

ELECYLINDER®

Wire Cylinder

EC-WER1
EC-WEGR2
WC-EC-S

Instruction Manual First Edition ME3832-1C



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Refer to [ELECYLINDER Electricity Section Instruction Manual (ME3816)] provided separately regarding electricity/control such as the electrical specifications, wiring, connection, parameters and control system and troubleshooting.

IAI Corporation

Please Read Before Use

Thank you for purchasing our product.

This instruction manual explains the handling methods, structure and maintenance of this product, providing the information you need in order to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.

Please download the user's manual from our website.

You can download it free of charge. User registration is required for the first time downloading.

URL : www.iai-robot.co.jp/data_dl/CAD_MANUAL/

When using the product, print out of the necessary portions of the relevant manual, or please display it on your computer, tablet terminal, etc. so that you can check it immediately.

After reading the instruction manual, keep it in a convenient place so that whoever is handling the product can refer to it quickly when necessary.

[Important]

- This instruction manual is an original document dedicated for this product.
- This product cannot be used in ways not shown in this instruction manual. IAI shall not be liable for any result whatsoever arising from the use of the product in any other way than what is noted in the manual.
- The information contained in this instruction manual is subject to change without notice for the purpose of product improvement.
- If any issues arise regarding the information contained in this instruction manual, contact our customer center or the nearest sales office.
- Use or reproduction of this instruction manual in full or in part without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the text are registered trademarks.

ELECYLINDER Instruction Manual Configuration

Product name	Instruction manual name	Control number
ELECYLINDER	Quick Start Guide	ME3765
ELECYLINDER	Digital Speed Controller Quick Start Guide	ME3810
ELECYLINDER	Instruction Manual (this document)	ME3832
ELECYLINDER	Electricity Section Instruction Manual	ME3816
ELECYLINDER	3 Position Mode Specification Instruction Manual	ME3837
PC Teaching Software	IA-OS First Step Guide * Refer to the guidance feature stored in IA-OS for how to operate	ME0391
PC Teaching Software for RC/EC	RCM-101-MW/RCM-101-USB Instruction Manual	ME0155
Touch Panel Teaching Pendant	Applicable for ELECYLINDER TB-02/02D Instruction Manual	ME0355
Touch Panel Teaching Pendant	Applicable for ELECYLINDER TB-03 Instruction Manual Wireless link	ME0375
Touch Panel Teaching Pendant	Applicable for ELECYLINDER TB-03 Instruction Manual Wired link	ME0376
Digital Speed Controller Teaching	Digital Speed Controller Instruction Manual	ME3818
RCON System	RCON Instruction Manual	ME0384
RSEL System	RSEL Instruction Manual	ME0392
REC System	REC Instruction Manual	ME0394

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Safety Guide

“Safety Guide” has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	- This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) - Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. - Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact - For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	• When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. • Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. • Do not step or sit on the package. • Do not put any heavy thing that can deform the package, on it. • When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. • When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment’s capability limit. • Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. • Do not get on the load that is hung on a crane. • Do not leave a load hung up with a crane. • Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	• The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. • Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. • Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. • Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. • When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring • Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. • Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. • Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. • When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. • Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. • Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire. (3) Grounding • The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. • For the ground terminal (PE) on the AC power cable of the controller and the grounding plate in the control panel, make sure for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment standards and criteria). For detail, follow the description in [an instruction manual of each controller or controller built-in actuator]. • Conduct functional grounding on the FG terminal for a controller supplying 24V DC or a controller built-in type actuator. In order to minimize influence to mechanical operation given by electromagnetic interference (noise) to an electrical device or insulation failure, conduct grounding on a terminal or a conductor that is electrically stable. The reference impedance should be Type D (Former Class 3, ground resistance 100Ω or less).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures • When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot’s movable range. When the robot under operation is touched, it may result in death or serious injury. • Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. • Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. • Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. • When the installation or adjustment operation is to be performed, give clear warnings such as “Under Operation; Do not turn ON the power!” etc. Sudden power input may cause an electric shock or injury. • Take the measure so that the work part is not dropped in power failure or emergency stop. • Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. • Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. • When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. • When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. • Place a sign “Under Operation” at the position easy to see. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. • When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. • Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. • Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	• Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. • Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. • Make sure to operate automatic operation start from outside of the safety protection fence. • In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. • When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	• When the work is carried out with 2 or more persons, make it clear who is to be the “leader” and who to be the “follower(s)” and communicate well with each other to ensure the safety of the workers. • Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. • When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. • When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. • When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. • Place a sign “Under Operation” at the position easy to see. • For the grease for the guide or ball screw, use appropriate grease according to the instruction manual for each model. • Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. • When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. • The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. • Pay attention not to lose the removed cover or screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	• Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	• When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. • When removing the actuator for disposal, pay attention to drop of components when detaching screws. • Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	• Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. • See Overseas Specifications Compliance Manual to check whether complies if necessary. • For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the instruction manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

Precautions for Handling

1. The Safety Guide attached with the product is intended to permit safe use of the product and thus to prevent risks and property damage. Be sure to read it before handling the product.

2. Do not attempt any handling or operation that is not indicated in this instruction manual.

3. Make sure to secure the wire cylinder properly in accordance with this instruction manual.

If the wire cylinder is not securely fixed, this may lead to abnormal noise, vibration, breakdown or shortened product life.

4. Make sure to observe the usage conditions and environment of the product.

Operation outside the warranty could cause decreased performance or product breakdown.

Use within the allowable range for each item.

Item	Cautions for use	Problems or breakdowns which may occur if the allowable range is exceeded
Speed and acceleration/deceleration	Use within the allowable range	May lead to abnormal noise, vibration, breakdown, or shortened product life.
Allowable moment		May lead to abnormal noise, vibration, breakdown, or shortened product life. If the case is extreme, it could cause flaking.

5. Use the unit with the pressing operation when holding a workpiece.
6. Do not attempt to give a shock to the unit, especially to the rod and fingers.
7. Avoid foreign objects getting into the moving part of the fingers.

Pinching foreign objects may cause malfunction of components.

8. When it is necessary to remove a workpiece while the power is off, do not attempt to pull the workpiece forcefully.

Either turn the manual tuning knob or take off the finger attachment on one end to remove the workpiece. Pulling off the workpiece forcefully to remove it may damage machinery.

9. Remove a gripped workpiece when stopping the machine for a long period of time.

Leaving it for a long time with a workpiece held may drop the performance or give a bad influence to the guides.

10. Do not attempt to have the pressing operation conducted for a long time exceeding 30 minutes. Pressing operation for a long time in an environment in high temperature may cause an error stop. Decrease the current limit or shorten the duration of the pressing operation in such a case.

11. Base oil separated from grease may overflow from inside of the wire cylinder to outside of it in some environment of use, installation posture and operational conditions.

Make a protection in case there is a risk of bad influence to peripheral devices due to base oil applied.

12. Hold the control wires loosely with a zip ties so there would not be any load of pulling, bending or twisting (rotation) applied on the wires.

13. For the first time to start up after installing a wire cylinder, have operation back and forth for more than 100 times as a running-in (aging).

14. An wire cylinder may drop its output load about 30 times at the beginning of restart after stop for a long period. The sliding area will be adapted in use and the drop of output load should get smaller at restart.

15. A wire controller possesses a self-locking feature, which disables a reversed operation from the output side of an actuator. Turn the manual operation knob on the wire controller to operate the wire.

16. Although there is a self-locking feature equipped to the gripper type, it is not a feature to guarantee that a gripped workpiece would not drop.
17. There may be some gap to the actual position and output load of an actuator compared to the set values and displayed values on the wire controller.
Change or adjust the setting values to align with the actual conditions of use.
18. The position of an actuator may fluctuate by influence of stretch of the wire and temperature changes.
By having an end stop (pressing), fluctuation in position can be made small.
19. The stroke operational range of sliders on a wire controller should be adjusted for each type of connected actuators. Using them in wrong combination may cause dent or bent of an inner wire, drop of output load or lack of stroke.

International Standard Compliance

The wire cylinder complies with the following overseas standards.
 Refer to the Overseas Standard Compliance Manual (ME0287) for more detailed information.

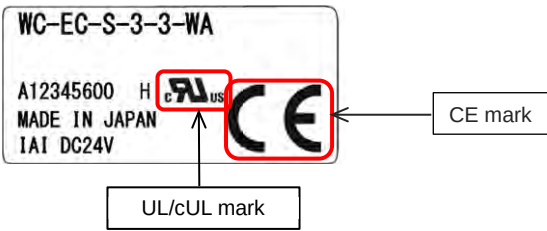
CE Marking ^(Note 1)			UL Standard
RoHS3 Directive	EMC Directive	RE Directive ^(Note 2)	
○	○	○	○ ^(Note 1)

If it is necessary to announce EC Declaration of Conformity with this product built in your facility, as this product itself declares the conformity to EU Directives in some specific conditions as stated below, you would be able to utilize this declaration.

EU Directives Applicable for EC Declaration of Conformity
 EMC Directive (2014/30/EU) To be checked in CE marking described in model nameplate.
 RoHS3 Directive (2011/65/EU + (EU)2015/863) Same as above.
 RE Directive (2014/53/EU)..... To be checked in EC Declaration of Conformity.

EC Declaration of Conformity proving conformity to RE Directive may be modified without notice according to addition of conformed models, specification change and so on. Consult with our sales person in charge if necessary.

(Note 1) The wire cylinder is not registered to UL Standards or has not been made EC Declaration of Conformity as the main unit model code, but has been made EC Declaration of Conformity as the wire controller model code “WC-EC”.



(Note 2) RE Directive applies to wire cylinders with WL (wireless communication specification) or WL2 (Wireless axis operation specification) in model name options.
 Certificates and self-declarations regarding the wireless function are handled under the model name below for the wireless circuit board.
 MODEL : IABL3827

Precautions for Handling Wireless Operation

When the option for wireless communication support (model: WL, WL2) is selected, a wireless communication circuit board is built into the wire cylinder. Certificates and self-declarations regarding the wireless function are handled under the model name below for the wireless circuit board.

Model name: IABL3827

This product uses the 2.4 GHz radio band known as an ISM band. This frequency range is used by various devices such as microwave ovens and wireless LAN, so that communication may be disrupted by radio disturbance.

Use of this device is permitted within the following countries (regions) only. Use in other countries (regions) requires certification to be obtained based on the laws and regulations of the relevant country (region).

Wireless frequency	2,400 to 2,483.5MHz
Wireless output	+5dBm

[US]

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference and
2. This device must accept any interference received, including interference that may cause undesired operation of the device.

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure limits. This transmitter must not be colocated or operating with any other antenna or transmitter.

[CANADA]

This device complies with Industry Canada licence-exempt RSS standards.

Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence

L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC RF Radiation Exposure Statement:

To comply with IC RF exposure requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

Pour se conformer aux exigences de conformité RF canadienne l'exposition, cet appareil et son antenne ne doivent pas être co-localisés ou fonctionnant en conjonction avec une autre antenne ou transmetteur.

[日本]

本製品で使用している無線モジュールは、工事設計認証を受けていますので、以下の事項を行うと法律で罰せられることがあります。

- 無線モジュールを分解/改造すること

[EU Member States]

- For details of the applicable standards, please refer to above mentioned international standards compliances.
- Import Corporation Name : IAI Industrieroboter GmbH
- * The product can be used in any country which is a member of EU.

[中国／CHINA]

- 许可编号 : CMIT ID=2018DJ0331
- 申请公司名 : IAI 株式会社
- 机型名 : IABL3827
- 制造国 : 日本 (Made in Japan)
- 进口企业名 : IAI (Shanghai) Co., Ltd.

[한국／KOREA]

- 식별 부호 : R-CRM-IAI-IABL3827
- 제조사명 : 주식회사 IAI
- 모델명 : IABL3827
- 제조국 : 일본(Made in Japan)
- 수입업자명 : IA KOREA Corp.

해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다

[ประเทศไทย / Thailand]

- ผู้ผลิต : IAI CORPORATION.
- ชื่อโมเดล : IABL3827
- ประเทศผู้ผลิต : ญี่ปุ่น (Made in Japan)
- ผู้นำเข้า : IAI Robot (Thailand) Co., Ltd.

[México / Mexico]

- Número de Certificación : IFT : RCPIATB19-1956
- Nombre de la Empresa Solicitante : IAI Corporation
- Nombre del Modelo : IABL3827
- País de Fabricación : Japón (Hecho en Japón)
- Nombre de la Empresa Importadora : IAI America, Inc.

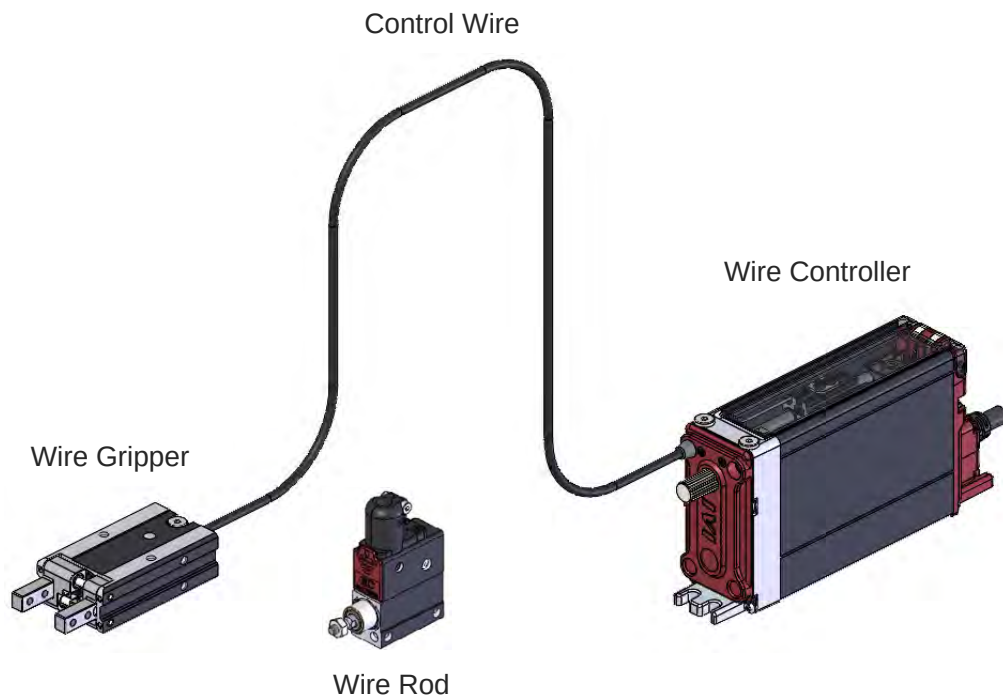
Precautions for Axis Operation with Wireless Connection

Touch Panel Teaching Pendant TB-03 (V2.30 or later) can operate the option model code -WL2 wire cylinder with wireless connection. For operation with wireless connection, secure safety by following the precautions below before use.

- The stop switch on Touch Panel Teaching Pendant TB-03 will not function during wireless connection. Prepare a device / circuit to stop the operation when emergency stop is required.
- For axis operation with wireless connection, operation testing (movement to forward and backward ends, jog operation, inching operation) is possible, but the control device is not designed for purposes of automatic operation. Construct a mechanical system based on the risks of the operating environment.
- Carry out risk assessment based on the standard/spec requirements of the machinery for installation. Dangerous operation, such as that requiring an automatic stop when control signals cannot be received (including disabled communication) is not acceptable.
- Stopping axis operation by wireless network cannot be used as a safety feature as defined in EN ISO 13849-1: 2015. It is also not compliant with Safety Category B or Categories 1 to 4 stated in EN ISO 13849-1: 2015.

Outline of Product

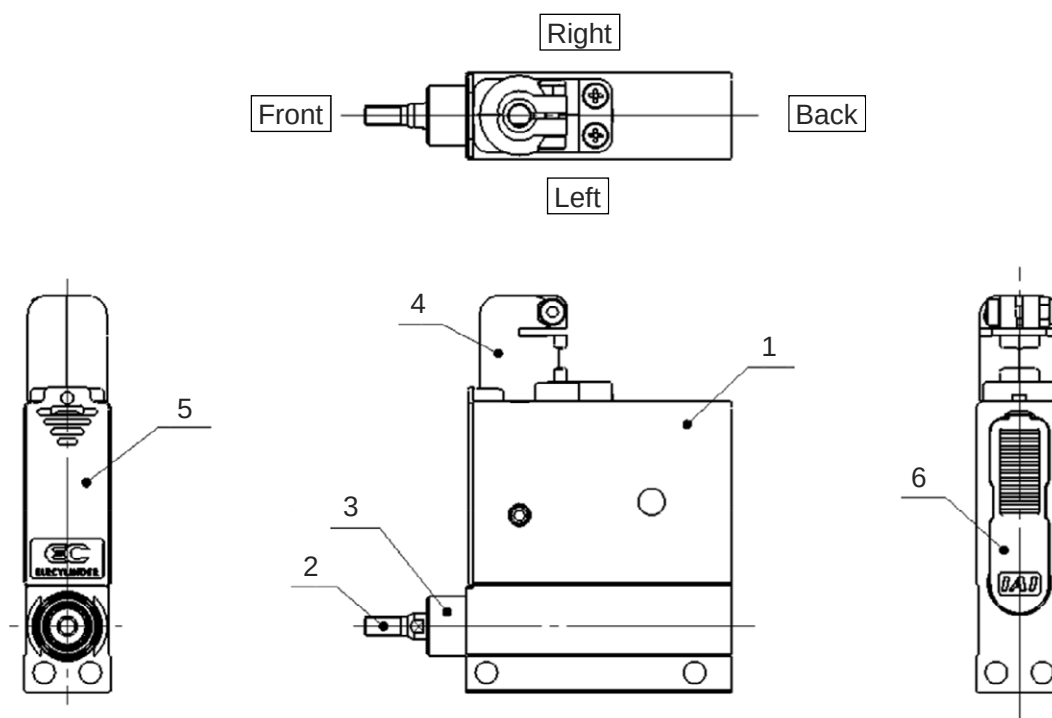
- The rod type and gripper type are an actuator constructed using control wires for power transmission.
- Operation of wires should be transmitted to pressing action of a rod and gripping action of grippers.
- Wires should be driven by a wire controller. Operation volume, velocity and pulling load of wires can be adjusted.
- A control wire is constructed with thin and flexible outer wires and high strength and high durability inner wires.
- As actuators and a wire controller are separate, there is a high degree of freedom in device layout.



Part Names

In this manual, shows the front / back / right / left of a wire cylinder as shown in the figure below.

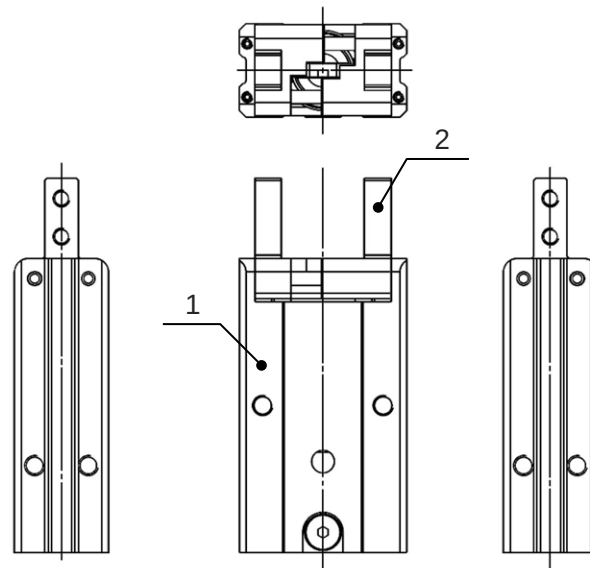
Rod Type (EC-WER1SA)



[Main Component Materials]

No.	Name	Material	Surface Treatment
1	Body	Dedicated Extruded Aluminum (A6063SS-T5 or equivalent)	Black Anodizing Treatment
2	Rod	SUS303Cu	
3	Rod Cover	C3604BD	Electroless Nickel Plating
4	Port	Plastic (POM)	
5	Front Cover	Plastic (PPE)	
6	Spacer	Plastic (POM)	

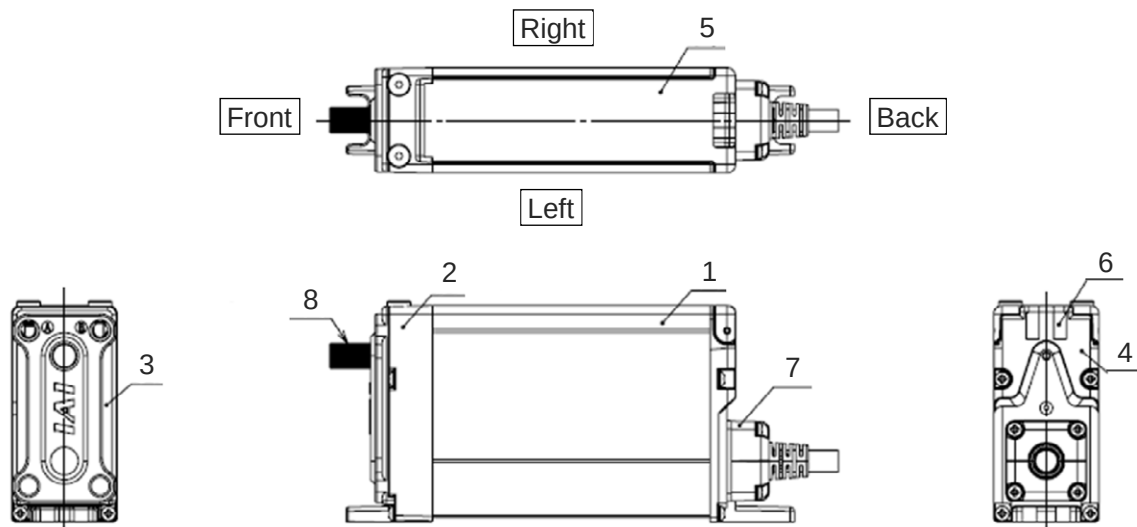
Gripper Type (EC-WEGR2)



[Main Component Materials]

No.	Name	Material	Surface Treatment
1	Body	Dedicated Extruded Aluminum (A6063SS-T5 or equivalent)	Black Anodizing Treatment
2	Finger	SUS316L	

Wire Controller (WC-EC-S)



[Main Component Materials]

No.	Name	Material	Surface Treatment
1	Frame	Dedicated Extruded Aluminum (A6063SS-T5 or equivalent)	Black Anodizing Treatment
2	Front bracket	Aluminum die-casting	
3	Front cover	Plastic (PBT)	
4	Rear cover	Plastic (PBT)	
5	Top cover	Plastic (ABS)	
6	LED Light Guide	Plastic (PC)	
7	Cable Box	Plastic (PBT)	
8	Manual Tuning Knob	Free-Cutting Brass (C3604BD)	Electroless Nickel Plating

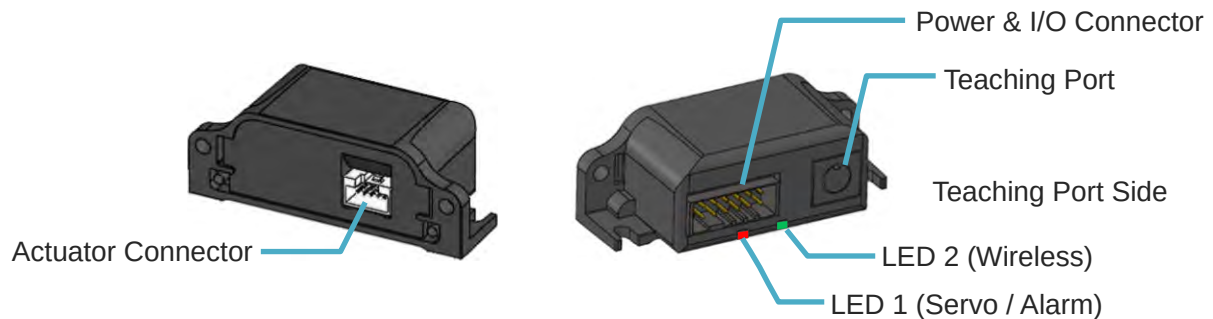
Control Wire



[Main Component Materials]

No.	Name	Material	Surface Treatment
1	Inner Wire	SUS316	Nylon Coating
2	Outer Wire	SUS304+PP	
3	Outer Wire End	PP	
4	Inner Wire End	SUS303	

Interface Box



[Actuator connector]

It is a connector to join an actuator.

It is not available for a direct connection to an actuator cable. Use the enclosed interface box conversion cable to join it to the interface box.

[Status indicator LED]

The LED lamp on the left in the view from the teaching port side is LED 1 (Servo / Alarm) to display the servo-on/off status and alarm status, and the one on the right is LED 2 (Wireless) to display the wireless status.

For the details of display states, refer to [3.6 Troubleshooting confirmations].

[Teaching port]

This connector is for the connection of a teaching pendant or PC teaching software.

When connecting, remove the cap.

[Power & I/O connector]

This connector connects power and I/O wiring.



