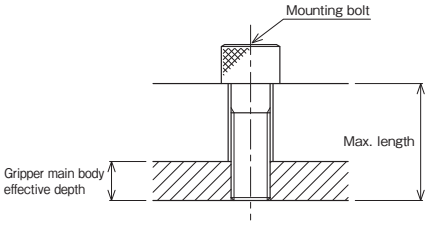
If the product is unusable or unnecessary, dispose of it appropriately as industrial waste.

Installation

Mounting bolts

⚠WARNING

- Firmly secure the gripper using the four tapped mounting holes.
- The tapped holes are made in the aluminum block. If the mounting bolt is tightened to an excessive torque, the threads may be damaged. Tighten the bolt to an appropriate torque. Provide the bolt with a locking part.
- The tapped mounting holes are through holes. If bolts are screwed in deeper than the gripper effective depth, internal parts may be damaged. Never use bolts with threaded portions which can be screwed in deeper than the gripper effective depth.



	Model	Tap	Effective depth (mm)	Recommended tightening torque (N·m)
Cam type	S*-20	M3	6(5)	0.55 to 0.70
	S*-28	M4	8(6)	1.15 to 1.55
	S*-42	M5	8(7.5)	2.65 to 3.20
Screw type	F*-20	M4	6	1.15 to 1.55
	F*-28	M5	7.5	2.65 to 3.20

- The values in parentheses are the effective depth for installation on upper surfaces.

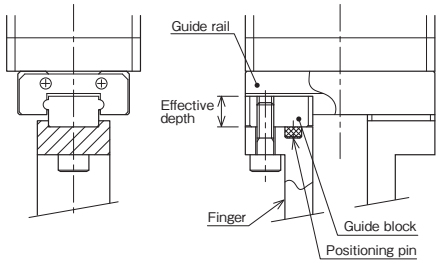
⚠CAUTION

Generally recommended tightening torque values are shown above.
Determine the torque in consideration of the materials of the actual mounting bolts, seating surface, etc.

Installation of attachment

⚠WARNING

- When installing or removing the attachment, firmly hold the attachment and tighten the bolt, taking care not to apply excessive force or shock to the guide block.
- The mounting tapped hole in the guide block is a through hole. If a bolt is screwed in deeper than the effective length, the bolt will interfere with the guide rail, resulting in product fault or damage.



The use of the positioning pin on the guide block can improve the installation accuracy and equality. A structure which holds the guide block side surfaces as shown in the figure can further improve the installation equality.

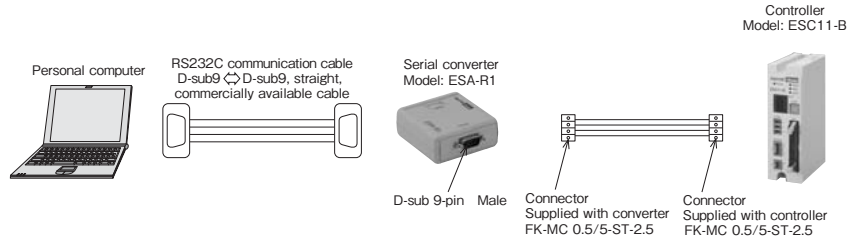
	Model	Tap	Effective depth (mm)
Cam type	S*-20	M3	5
	S*-28	M4	5
	S*-42	M5	8
Screw type	F*-20	M3	5
	F*-28	M4	7.5

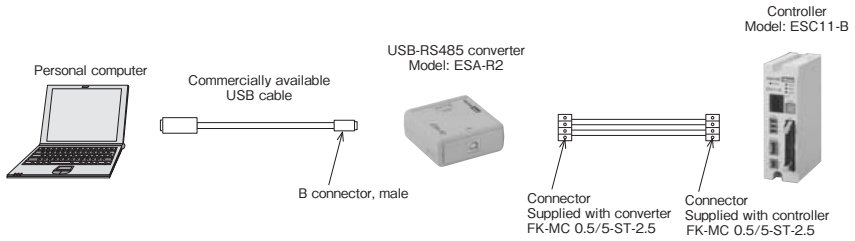
⚠CAUTION

When fitting the fingers, tighten them to a torque appropriate to the finger material.

Connection of personal computer and controller

To connect the personal computer and the controller, a communication cable and a serial converter (optional) are necessary.
Connect the personal computer and the controller as shown in the following connecting diagrams.





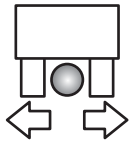
⚠CAUTION

- Before connecting or disconnecting the communication cable to or from the controller, turn off power to the controller. Failure to do so can cause trouble.
- Do not turn off power to the controller while data is being transferred between the controller and the personal computer.
- To connect the controller and the personal computer, use a serial converter (ESA-R1 or ESA-R2, optional).
- For ESA-R1, use a commercially available straight RS232C cable.
- For ESA-R2, use a B type male connector on the converter side of the USB cable.
- Before operating the support software, install an emergency stop circuit externally so that operation can be stopped and power can be disconnected immediately.
- Specifications for communication cable (recommended product)

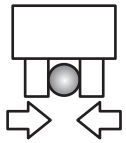
Hitachi Cable, Ltd. CO-SPEV-SB (A) 4P×0.3SQ LF

Mode		Gripping	Movement
Acceleration/ deceleration	Absolute	Gripping of work ◇Fast tact and low impact ◆When the variation in work shape is small	Return of fingers
	Incremental	Gripping of work ◇Fast tact and low impact ◆When the variation in work shape is small	Return of fingers
Constant speed	Open	Gripping on work internal surface ◇Unknown shape of work (large variation) ◆Application of shock to work	
	Closed	Gripping on work external surface ◇Unknown shape of work (large variation) ◆Application of shock to work	
Constant speed ZON	Open	Gripping on work internal surface ◇Large variation in work shape ◇Judgment of acceptability of gripping size ◆Application of shock to work	
	Closed	Gripping on work external surface ◇Large variation in work shape ◇Judgment of acceptability of gripping size ◆Application of shock to work	

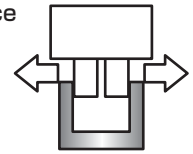
Return of fingers



Gripping on work external surface

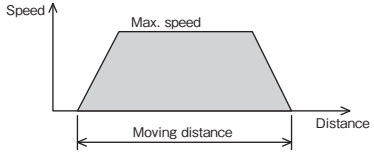


Gripping on work internal surface



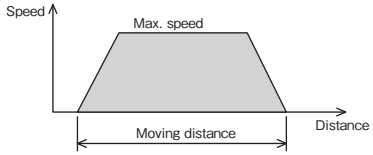
■Absolute position movement

- The gripper moves by the specified distance from the original position according to the trapezoidal speed control.
- If the gripper is stopped by external force on the way to the specified position, an alarm occurs.



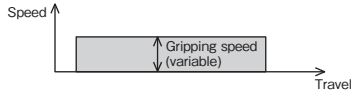
■Incremental position movement

- The gripper moves by the specified distance from the current position according to the trapezoidal speed control.
- If the gripper is stopped by external force on the way to the specified position, an alarm occurs.



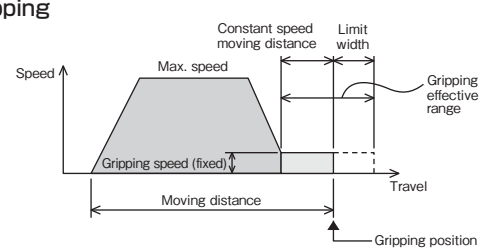
■Gripping during movement at constant speed (opening and closing)

- The gripping force is specified, and the gripper moves at a constant speed to the stroke end in the opening (closing) direction. At the stroke end, the INPOS signal is output.
- When the gripper grips work in the middle of the stroke, the HOLD signal is output.



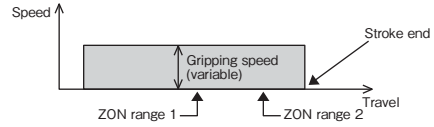
■Movement to absolute position with acceleration and deceleration and gripping

- The gripper moves (to the absolute or incremental position) according to the trapezoidal speed control and acts at a constant speed with the specified grip force just before the specified position to grip the work.
- When the gripper grips the work in the range of the limit width and constant speed moving travel, the HOLD signal is output.

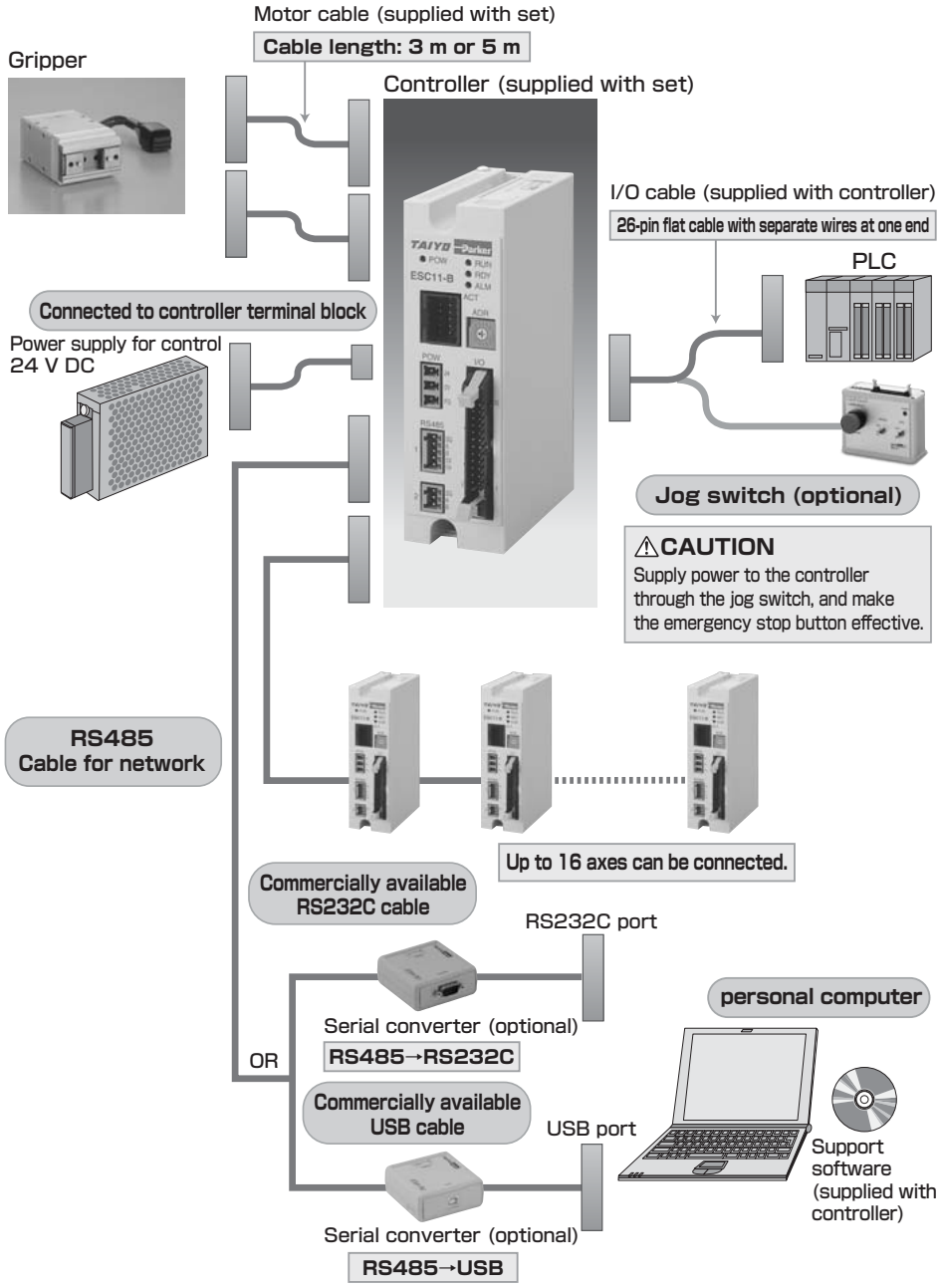


■Constant speed movement and gripping with zone (opening and closing)

- The gripper moves to the stroke end in the closing (opening) direction at a constant speed. At the stroke end, the INPOS signal is output.
- When the gripper grips the work in the middle of the stroke, the HOLD signal is output.
- When the gripper grips the work in the specified ZON range, the ZON signal is output.



ESG1 Total System



Series Configuration

	Type	Model number	Photo	Grip force (N)	Stroke (mm)	Stop repeatability (mm)	Max. speed (mm/s)
Gripper	Single cam type	ESG1-SS-2005-3N		0.9 to 3	3.2	±0.03	100
		ESG1-SS-2005-5N		1.5 to 5	3.2	±0.02	100
		ESG1-SS-2010		1.8 to 6	7.6	±0.02	100
		ESG1-SS-2815		6.6 to 22	14.3	±0.02	100
		ESG1-SS-4225		13.5 to 40	23.5	±0.02	100
	Double cam type	ESG1-SD-2005		15 to 50	5	±0.03	60
		ESG1-SD-2810		45 to 150	10	±0.03	60
		ESG1-SD-4220		75 to 250	19.3	±0.03	45
	Screw type straight style	ESG1-FS-2020		15 to 50	19	±0.01	50
		ESG1-FS-2840		45 to 150	38	±0.01	50
	Screw type tee style	ESG1-FT-2020		15 to 50	19	±0.01	50
		ESG1-FT-2840		45 to 150	38	±0.01	50

	Model number	Photo	Power supply voltage (V)	Consumption current (A)	External interface	Number of points
Controller	ESC11-B		24 V DC ±10%	1 A MAX	Parallel input/output Serial network	31 points + original point

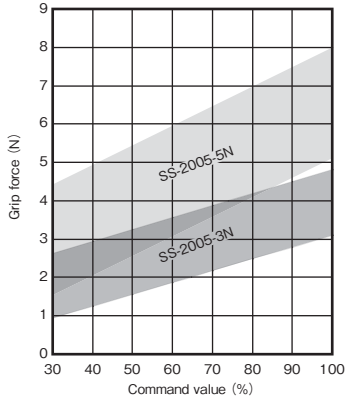
Minimized design, a small ball guide and a uniquely designed cam.