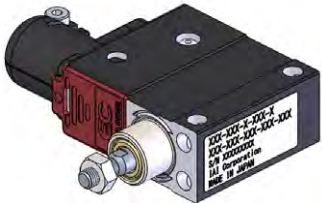
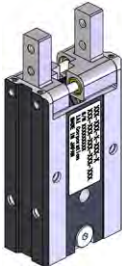
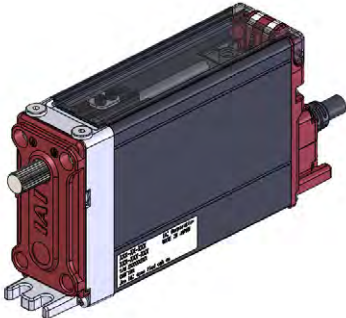
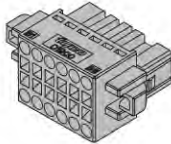
ELECYLINDER

Chapter 1

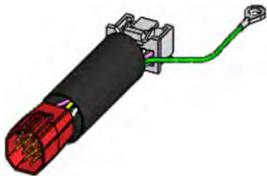
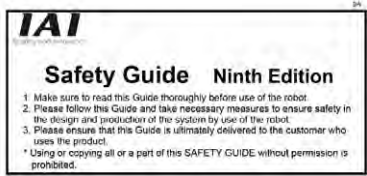
Specifications

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1.1.1 Components

Wire Cylinder Quantity: 1  Rod Type  Gripper Type	
Accessories <u>Wire Controller Quantity: 1</u>  <u>Control Wire Quantity: 1</u>  <u>Power & I/O Cable Quantity: 1</u> (Note 1)  Standard Cable or 4-way Connector Cable <u>Power & I/O Connector Quantity: 1</u> (Note 1)  Components included as selected in the model number	

1.1 Checking the Product

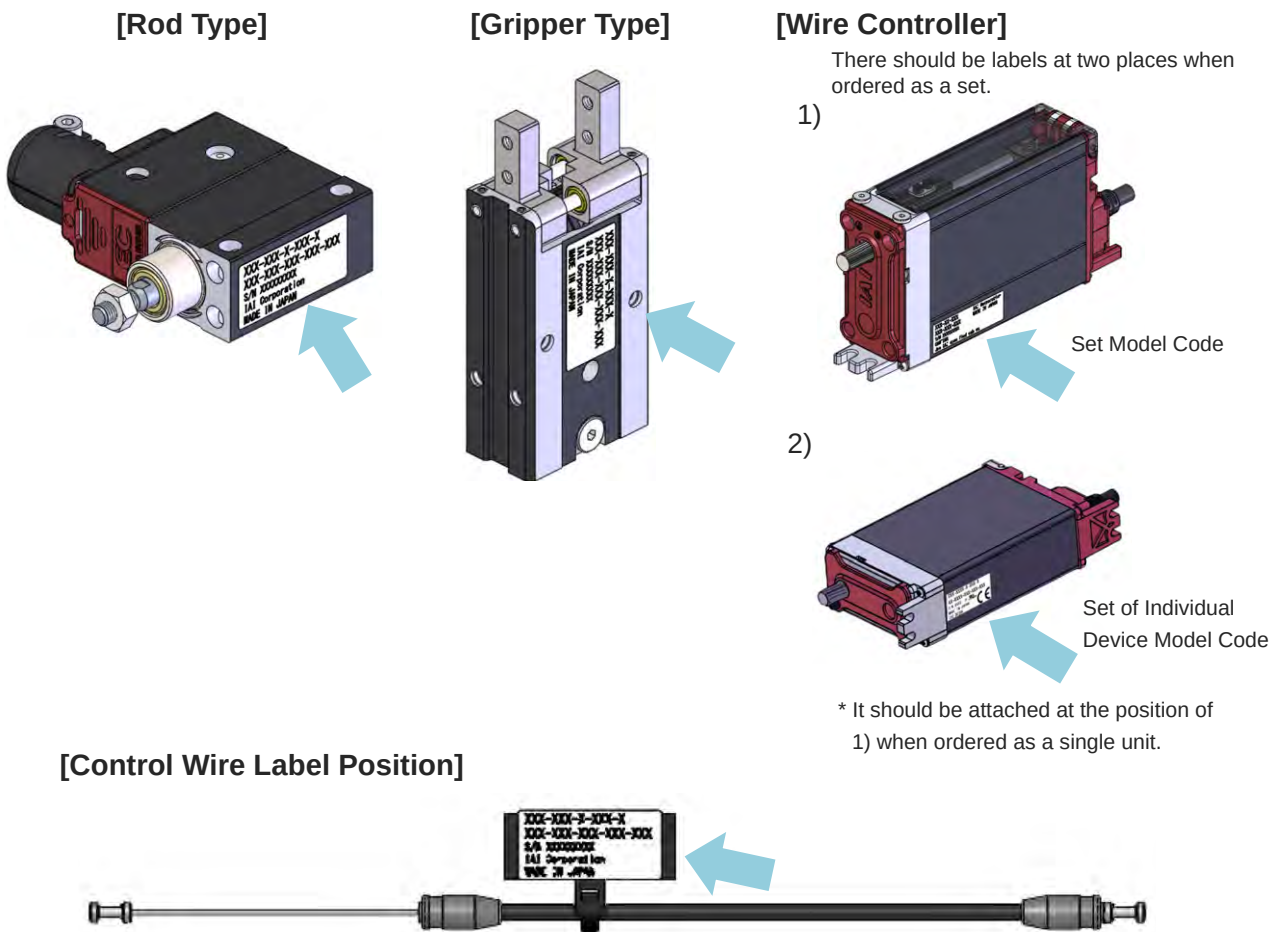
<u>Interface Box, Protective Cap</u> <u>Quantity: 1 each</u> (Note 1) 	<u>Conversion Cable</u> <u>Quantity: 1</u> (Note 1) 
<u>Safety Guide</u> <u>Quantity: 1</u> 	<u>Quick Start Guide</u> <u>Quantity: 1</u> 

(Note 1) It should not be enclosed when ACR specification is selected.

1.1.2 How to read the model nameplate

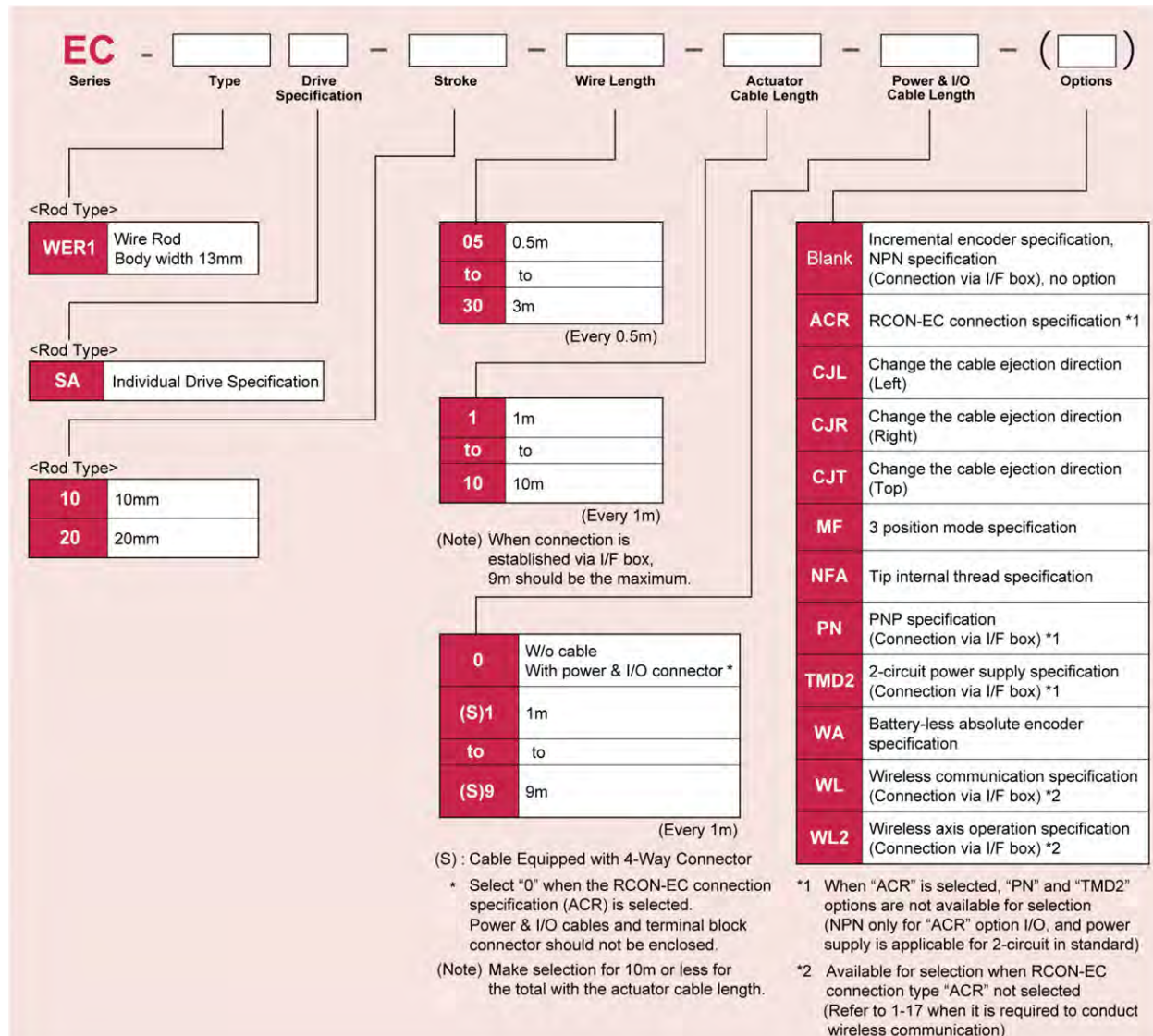
As each component of a wire cylinder is in a bundle of the same set, the serial number should be the same number. In case of having several units connected, make sure that there is no mistake in combination.

Device	Printed Model Code	Printed Serial Number
Actuator	Set of Individual Device Model Code	Same Serial Number
Control Wire	Set of Individual Device Model Code	
Wire Controller	Set Model Code	
	Set of Individual Device Model Code	

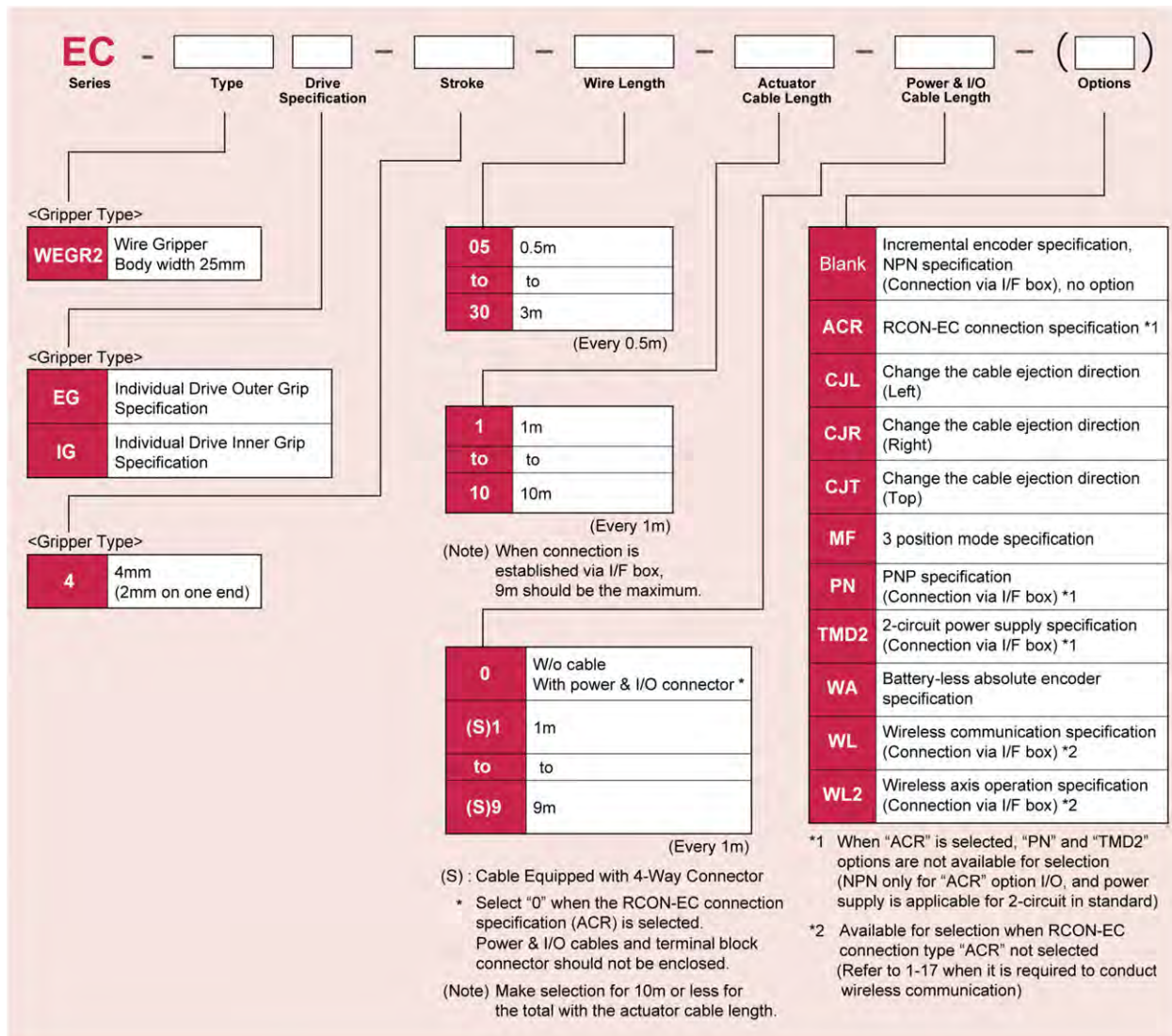


1.1.3 How to read the model number

(1) Rod Type



(2) Gripper Type



1.2 Mechanical Specifications

1.2.1 Rod type

[1] Main Specifications

Model number			EC-WER1SA- ①-②-③-④(-⑤)	
Stroke		Stroke (mm)	10	20
Horizontal	Payload	Max. Payload (kg)	0.75	
	Speed	Max. Velocity (mm/s) (Setting Value) ^(Note 1)	100	
		Max. Velocity (mm/s) (Actual Velocity) ^(Note 1)	91	87
		Min. Velocity (mm/s)	5	
	Acceleration/ Deceleration	Rated Acceleration/Deceleration (G)	0.3	
		Max. Acceleration/Deceleration (G)	0.3	
Vertical ^(Note 2)	Payload	Max. Payload (kg)	0.25	
	Speed	Max. Velocity (mm/s) (Setting Value) ^(Note 1)	100	
		Max. Velocity (mm/s) (Actual Velocity) ^(Note 1)	91	87
		Min. Velocity (mm/s)	5	
	Acceleration/ Deceleration	Rated Acceleration/Deceleration (G)	0.3	
		Max. Acceleration/Deceleration (G)	0.3	
Pressing		Max. Pressing Thrust (N) ^(Note 3)	11.5	12.29
		Pressing Velocity (mm/s) (Setting Value) ^(Note 1)	20	
		Pressing Velocity (mm/s) (Actual Velocity) ^(Note 1)	18	17
Spring reaction force (Rod Pulling Force)		Spring Load at Backward End (N)	1.8	
		Spring Load at Forward End (N)	4.36	

Legend ①Stroke ②Control Wire length ③Actuator cable length ④Power & I/O cable length ⑤Option

(Note 1) There should be some gap between the wire controller setting (command) value and the rod actual velocity (reference).

(Note 2) For installation with the rod oriented downwards, as the rod pulling operation should be activated with the spring reaction force, it is available to perform the pressing operation, but not available for transportation.

(Note 3) It is a reference under condition of current limit at 100%, at stroke end and with wire routing (length 1m, bending angle 360deg, bending R25).



Caution

- Setting the lower less than speed the minimum speed may cause such concerns of generating abnormal noise or making the speed unstable.

[2] Actuator Specifications

Item	Content
Drive system	Wire CAM Structure Compression Spring
Positioning repeatability	±0.01mm (While Pressing) ±0.3mm (When Not in Pressing Operation) ±0.05mm (During Return with Backward End Spring)
Lost motion	0.35mm/0.7mm/1mm/1.3mm or less (Wire bending angle 0deg/180deg/360deg/540deg)
Ambient operating temperature/humidity	0 to 40°C, 85% RH or less (Non-condensing)
Degree of protection	IP20
Vibration and impact resistance	4.9m/s ²
International Standard Compliance	CE Marking, RoHS3 Directive

* The positioning repeatability should differ in the pressing operation and in operation not in pressing (positioning operation).

* While Pressing

: It is a state that the rod is hit and stopped in the pressing operation.

When Not in Pressing Operation

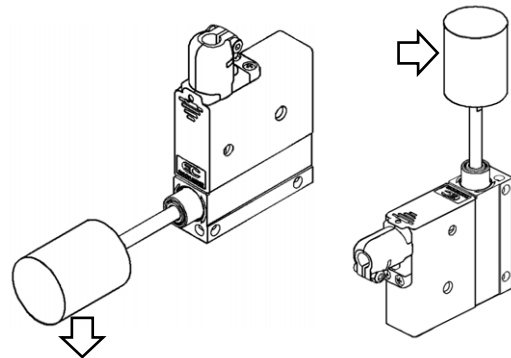
: It is a positioning operation not being hit and stopped, and is a positioning stop before the forward mechanical end.

During Return with Backward End Spring : It is a state that the rod has already returned to the backward end by the built-in spring.

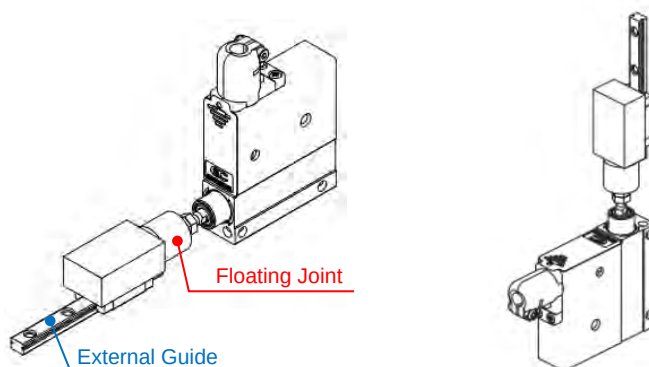
* The lost motion is a reference for when the wire bending angle is 0deg, 180deg, 360deg and 540deg.

[3] Rod Tip Load

stroke (mm)	10	20
Allowable Side Load (N)	0.81	0.62

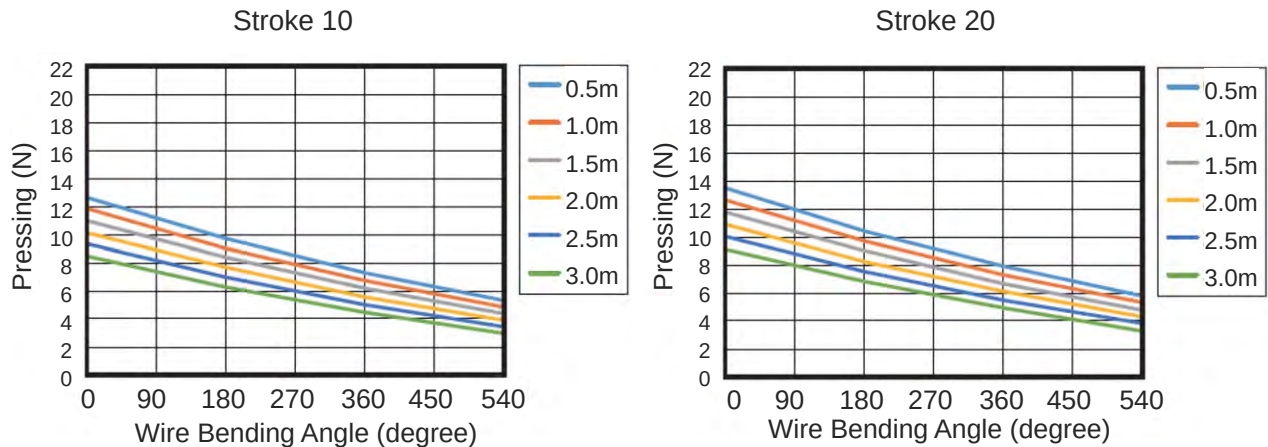


In case there is high side load applied on the rod tip, or when it is required to have the rod not to rotate, or when it is required to have vibration small, use an external guide. For the link between the rod and the external guide, use the floating joint so there is no center offset (twist).



[4] Pressing

The pressing force should vary depending on wire length and bending angle. Also, as a wire cylinder uses the wire operation force to the direction of the rod going out and the spring is used to the direction of the rod pulled in, pressing should be used in the direction of the rod going out.



(Note) The pressing force is under condition of current limit at 70%, at stroke end, with wire bending radius R25.

(Note) The pressing force can be tuned by changing the current from 70 to 100%.

The pressing force by current limit should be added approximately by 0.8N for every 5% of increase from 70%.

1.2.2 Gripper type

[1] Main Specifications

Model number		EC-WEGR2- ①-②-③-④(-⑤)
Grip Operation	Max. Grip Force (N) (Both Sides) (Note 1)	10
	Max. Velocity in Grip Operation (mm/s) Both Sides (Setting Value) (Note 2)	20
	Max. Velocity in Grip Operation (mm/s) Both Sides (Actual Velocity) (Note 2)	20
Approach Operation	Max. Velocity (mm/s) Both Sides (Setting Value) (Note 2)	100
	Max. Velocity (mm/s) Both Sides (Actual Velocity) (Note 2)	100
	Min. Velocity (mm/s) Both Sides (Setting Value) (Note 2)	5
	Min. Velocity (mm/s) Both Sides (Actual Velocity) (Note 2)	5
	Rated Acceleration/Deceleration (G) Both Sides	0.3
	Max. Acceleration/Deceleration (G) Both Sides	0.3
Stroke	Open/close Stroke (mm) (Both Sides) (Setting Value) (Note 2)	4
	Open/close Stroke (mm) (Both Sides) (Actual Open/Close Amount) (Note 2)	4

Legend ① Drive specification (Inner grip and outer grip) ② Control wire length

③ Actuator cable length ④ Power & I/O cable length ⑤ Option

(Note 1) It is the total amount of both fingers under condition of current limit at 100%, at the center of open/close stroke, grip point distance L=23, wire routing length 1m, with bending angle 360deg.

(Note 2) It is the setting (command) value to a wire controller and actual velocity / actual open/close amount of fingers (reference).



Caution

- Setting the lower less than speed the minimum speed may cause such concerns of generating abnormal noise or making the speed unstable.

[2] Actuator Specifications

Item	Content
Gripping structure	Wire CAM Structure
Releasing structure	Compression Spring CAM Structure
Operation system	Individual Drive Type
Positioning repeatability	±0.01mm
Lost motion	0.35mm/0.7mm/1mm/1.3mm or less (Wire bending angle 0deg/180deg/360deg/540deg)
Backlash (One-side finger)	0.5 mm or less
Body	Dedicated Extruded Aluminum (A6063SS-T5) Black Anodizing Treatment
Static allowable moment (Note 1)	Ma direction: 0.38N·m, Mb direction: 0.38N·m, Mc direction: 0.74N·m
Ambient operating temperature/humidity	0 to 40°C, 85% RH or less (Non-condensing)

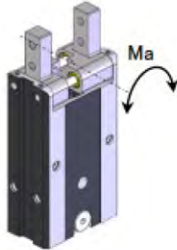
Note 1 Even if the load goes moment and the load overhang length are in the allowable ranges, abnormal vibration or noise may occur because of influence of the way of installing the main body or transported object or the stiffness of the overhang installation beams.

Revise the conditions for operation in such cases.

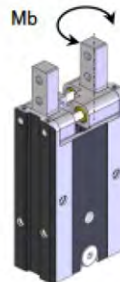
* The lost motion is a reference for when the wire bending angle is 0deg, 180deg, 360deg and 540deg.

[3] Moment Direction

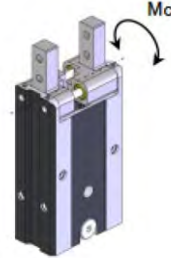
(Ma direction)



(Mb direction)



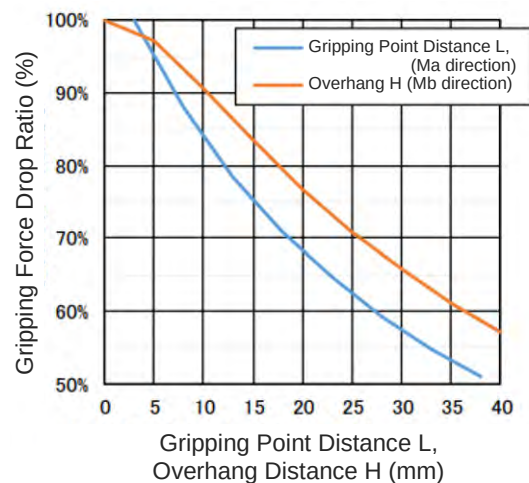
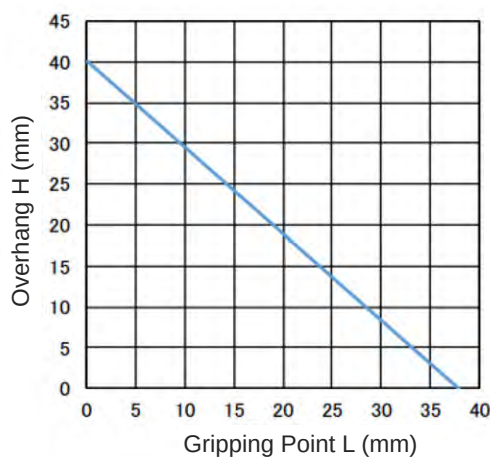
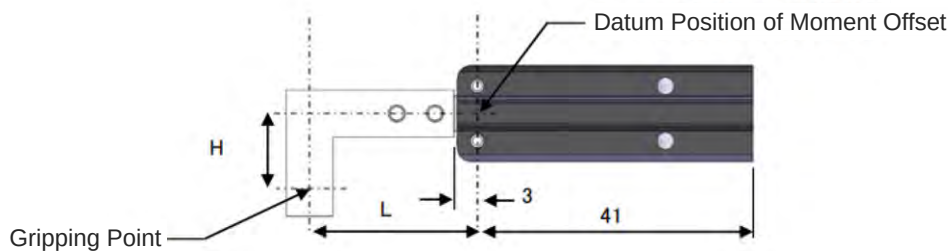
(Mc direction)

**Distance to Gripping Point**

Gripping Point Distance L and Overhang H should be used in the range shown in the graph below.

Grip force at a position with overhang from the fingers should drop the grip force.

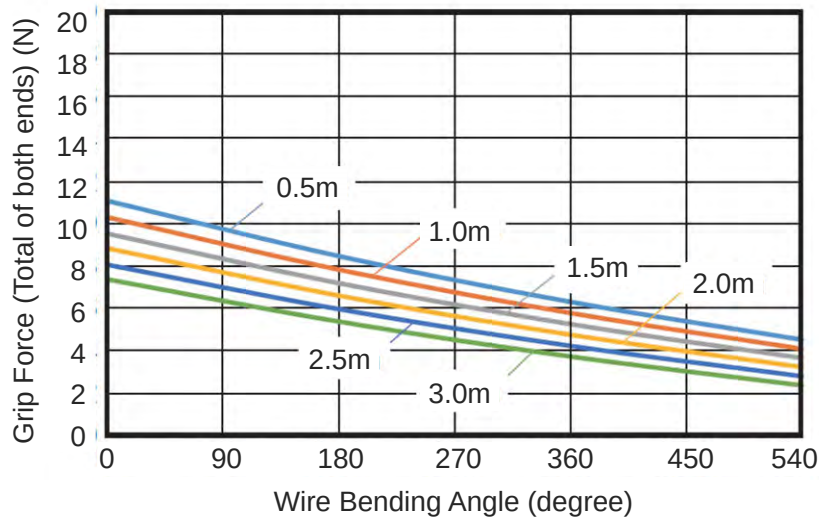
Refer to the graph for the drop ratio.

**Caution**

- If the actuator is used with excessive allowable moment and overhang load, it may not only lead to abnormal noise and vibration but also significantly reduce the life of the wire cylinder.
- Keep the mounted object center of gravity at or below 1/2 the overhang load length.

[4] Grip Force

The grip force should vary depending on wire length and bending angle.



(Note) The grip force is the total amount (reference) of both fingers in case of current limit at 70%, at the center of open/close stroke, grip point distance $L=23$, with wire bending radius $R25$.

(Note) The grip force can be tuned by changing the current from 70 to 100%.

The grip force by current limit should be added approximately by 0.7N for every 5% of increase from 70%.

(Note) For gripping (pressing), velocity should be fixed at 20mm/s.

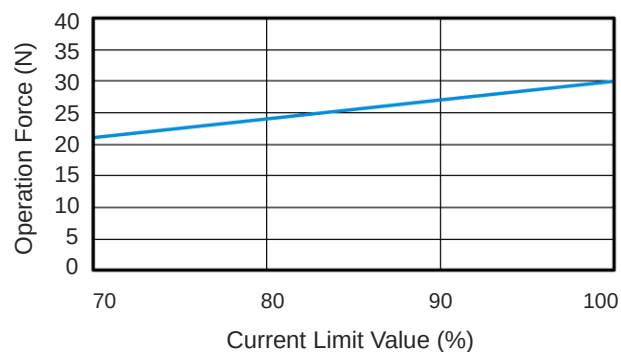
1.2.3 Wire controller (Enclosed to Actuator)

A wire controller is equipped with a motor and controller built in to drive actuators.

[1] Main Specifications

Item		Content			
		No Indication of Model Code (Max. Stroke Setting)	EC-WEGR2	EC-WER1SA-10	EC-WER1SA-20
Wire Operation Velocity / Acceleration/Deceleration	Max. Velocity (mm/s)	100			
	Min. Velocity (mm/s)	5			
	Rated Acceleration/Deceleration (G)	0.3			
	Max. Acceleration/Deceleration (G)	0.3			
Wire Operation Force Pulling (Pressing) Operation	Max. Pulling (Pressing) Thrust (N)	30			
	Max. Pulling (Pressing) Velocity (mm/s)	20			
Stroke	Stroke (mm)	30	10.05	17.15	29.4
Operation Volume Accuracy	Min. Feeding Volume (mm)	0.01			
	Positioning Repeatability (mm)	±0.05			
	Lost Motion (mm)	0.2			

[2] Wire Operation Force



Caution

- The relation between the wire operation force and current limit is a reference.
- The wire operation force is when the number of connected wire is one.

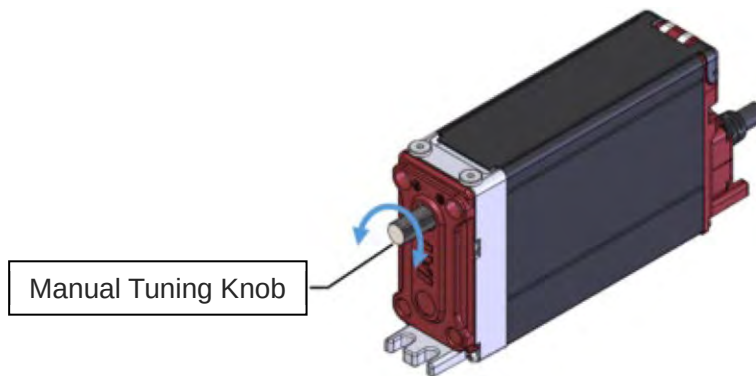
[3] Controller Specifications

Item	Content
Drive system	Lead Screw ($\Phi 4$ Lead 2)
Motor / Lead Screw Joint	Timing Belt (Gear Ratio 1:1)
Wire Operation Load	30N (1 pc of Wire, Current Limit 100%)
Operation Life	10 million times back and forth operation
Ambient operating temperature/humidity	0 to 40°C, 85% RH or less (Non-condensing)
Degree of protection	IP20
Vibration and impact resistance	4.9 m/s ²
Motor type	□20 pulse motor
Encoder type	Incremental / Battery-less absolute
Encoder pulse count	16384 pulse/rev

[4] Manual Operation

When it is required to fine-tune the position manually, turn the manual tuning knob equipped on a wire controller to tune it.

- Do not attempt to turn it during operation.
- Manual operation should be conducted with the servo off.
- Do not apply excess torque when turning. The internal structure may get damaged.

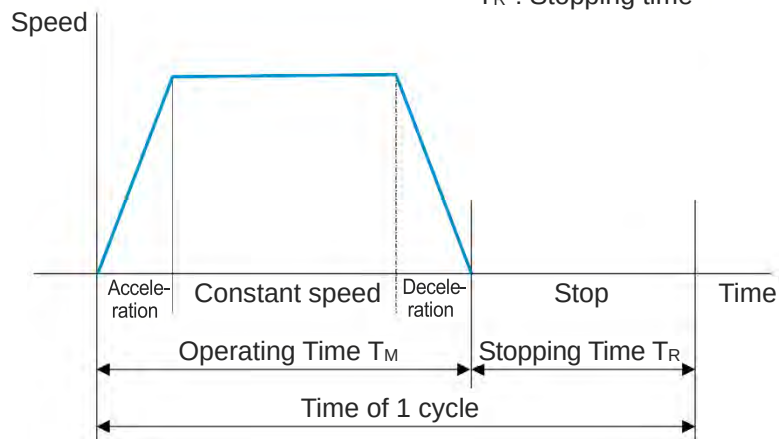


1.3 Duty Ratio

The duty ratio is the operating rate, shown in percentage (%), of the actuator operating time within one cycle.

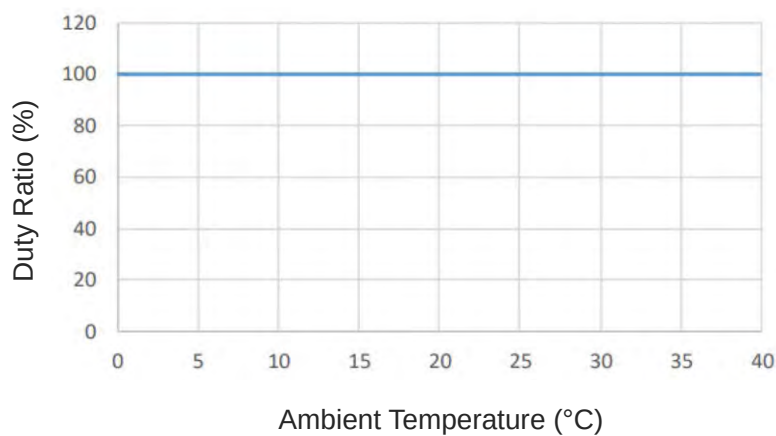
$$D = \frac{T_M}{T_M + T_R} \times 100 (\%)$$

D : Duty ratio
 T_M : Operating time
 (including push-motion operation)
 T_R : Stopping time



The wire cylinder is capable for continuous operation in 100% of the duty ratio.

The relation of the ambient temperature and duty ratio



1.4 Options

1.4.1 RCON-EC connection specification (Model: ACR)

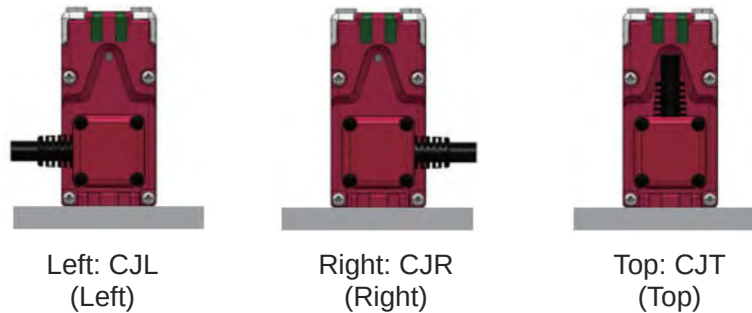
It should be selected when the field network connection is established via R-unit (connected to RCON-EC).

- * It is the specification to link directly to RCON-EC. It is necessary to prepare an interface box, interface box conversion cable and power & I/O cables separately when the wireless communication is to be performed.

1.4.2 Change in cable ejection orientation (Model: CJL, CJR, CJT)

The direction to eject cable attached on a wire controller can be changed.

The direction for change can be selected from left (model code: CJL), right (model code: CJR) and top (model code: CJT).



1.4.3 3 position mode specification (Model: MF)

It is an option that three-point positioning (intermediate stop) becomes capable.

Refer to [ELECYLINDER 3 position mode specification Instruction Manual (ME3837)] provided separately for details.

1.4.4 Tip internal thread specification (Model: NFA) *For EC-WER1 only

It is an option to change the attachment thread to fix such as a fixture on the rod tip with one piece of screw to an internal thread. It cannot be installed by a user after delivery.

1.4.5 PNP specification (Model: PN)

I/O input/output specifications are NPN specification as standard.
Specifying this option changes the unit to PNP specification.

1.4.6 2-circuit power supply specification (Model: TMD2)

It is an option to supply motor power and control power individually.

1.4.7 Battery-less absolute encoder specification (Model: WA)

The standard specification is for incremental encoder.
Specifying this option changes the unit to battery-less absolute encoder specification.

1.4.8 Wireless communication specification (Model: WL)

The models with wireless communication specification have built-in wireless circuit boards and enable wireless communication between the Wire Cylinder and the Touch Panel Teaching Pendant.

1.4.9 Wireless axis operation specification (Model: WL2)

The wireless axis operation specification includes a built-in wireless circuit board enabling wireless communication between the Wire Cylinder and the Touch Panel Teaching Pendant.
Specifying WL2 enables operation testing of axis operation (movement to forward and backward ends, jog operation, inching operation) as well as the operation via wireless communication enabled with WL. However, the control device is not designed for purposes of automatic operation. Be sure to refer to Intro-14 [Precautions for Axis Operation with Wireless Communication].
(Note) Changes from WL to WL2 and from WL2 to WL cannot be performed by the customer.
Please contact us.

- * The certificates and self-declaration related to wireless features are conducted as the wireless circuit board for the following model name.
Model Name: IABL3827
For details, refer to Intro-12 [Precautions for Handling Wireless Operation].

ELECYLINDER

Chapter 2

Installation

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2.7 Interface box installation 2-27

2.1 Precautions for Transportation

[Handling the package]

- Do not damage or drop the package.
The package is not specially designed to withstand dropping or shock due to collision.
- Keep the unit in horizontal position for storage or transportation.
- Do not climb onto the package.
- Do not put anything that could deform the package on it.



[Package opened]



2.1 Precautions for Transportation

[Handling after unpacking]

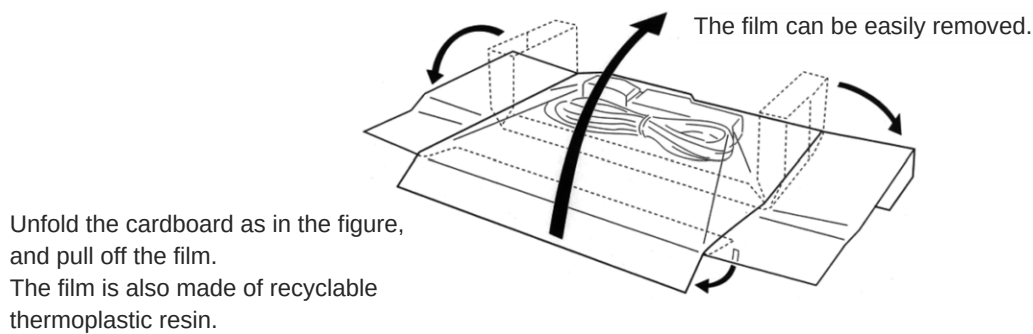
- Hold the main unit part to bring it.
- Do not attempt to hold the cover or cable for transportation.
- Do not damage or drop the package during transportation.
- Do not apply excessive force to any part of the wire cylinder.

Reference

These packaging materials can be recycled as cardboard.

The cardboard and urethane film are attached only with thermal bonding and use no adhesive.

This means they can be recycled as cardboard when disposed of, reducing industrial waste cost burdens.



[Handling when assembled into machinery (system)]

- Hold the gripper and rods so they would not move unexpectedly during transportation.
- If the wire cylinder body or any moving part is overhanging, fix it appropriately to avoid large wobbles due to external vibration. When transporting without fixing the tip, do not apply impact of 0.3G or more.
- When suspending machinery (system) with ropes, be careful not to catch the rope on the wire cylinder, cables or wires.

2.2 Installation and Storage/Preservation Environment

Usage is possible in environments of pollution degree 2 or equivalent.

Pollution degree 2: Environment in which generally only nonconductive pollution occurs, but temporary conductive pollution may occur due to condensation (IEC 60664-1)

2.2.1 Installation environment

In general, it is an environmental that an operator can work without protection gear.

Avoid the following locations for installation.

- Where the unit receives radiant heat from strong heat sources such as heat treatment furnaces
- Where the ambient temperature exceeds the range of 0 to 40°C
- Where the temperature changes rapidly and condensation occurs
- Where the relative humidity is out of the range from 10%RH to 85%RH
- Where the unit receives direct sunlight
- Where the unit is exposed to corrosive or combustible gases
- Where the ambient air contains a large amount of dust, salt or iron (at levels exceeding those typical of an assembly plant)
- Where the unit is subject to splashed water or oil (including oil mist or cutting fluid) or chemical solutions
- Where the body receives impact or vibration
- Where the altitude is more than 1,000m

Provide sufficient work space for the following maintenance and inspection.

- Space to insert the teaching tool connector
- Space to replenish grease
- Space for wire controller replacing work

For details, refer to [Chapter 4 Maintenance and Inspection].

When using the product in any of the locations specified below, provide a sufficient shield.

- Where noise is generated due to static electricity, etc
- Where the unit is subject to a strong electric or magnetic field
- Where the unit is subject to ultraviolet or radiation

2.2.2 Storage/preservation environment

- For the storage and preservation environment, see the installation environment.
However, give especial consideration to the prevention of condensation during long-term storage/preservation.
- Unless especially specified, desiccant is not included in the package at shipping.
If the product is to be stored/preserved in an environment where condensation is anticipated, take condensation preventive measures.
- For short-term storage, it can be stored at 60°C or below.
For storage of one month or more, make sure that the temperature does not exceed 50°C.
- The product should be placed horizontally for storage and preservation.
If storing in the packaged condition, observe the conditions, if any, regarding storage orientation.
Refer to horizontal orientation in [2.3.1, 2.4.1, 2.5.1 Mounting orientation] for the status of the horizontal orientation.

2.2.3 Installation surface

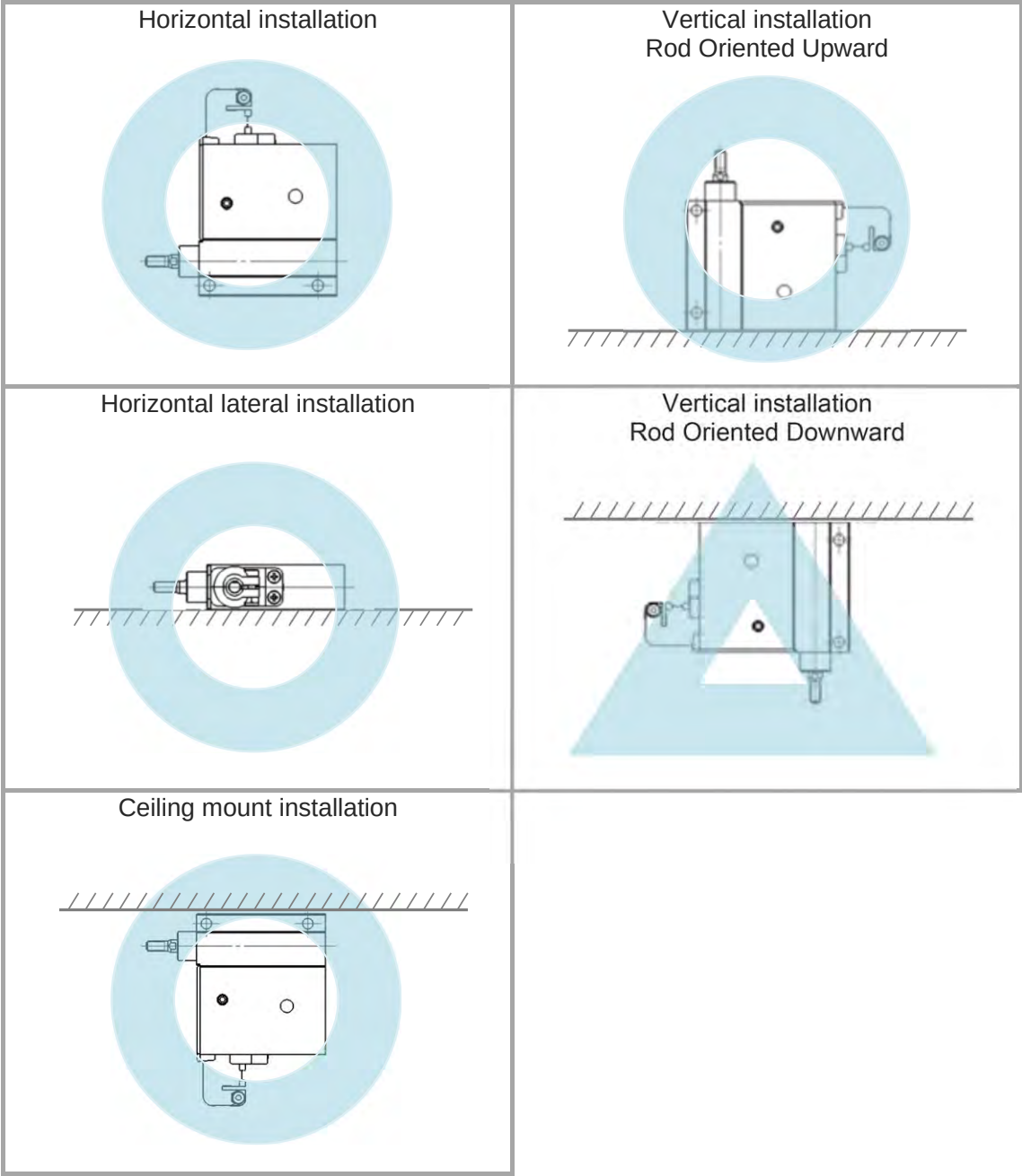
- The body mounting surface should be a machined surface or a plane with similar accuracy, with flatness within 0.05mm/m.
- The mounting frame should have a structure rigid enough to prevent the generation of vibration.
- Also consider the necessary space for maintenance work such as wire cylinder replacement and inspection.

2.2.4 Mounting bolt

- Use a high-tensile hex socket head cap screw with ISO-10.9 or higher for attachment male screws.
- The effective length of engagement between a screw and a female thread should secure 1.5 times or more of the nominal diameter.
- Screws to install an actuator should be prepared by a user.

2.3 Installation of rod type

2.3.1 Mounting orientation



○: Available for Installation

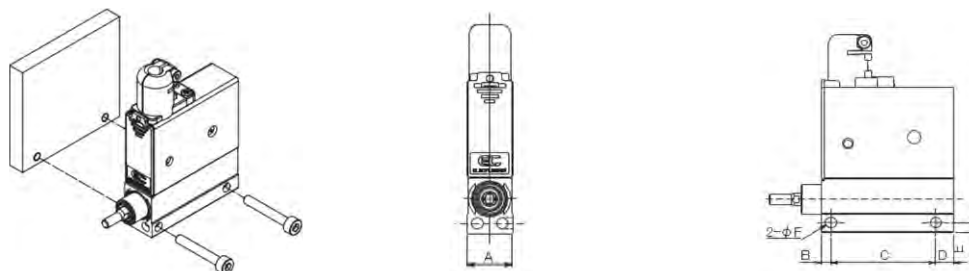
△: As the rod pulling operation is brought by reaction force of a spring, it can be used for pressing operation but cannot be used for transportation.

2.3.2 Body mounting

Fixation is available at the bolt holes on the side, front and back of the body.

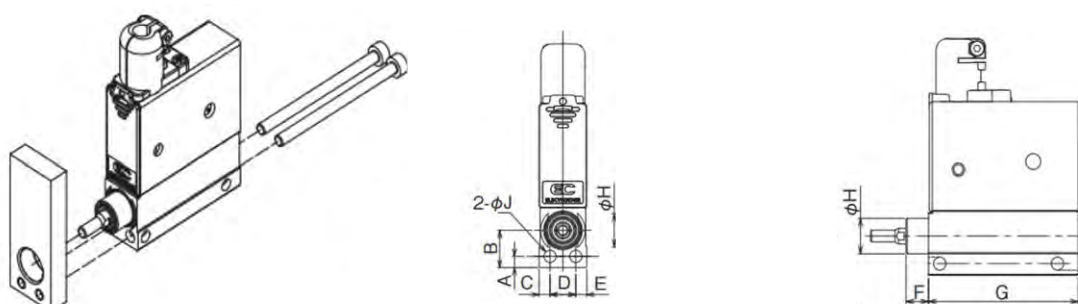
For details regarding the position and dimensions, refer to [Chapter 5 External Dimensions].

[1] Fixation at Side



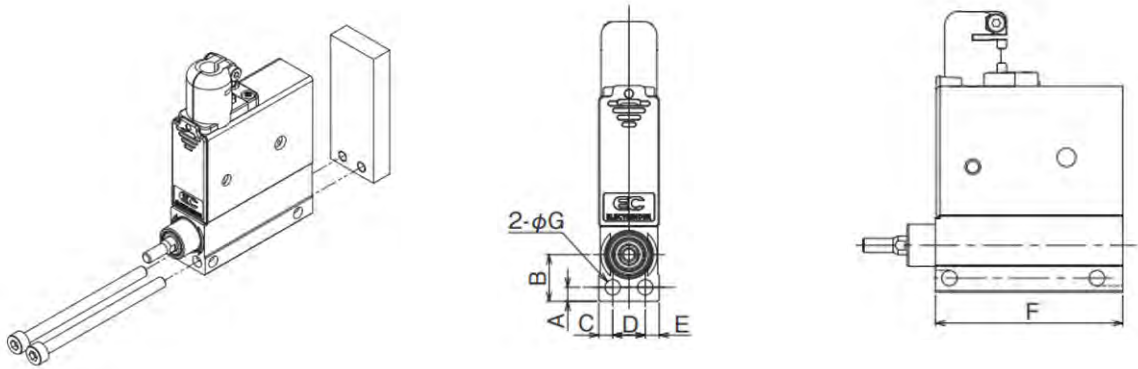
Stoke	Bolt size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
10	M3	13	3	21.5	3	3	3.3
20				31.5	5	5	

[2] Fixation at Front



Stoke	Bolt size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)
10	M3	3	10	3	7	3	6	27.5	9h9	3.3
20								40		

[3] Fixation at Back



Stoke	Bolt size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
10	M3	3	10	3	7	3	27.5	3.3
20							40	

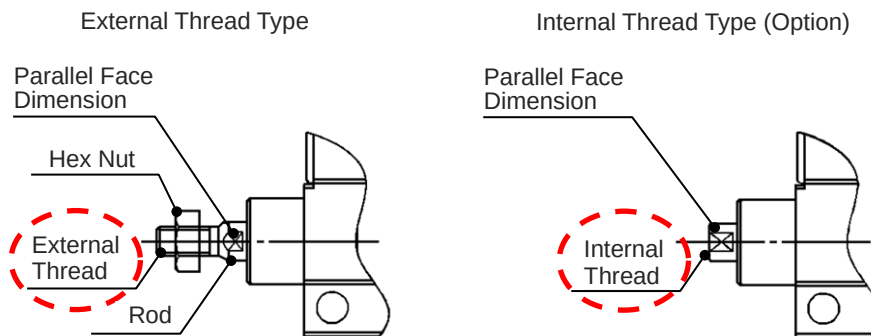
Fixing bolt	Tightening torque (N·m)
M3	0.83

2.3.3 Mounting transported objects

When applying a transported object on the external thread at the rod tip, tighten it with the enclosed hex nut.

Hold the parallel faces on the rod with a wrench.

The internal thread type is an option (model code: NFA).



Rod Tip	Thread Dimensions	Tightening torque (N·m)			Parallel Face Dimension
		Copper	Aluminum	Resin	
External Thread	M3×0.5 Thread Effective Length 5.5mm	1.54	0.83	0.54	3.5
Internal Thread	M2.5×0.45 Thread Effective Length 5mm	0.87	0.46	0.3	3.5

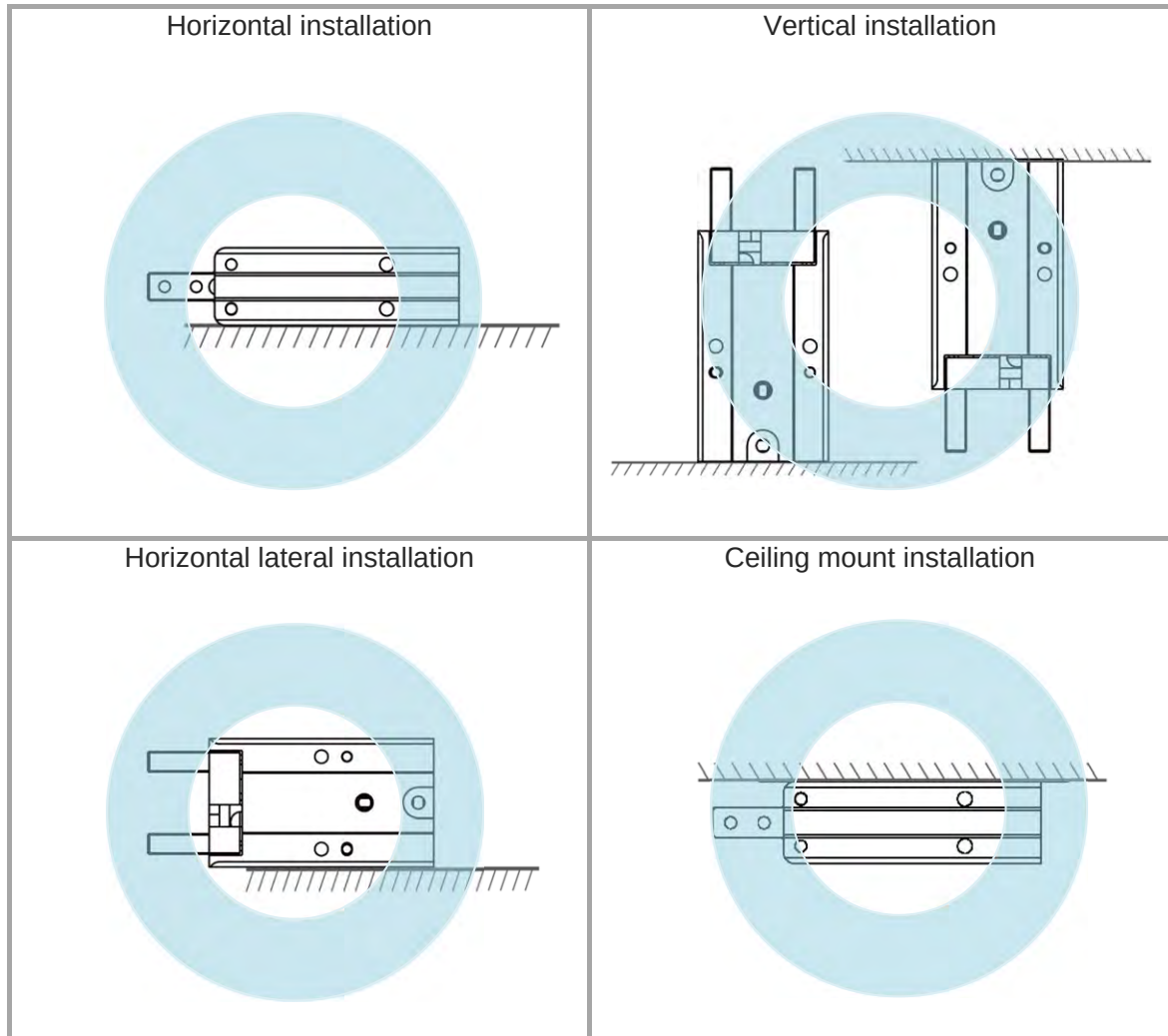


Caution

- Be careful with regard to the length of the mounting bolt.
- The use of screw-in depth greater than that of the screw holes may damage the screw hole or reduce the mounting strength of the transported object, leading to decreased accuracy or unexpected accidents.

2.4 Installation of gripper type

2.4.1 Mounting orientation



O: Available for Installation

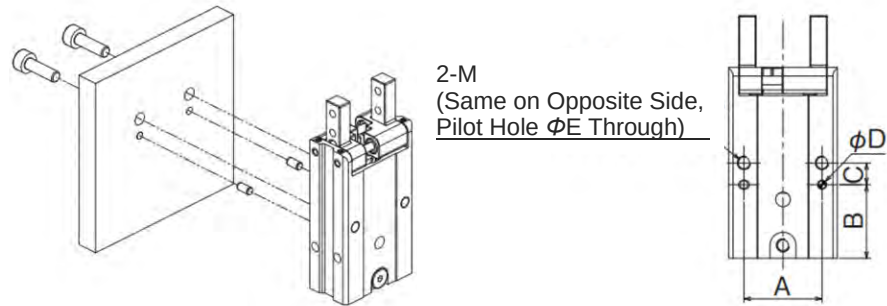
2.4 Installation of gripper Type

2.4.2 Body mounting

There are ways of fixing the body to use the threaded holes at the back of the body, through holes at the front of the body, threaded holes on the side of the body and threaded holes on the bottom of the body.

For details regarding the position and dimensions, refer to [Chapter 5 External Dimensions].