Specifications/Single Cam Type: SS

Model number			ESG1-SS-2005-3N	ESG1-SS-2005-5N
Gripping force	Max. continuous rating	〔N〕	3	5
	Min. setting	〔%〕(N)	30(0.9)	30(1.5)
	Resolution	〔%〕(N)	1(0.03)	1(0.05)
Opening/closing stroke		〔mm〕	3.2	
Speed	Max. (rating)	〔mm/sec〕	100	
	Min. setting	〔%〕(mm/sec)	20(20)	
	Resolution	〔%〕(mm/sec)	1(1)	
	Constant speed movement gripping mode (max)	〔%〕	50	
Position	Repeatability	〔mm〕	±0.03	±0.02
Guide structure			Linear guide	
Max. gripping weight Note 4)		〔kg〕	0.3	0.5
Working temperature range		〔℃〕	0 to +40(No freezing)	
Working humidity range		〔%〕	RH35 to 90(No condensing)	
Storage temperature		〔℃〕	−10 to +60(No freezing)	
Weight		〔g〕	90	

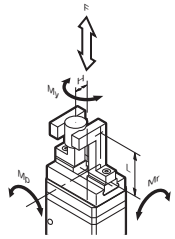
Note 1) When designing the fingers, reduce their length and weight to a minimum.
Note 2) Set the parameters and operation mode to avoid application of excessive impact force to the fingers during operation.
Note 3) When attaching and removing the fingers, tighten or loosen the bolts while firmly supporting the fingers to avoid application of excessive force or impact to the guide block.
Note 4) The weight of a work to be gripped shall be about 1/10 to 1/20 of the grip force. (When the gripper is moved and turned with the work gripped, design the gripper with more allowance.)
Note 5) The weight of a work which can be gripped significantly varies depending on the material and shape of the fingers and the gripping surface condition.

■Relationship between Gripping Force and Command Value



● The graph of relationship between grip force and specified value is given for your reference. The actual grip force may vary.

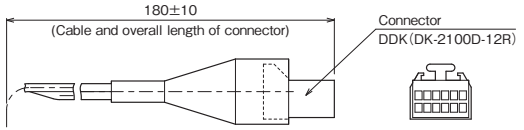
■Allowable Load and Load Moment



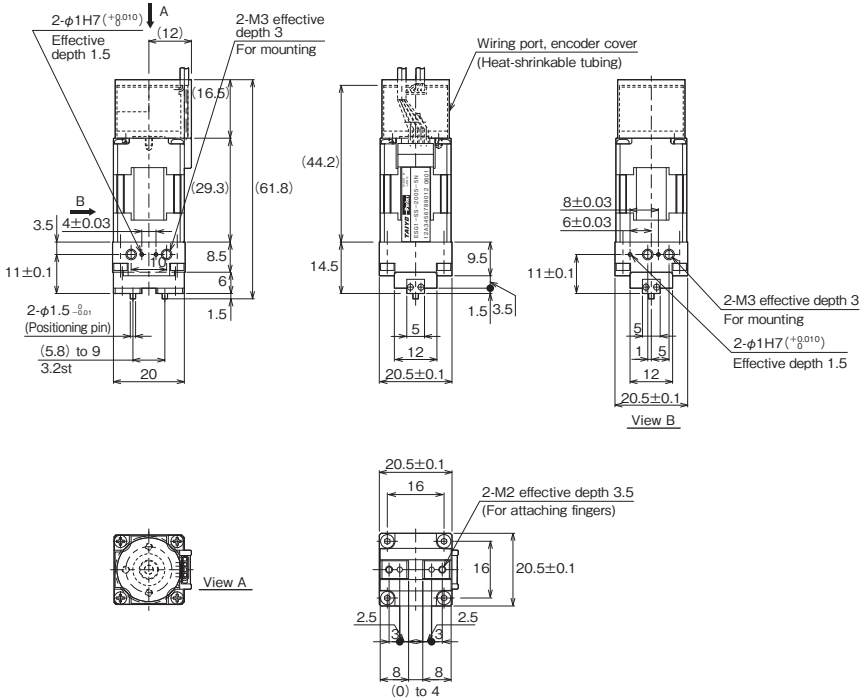
				Single Cam Type	
				ESG1-SS-2005-3N	ESG1-SS-2005-5N
Guide	Allowable load	F	〔N〕	12	
	Allowable pitching moment	Mp	〔N·m〕	0.04	
	Allowable yawing moment	My	〔N·m〕	0.04	
	Allowable rolling moment	Mr	〔N·m〕	0.08	
Finger	Max. weight (one pair)		〔g〕	10	
	Max. gripping position	L	〔mm〕	20	
	Max. overhang	H	〔mm〕	20	

● Attach the fingers in such a way that the allowable load and allowable moments of the guide are less than the values shown in the above table. The finger weight, gripping position (L) from the mounting surface to the gripping point and overhang (H) shall be less than the values shown in the table. Contact us for the combination of L and H.

Dimensional Drawings/Single Cam Type: SS-2005



Note) Avoid excessively bending the cable, and secure the cable to prevent it moving. When securing it, take care not to apply undue force to the cable root.



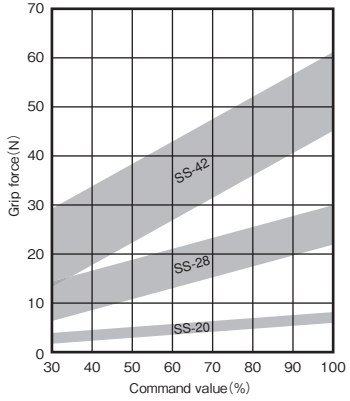
Simple and space-saving by the unique cam structure. Since the self-lock does not function, the fingers can be moved by external force.

Specifications/Single Cam Type: SS

Model number			ESG1-SS-2010	ESG1-SS-2815	ESG1-SS-4225
Gripping force	Max. continuous rating	〔N〕	6	22	40
	Min. setting	〔%〕(N)	30(1.8)	30(6.6)	34(13.5)
	Resolution	〔%〕(N)	1(0.06)	1(0.22)	1(0.45)
Opening/closing stroke		〔mm〕	7.6	14.3	23.5
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 movement gripping mode (max)	〔%〕	50	50	50
Position	Repeatability	〔mm〕	±0.02	±0.02	±0.02
Guide structure			Linear guide		
Max. gripping weight Note 4)		〔kg〕	0.06	0.22	0.45
Working temperature range		〔℃〕	0 to +40		
Working humidity range		〔%〕	RH35 to 90(No condensing)		
Storage temperature		〔℃〕	−10 to +60		
Weight		〔g〕	160	300	580

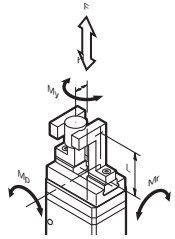
Note 1) When designing the fingers, reduce their length and weight to a minimun.
Note 2) Set the parameters and operation mode to avoid application of excessive impact force to the fingers during operation.
Note 3) When attaching and removing the fingers, tighten or loosen the bolts while firmly supporting the fingers to avoid application of excessive force or impact to the guide block.
Note 4) The weight of a work to be gripped shall be about 1/10 to 1/20 of the grip force. (When the gripper is moved and turned with the work gripped, design the gripper with more allowance.)
Note 5) The weight of a work which can be gripped significantly varies depending on the material and shape of the fingers and the gripping surface condition.

■Relationship between Gripping Force and Command Value



● The graph of relationship between grip force and specified value is given for your reference. The actual grip force may vary.

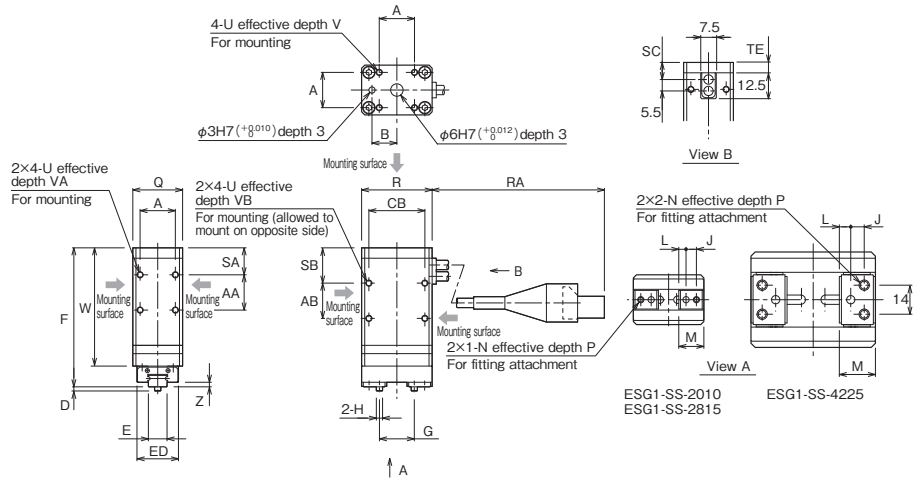
■Allowable Load and Load Moment



				Single cam type		
				ESG1-SS-2010	ESG1-SS-2815	ESG1-SS-4225
Guide	Allowable load	F	〔N〕	450	350	600
	Allowable pitching moment	Mp	〔N·m〕	0.7	0.5	1.1
	Allowable yawing moment	My	〔N·m〕	0.8	0.6	1.3
	Allowable rolling moment	Mr	〔N·m〕	2.3	2.8	8.6
Finger	Max. weight (one pair)		〔g〕	15	30	50
	Max. gripping position	L	〔mm〕	20	20	25
	Max. overhang	H	〔mm〕	20	25	30

● Attach the fingers in such a way that the allowable load and allowable moments of the guide are less than the values shown in the above table. The finger weight, gripping position (L) from the mounting surface to the gripping point and overhang (H) shall be less than the values shown in the table. Contact us for the combination of L and H.

Dimensional Drawings/Single Cam Type: SS



Note) Avoid excessively bending the cable, and secure the cable to prevent it moving. When securing it, take care not to apply undue force to the cable root.

Dimensional Table

Model number \ Symbol	A	AA	AB	B	CB	D	E	ED	F	G	H	J	L
ESG1-SS-2010	17	17	17	12	27	2	$9^{0}_{-0.05}$	20	71	8.4 to 16	$\phi 3^{0}_{-0.01}$	5	3.5
ESG1-SS-2815	24	24	14	15	38	2	$14^{0}_{-0.05}$	25	78	9.6 to 23.9	$\phi 3^{0}_{-0.01}$	6	4.3
ESG1-SS-4225	36	25	13	20	50	3	$24^{0}_{-0.05}$	40	86	12 to 35.5	$\phi 4^{0}_{-0.012}$	6.5	5.5

Model number \ Symbol	M	N	P	Q	R	RA	SA	SB	SC	TE	U	V	VA	VB	W	Z
ESG1-SS-2010	12.1	M3	5	24	34	165±10	13	17	8.3	5	M3	5	6	6	61	2.2
ESG1-SS-2815	15	M4	5	32	46	140±10	16	21	9.3	6	M4	6	8	8	69	2
ESG1-SS-4225	17.4	M5	8	46	60	235±10	18	24	10.8	7.5	M5	7.5	8	10	72	3

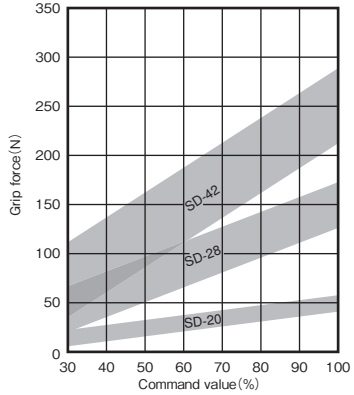
The double cam structure with special gears realizes a simple structure, space-saving design and high gripping force.

Specifications/Double Cam Type: SD

Model number			ESG1-SD-2005	ESG1-SD-2810	ESG1-SD-4220
Gripping force	Max. continuous rating	〔N〕	50	150	250
	Min. setting	〔%〕(N)	30(15)	30(45)	30(75)
	Resolution	〔%〕(N)	1(0.5)	1(1.5)	1(2.5)
Opening/closing stroke		〔mm〕	5	10	19.3
Speed	Max. (rating)	〔mm/sec〕	60	60	45
	Min. setting	〔%〕(mm/sec)	20(12)	20(12)	20(9)
	Resolution	〔%〕(mm/sec)	1(0.6)	1(0.7)	1(0.45)
	Constant speed movement gripping mode (max)	〔%〕	50	50	50
Position	Repeatability	〔mm〕	±0.03	±0.03	±0.03
Guide structure			Linear guide		
Max. gripping weight Note 4)		〔kg〕	0.5	1.5	2.5
Working temperature range		〔℃〕	0 to +40		
Working humidity range		〔%〕	RH35 to 90(No condensing)		
Storage temperature		〔℃〕	−10 to +60		
Weight		〔g〕	200	350	800

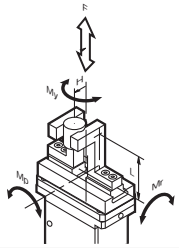
Note 1) When designing the fingers, reduce their length and weight to a minimum.
Note 2) Set the parameters and operation mode to avoid application of excessive impact force to the fingers during operation.
Note 3) When attaching and removing the fingers, tighten or loosen the bolts while firmly supporting the fingers to avoid application of excessive force or impact to the guide block.
Note 4) The weight of a work to be gripped shall be about 1/10 to 1/20 of the grip force. (When the gripper is moved and turned with the work gripped, design the gripper with more allowance.)
Note 5) The weight of a work which can be gripped significantly varies depending on the material and shape of the fingers and the gripping surface condition.

■Relationship between Gripping Force and Command Value



● The graph of relationship between grip force and specified value is given for your reference. The actual grip force may vary.

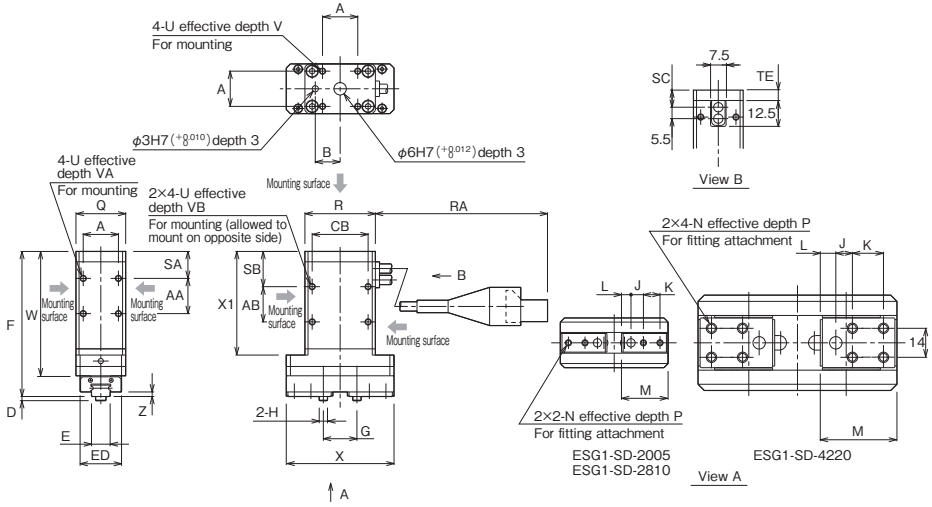
■Allowable Load and Load Moment



				Double Cam Type		
				ESG1-SD-2005	ESG1-SD-2810	ESG1-SD-4220
Guide	Allowable load	F	〔N〕	1000	1000	2000
	Allowable pitching moment	Mp	〔N·m〕	6.7	8.1	20.1
	Allowable yawing moment	My	〔N·m〕	4	4.8	12
	Allowable rolling moment	Mr	〔N·m〕	5.1	7.8	25.9
Finger	Max. weight (one pair)		〔g〕	40	80	200
	Max. gripping position	L	〔mm〕	30	30	50
	Max. overhang	H	〔mm〕	20	20	30

● Attach the fingers in such a way that the allowable load and allowable moments of the guide are less than the values shown in the above table. The finger weight, gripping position (L) from the mounting surface to the gripping point and overhang (H) shall be less than the values shown in the table. Contact us for the combination of L and H.