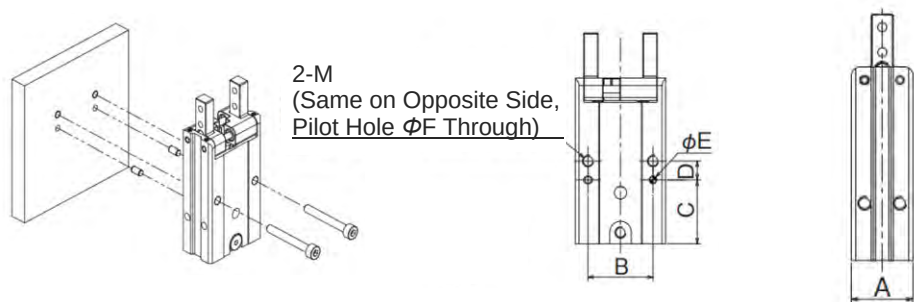
[1] When Using Screw Holes at Back



A (mm)	B (mm)	C (mm)	D (mm)	M (mm)
18	17	5	2H7 $^{+0.010}_0$ depth 2	M3 depth 6

Screw size	Tightening torque (N·m)
M3	0.83

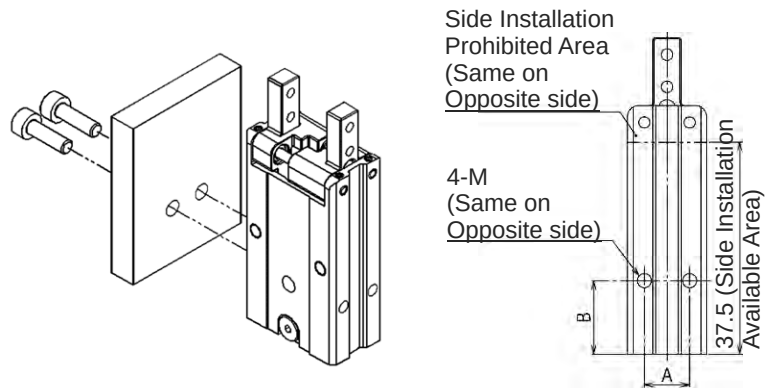
[2] When Using Through Holes at Front



Bolt size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)
M2.5	14	18	17	5	2H7 $^{+0.010}_0$ depth 2	2.6

Screw size	Tightening torque (N·m)
M2.5	0.45

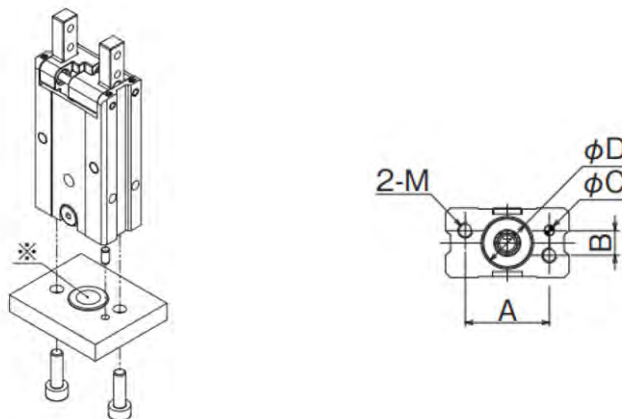
[3] When Using Screw Holes on Side



A (mm)	B (mm)	M (mm)
8	13	M3 depth 6

Screw size	Tightening torque (N·m)
M3	0.83

[4] When using the screw holes on the bottom

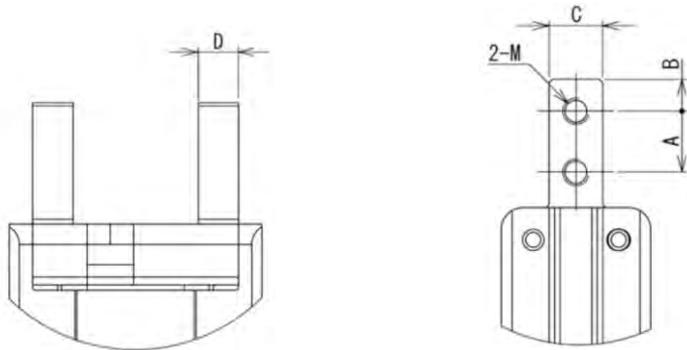


A (mm)	B (mm)	C (mm)	D (mm)	M (mm)
17	5	2H7 ^{+0.010} ₀ depth 3	10H7 ^{+0.015} ₀ depth 1	M3 depth 6

Screw size	Tightening torque (N·m)
M3	0.83

* An interference avoidance (φ8) is required in order to attach a control wire.

2.4.3 Attaching Finger Part

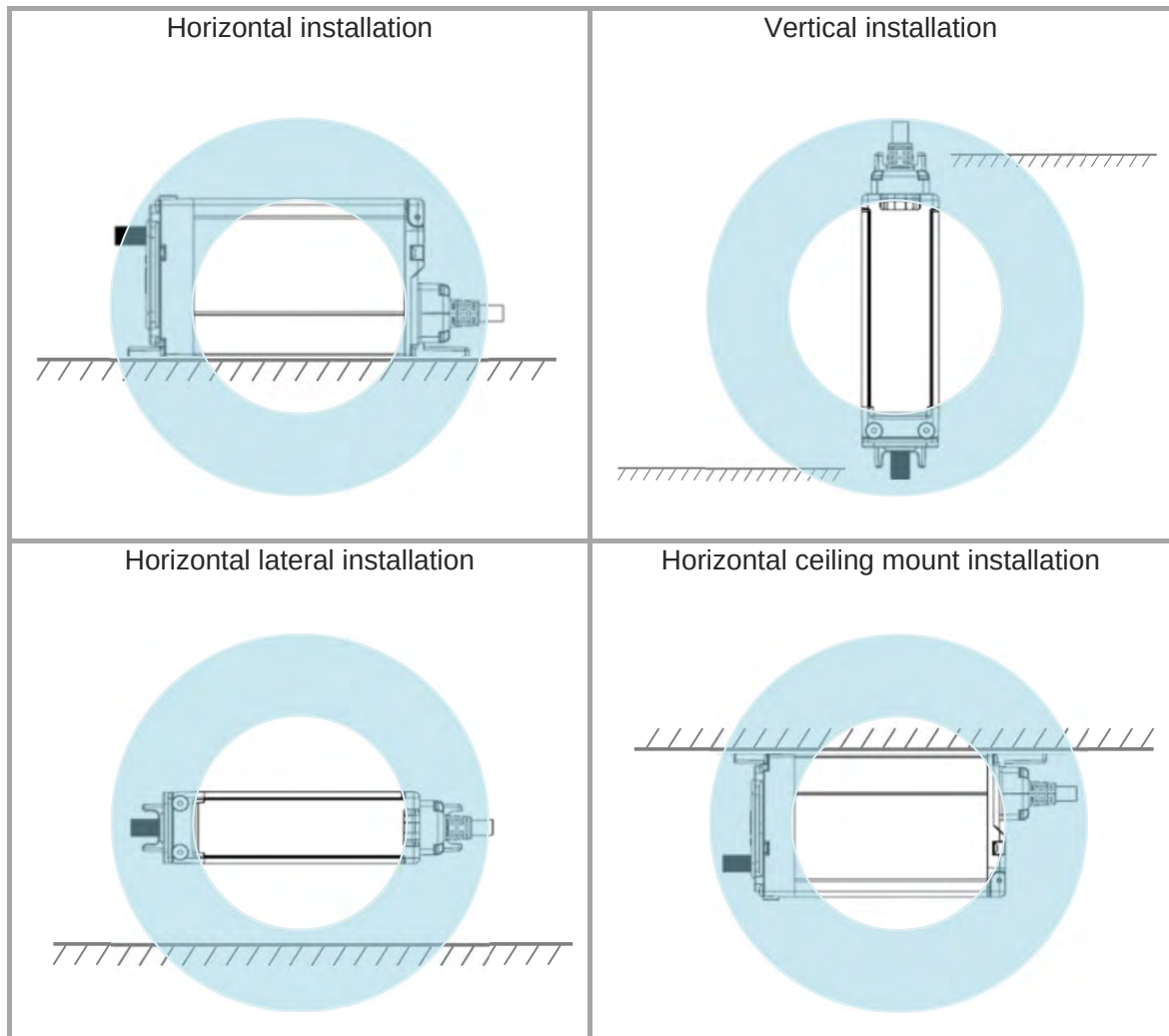


A (mm)	B (mm)	C (mm)	D (mm)	M (mm)
5.7	3	5 ⁰ _{-0.05}	4 ⁰ _{-0.1}	2.5 x 0.45

Screw size	Tightening torque (N·m)
M2.5	0.45

2.5 How to Install Wire Controller (Enclosed in Actuator)

2.5.1 Mounting orientation



O: Available for Installation

There are a motor, encoder and controller to activate an actuator built in the wire controller. 16 units at the maximum can be allocated closely to each other.

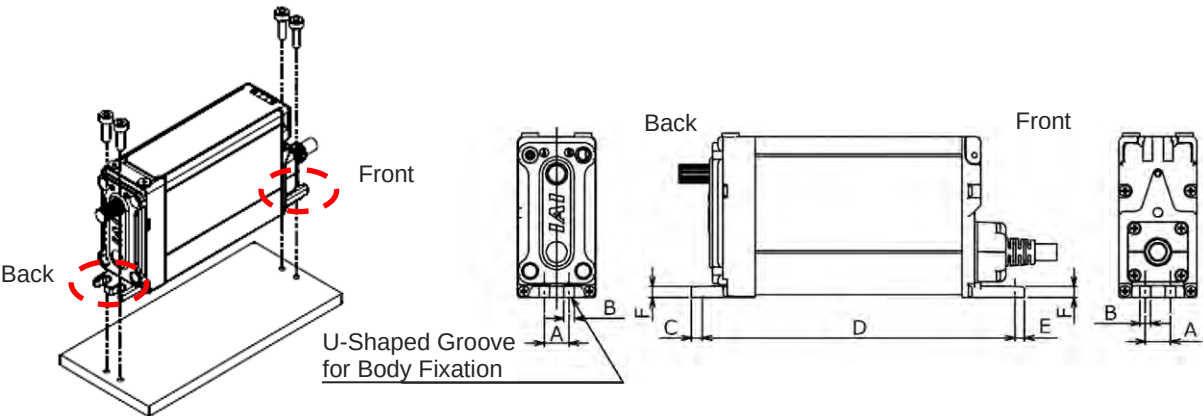
Pitch for installation should secure 10mm or more.

2.5.2 Body mounting

Fix the unit using the U-shaped grooves on it. The material to fix at the front is aluminum and the material at the back is plastic.

As Tightening up with excess torque may deform the plastic material, follow the tightening torque specified in the table below.

For details regarding the position and dimensions, refer to [Chapter 5 External Dimensions].

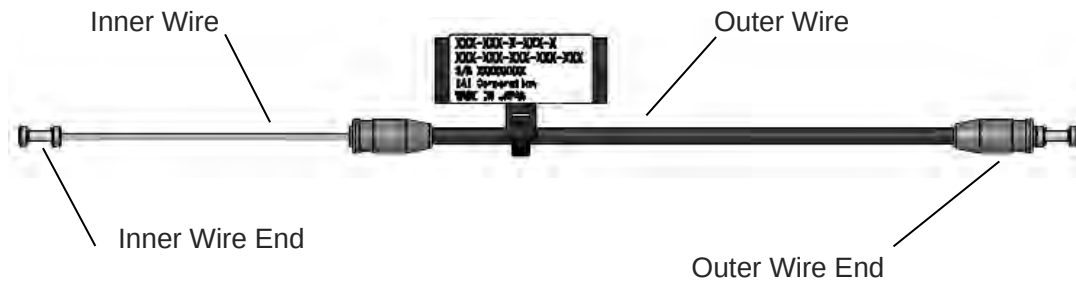


Screw size	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	Tightening torque (N·m)
M3	8	3.4	3.5	100	3	3.6	0.54

2.6 How to Install Control Wire (Enclosed in Actuator)

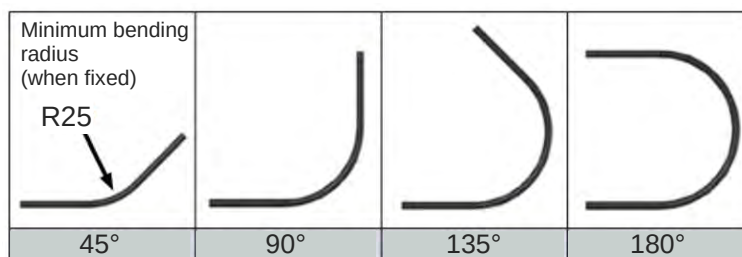
2.6.1 Outline

The control wire should be delivered in separate state. After attaching it on an actuator main body, pay attention to the followings to establish connection.

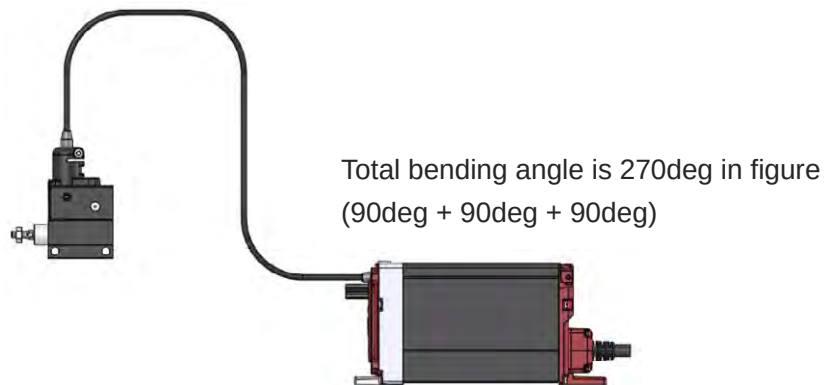


- There is no orientation in a control wire. Both ends can be connected to an actuator and a wire controller.
- Consider equipment layout so the bending angle of a controller gets as small as possible. Large bending angle could cause drop of output and operation failure.
- The bending radius of a control wire (when it is fixed) should be R25 or more.
- When a control wire is installed movable, it should be R38 or more. Although it is available to use in flexion move in a U shape, it is not available to use in twist move.
- Hold the control wires loosely with a cable band so there would not be any load of pulling, bending or twisting (rotation) applied on the wires.

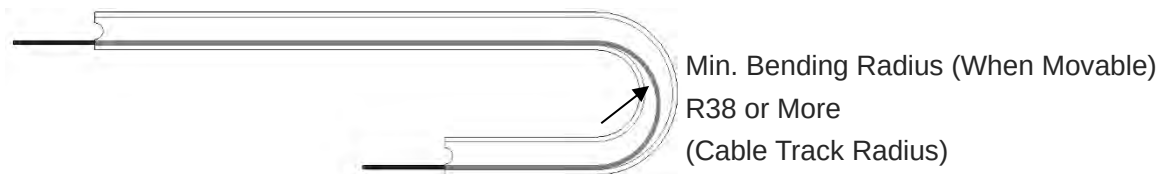
[1] Way to Think Wire Bending Angle



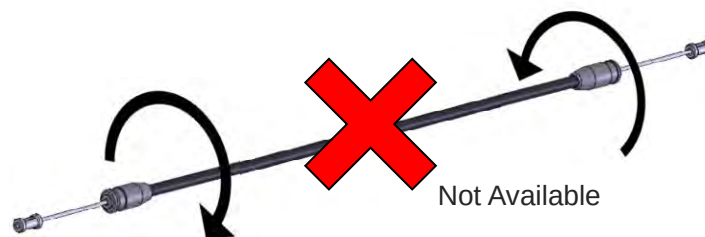
[2] To Read Wire Bending Angle



[3] Wire Flexion Move



[4] Wire Twist Move



2.6.2 How to Make Connection (On Actuator Side, Gripper Type)

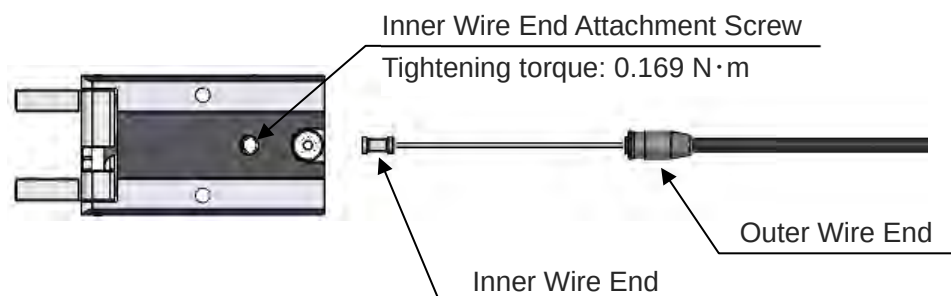
[1] Gripper type

◆ Preparation

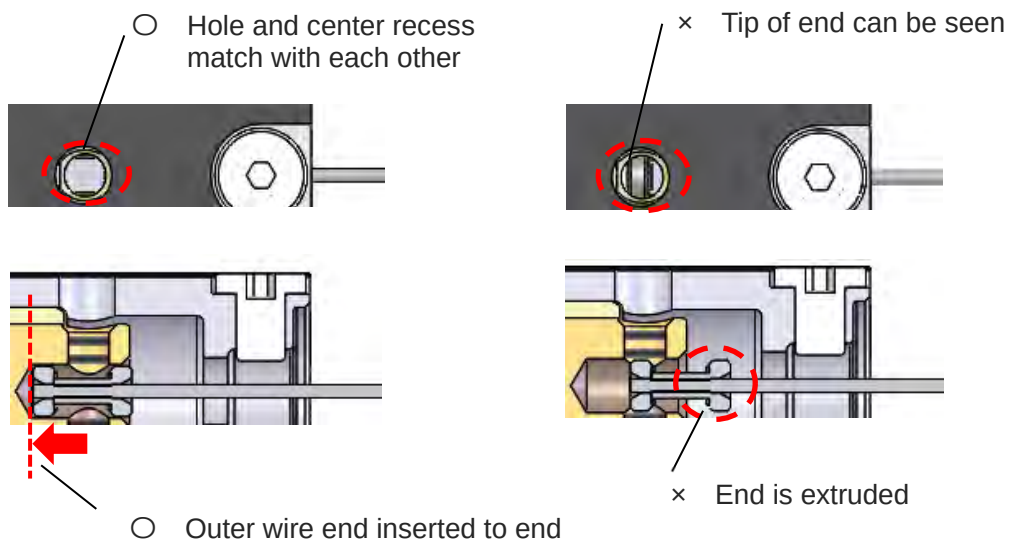
- Hex wrench (parallel faces: 1.5mm)

◆ Connection Procedures

1. Take off the inner wire end attachment screw. Insert the inner wire end straight from the hole on the bottom.

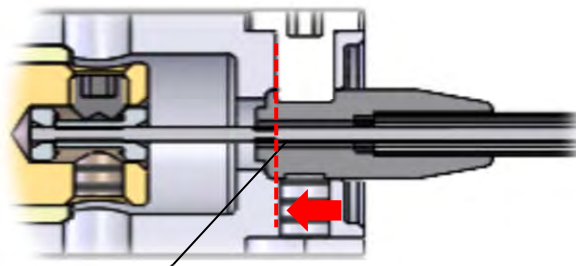
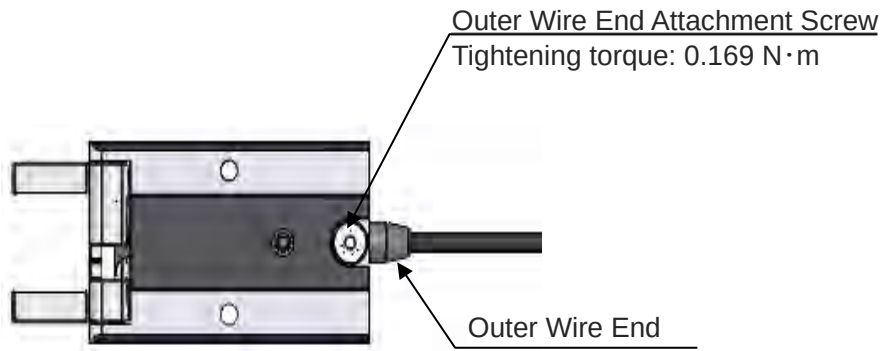


2. Confirm that the inner wire end is firmly inserted till the end of the hole. The position where the recess at the center of the inner wire end matches with the hole for the set screw should be the right position. With the inner wire end inserted to the end, tighten up the inner wire end attachment screw.



2.6 How to Install Control Wire (Enclosed in Actuator)

- Loosen the outer wire end attachment screw by approximately 1mm, insert the outer wire end at the wire attachment port on the bottom of the body till it reaches the end, and tighten the attachment screw.



Insert outer wire end till it reaches end of hole

2.6.3 How to Make Connection (On Actuator Side, Rod Type)

[1] Rod type

◆ Preparation

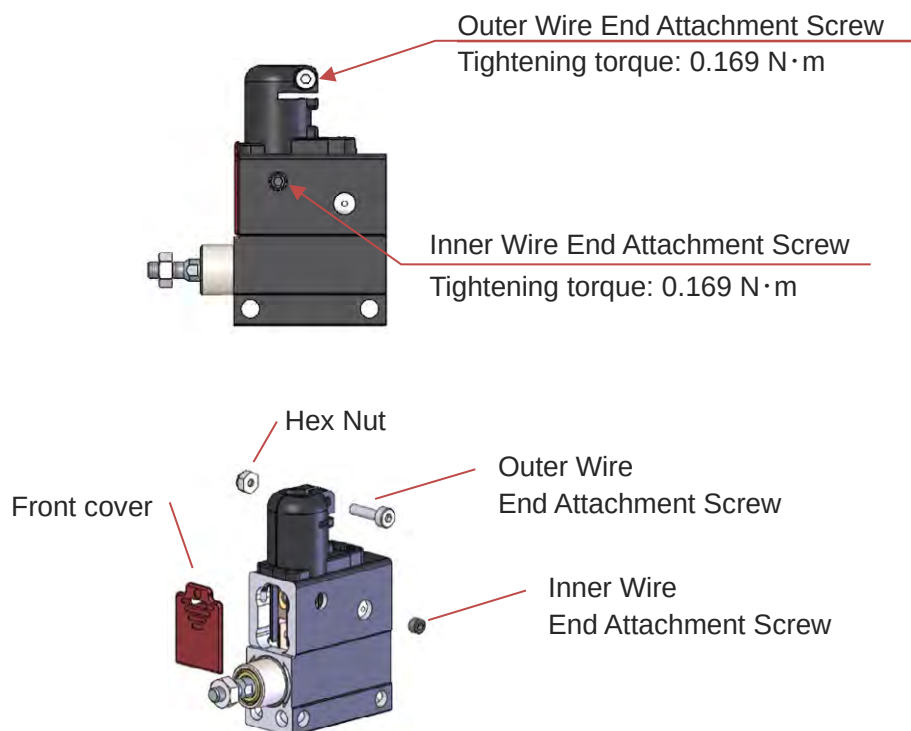
- Hex wrench (parallel faces: 1.5mm)

◆ Connection Procedures

1. Confirming Wire Attaching Orientation

The inner wire end attachment screw and the outer wire end attachment screw on delivery should be attached as shown in the figure below.

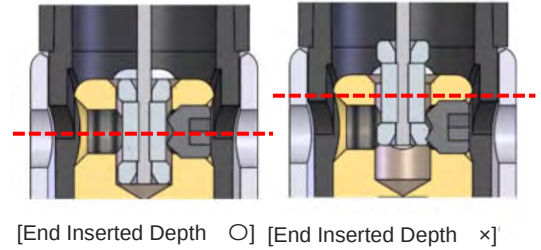
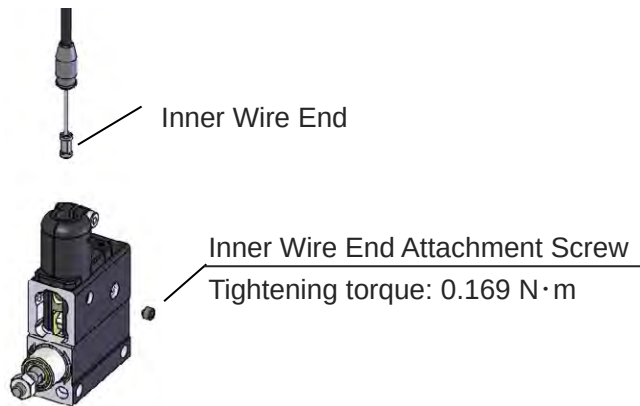
Adopting to the installation posture and installation surface of the rod type, the orientation of the inner wire end attachment screw can be changed. The outer wire end attachment screw can be changed to the opposite by swapping the screw and hex nut positions.



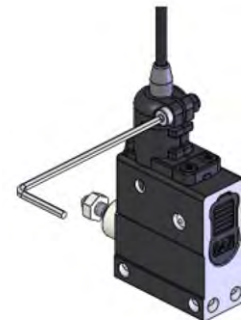
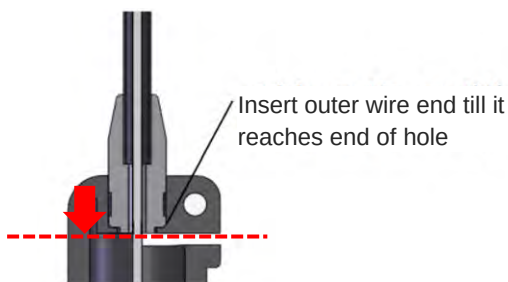
2. Take the front cover off. It can be taken off by hanging the snap features to the top of the front cover. Although this procedure is not mandatory, it makes a work to check the condition of the inner wire end insertion and installation.

2.6 How to Install Control Wire (Enclosed in Actuator)

3. Insert the inner wire end straight at the hole on the port and check if the inner wire end has reached the end of the hole. Confirm that the recess of the inner wire end is matched with the hole for the set screw as shown in the figure, and tighten it up with the inner wire end attachment screw.



4. Insert the outer wire end till it reaches the end of the hole on the port. Tighten up the outer wire end attachment screw.

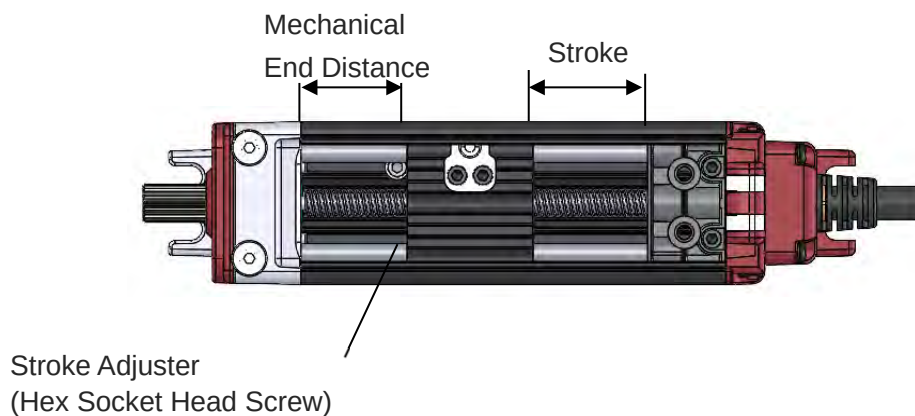


2.6.4 How to Make Connection (On Wire Controller Side)

[1] Wire Controller

A wire controller is adjusted on delivery to match the actuator type to be connected. When the combination is correct, it is not necessary to adjust its stroke.

If the combination is not correct, there could be lack of wire operation amount or excess length of wire. Move the stroke adjuster (hex socket head screw) to adjust the stroke so the distance to the mechanical end gets into that in the table below.



	WEGR2	WER1SA-10	WER2SA-20
Mechanical End Distance (mm) (* Reference for Adjustment)	23.55	16.45	4.2
Stroke (mm) (Parameter Setting)	10.05	17.15	29.4

Connection to the controller end should be conducted after connection to the actuator end and routing of the control wire is completed. The stroke of an inner wire may vary depending on the condition of wire routing.