Dimensional Drawings/Double Cam Type: SD



Note) Avoid excessively bending the cable, and secure the cable to prevent it moving. When securing it, take care not to apply undue force to the cable root.

Dimensional Table

Model number \ Symbol	A	AA	AB	B	CB	D	E	ED	F	G	H	J	K	L
ESG1-SD-2005	17	17	17	12	27	2	$9^{0}_{-0.05}$	20	74	10.6 to 15.6	$\phi 4^{0}_{-0.01}$	6	8	4.6
ESG1-SD-2810	24	24	14	15	38	2	$14^{0}_{-0.05}$	25	80	12.6 to 22.6	$\phi 5^{0}_{-0.01}$	7	10	5.65
ESG1-SD-4220	36	25	13	20	50	3	$24^{0}_{-0.05}$	40	89	17.0 to 36.3	$\phi 6^{0}_{-0.012}$	8	15	7.5

Model number \ Symbol	M	N	P	Q	R	RA	SA	SB	SC	TE	U	V	VA	VB	W	X	X1	Z
ESG1-SD-2005	22.5	M3	5	24	34	165±10	13	17	8.3	5	M3	5	6	6	64	52	54	2.2
ESG1-SD-2810	27.5	M4	5	32	46	140±10	16	21	9.3	6	M4	6	8	8	71	67	61	2
ESG1-SD-4220	37	M5	8	46	60	235±10	18	24	10.8	7.5	M5	7.5	8	10	75	96	62	3

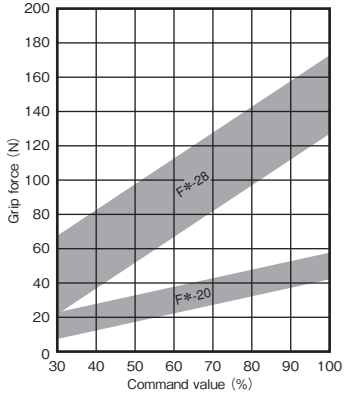
High efficiency and accuracy on long stroke is provided by use of belt drive on ball screw.

Specifications/Screw Type Straight style FS, tee style FT

Model number			ESG1-FS-2020	ESG1-FT-2020	ESG1-FS-2840	ESG1-FT-2840
Gripping force	Max. continuous rating	〔N〕	50		150	
	Min. setting	〔%〕(N)	30(15)		30(45)	
	Resolution	〔%〕(N)	1(0.5)		1(1.5)	
Opening/closing stroke		〔mm〕	19		38	
Speed	Max. (rating)	〔mm/sec〕	50		50	
	Min. setting	〔%〕(mm/sec)	20(10)		20(10)	
	Resolution	〔%〕(mm/sec)	1(0.5)		1(0.5)	
	Constant speed movement gripping mode (max)	〔%〕	50		50	
Position	Repeatability	〔mm〕	±0.01		±0.01	
Guide structure			Linear guide			
Max. gripping weight Note 4)		〔kg〕	0.5		1.5	
Working temperature range		〔℃〕	0 to +40			
Working humidity range		〔%〕	RH35 to 90(No condensing)			
Storage temperature		〔℃〕	−10 to +60			
Weight		〔g〕	420	420	880	890

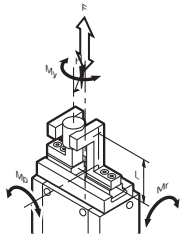
Note 1) When designing the fingers, reduce their length and weight to a minimum.
Note 2) Set the parameters and operation mode to avoid application of excessive impact force to the fingers during operation.
Note 3) When attaching and removing the fingers, tighten or loosen the bolts while firmly supporting the fingers to avoid application of excessive force or impact to the guide block.
Note 4) The weight of a work to be gripped shall be about 1/10 to 1/20 of the grip force. (When the gripper is moved and turned with the work gripped, design the gripper with more allowance.)
Note 5) The weight of a work which can be gripped significantly varies depending on the material and shape of the fingers and the gripping surface condition.

■Relationship between Gripping Force and Command Value



● The graph of relationship between grip force and specified value is given for your reference. The actual grip force may vary.

■Allowable Load and Load Moment

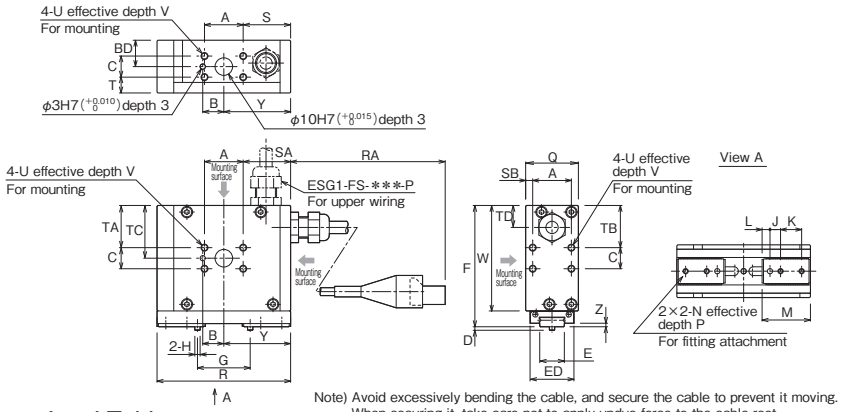


				Screw Type	
				ESG1-F*-2020	ESG1-F*-2840
Guide	Allowable load	F	〔N〕	1000	1300
	Allowable pitching moment	Mp	〔N·m〕	3.5	5
	Allowable yawing moment	My	〔N·m〕	4.2	6
	Allowable rolling moment	Mr	〔N·m〕	7.3	12.7
Finger	Max. weight (one pair)		〔g〕	40	80
	Max. gripping position	L	〔mm〕	30	30
	Max. overhang	H	〔mm〕	20	20

● Attach the fingers in such a way that the allowable load and allowable moments of the guide are less than the values shown in the above table. The finger weight, gripping position (L) from the mounting surface to the gripping point and overhang (H) shall be less than the values shown in the table. Contact us for the combination of L and H.

Dimensional Drawings/Screw Type

Straight type: FS



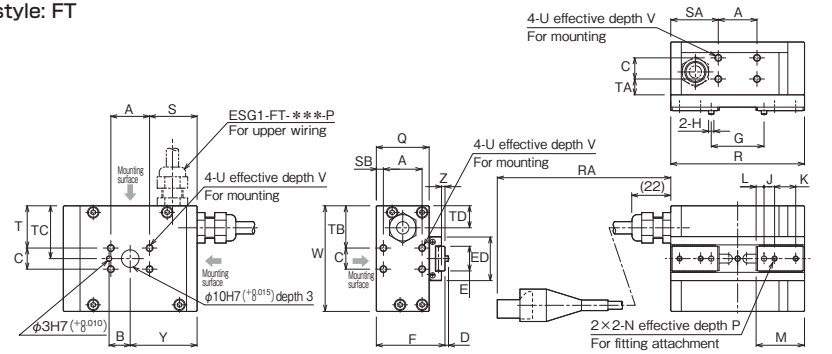
Note) Avoid excessively bending the cable, and secure the cable to prevent it moving. When securing it, take care not to apply undue force to the cable root.