◆ Preparation

- Hex wrench (parallel faces: 1.5mm)

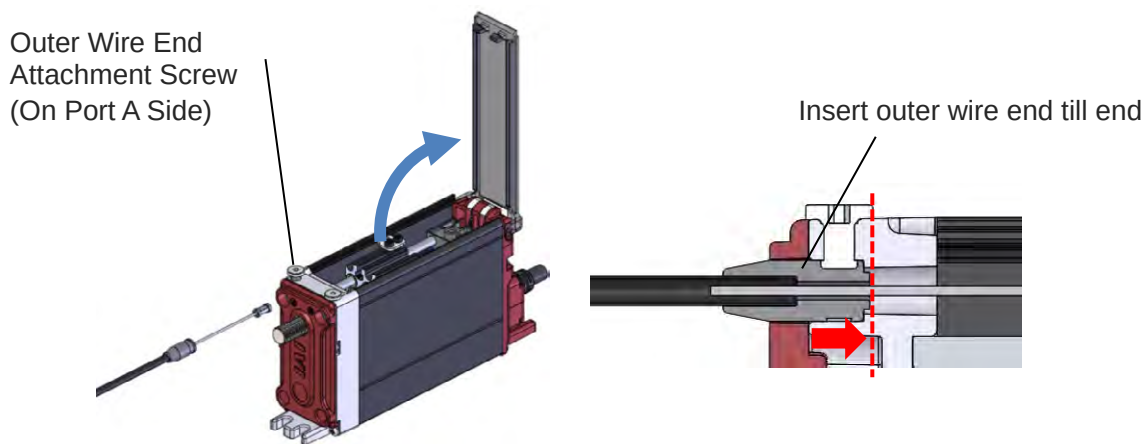
◆ Connection Procedures

1. Open the top cover.

Loosen the outer wire end attachment screw (on Port A side).

Insert the outer wire end to the end of Port A and tighten up the attachment screw.

(Tightening torque: 0.169N·m)

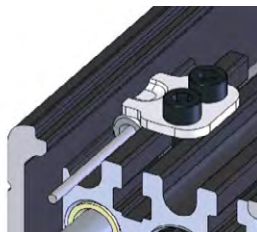


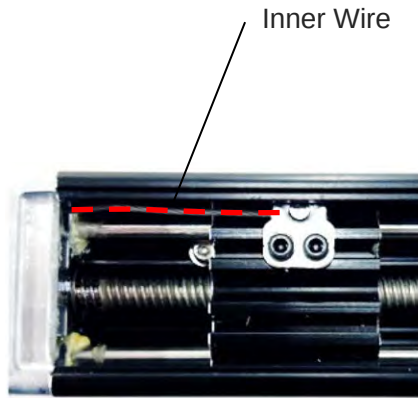
2. Move the slider to the home position (position where it hits the stroke adjuster).

Loosen the hex socket head screw fixing the connector, pinch the inner wire end at the bottom of the connector and fix it. (Tightening torque of connector fixing screw 0.169N·m, hex parallel face 1.5)

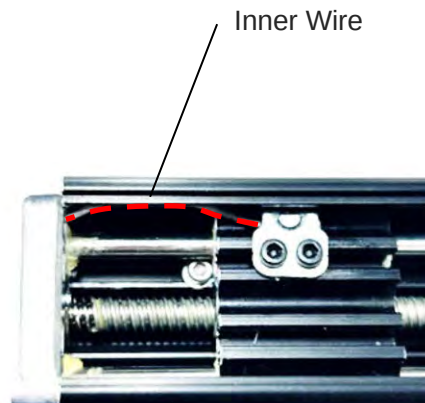
At this moment, confirm that the inner wire end is fit in the U-shaped groove on the slider.

Confirm that it is not out of the U-shaped groove and contact the frame. It is not necessary to apply tension to the inner wire. In case looseness of the inner wire is large, move the connector position to make the looseness of it small.



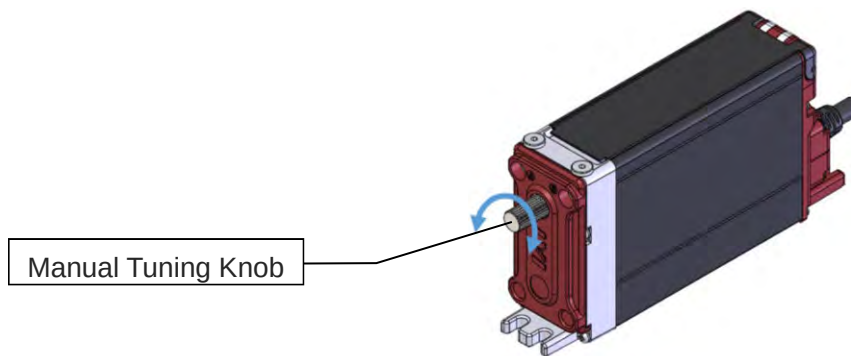


○ Wire is fixed at appropriate position



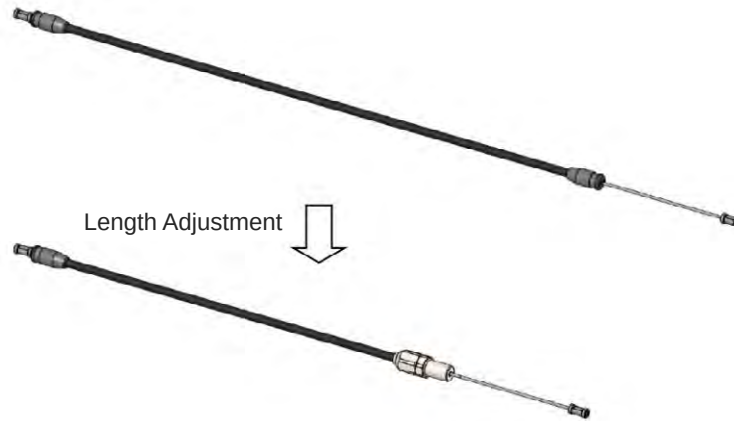
× Wire is loose

3. Turn the manual tuning knob to operate the slider to confirm that the actuator operates in normal condition, and close the top cover.



2.6.5 Wire Length Adjustment

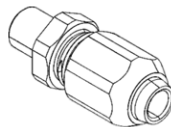
When there is excess length of a wire when routing it to equipment, avoid to adjust the length by rolling the wire in loop. It is recommended a way of routing without increasing the bending angle of the wire in the length adjustment work.



◆ Preparation

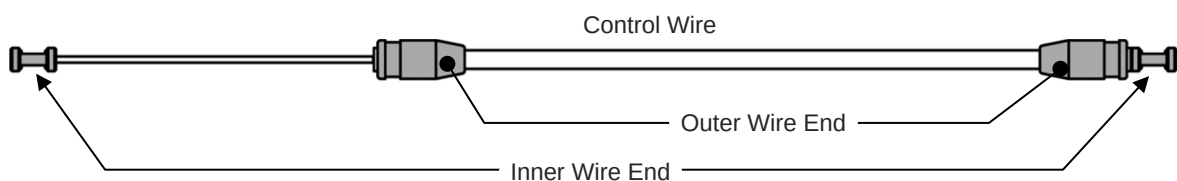
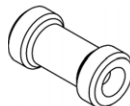
- Hex Wrench or Torque Wrench Parallel Faces: 1.5mm
- Nippers / Pliers / Wire Cutter
- Crimping Tool (JIS C9711 Nominal Size 1.25)
- Wire Stripper (AWG24-26)
- Scale
- Caliper
- Protection Equipment (e.g. Cotton Work Gloves)
- Outer Wire End for Replacement

Model
EC-OWE



- Inner Wire End for Replacement

Model
EC-IWE



◆ Adjustment Procedures

1. Cut the inner wire end on the side to cut it shorter.



2. Pull out the inner wire once so it would not be cut together when cutting the outer wire.



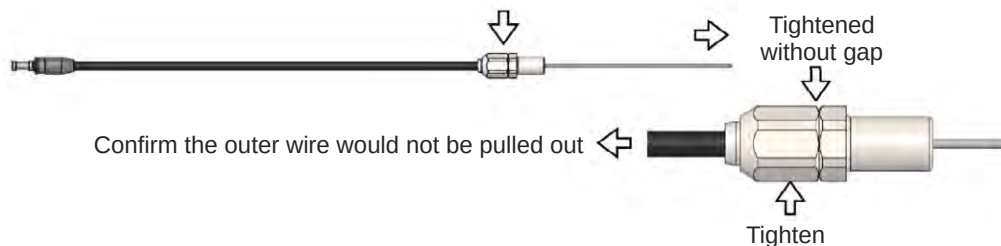
3. Cut the outer wire with nippers / pliers / wire cutters.
As the outer wire is a hard steel wire, it requires a large force to cut it.
Neaten the roundness of the collapsed cut face after cutting.



4. Insert the outer wire end till the end to attach it.



5. Tighten it up till the gap in the outer wire end is tightened. (Tightening torque 0.1Nm)
Put the inner wire back.



6. Insert the inner wire end to the wire.
If sheath on the inner wire is removed, the wire gets loose and gets difficult to insert.



7. Cut the inner wire to the length of the wire stroke, and remove sheath at the end.
Set the inner wire end at the other end close to the outer wire end to measure the stroke.
A wire stripper with its cable size AWG24-AWG26 should be used to remove sheath.



8. Crimp the inner wire end.
- Set the inner wire end to the inner wire at the area where sheath was removed, and crimp it with a crimping tool.



Crimping Tool

Non-insulated crimp-type terminal lug for cable / for slave JIS C9711 spare size 1.25

(Reference) Crimping Tool and Recommended Crimp Count

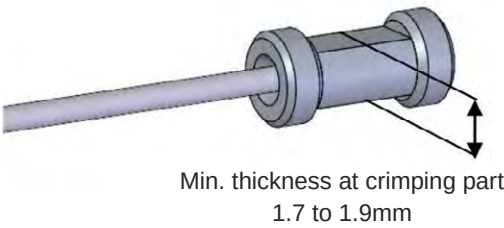
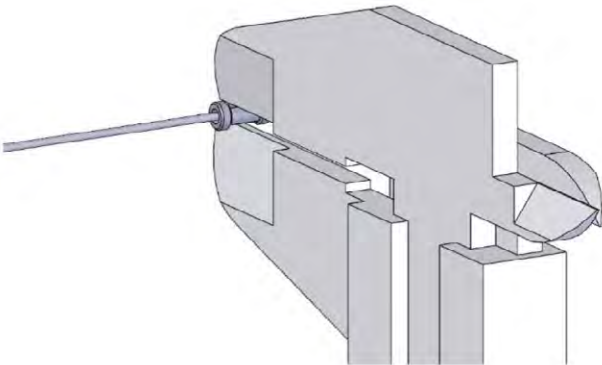
Manufacturer	Brand Name	Model	Nominal Size	Crimp Count
MINORU-TEC CO.,LTD.	MARVEL	MH-5/MH-5S	1.25	1
Lobtex Co., Ltd.	LOBSTER	AK1MA2	1.25	1
JEFCOM.CO.JP.	JEFCOM	DC-2MAS	1.25	1
Maxell Izumi Co., Ltd.	IZUMI	PALM-125A	1.25	1
Tsunoda Corporation Limited.	TSUNODA	TP-5	1.25	1
HOZAN CO., LTD.	HOZAN	P-726	1.25	2
NICHIFU Co.,Ltd.	NICHIFU	NH-69	1.25	2

Crimping condition may differ depending on the crimping tool to use.

Measure the thickness at the crimped area with a caliper, and crimp it to 1.7 to 1.9mm.

Crimping should complete if the thickness comes to 1.7 to 1.9 in one time of crimping.

If it is thicker than 1.9 in one time, turn the wire end by 180deg and crimp it for the second time.



2.7 Interface box installation

This product requires connection of an interface box.

For details regarding electrical such as wiring, refer to [ELECYLINDER Electricity Section Instruction Manual (ME3816) 3.2 Interface box installation and wiring] provided separately.

- Is there is no dust and splash proof function in the interfacing box, pay attention not to have it exposed to water or dust.
- The interface box can be mounted on two body surfaces.
(Interface box orientation is irrelevant)

Horizontal surface mounting

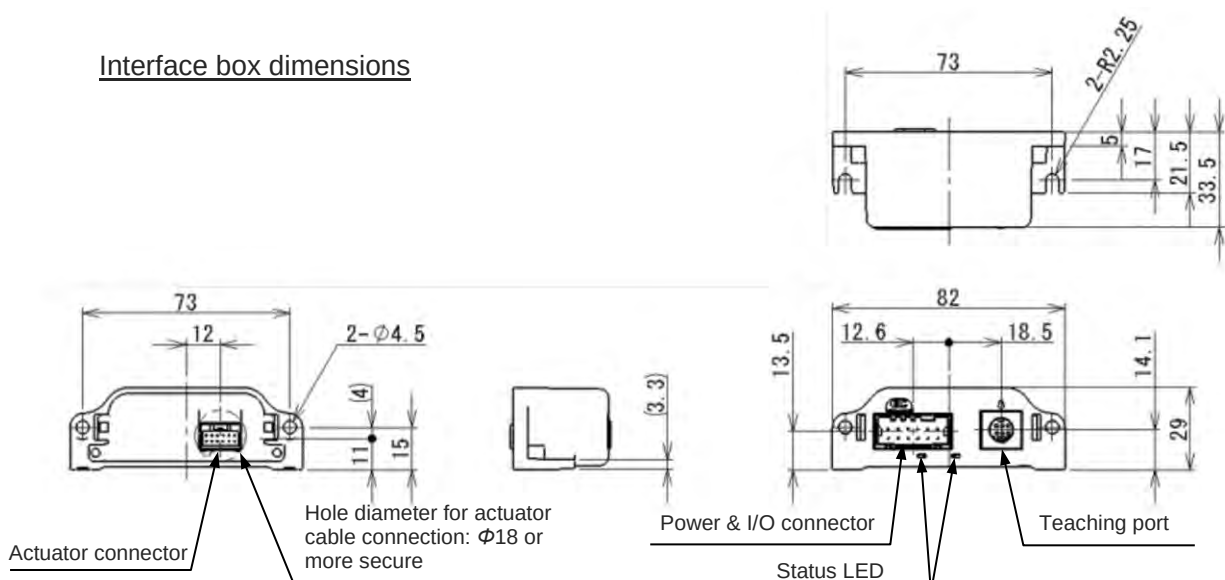


Vertical surface mounting



- When mounting the interface box on a vertical surface, prepare a cable pass-through hole of $\Phi 18\text{mm}$ or more for the actuator.

Interface box dimensions



- The solderless ring tongue terminal (0.5-5 R type) on the interface box conversion cable should be fixed at a position where it can be used as a FG (frame grounding).
(Fasten jointly with the interface box fixing bolt, or fix with a dedicated screw holes)
- Install the wireless specification interface box so that it is not separated from the touch panel teaching pendant by metal panels, etc. Obstacles of this kind may adversely affect wireless communication.

ELECYLINDER

Chapter 3

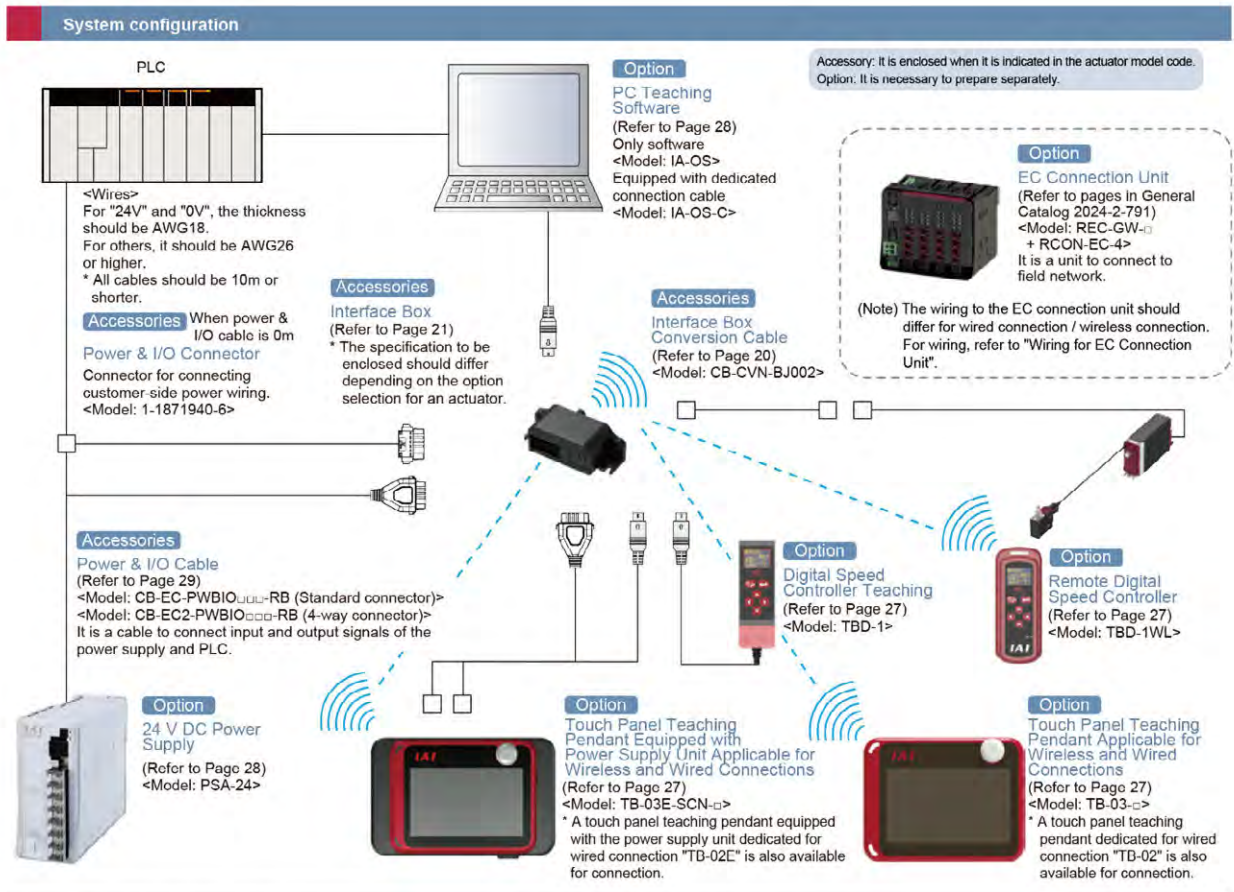
Electricity and Control

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3.1 System configuration

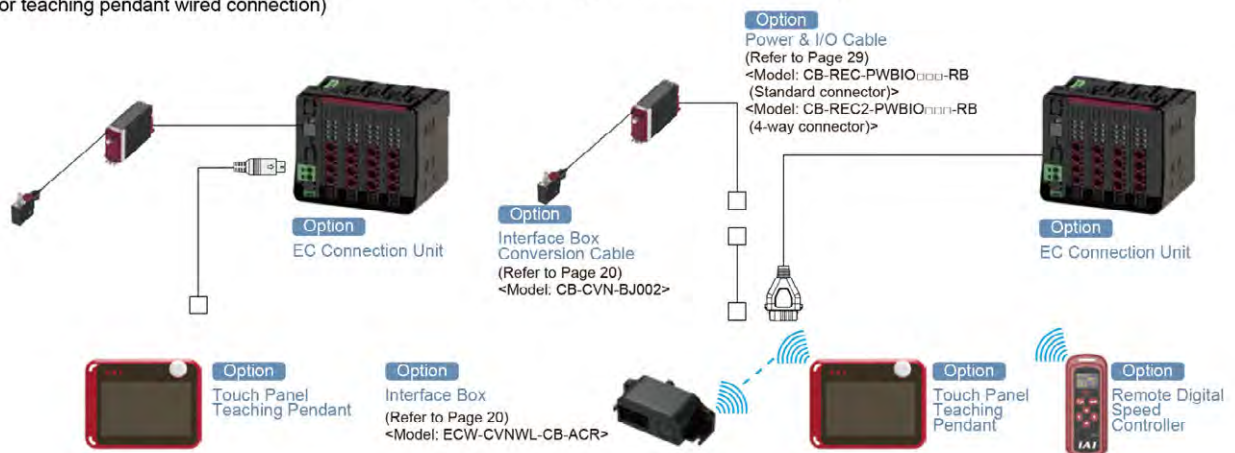
Reference

- For electric / control details such as electrical specification, wiring, connection, parameters and how to control, and also trouble shooting, refer to [ELECYLINDER Electric Section Instruction Manual (ME3816)] provided separately.



Wiring for EC Connection Unit
(For teaching pendant wired connection)

(For teaching pendant wireless connection)



Supply 24V DC to the wire cylinder and input a signal from a master device to the wire cylinder. This enables the wire cylinder to operate.
This manual introduces an example using a PLC connected as the master device.

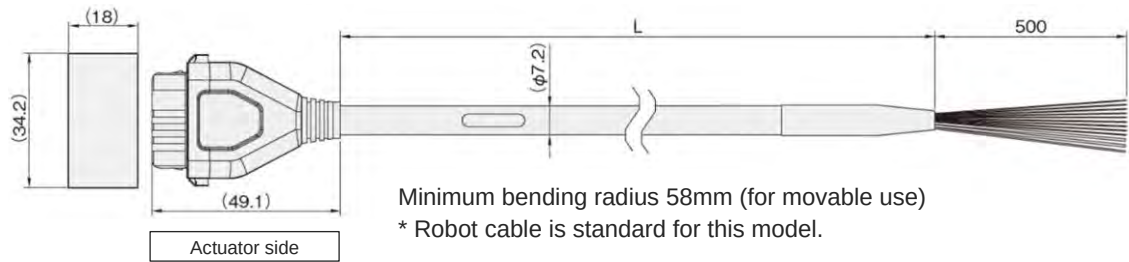
3.2 Cable and Connector

3.2.1 Power & I/O cable

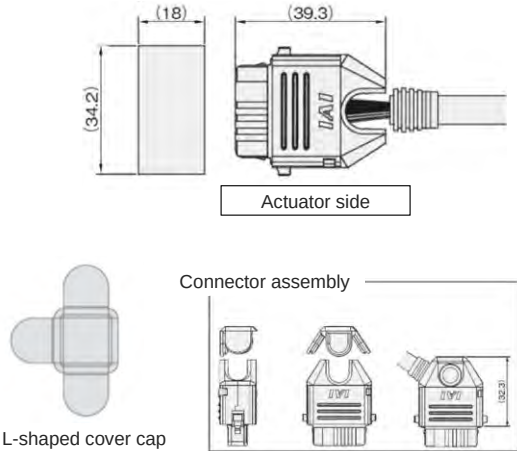
It should come with the product when the cable length is indicated in the model code. (except for the option RCON-EC Connection Type (-ACR))

◆ Model CB-EC-PWBIO□□□-RB (Standard connector): Accessories
CB-EC2-PWBIO□□□-RB (4-way connector)

- Standard connector



- 4-way connector



Color	Signal name		Pin No.
	2-Point Positioning	3-Point Positioning	
Black (AWG18)	0V	0V	A1
Red (AWG18)	24V	24V	B1
Light blue (AWG22)	(reserve) (Note 1)	(reserve) (Note 1)	A2
Orange (AWG26)	ST0	ST0	B3
Yellow (AWG26)	ST1	ST1	B4
Green (AWG26)	RES	(reserve)	B5
Pink (AWG26)	(reserve)	RES	B6
Blue (AWG26)	LS0/PE0	LS0/PE0	A3
Purple (AWG26)	LS1/PE1	LS1/PE1	A4
Gray (AWG26)	*ALM	LS2	A5
White (AWG26)	(reserve)	*ALM	A6
Brown (AWG26)	BKRLS	BKRLS	B2

Note 1 24V (control) when 2-circuit power supply specification (TMD2) are selected.

(Note) Cable in yellow green and light gray not in use.

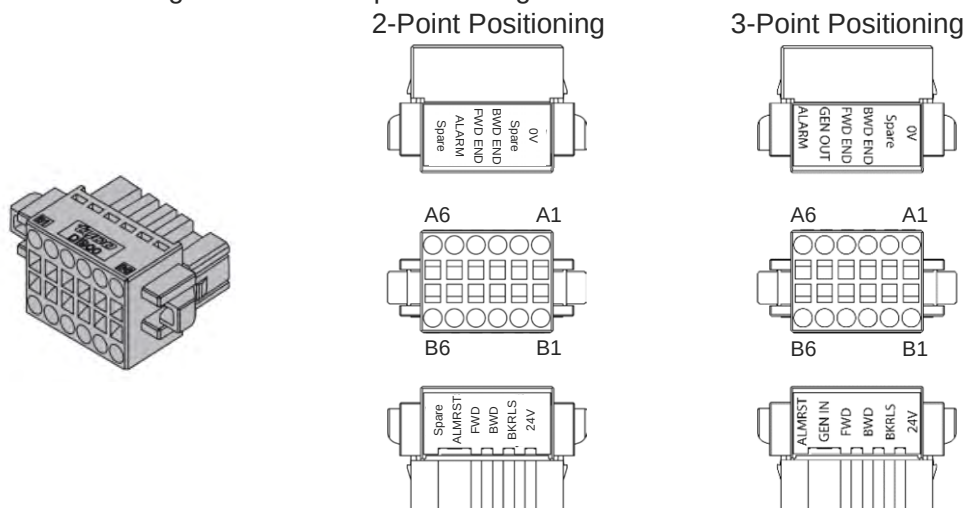
(Note) The signal name of Pin No. B3 is FWBW and Pin No. B4 is not for use in the single solenoid type.

- The wiring on the opposite side of the connector has not been processed.
- The cable length (L) is available from 1m to 9m. Specify the length in increments of 1m.
- Sample model number: Cable length 3m → CB-EC(2)-PWBIO030-RB

3.2.2 Power & I/O connector (Accessories)

It should be enclosed when "0" is indicated in the model code for the cable length. (Excluding option RCON-EC connection specification (-ACR))

Connector for connecting customer side power wiring.



Option	Connector Single Model Code
None	1-1871940-6
TMD2 (2-circuit power supply specification)	1-1871940-6-TMD2
MF (3 position mode specification)	1-1871940-6-MF * MF+TMD2 Type with Seal Enclosed
Described in English	1-1871940-6-ENG

Pin No.	Signal name		Function
A1	0V		Ground
A2	Spare (CP: 2-circuit power supply specification)		Spare (24V for control power supply when power supply 2-system specification)
A3	BWD END		Backward completion (Pressing complete 0 when pressing operation)
A4	FWD END		Forward completion (Pressing complete 1 when pressing operation)
A5	2-Point Positioning	ALARM	Alarm Output
	3-Point Positioning	General OUT	Intermediate Point Complete
A6	2-Point Positioning	Spare	Spare
	3-Point Positioning	ALARM	Alarm Output
B1	24V (MP: 2-circuit power supply specification)		24V power supply (24V for motor power supply when power supply 2-system specification)
B2	BKRLS		Brake release input
B3	BWD ^(Note 1)		Backward command
B4	FWD ^(Note 1)		Forward command
B5	2-Point Positioning	ALMRST	Alarm Clear Signal Input
	3-Point Positioning	General IN	Spare
B6	2-Point Positioning	Spare	Spare
	3-Point Positioning	ALMRST	Alarm Clear Signal Input

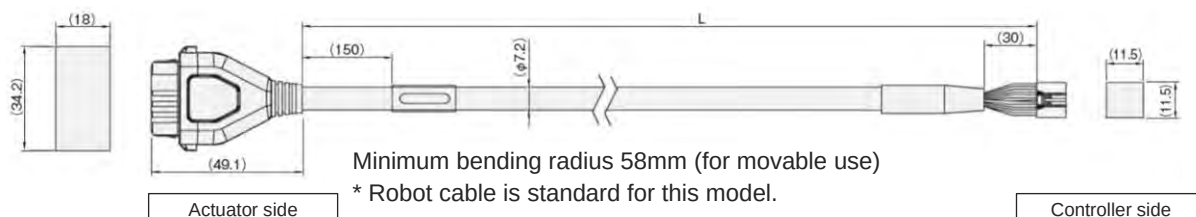
Note 1: B4 should not be used and B3 should be the forward/backward command in the single solenoid system.