Dimensional Table

Model number \ Symbol	A	B	BD	C	D	E	ED	F	G	H	J	K	L	M
ESG1-FS-2020	22	12	15	12	2	14 −0.05 0	25	69	10.5 to 29.5	φ3 −0.01 0	6	12	4.5	27.5
ESG1-FS-2840	30	15	20	16	2	18 −0.05 0	30	84	13 to 51	φ4 −0.012 0	8	14	5.5	34.5

Model number \ Symbol	N	P	Q	R	RA	S	SA	SB	T	TA	TB	TC	TD	U	V	W	Y	Z
ESG1-FS-2020	M3	5	30	76	175±10	27	27	4	9	24	24	30	12.5	M4	6	60	38	2
ESG1-FS-2840	M4	7.5	40	110	135±10	40	40	5	12	28	28	36	14	M5	7.5	72	55	3

Tee style: FT



Note) Avoid excessively bending the cable, and secure the cable to prevent it moving. When securing it, take care not to apply undue force to the cable root.

Dimensional Table

Model number \ Symbol	A	B	C	D	E	ED	F	G	H	J	K	L	M	N
ESG1-FT-2020	22	12	12	2	14 −0.05 0	25	39	10.5 to 29.5	φ3 −0.01 0	6	12	4.5	27.5	M3
ESG1-FT-2840	30	15	16	2	18 −0.05 0	30	52	13 to 51	φ4 −0.012 0	8	14	5.5	34.5	M4

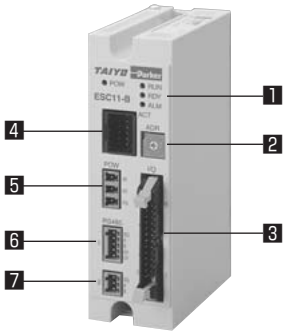
Model number \ Symbol	P	Q	R	RA	S	SA	SB	T	TA	TB	TC	TD	U	V	W	Y	Z
ESG1-FT-2020	5	30	76	175±10	27	27	4	24	9	24	30	12.5	M4	6	60	38	2
ESG1-FT-2840	7.5	40	110	135±10	40	40	5	28	12	28	36	14	M5	7.5	72	55	3

Specifications/Controller: ESC11-B

Basic Specifications

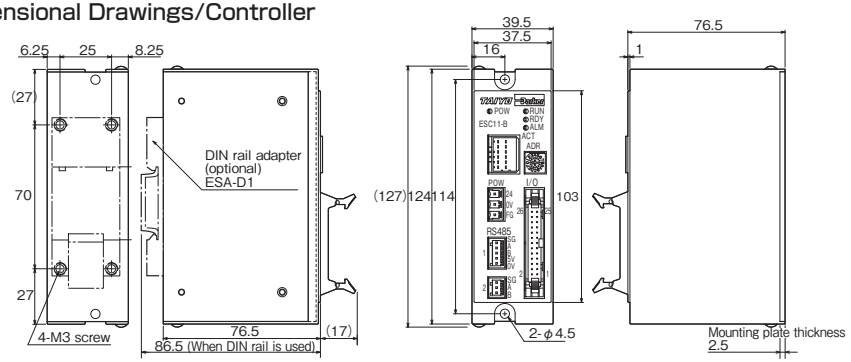
Number of control axes		1 axis
Position detecting method		Optical rotary encoder
Min. set travel		0.01 mm
Speed setting		Max. speed is set automatically, and speed can be set at each point.
Number of points		31 points + original point
Teaching method		MDI (input of coordinate values), teaching playback, direct teach (support software applicable to personal computer)
Protective function (alarm)		Overcurrent, overload, abnormal voltage, voltage drop, system trouble, excessive machine reference, excessive position error, feedback error, point data failure, data writing failure
Monitor		Alarm history, I/O status, alarm, motor current, supply voltage
External input/output	Input Photocoupler insulation 5 mA TYP/1 point	5 points: Command point setting (5-bit binary)
		3 points: Control input
	Output Photocoupler insulation 30 mA MAX/1 point	5 points: Completion point setting (5-bit binary)
		7 points: Control output
	Network	RS485 2 ports (one channel with power supply and one channel without power supply, multi-dropped connection of up to 16 axes)
	LED indication	Power supply lamp (POW: green), internal operation lamp (RUN: yellow), receiving status lamp (RDY: yellow), error status lamp (ALM: red)
Power supply		24 V DC ±10% 1 A MAX (common to motor and control)
General	Working temperature	0 to +40℃
	Working humidity	35 to 85%RH (No condensing)
	Storage temperature	−10 to +65℃ (No freezing)
	Insulation resistance	500 V DC 10 MΩ
	Vibration resistance	0.5 G 10 to 55Hz
	Weight	260 g
	Accessories	I/O cable (with connector at one end), CD-ROM (support software applicable to personal computer), connectors (I/O, power supply, serial), terminal resistance

■Names and Functions of Parts



1	Indicating lamp	POW	Power supply lamp (green)
		RUN	Internal operation lamp (yellow)
		RDY	Receiving status lamp (yellow)
		ALM	Error status lamp (red)
2	Address setting SW	CH address	0, 1, 2,....9, A, B, C....F
3	I/O connector		
4	Actuator terminal (ACT)		
5	Power supply terminal (input of 24 V DC)		
6	RS485 terminal 1		Connection to personal computer through serial converter when support software is used For network
7	RS485 terminal 2		To be connected to other controller For network

Dimensional Drawings/Controller



Notes) ●When mounting the controller directly using the M3 screws, determine the screw length so that the screw depth is 4 mm or less to prevent interference of the protruding screws with internal parts. (Tightening torque: 49 N·cm)
●To attach the DIN rail adapter, use pan-head machine screws M3×8ℓ. (Tightening torque: 49 N·cm)

Power Supply Terminal (POW)

Terminal block PHOENIX MC1.53-G-5.08

No.	Symbol	Function
1	+V24	Motor power supply and control power supply
2	0 V	0 V of power supply
3	FG	Frame ground (terminal for D grounding)

Actuator Terminal (ACT)

No.	Symbol	Function
A1	EA	Encoder signal input phase A
A2	EZ	Encoder signal input phase Z
A3	0 V	Encoder 0 V power supply output
A4	—	NC
A5	BN	Motor output phase B−
A6	B	Motor output phase B
B1	EB	Encoder signal input phase B
B2	+5 V	Encoder +5 V power supply output
B3	SLD	Shielded wire
B4	—	NC
B5	A	Motor output phase A
B6	AN	Motor output phase A−

RS485 Terminal 1

Between serial RS485 and PC Terminal block PHOENIX MC 0.5/5-G-2.5

No.	Symbol	Function
1	SG	Signal ground
2	A	RS485 signal A
3	B	RS485 signal B
4	+5 V	Supply voltage +5 V to special converter
5	0 V	Supply voltage 0 V to special converter

I/O connector

Cable connector AXM226011, Panasonic Electric Works Co., Ltd.

No.	Symbol	I/O	Logic	Function
1, 2	+V24	–	–	+ of power supply for I/O (supplied from outside)
3-6	COM	–	–	0 V of power supply for I/O (supplied from outside)
7	IPOS0	I	Positive logic	Position data Bit 0
8	IPOS1	I	Positive logic	Position data Bit 1
9	IPOS2	I	Positive logic	Position data Bit 2
10	IPOS3	I	Positive logic	Position data Bit 3
11	IPOS4	I	Positive logic	Position data Bit 4
12	START	I	Positive logic	Execution command input
13	SEL	I	Positive logic	Selection input
14	INLOCK	I	Negative logic	Input for temporarily stopping operation of main body
15	READY	O	Positive logic	Signal "1" when input signal can be received
16	BUSY	O	Positive logic	Signal "1" during execution of special command
17	ALARM	O	Negative logic	Signal "0" upon occurrence of alarm
18	INPOS	O	Positive logic	Signal "1" upon completion of positioning
19	HOLD	O	Positive logic	Output "1" upon holding
20	OPOS0	O	Positive logic	No. of position to which gripper has moved Upon occurrence of alarm, the No. is output. When the digit is specified with IPOS# upon switching of function, the position is output in BCD data.
21	OPOS1	O	Positive logic	
22	OPOS2	O	Positive logic	
23	OPOS3	O	Positive logic	
24	OPOS4	O	Positive logic	
25	RORG	O	Positive logic	Output "1" upon completion of origin return
26	ZON	O	Positive logic	Signal "1" in specified area

RS485 Terminal 2

Between serial RS485 and controller Terminal block PHOENIX MC0.5/3-G-2.5

No.	Symbol	Function
1	SG	Signal ground
2	A	RS485 signal A
3	B	RS485 signal B

How to order

■Cam type

Single cam type: ESG1 – SS – 2815 – C13

① Model ② Type ③ Nominal size ⑤ Number for ordering set

Nominal size

2010
2815
4225

Number for ordering set

None	Gripper only
–C13	With controller and motor cable (3 m)
–C15	With controller and motor cable (5 m)

Double cam type: ESG1 – SD – 2810 – C13

① Model ② Type ③ Nominal size ⑤ Number for ordering set

Nominal size

2005
2810
4220

Number for ordering set

None	Gripper only
–C13	With controller and motor cable (3 m)
–C15	With controller and motor cable (5 m)

■Screw type

① Model ② Type ③ Nominal size ④ Wiring direction ⑤ Number for ordering set

Screw type straight style: ESG1 – FS – 2840 – P – C13

Screw type tee style: ESG1 – FT – 2840 – P – C13

Nominal size

2020
2840

Number for ordering set

None	Gripper only
–C13	With controller and motor cable (3 m)
–C15	With controller and motor cable (5 m)

Wiring direction

None	Side wiring (standard)
–P	Upper wiring (order made)

★Items in set

When a set is ordered, the gripper main body will come with the following items.

- Gripper main body
- Controller ESC11-B
- Motor cable ESA-C1[3]
- I/O cable ESA-F1 (26-pin flat cable with separate wires at one end)
- Support software ESA-S01

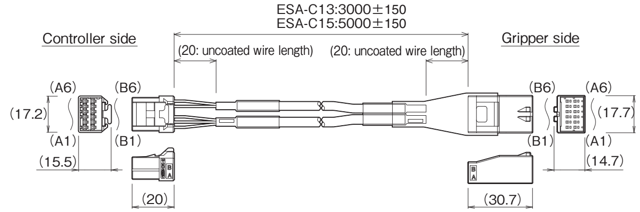
Cable length

Symbol	Length
3	3m
5	5m

Explanation of options

■Motor cable ESA-C13/C15

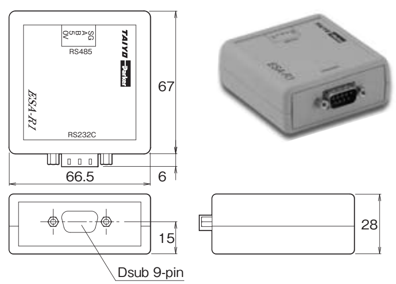
- A highly flexible cable is used to connect the gripper main body and the controller.



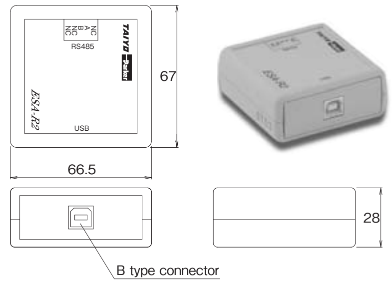
■Serial converter

- It converts RS485 serial signals of the controller to RS232C signals or USB signals for personal computer.
- Use this unit when using the support software for personal computer.
- Power is supplied from the controller.
- The user is asked to prepare an RS232C cable (straight) or USB cable for connecting the serial converter and the personal computer.

- RS232C-RS485 serial converter ESA-R1



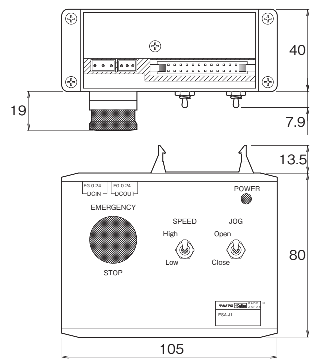
- USB-RS485 serial converter ESA-R2



■Jog switch ESA-J1

- The fingers can be easily opened and closed without setting of point data or parameters.
- The double cam type and screw type grippers are controlled by the self-lock. To manually open and close the fingers of such a gripper, use this device.
- The switch is provided with an emergency stop switch.

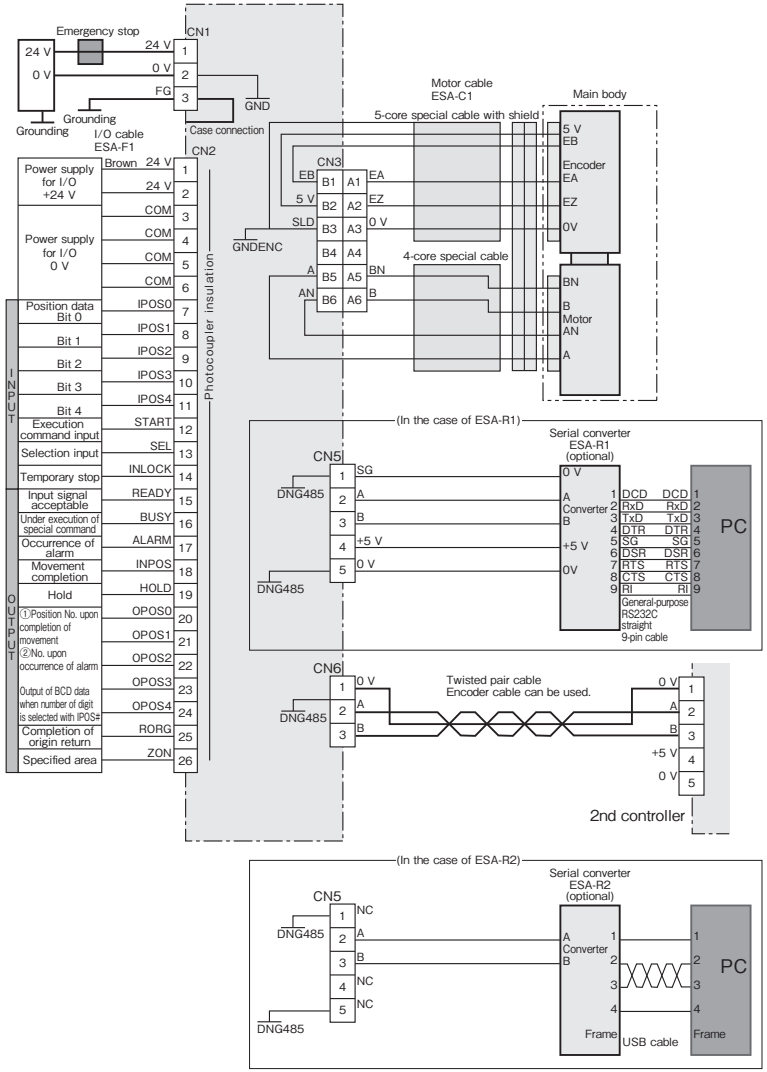
Note) It cannot be used for the single cam type.