3.2.3 RCON-EC connection specification - Power & I/O cable

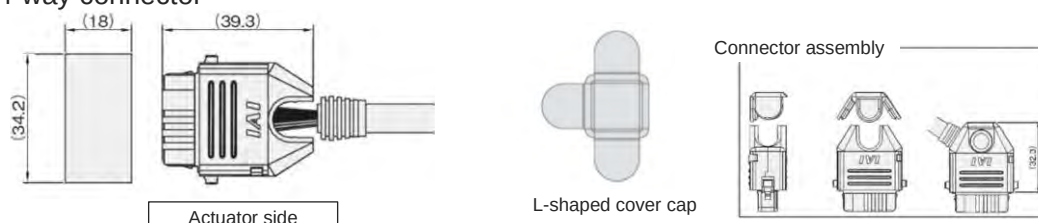
It should come with the product RCON-EC Connection Type (-ACR)) is selected in the option.

◆ Model CB-REC-PWBIO□□□-RB (Standard connector): Accessories CB-REC2-PWBIO□□□-RB (4-way connector)

• Standard connector



• 4-way connector

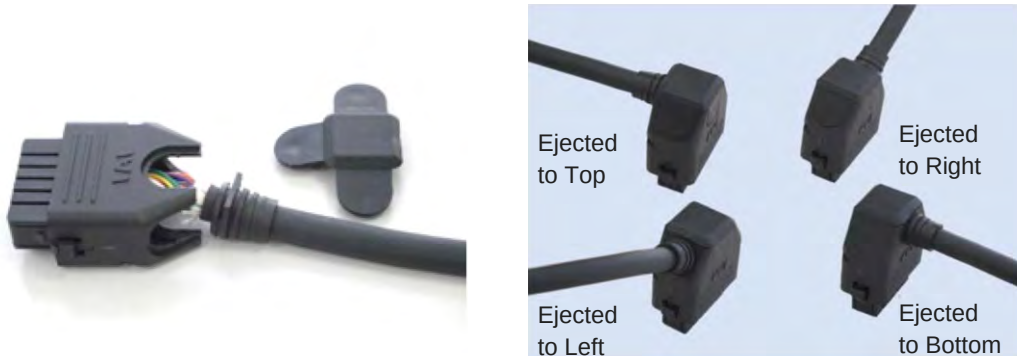


Color	Signal name	Pin No.	Pin No.	Signal name	Color
Black (AWG18)	0V	A1	2	0V	Black (AWG18)
Red (AWG18)	24V (MP)	B1	1	24V (MP)	Red (AWG18)
Light blue (AWG22)	24V (CP)	A2	12	24V (CP)	Light blue (AWG22)
Orange (AWG26)	IN0	B3	7	OUT0	Orange (AWG26)
Yellow (AWG26)	IN1	B4	8	OUT1	Yellow (AWG26)
Green (AWG26)	IN2	B5	9	OUT2	Green (AWG26)
Yellow green (AWG26)	SD+	B6	6	SD+	Yellow green (AWG26)
Light gray (AWG26)	SD-	A6	10	SD-	Light gray (AWG26)
Blue (AWG26)	OUT0	A3	3	IN0	Blue (AWG26)
Purple (AWG26)	OUT1	A4	4	IN1	Purple (AWG26)
Gray (AWG26)	OUT2	A5	5	IN2	Gray (AWG26)
Brown (AWG26)	BKRLS	B2	11	BKRLS	Brown (AWG26)
			13	FG	Green (AWG26)

- The wiring on the opposite side of the connector has not been processed.
- The cable length (L) is available from 1m to 9m. Specify the length in increments of 1m.
- Sample model number: Cable length 3m → CB-REC(2)-PWBIO030-RB

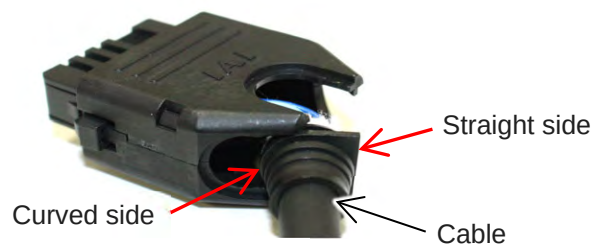
■About 4-way Connector

It is a cable capable to change the orientation of the connector in four ways.



Follow the process bellow to build up the connector in the orientation of your demand.

- 1) Insert the cable by sliding it from the curved side of the cable-end to your desire direction.



- 2) Be sure to check that the cable is settled firmly and insert two tabs of the cover along the slits of socket.



- 3) Then, push the last tab to the socket.

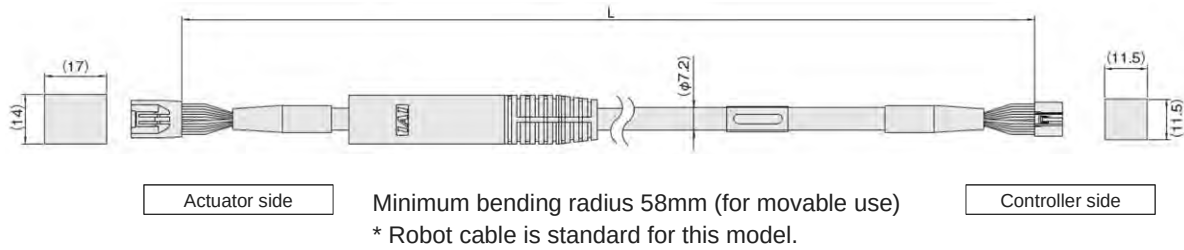


3.2 Cable and connector

3.2.4 Relay Extension Cable for RCON-EC Connection

It is to be used to extend the power supply I/O cable for the RCON-EC connection specification.

◆ Model CB-REC-PWBIO□□□-RB-JY



Color	Signal name	Pin No.	Pin No.	Signal name	Color
Black (AWG18)	0V	2	2	0V	Black (AWG18)
Red (AWG18)	24V (MP)	1	1	24V (MP)	Red (AWG18)
Light blue (AWG22)	24V (CP)	12	12	24V (CP)	Light blue (AWG22)
Orange (AWG26)	OUT0	7	7	OUT0	Orange (AWG26)
Yellow (AWG26)	OUT1	8	8	OUT1	Yellow (AWG26)
Green (AWG26)	OUT2	9	9	OUT2	Green (AWG26)
Yellow green (AWG26)	SD+	6	6	SD+	Yellow green (AWG26)
Light gray (AWG26)	SD-	10	10	SD-	Light gray (AWG26)
Blue (AWG26)	OUT0	3	3	IN0	Blue (AWG26)
Purple (AWG26)	OUT1	4	4	IN1	Purple (AWG26)
Gray (AWG26)	OUT2	5	5	IN2	Gray (AWG26)
Brown (AWG26)	BKRLS	11	11	BKRLS	Brown (AWG26)
Green (AWG26)	FG	13	13	FG	Green (AWG26)

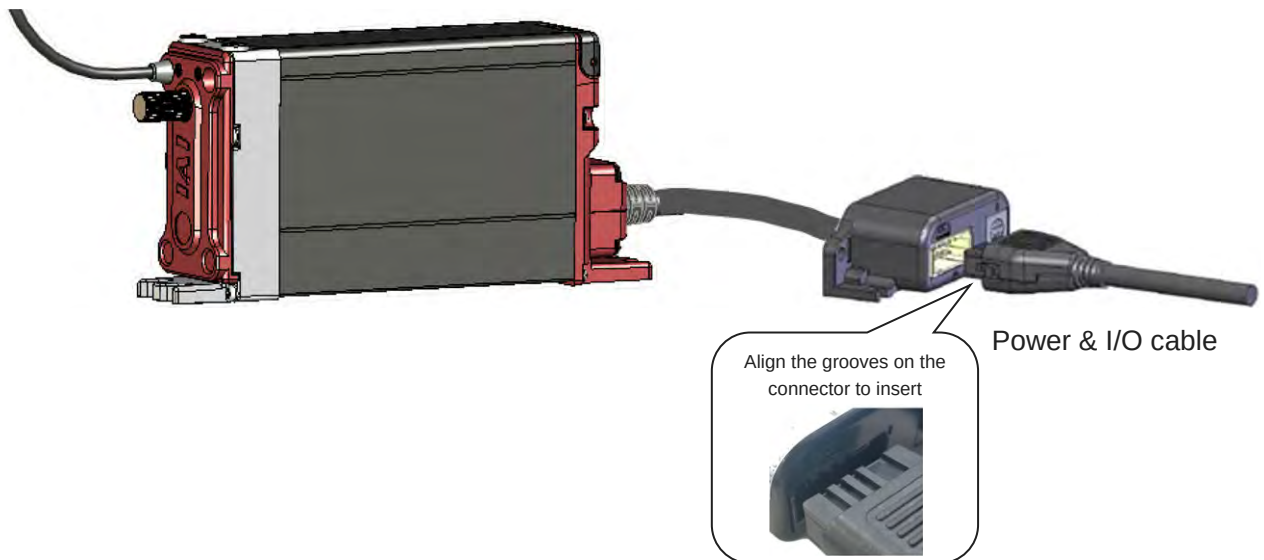
- The unit of 1m is the standard (1 to 9m). 0.5m is also in the standard.
Any length halfway out of above should be the special specification.
- Sample model number: Cable length 3m → CB-REC-PWBIO030-RB-JY

(Note) Select the length of cables to make the total of the power & I/O cable in the RCON-EC connection specification and the relay extension cable above at 10m or less.

3.2.5 Power & I/O cable connection

Connect the power & I/O cable to an interface box.
Insert it till it makes a “click” noise.

[Cable connection diagram]



Caution

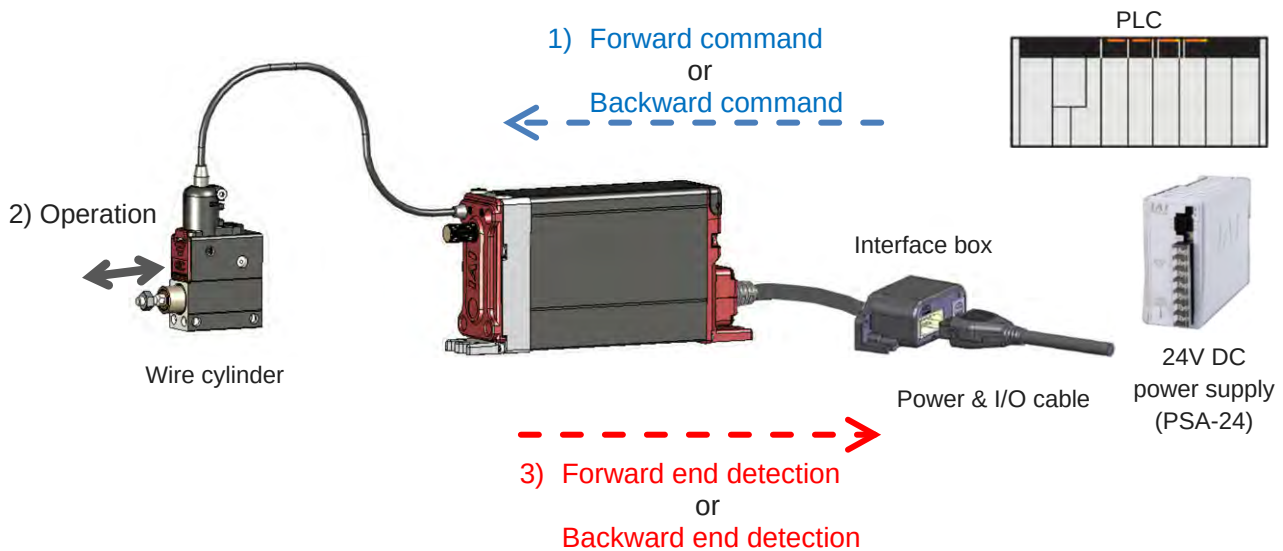
- The connector must be inserted in a given direction.
Align the arrow on the connector and insert until you hear the click.
- Take appropriate care to prevent unused wiring in the loose wire end on the cable from shorting out other wires by protecting them with insulation tape.

3.3 Basic operation

An input signal from a master device to the wire cylinder triggers operation of the wire cylinder. The wire cylinder status can also be determined when the master device receives signal output from the wire cylinder.

Control is just as simple as when using a solenoid valve (SOL valve) and air cylinder drive. Shown below is an image when connecting wire cylinder with PLC as the host device.

- Image of Connecting PLC and wire cylinder (Drive Between 2 Points)
 - 1) Input a movement command signal from the PLC. (forward or backward)
 - 2) The wire cylinder operates.
 - 3) A position detection signal is output from the wire cylinder. (forward end or backward end)



Reference

- Refer to [ELECYLINDER Electricity Section Instruction Manual (ME3816)] provided separately for details of control systems.

3.4 Operation and Setting

3.4.1 Wire Pulling (Pressing)

A wire cylinder activates by pulling wires. By moving a slider on a wire controller, a wire should be pulled.

A wire cylinder is available for both positioning operation and pressing operation.

As wires could receive influence of stretch, abrasion, temperature change and bending angle, the movement volume at the tip may fluctuate for positioning operation. In case an accurate positioning is required, it is recommended to have an external stopper to perform pressing operation.

When it is required to clamp a workpiece in the rod type, use the pressing operation.

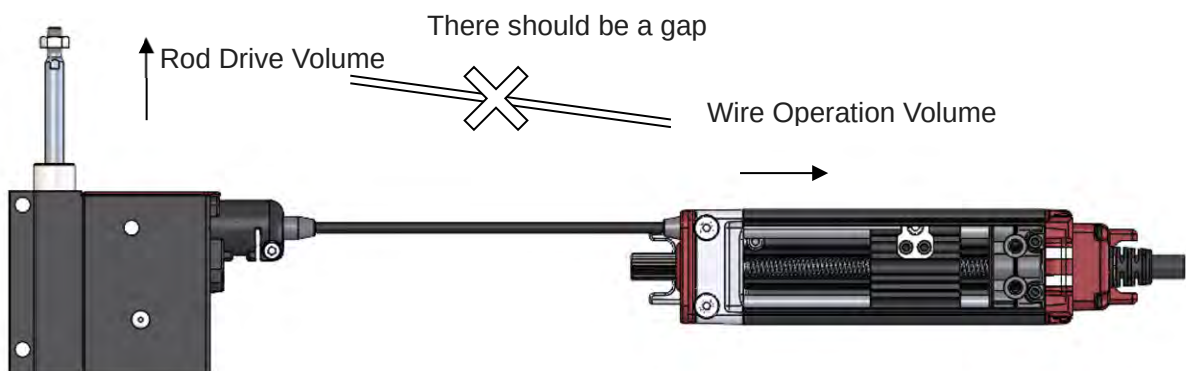
When it is required to grip a workpiece in the gripper type, use the pressing operation.

3.4.2 Wire Operation Amount and Actuator Output Terminal Movement Amount

The operation setting of a wire cylinder should be made by the operation volume of wires of a wire controller.

As there is some gap between the movement amount on the actuator output end and wire operation amount, it is necessary to set the wire operation amount in accordance with the actual condition of use.

The setting of the pressing force should be the pulling force (reference) of a wire controller. The output load of an actuator should be lower than the wire pulling force of a wire controller due to influence of the wire routing and the actuator internal structure.



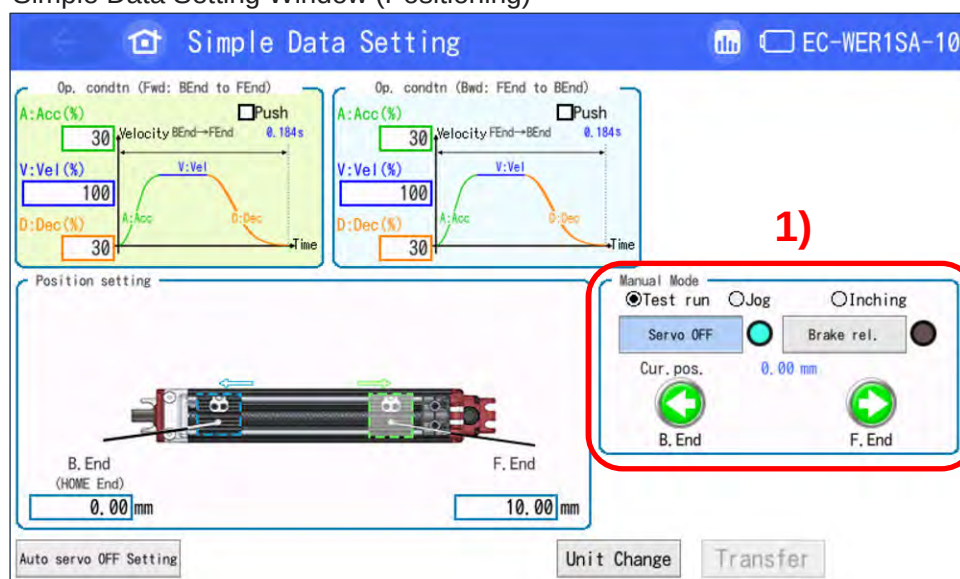
3.4.3 Stop Position / Operational Condition (AVD) / Pressing Force

Operation and settings of a wire cylinder should be the same as those described in [ELECTRICITY Section Instruction Manual (ME3816)] provided separately. Refer to it for details of how to control.

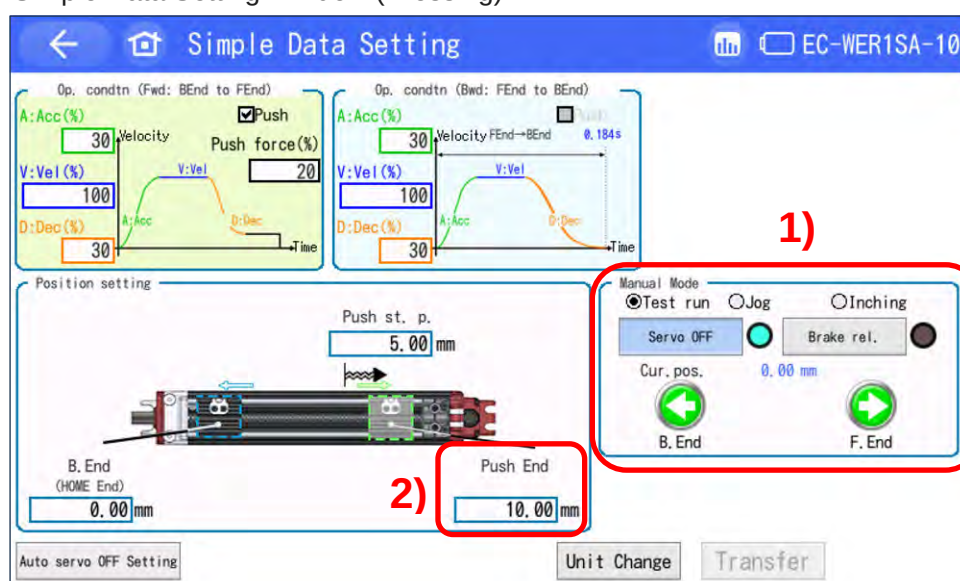
Here, describes areas different from the ways to control described in [ELECTRICITY Section Instruction Manual (ME3816)] provided separately.

- 1) At the right bottom of the simple data setting window, the button for manual mode should be fixed, and it cannot be switched to the display of transfer history.

Simple Data Setting Window (Positioning)



Simple Data Setting Window (Pressing)



- 2) It is available to set up the push end during the simple pressing operation.
(Refer to 3.4.4, 3.4.5)

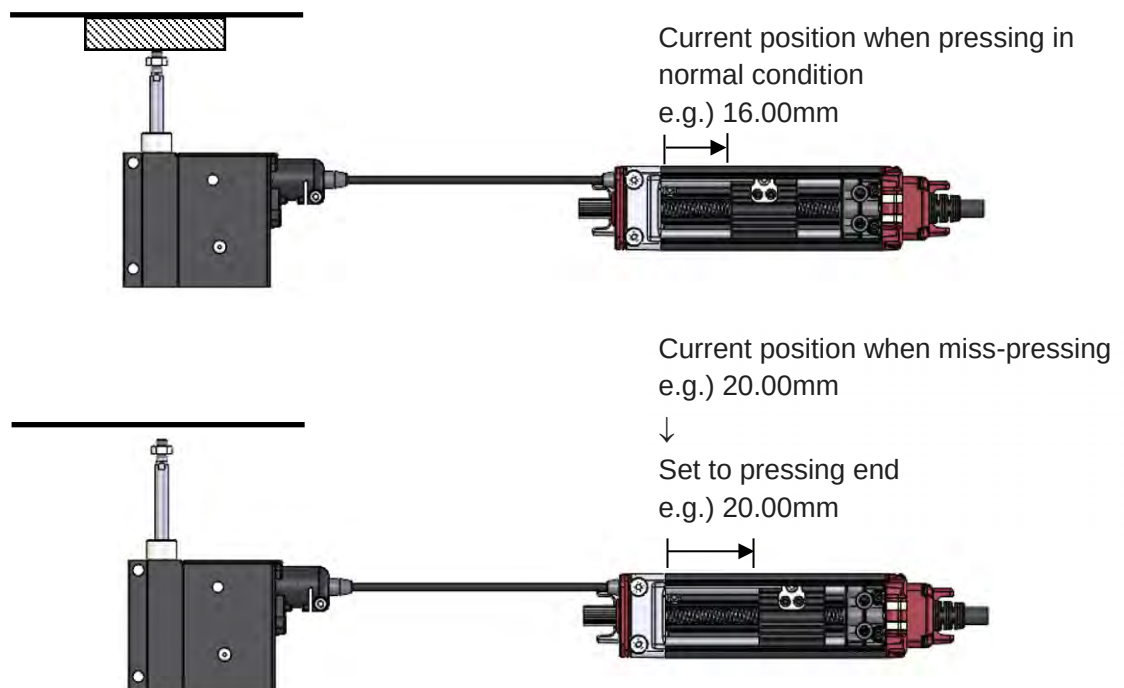
3.4.4 How to Check Miss-Pressing of Wire Rod

The wire rod is not set to judge miss-pressing of a rod in the initial setting.

It is necessary to adjust the pressing end of a wire controller (position data edit) when it is required to make judgment of miss-pressing.

After installing a wire rod and routing wires, make adjustment below.

- 1) Press a workpiece towards a rod to read the current position of a wire controller.
As there is fluctuation in pulling volume (approx. 0.3 to 1 mm) for the initial running-in soon after wires are routed, make operation for about 100 times for running-in.
- 2) Take the workpiece off and forward the rod to a position where it is judged as miss-pressing.
Forward the actuator with the wire controller with the JOG operation or by turning the manual operation knob.
Read the current position of the wire controller.
- 3) Input the current position that was read in 2) to the pressing end.
With this, miss-pressing of the rod and the slider position of the judged wire controller should be set.
- 4) Perform pressing in a trial run to check the output of the pressing complete signal.
When the pressing finishes in normal condition, the pressing complete signal should turn on.
When the pressing ends with a miss-pressing, the pressing complete signal should be kept off.
As the judgment should not be stabled when the pressing normal condition and the current position of the miss-pressing are close to each other, set up the pressing end by checking the pressing complete signal.



3.4.5 How to Check Miss-Gripping of Wire Gripper

In the default of a wire gripper on delivery, it is not set to judge miss-gripping.

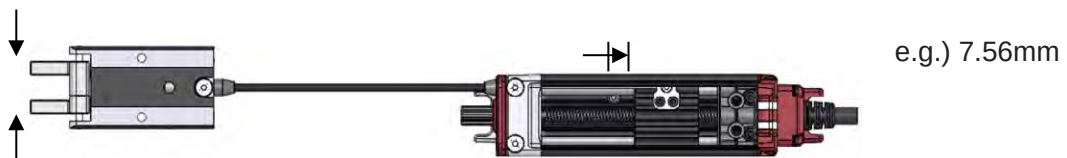
When it is required to judge miss-gripping, it is necessary to adjust the pressing end (position data edit) of a wire controller.

After installing a wire gripper and routing wires, make adjustment below. The explanation below takes EG Type (outer grip) as an example. The directions to open and close fingers should be in the opposite ways for IG Type (inner grip).

- 1) Without a workpiece, make a miss-gripping operation (pressing) to fully close the fingers. Have the pressing force at the setting of use, and set the pressing end position at 10.05mm (default).

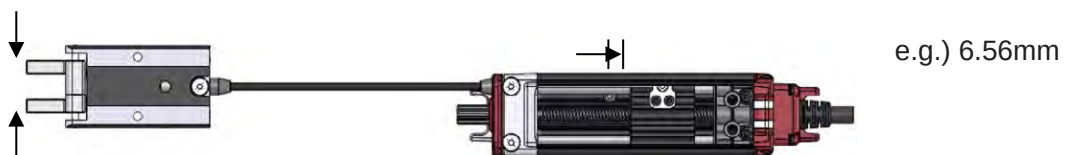
Read the current position of the controller where the fingers has stopped fully closed.

As there is fluctuation in pull-in amount (approx. 0.3 to 1mm) due to initial fit-in at the beginning after wires are routed, have fit-in operation for approximately 100 times to settle them down before reading the current position.

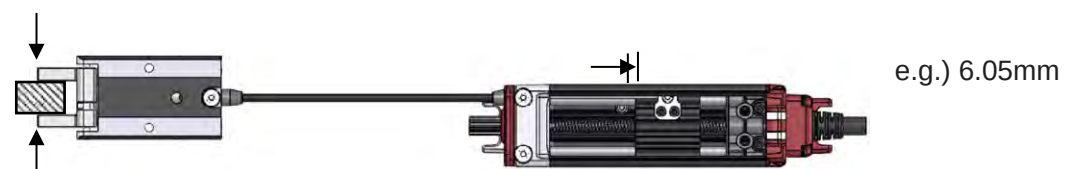


- 2) Set the position -1mm from the current position read in 1) to the pressing end position. Perform a gripping operation to confirm that miss-pressing (pressing complete signal off) gets output at the fully closed position.

In case the miss-pressing does not output (pressing complete signal on), make the pressing end position smaller.



- 3) With a workpiece, perform gripping operation (pressing) to confirm that the workpiece is gripped without miss-pressing (pressing complete signal on). Also, at that time, make sure that the current position is stopped before the pressing end position. If it gets judged miss-pressing even if gripping is performed in normal condition, make the pressing end position larger.



Caution When the positions of fingers with a workpiece gripped is close to the fully closed, the normal gripping and miss-gripping get too close and stable judgment cannot be gained. Have the gripping point close to the center of the finger stroke.

3.5 Teaching tools

For setup and operation of wire cylinder, the following teaching tools are to be used.

◆ Digital speed controller teaching / Remote digital speed controller



Digital speed controller teaching (Wired)
TBD-1



Remote digital speed controller (Wireless)
TBD-1WL

Refer to [Digital Speed Controller / Digital Speed Controller Teaching / Remote Digital Speed Controller (ME3818)] for how to use them.

◆ Touch panel teaching pendant



TB-03 (Wireless/Wired)



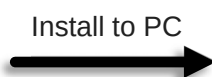
TB-02 (Wired)

Refer to [ELECYLINDER Applicable Teaching Pendant TB-03 (Wireless: ME0375 / Wired: ME0376)] or [ELECYLINDER Applicable Teaching Pendant TB-02 (ME0355)] for how to use them.