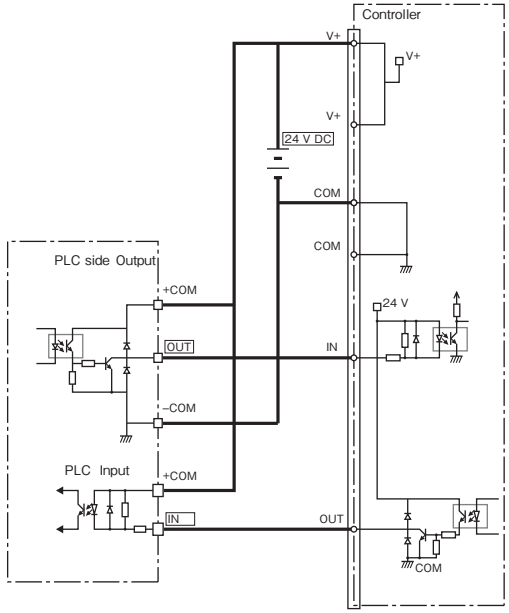
■DIN rail adapter ESA-D1

To fit the DIN rail adapter to the controller, use pan-head machine screws M3×8ℓ. (Tightening torque: 45 N·cm)

【External wiring diagram of ESC11-B】



Input/output equivalent circuit and characteristic table



Specifications for Input Block

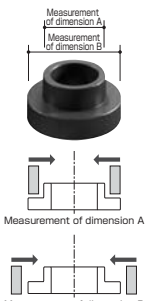
Item		Specifications
Number of points		5
Input voltage		24 V DC ±10%
Input current	Rating	5 mA at 24 V DC
	ON	3 mA MIN
Operating current	OFF	1 mA MAX
Insulation		Photocoupler

Specifications for Output Block

Item		Specifications
Number of points		12
Opening/closing voltage		24 V DC ±10%
Opening/closing current	Rating	30 mA MAX at 24 V DC
Residual voltage	ON	0.5 V MAX at 24 V DC
Leakage current	OFF	100 mA MAX
Insulation		Photocoupler

Application examples

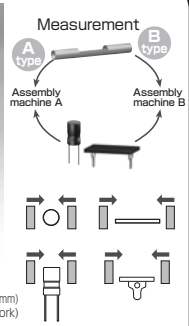
Confirmation of dimensions of machined zones of odd-shaped parts



Measuring function (measurement of work size ±0.05 mm)
Speed control (no scratches on work)
Multi-point position control (measurement at several points)
Real-time output of measurement results

＊Monitoring (image processing) requires a large number of measurements and is unfavorable from the viewpoint of cost and processing capacity.

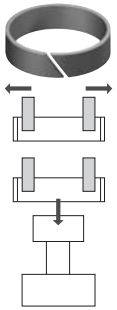
Identification and sorting of mixed parts for assembly of parts



Measuring function (measurement of work size ±0.1 mm)
Speed control (prevention of scratching of work)
Multi-point position control (applicability to various kinds of work)
Reduction of setup change operation (reduction of tact time and improvement of productivity)

＊Since automatic assembly of mixed parts could not be performed, spaces and facilities for storing parts by type were required.

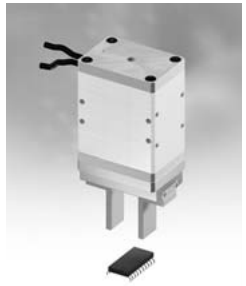
Transfer of plastic rings with prevention of deformation

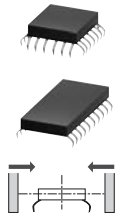


Measuring function (retention of work shape)
Grip force control (retention of work shape and prevention of scratching)
Speed control (retention of work shape and prevention of scratching)
Multi-point position control (applicability to various kinds of work)

＊Pneumatic devices cannot control the grip force and speed, may scratch the work and cannot reduce the tact time.

Assembly and transfer to chips. Prevention of deformation, and confirmation of lead length





Measuring function (confirmation of lead length ±0.1 mm)
Grip force control (retention of work shape and prevention of scratching)
Speed control (retention of work shape and prevention of scratching)
Multi-point position control (applicability to various kinds of work)

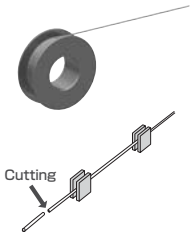
＊Applicable to clean rooms
- Installation of vacuum port
- Specified grease is used. (Generally, K grease is used.)

At present, the lead length cannot be measured, and defectives can be detected only after mounting the chips on boards.

Glass container forming process

Measuring function (setting of forming size)
Grip force control (setting of forming force)
Speed control (setting of forming speed)
Multi-point position control (applicability to various kinds of work)

Cutting and transfer of wires for electronic/ semiconductor use

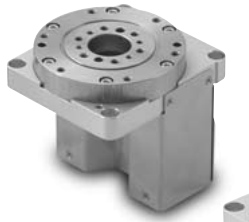


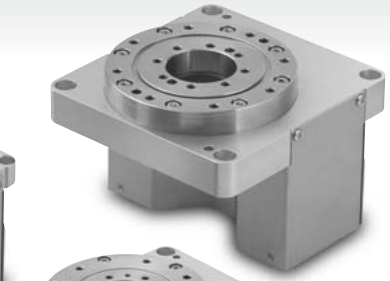
Grip force control (prevention of deformation of work)
Speed control (prevention of deformation and scratching of work)
HOLD signal (prevention of failure in gripping)
Simultaneous operation of several units (reduction of tact time)

＊Pneumatic units cannot be used for bonding wire manufacturing process because the process must be conducted in a clean room.

Related products

Anti-backlash Ultra-compact electric rotary actuators ESR1*series*





Variations of electric models added!

Features

- **Anti-backlash is achieved by use of newly developed technology.**
  - High-accuracy type
  - <Stop position repeatability ±10 sec>
  - Standard/high-torque type
  - <Stop position repeatability ±30 sec>
- **Each of three models, i.e. standard, high-torque and high-accuracy models, comes in three sizes.**
  - Max. torque: 0.16 to 5.6N·m
  - Rated rotation speed: 0.4 to 3.6rps
- **Use of built-in controller reduces wiring work.**
  - Standard and high-torque types
  - <High-accuracy type uses external controller.>
- **Cross roller bearing allows a ultra-thin and compact body.**
  - New technique for assembly of bearing, gear and motor

How to order

▶ **Standard/high-torque type rotary actuator main body**

ESR1 − BS − 2070 − N0 3

Type
- BS Standard type : Deep ball bearing
- BG High-torque type: Deep ball bearing

Nominal size (motor side length, table outer diameter)
- 2070 20 mm·φ70 mm
- 2880 28 mm·φ80 mm
- 4295 42 mm·φ95 mm

Built-in controller body

Cable length
- 3 3 m
- 5 5 m

▶ **High-accuracy type rotary actuator body**

ESR1 − CH − 2070 − C0 3

Type
- CH High-accuracy type: Cross roller

Nominal size (motor side length, table outer diameter)
- 2070 20 mm·φ70 mm
- 2880 28 mm·φ80 mm
- 4295 42 mm·φ95 mm

Controller and power supply
- C0 With controller, without power supply
- C1 With controller, with 50-W power supply
- C2 With controller, with 100-W power supply

Cable length
- 3 3 m
- 5 5 m

▶ **High-accuracy type controller**

ESC12−B