◆ IA-OS (PC teaching software)



IA-OS

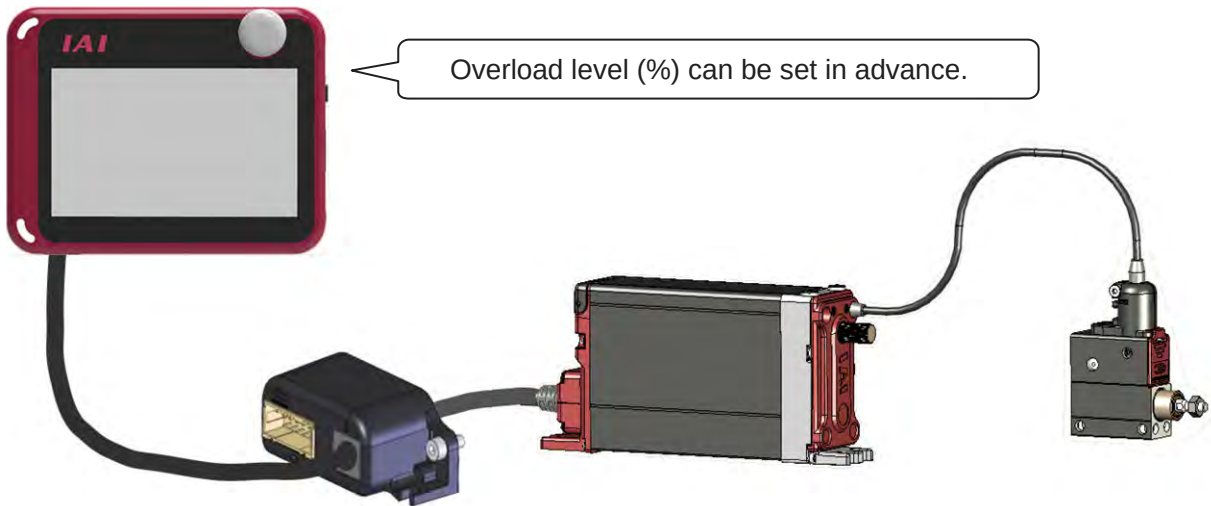


Refer to [IA-OS Fast Step Guide (ME0391)] for how to install.
Refer to the [help window in IA-OS] for how to use.

3.6 Preventive/predictive maintenance

The wire cylinder has a **predictive maintenance function** that notifies the user with an "overload warning" when the load exceeds normal status.

It also has a **preventive maintenance function** that prompts the user to perform maintenance if the travel count or the travel distance exceeds the set values.



Preventative maintenance	Predictive maintenance
Travel distance (km/m)	Overload warning
Travel count (times)	

If the criteria are set in advance, the LED built into the body will flash green/red to notify that the maintenance period is up.

Preventative maintenance

- Regular maintenance that is performed based on a reference period regardless of whether or not there are equipment breakdowns.
- Prevents unexpected breakdowns.
- Extends service life.

Predictive maintenance

- Maintenance that is performed when, based on regular equipment monitoring, an abnormality is predicted to occur.
- Predicts unexpected breakdowns.
- Prevents sudden line stoppages.

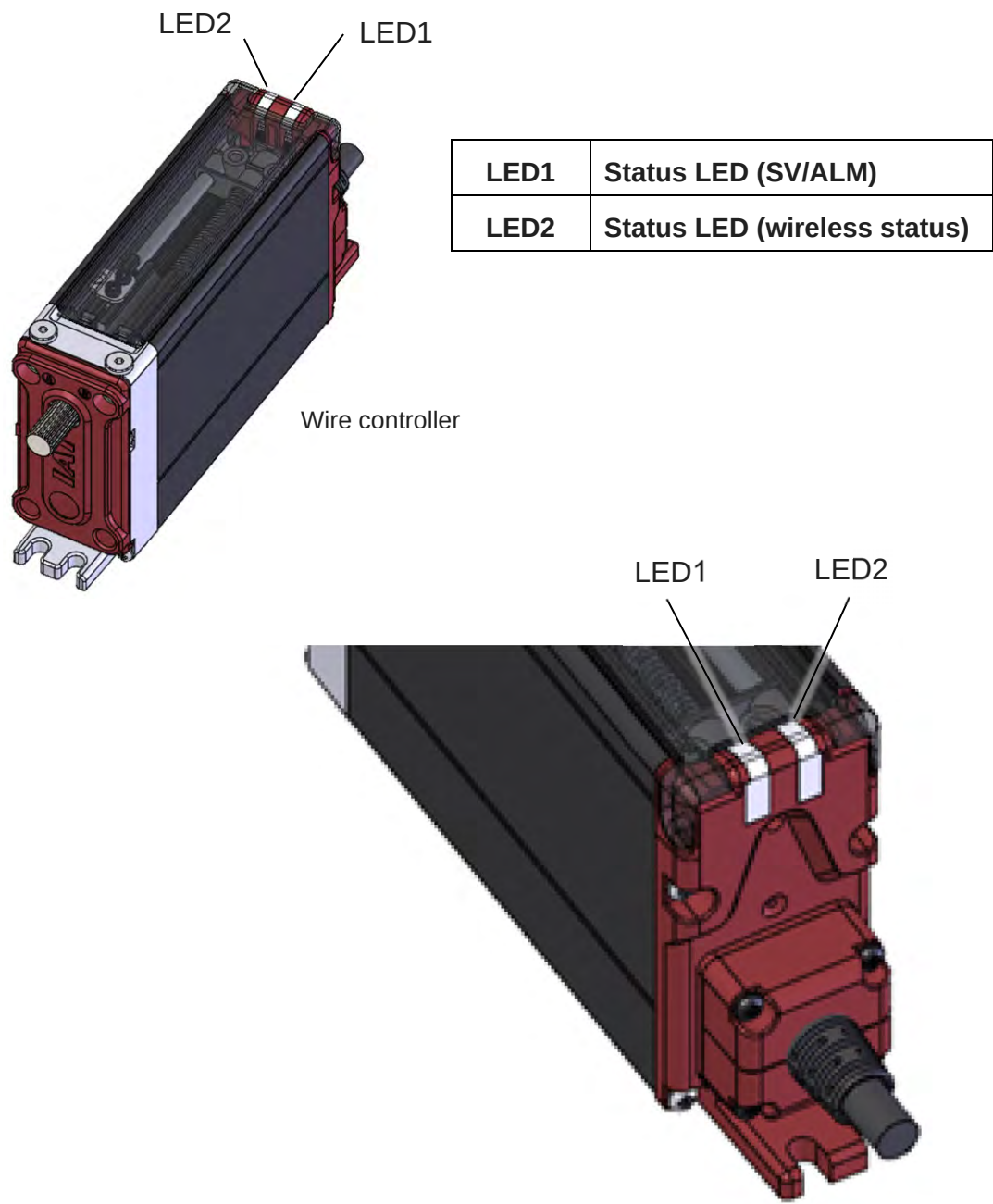
Reference

- Refer to [ELECYLINDER Electricity Section Instruction Manual (ME3816)] provided separately for how to set up / how to use the preventive and predictive maintenance functions.

3.7 Wire Cylinder Condition and Check Items at Trouble Occurrence

3.7.1 Wire Cylinder Condition (LED display)

The condition of a wire cylinder can be checked in the status LED lamps on the wire controller.



A wire cylinder is capable of adding displays for such as "Forward End / Backward End" like the auto switch on an air cylinder to the LED lamps. (When setting in Parameter No. 10: LED Lighting System Automatic Switch Setting = "Enable")

[1] Ordinary Status LED Display

If Parameter No. 10 is set to "Disable (default setting on delivery from factory)" and the ordinary status LED display (servo-on/off, emergency stop, alarms, wireless status, etc.) should be performed.

● : Light ON, ★ : Blinking, × : Light OFF

LED1	LED2	Color	Operation status
×	×	-	Power OFF
			Servo OFF
●	●	Orange	In Initializing at Startup
×	★	Green	In Wireless Connection
×	★	Red	Wireless Hardware Error
●	×	Red	Alarm
	×		In Emergency Stop
★↔★	×	Green, Red	Minor malfunction alarm
●	×	Green	Servo ON
★	×	Green	In process of automatic servo OFF

[2] LED Display when LED Lighting System Automatic Switch Setting = "Enable"

If Parameter No. 10 is set to "Enable", "Forward End / Backward End", "Pressing Complete" and "Miss-Pressing Detected" should be shown in addition to the ordinary status LED displays.

● : Light ON, ★ : Blinking, × : Light OFF

LED1	LED2	Color	Operation status
In addition to LED displays in "Disable", following displays are to be added.			
×	●	Orange	Backward End [LS0]
●	×	Orange	Forward End [LS1]
×	★	Orange	Pressing Complete in Backward End Direction [PE0]
★	×	Orange	Pressing Complete in Forward End Direction [PE1]
×	●	Orange	Miss-Pressing Detected in Backward End Direction
●	×	Orange	Miss-Pressing Detected in Forward End Direction

3.7.2 Troubleshooting confirmations

If a problem occurs, check the following points first in order to ensure quick recovery and prevent recurrence of the problem.

(1) Check status indicator LED

Check the status of LED1 and LED2. Refer to 3.7.1 for LED status.

(2) Check for abnormality in the master device (PLC, etc.)

(3) Check the voltage of the main power supply (24VDC)

Check for momentary power failure, voltage drop, power failure, etc.

(4) Confirm the generated alarm

Check the alarm information with the teaching tool.

(5) Check the connectors for disconnection or incomplete connection

(6) Check the cables for connection error, disconnection or snagging

Cut off the main power supply of the equipment (to avoid electric shock) and remove the cables around the measurement point (to avoid conductivity through the surrounding circuit) before checking the conductivity.

(7) Check the I/O signals

Use the master device and wire cylinder teaching tool to check for inconsistency or abnormality in the input/output signal status of the two units.

(8) Check the noise elimination measures (grounding, connection of noise suppressor, etc.)

(9) Check the events leading to the occurrence of the problem, as well as the operating conditions at the time of occurrence

(10) Analyze the cause

(11) Countermeasures



Caution

- When troubleshooting, exclude normally functioning parts from the targets to narrow down the causes.
- First, check (1) to (10) so that countermeasures can be taken swiftly.

Reference

- Refer to [ELECYLINDER Electricity Section Instruction Manual (ME3816)] provided separately for details / measures of trouble diagnosis and generated alarms.
- For details / measures of the generated alarms, it can also be checked in the help window in IA-OS and the touch panel teaching tool.

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Chapter 4

Maintenance and Inspection

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4.1 Precautions for Maintenance and Inspection Work

Make sure to read the following precautions before conducting any maintenance or inspection work.



Warning

- Do not climb on or put anything on the wire cylinder.

Otherwise, this may lead to accidental falling, injury or damage to the product due to falling objects, product loss of function or performance degradation, or shortening of product life.



Caution

- Check that the power to the wire cylinder is OFF before conducting any maintenance or inspections.
- Be careful not to lose the cover or any removed screws.
Be sure to return the product to the original condition after maintenance and inspection work.
Mounting in an incomplete state may cause injuries or damage to the product.
- Do not modify, disassemble/assemble, or use maintenance parts not specified on your own discretion under any circumstances.



Notice

- First, be sure to wipe off the old grease, and then supply new grease.
- The degradation speed of grease may differ depending on the operating environment (temperature, humidity and ambient atmosphere).

It is recommended to shorten the grease supply period if the actuator is used under poor environmental conditions such as high temperatures, high humidity or dusty atmospheres. Also, it is recommended to improve the environmental conditions in case the grease changes color notably due to poor operating conditions.

- Base oil may separate from the grease due to the mounting orientation or operating conditions.

Base oil may also leak from the inside of the wire cylinder to the exterior through gaps. Check visually for oil drips when supplying grease.

Wipe it off in case of any dripping.

- The wire cylinder stored for 6 months or more may suffer from grease degradation. Supply grease before the start of use.

For details, refer to [4.5 Grease Supply].

4.2 Inspection

Follow the maintenance inspection schedule below.

It is assumed that the equipment is operating 8 hours per day.

If the equipment is running continuously night and day or otherwise running at a high operating rate, inspect more often.

4.2.1 Inspection items and schedule

Inspection period	External inspection	Internal inspection	Grease Supply
Start of work inspection	○	—	—
1-month inspection	○	○	[4.2.2 Grease supply period (Reference)] dependent
3-month inspection	○	○	
6-month inspection	○	○	
Every 6 months thereafter	○	○	

4.2.2 Grease supply period (Reference)

Type	Grease supply period (Reference)
Wire Gripper	10 million times
Wire Rod	10 million times
Wire Controller	10 million times



Caution

- Speed of grease degradation may differ depending on the environment of use (temperature, humidity and peripheral atmosphere).
Supply grease when there is deterioration or abrasion confirmed.

4.3 Visual Inspection

Refer to [4.5 Grease Supply] for detailed information about the greasing method.

Refer to [4.6 Component Replacement] for detailed information about specific component replacement and adjustment methods.

4.3.1 External visual inspection

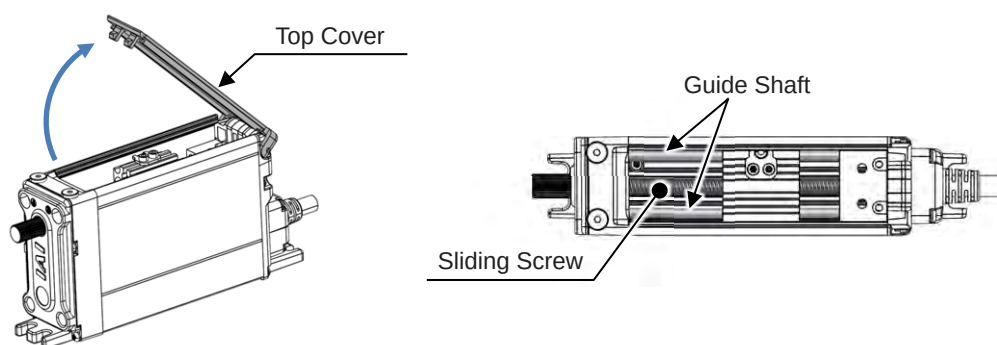
Inspection items	Maintenance work
Is abnormal noise or vibration generated?	Refer to [Troubleshooting in ELECYLINDER Electricity Section Instruction Manual (ME3816)] for help.
Are the wire cylinder mounting bolts loose?	Tighten them further. Refer to the tightening torque
Is the cable scratched?	Replace if the damage is severe.
Is the connector loose?	Re-insert correctly.
Is grease dripping out?	Clean up any drips and replenish the grease.
Is there any abnormal damage on outer wire? (Damage on sheathe, breakage of steel wire or outer end being off)	Replace the control wire

4.3.2 Internal visual inspection

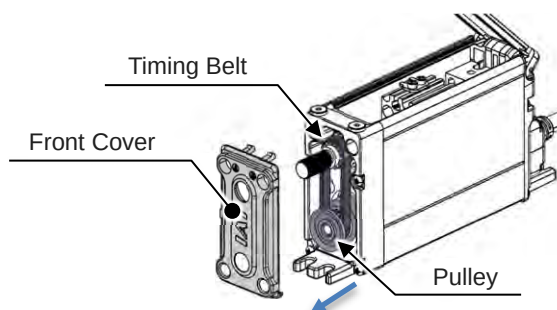
Inspection items	Maintenance work
Looseness on Inner Wire	Adjust again the attachment of inner wire.
Is there any abnormal damage on inner wire? (Abrasion, bending on wire, damage on sheathe or breakage on steel wire)	Replace the control wire.
Condition of sliding screw and guide shafts in wire controller and lubrication of grease	Wipe off the deteriorated grease and supply new grease.
Is the belt significantly worn out on the teeth area? Is there any crack on the teeth area? Is there any chipped tooth?	Consult with IAI when there is abnormality confirmed.
Is the belt hardened, softened or deformed (shrunk or expanded)?	Consult with IAI when there is abnormality confirmed.
Is there any significant abrasion on pulley teeth?	Consult with IAI when there is abnormality confirmed.

[1] How to Inspect Wire Controller

1. Open the top cover and inspect the sliding screw and guide shafts.



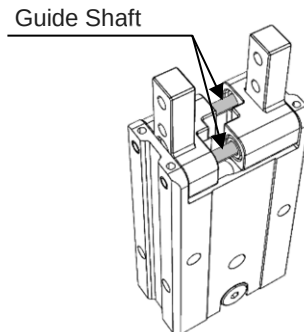
2. Take the front cover off and inspect the timing belt and pulley.



3. Put the top cover and front cover back on.

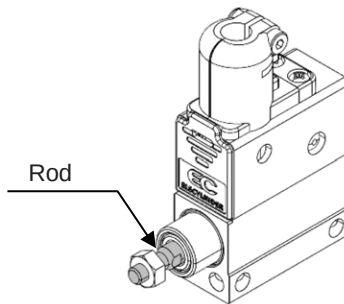
[2] How to Inspect Wire Gripper

1. The guide shaft surfaces should be inspected visually.



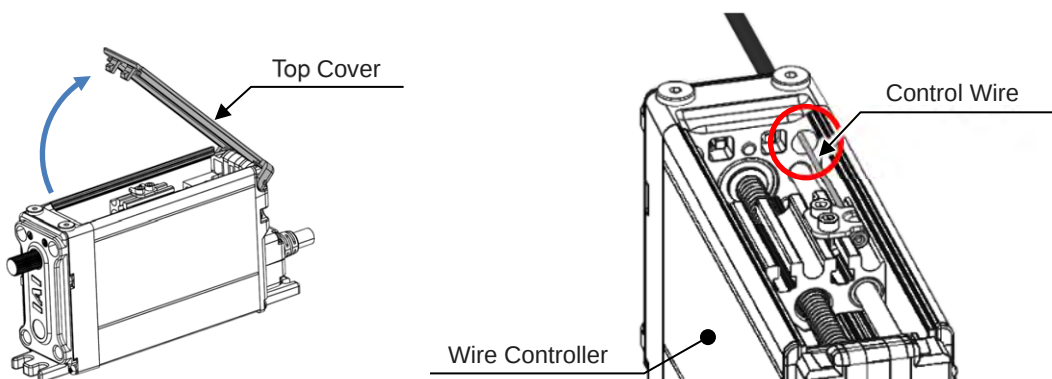
[3] How to Inspect Wire Rod

1. Inspect lubricant condition of the rod and wear debris visually.



[4] How to Inspect Control Wire

1. Open the top cover.
2. Inspect that there is no wear debris occurred at the wire controller connection part.



4.4 Cleaning

4.4.1 External cleaning

- Clean exterior surfaces as necessary.
- For the rod type, if grease base oil etc. drips on the rod sliding surface and its periphery, wipe it off with a soft cloth, etc.
- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air, as it may cause dust to get in through gaps.
- Do not use petroleum-based solvents as they can harm resin and painted surfaces.
- To remove severe buildup, wipe gently with a soft cloth soaked in a neutral detergent or alcohol.

4.4.2 Internal cleaning

- Use a soft cloth to wipe away dirt and buildup.
- Do not blow too hard with compressed air, as it may cause dust to get in through gaps.
- Do not use petroleum-based solvents, neutral detergent or alcohol.

4.5 Grease Supply

4.5.1 Grease to be used



Caution

- Do not attempt to use any grease other than what is indicated.
- Excess supply can increase sliding resistance.

The performance may drop as the load to a motor could increase.

Type	Place to apply	Grease	Manufacturer
Wire Controller	Sliding screw Guide shaft	Grease Multemp AC-D	Kyodo Yushi Co.,Ltd.
Wire Rod	Rod sliding part		
Wire Gripper	Guide shaft		

4.5.2 How to supply grease



Caution

- Do not attempt to supply grease while the machinery is in operation. Turn the power off before start working.
- When using a PC teaching to work, prepare an emergency stop button (emergency stop circuit) within your reach to conduct the work.
- Do not supply grease excessively. It may cause errors.
- If the grease enters your eye, rinse it off your eye with clean water for 15 minutes, and then immediately see a specialist physician for appropriate care.
- After supplying grease, wash your hands well with soap.

◆ Preparation

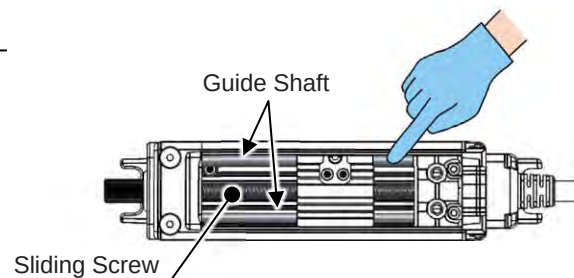
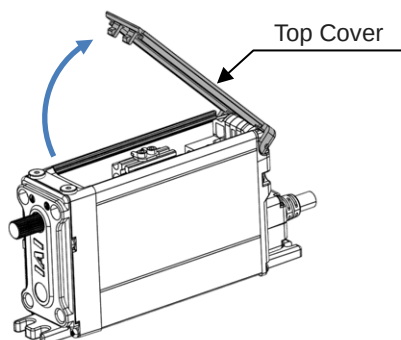
- Protection Equipment (Rubber gloves, etc.)
- Grease

◆ How to supply grease

[1] Wire Controller

1. Open the top cover.
2. Supply grease on the sliding screw and the guide shafts (2 pcs).
3. Close the top cover.

Reference for grease supply volume	
Sliding Screw	0.04g
Guide Shaft	0.02g

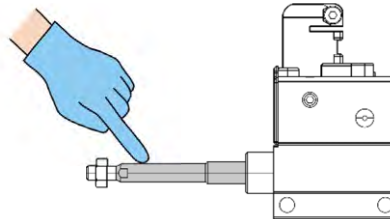


[2] Wire Rod

1. Pull out the rod.

2. Supply grease.

Reference for grease supply volume	
10st	0.02g
20st	0.03g



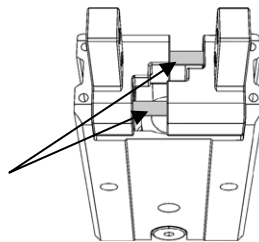
[3] Wire Gripper

1. Supply grease on the guide shafts (2 pcs).

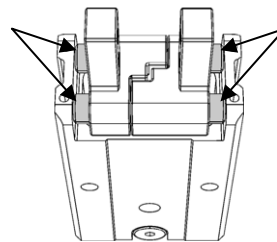
Reference for grease supply volume	
EG	0.002g × 2 places
IG	0.001g × 4 places

- Place to apply

EG: Individual Drive Outer Grip
Specification

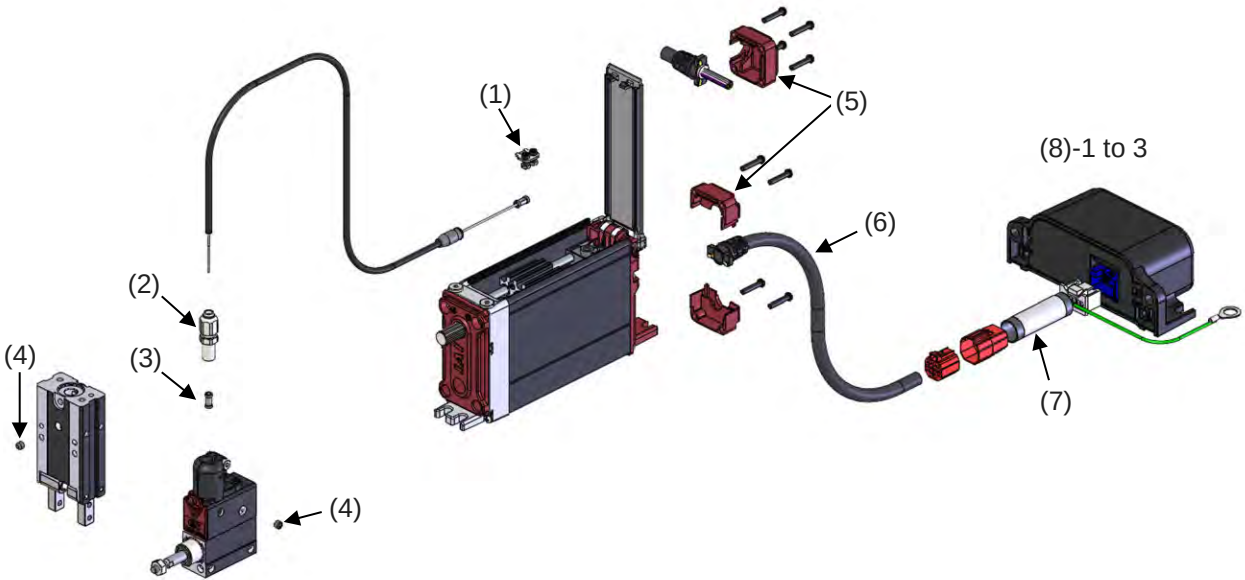


IG: Individual Drive Inner Grip
Specification



4.6 Component Replacement

4.6.1 List of parts for replacement



(1) Control Wire Fixing Bracket
(Enclosed with Bolts and Nuts)

Model
EC-CWF

(2) Outer Wire End (Control Wire)

Model
EC-OWE

(3) Inner Wire End (Control Wire)

Model
EC-IWE

(4) Control Wire Set Screw (M3 × 2.5 Set Screw)

Model
EC-SSW3

(5) Cable Box

Cable ejection direction	Model
Back	EC-CASBR-SLTGD3
Side	EC-CASBS-SLTGD3

(6) Actuator Cable Assembly

Model (□ shows cable length)
CB-EC-GRBP8-MPA□□□-AS

(7) Interface Box Conversion Cable

Model
CB-CVN-BJ002

(8)-1 Interface Box

Wireless	I/O	Model
None	NPN	ECW-CVN-CB
	PNP	ECW-CVP-CB
WL WL2	NPN	ECW-CVNWL-CB
	PNP	ECW-CVPWL-CB

(8)-2 2-circuit power supply interface box

Wireless	I/O	Model
None	NPN	ECW-CVN-CB-TMD2
	PNP	ECW-CVP-CB-TMD2
WL WL2	NPN	ECW-CVNWL-CB-TMD2
	PNP	ECW-CVPWL-CB-TMD2

(8)-3 RCON-EC connection specification 2-circuit power supply interface box

Wireless	I/O	Model
WL WL2	NPN _REC	ECW-CVNWL-CB-ACR

4.6.2 How to replace control wire fixing bracket

Applicable Models: Wire Controller (WC-EC-S)

◆ Preparation

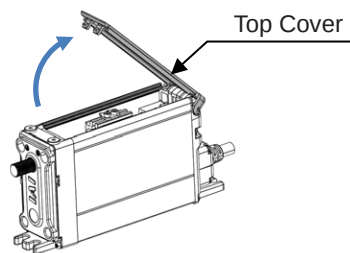
- Hex Wrench or Torque Wrench Parallel Faces: 1.5mm
- Protection Equipment (e.g. Cotton Work Gloves)
- Control Wire Fixing Bracket for Replacement (Enclosed with Bolts and Nuts)

Model
EC-CWF

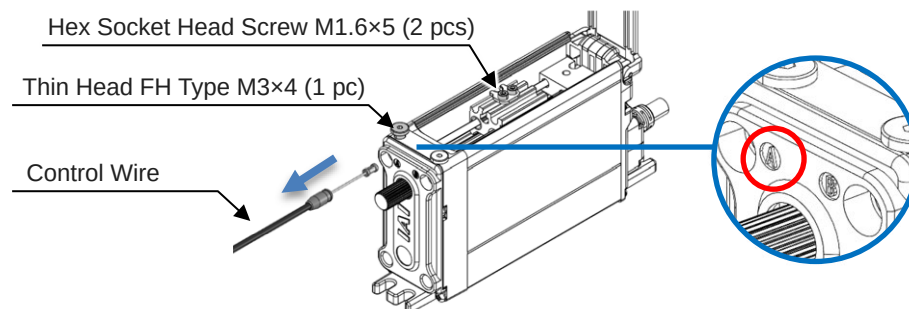


◆ Replace Procedure

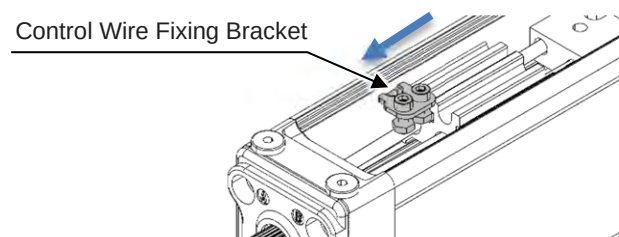
1. Open the top cover.



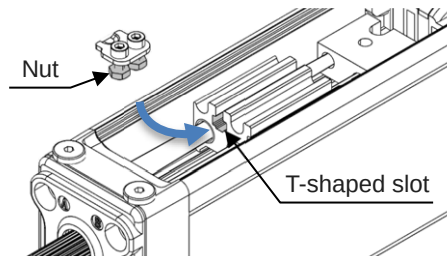
2. Loosen the thin head FH type (1 pc on A side) and hex socket head screws (2 pcs), and pull out the control wire.



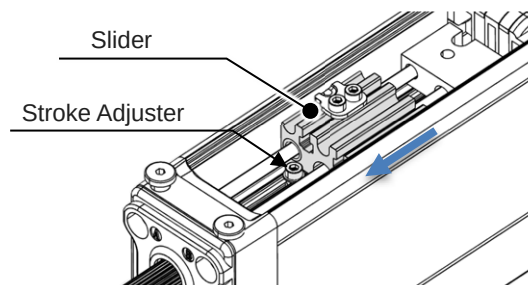
3. Slide the control wire fixing bracket aside to take it off.



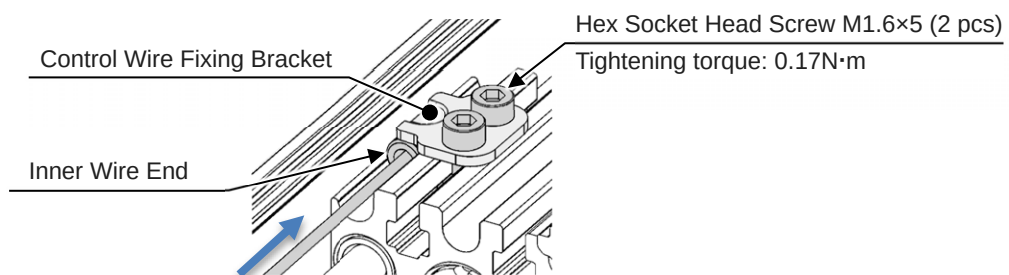
4. Insert the nut of a control wire fixing bracket for replacement to the T-shaped slot on the slider.



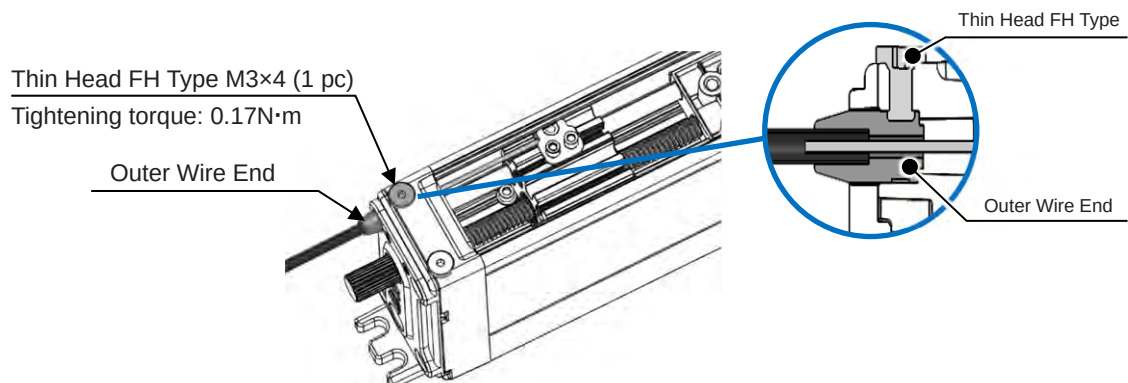
5. Move the slider to the home position (where it hits the stroke adjuster).
 * The position of the stroke adjuster may differ depending on the actuator to be connected.



6. Insert the inner wire end of the control wire under the fixing bracket and fix it with the hex socket head screws.



7. Insert the outer wire end will the end, and tighten up the thin head FH type (1 pc on A side).
 * In case looseness of the wire is large, adjust the position of the fixing bracket.



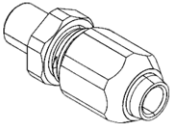
8. Close the top cover.

4.6.3 Replacing outer wire end and inner wire end

◆ Preparation

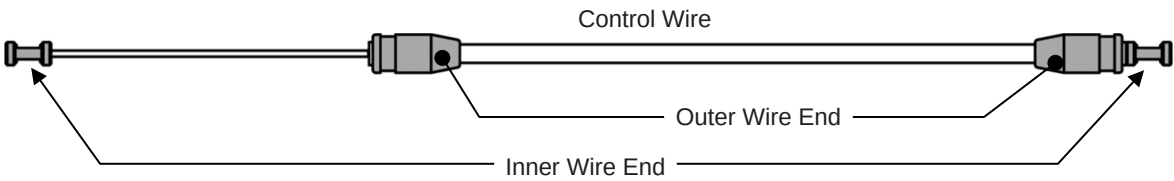
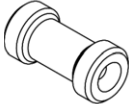
- Hex Wrench or Torque Wrench Parallel Faces: 1.5mm
- Nippers / Pliers / Wire Cutter
- Crimping Tool (JIS C9711 Nominal Size 1.25)
- Wire Stripper (AWG24-26)
- Scale
- Caliper
- Protection Equipment (e.g. Cotton Work Gloves)
- Outer Wire End for Replacement

Model
EC-OWE



- Inner Wire End for Replacement

Model
EC-IWE



◆ Replace Procedure

For how to replace it, refer to [2.6 How to Install Control Wire (Enclosed in Actuator)].

4.6.4 Replacing control wire set screw

Applicable Models: Wire Gripper (EC-WEGR2), Wire Rod (EC-WER1)

◆ Preparation

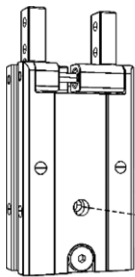
- Hex Wrench or Torque Wrench Parallel Faces: 1.5mm
- Protection Equipment (e.g. Cotton Work Gloves)
- Control Wire Set Screw for Replacement (M3×2.5 Set Screw)

Model
EC-SSW3



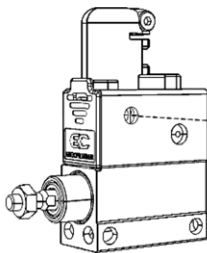
◆ Replace Procedure

1. Remove the hex socket head set screw (1 pc).
2. Attach a hex socket head set screw (1 pc) for replacement.



Hex Socket Head Set Screw
(1 pc)
Tightening torque: 0.17N·m

Wire Gripper (EC-WEGR2)



Hex Socket Head Set Screw
(1 pc)
Tightening torque: 0.17N·m

Wire Rod (EC-WER1)

4.6.5 Replacing actuator cable assembly (Changing cable ejection direction)

◆ Preparation

- Phillips Screwdriver
- Protection Equipment (e.g. Cotton Work Gloves)
- Actuator Cable Assembly for Replacement * ○○○ represents the cable length

Model
CB-EC-GRBP8-MPA○○○-AS

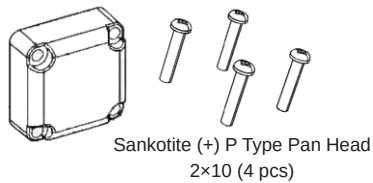
- Cable Box for Replacement

Cable Ejection Direction	Model
Back	EC-CASBR-SLTGD3
Side	EC-CASBS-SLTGD3

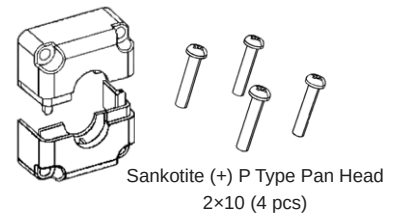
Actuator Cable



Cable Box (Ejection to Side)

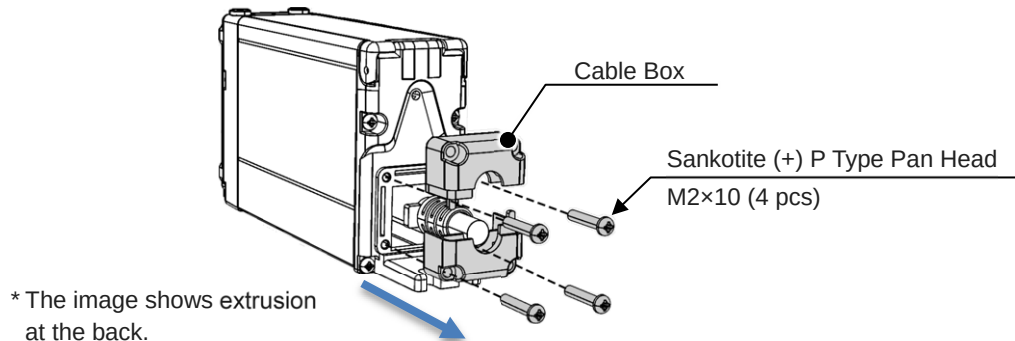


Cable Box (Ejection to Back)

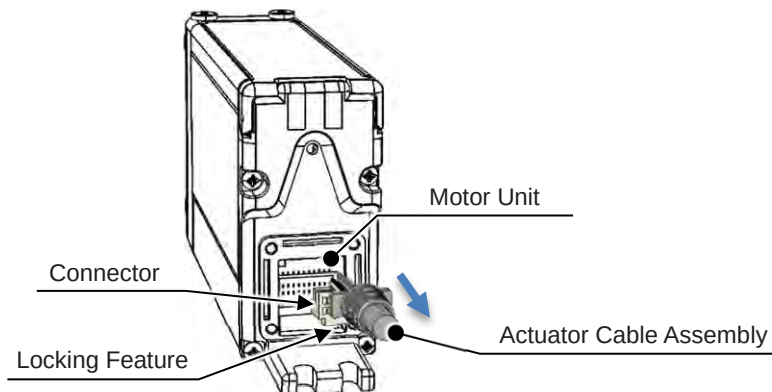


◆ Replace Procedure

1. Remove the cable box fixing screws (4 pcs) and take the cable box off.

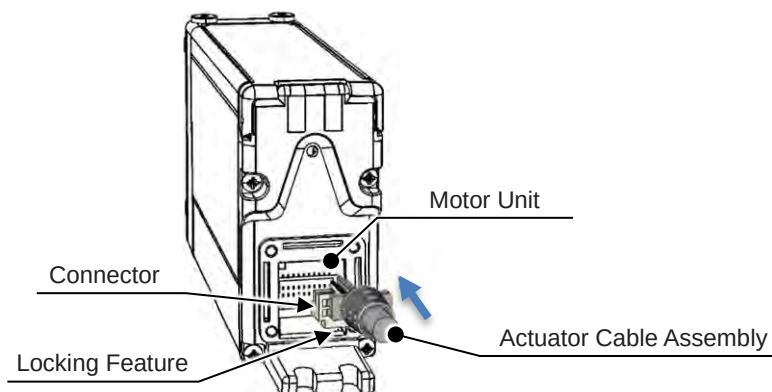


2. Pull off the connector on the actuator cable assembly from the motor unit.
* Press the locking feature with such as a slotted screwdriver to pull it off.



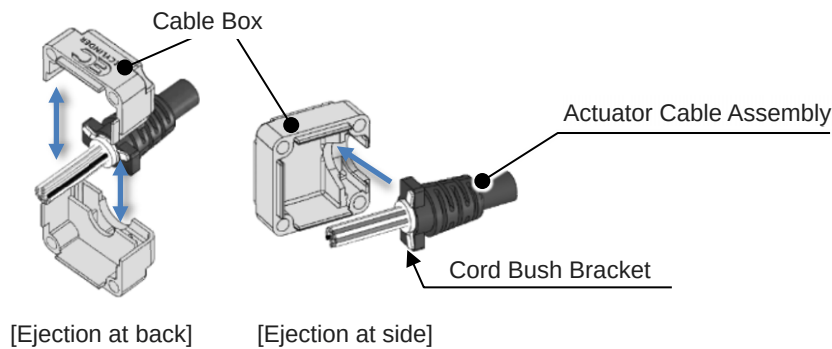
3. Take off the connector on the interface box or the actuator cable assembly on the RCON side.
(It is not necessary when changing cable ejection direction only.)

4. Join the connector on an actuator cable assembly for replacement to the motor unit.
* Pay attention to the orientation of the locking feature on the connector



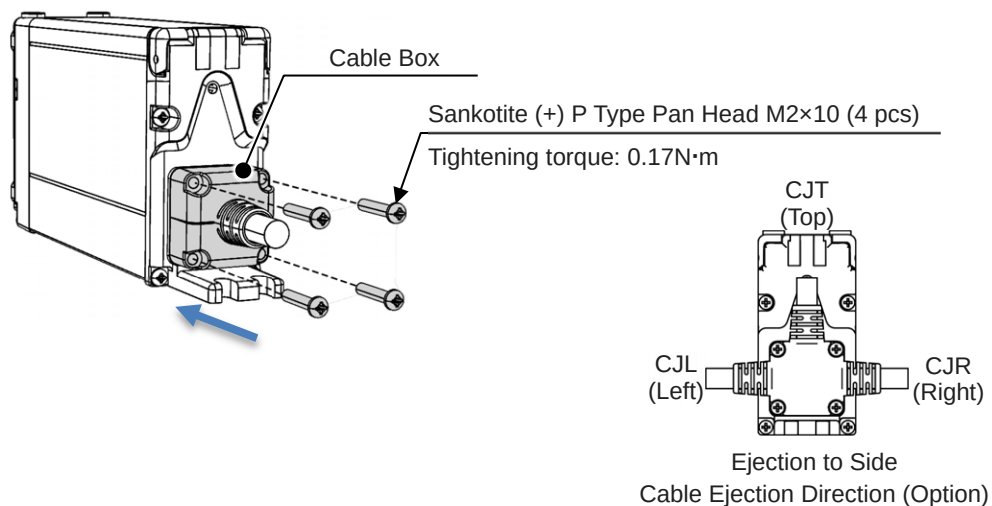
5. Attach the cable box to the actuator cable assembly.

- Put the cord bush and the bracket to the groove on the cable box.



6. Attach the cable box with the screws (4 pcs).

- * Pay attention to ejection direction for the cable ejection on side.
- * Pay attention not to pinch cables.



7. Join the connector on the interface box or the actuator cable assembly on the RCON side.
(It is not necessary when changing cable ejection direction only.)

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Chapter 5

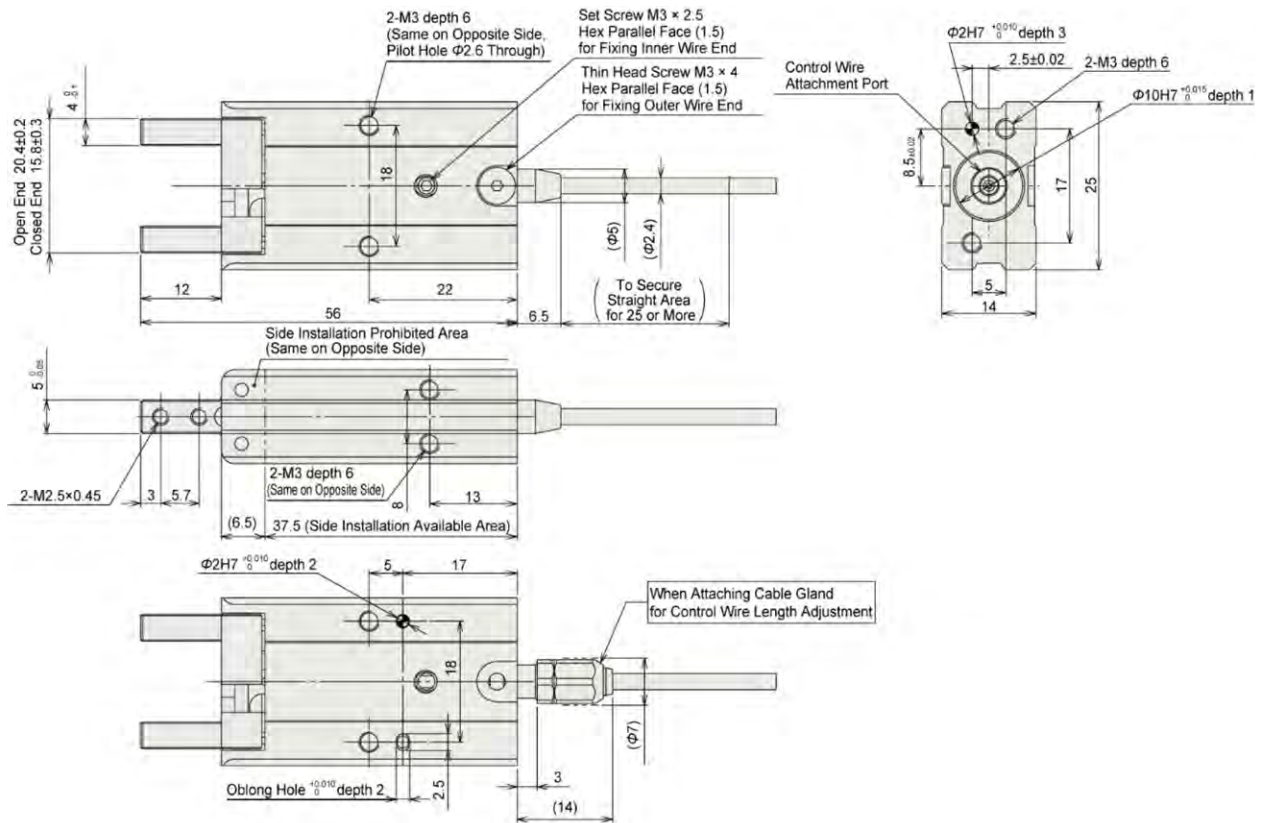
External Dimensions

5.1	Wire Gripper (EC-WEGR2).....	5-1
5.2	Wire Rod (EC-WER1)	5-2
5.3	Wire Controller (WC-EC-S).....	5-3

5.1 Wire Gripper (EC-WEGR2)

(Note) Hold the control wires with a string such as a zip ties so there would not be any load of pulling, bending or twisting (rotation) applied on the wires.

(Note) When the unit is required to be installed at the bottom, it is necessary to have a cut-off to put the control wire through.



■ Mass

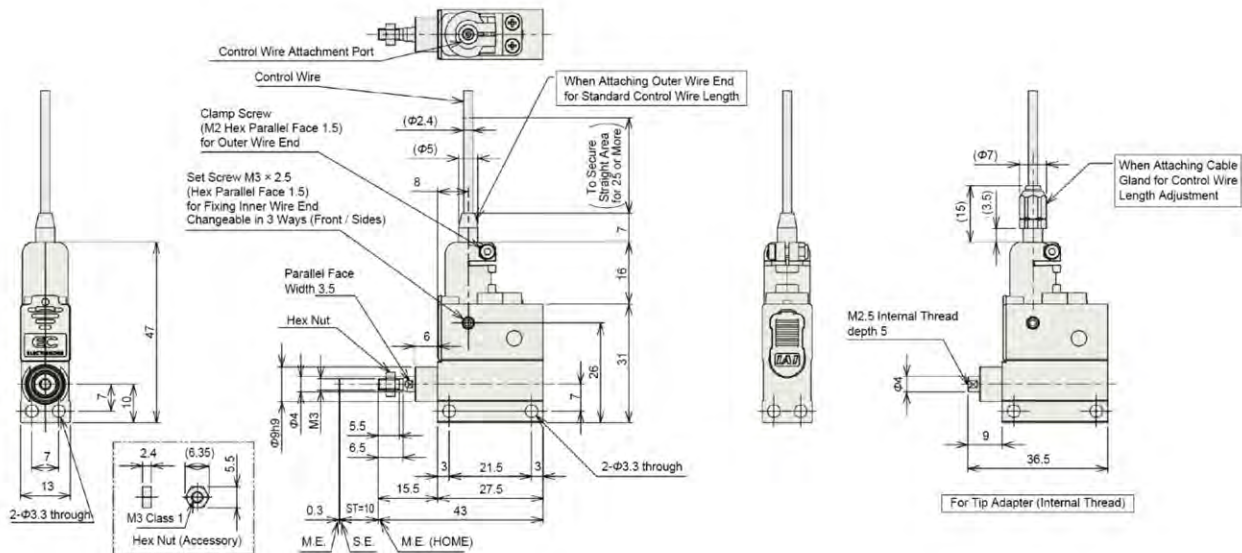
Item	Content
Mass	43g

5.2 Wire Rod (EC-WER1)

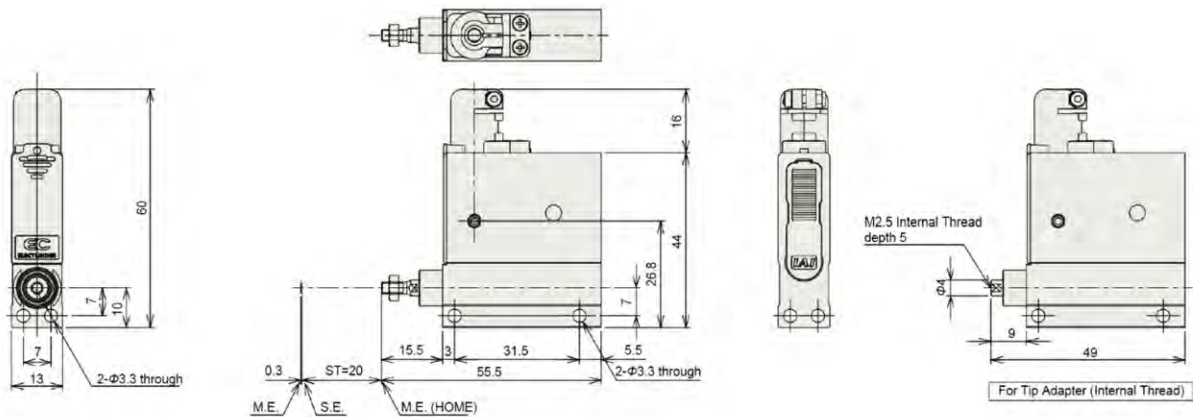
(Note) Hold the control wires with a string such as a zip ties so there would not be any load of pulling, bending or twisting (rotation) applied on the wires.

M.E.: Mechanical end
S.E.: Stroke end
ST : Stroke

■ Stroke 10



■ Stroke 20



■ Mass by Stroke

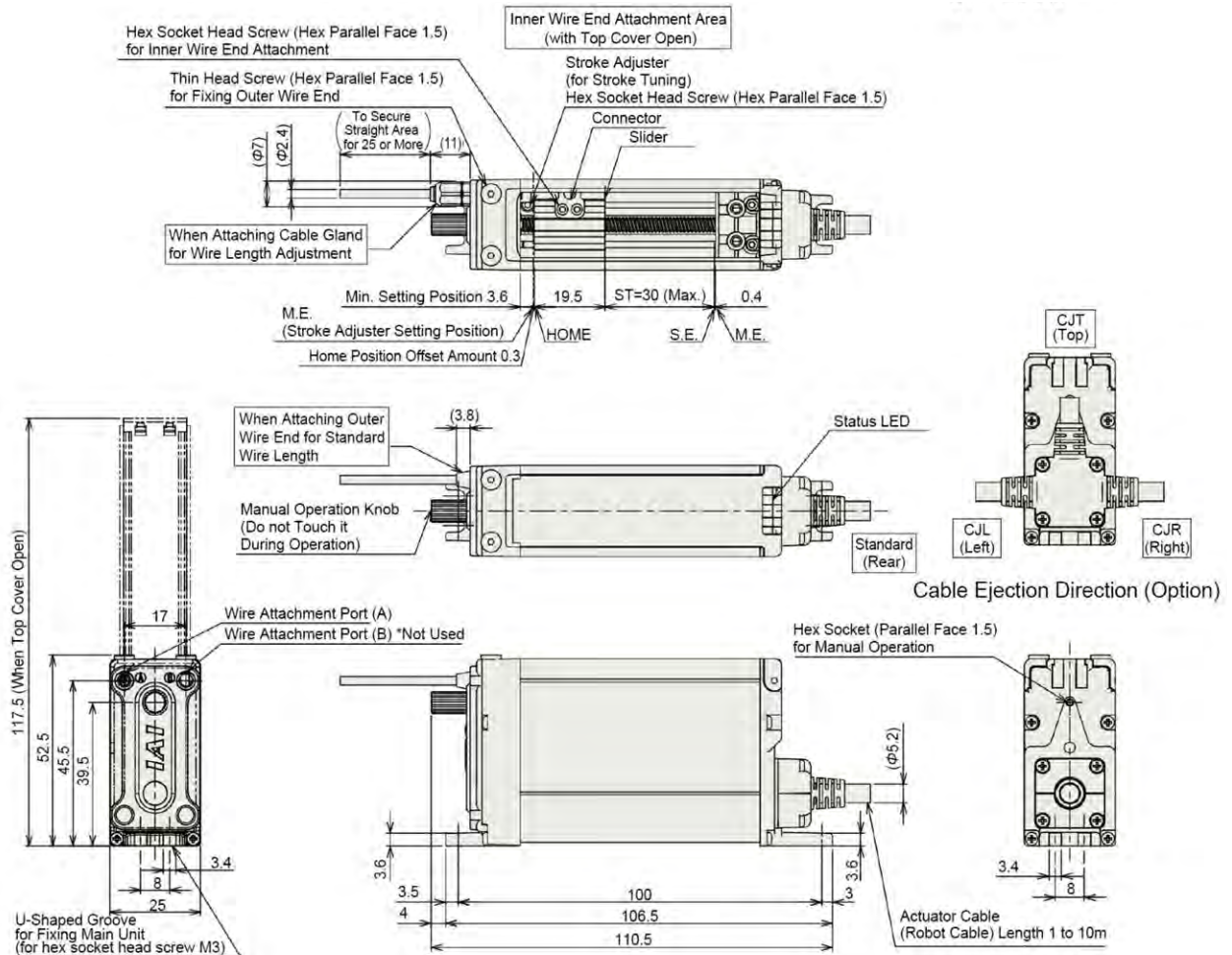
Stroke	10	20
Mass	32g	48g

5.3 Wire Controller (WC-EC-S)

(Note) When installing control wires, turn the power off and open the top cover.

(Note) Hold the control wires with a string such as a zip ties so there would not be any load of pulling, bending or twisting (rotation) applied on the wires.

M.E.: Mechanical end
S.E.: Stroke end
ST : Stroke



Unit (mm)

Connected Cylinder	No Indication of Model Code (Max. Stroke Setting)	EC-WEGR2	EC-WER1SA-10	EC-WER1SA-20
Stroke Adjuster Setting Position	3.6	23.55	16.45	4.2
Stroke	30	10.05	17.15	29.4

■ Mass

Item	Content
Mass	32g

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Chapter 6

Life

6.1	Concept of Life for Wire Controller	6-1
-----	---	-----

6.1 Concept of Life for Wire Controller

The wire controller life is as shown below.

Life (Reference): 10,000,000 times of gripping operation

The wire controller life could vary largely depending on the condition of use, environment and maintenance.



6. Life

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Chapter 7

Warranty

7.1	Warranty period	7-1
7.2	Scope of the warranty	7-1
7.3	Honoring the warranty	7-1
7.4	Limited liability	7-2
7.5	Conformance with applicable standards/regulations, etc., and application conditions	7-2
7.6	Other items excluded from warranty	7-2

7.1 Warranty period

Whichever of the following periods is shorter:

- 18 months after shipment from IAI
- 12 months after delivery to a specified location
- 2,500 operational hours

7.2 Scope of the warranty

Our products are covered by warranty when all of the following conditions are met.

Faulty products covered by warranty will be replaced or repaired free of charge:

- (1) The breakdown or malfunction in question pertains to our product as delivered by IAI or our authorized dealer.
- (2) The breakdown or malfunction in question occurred during the warranty period.
- (3) The breakdown or malfunction in question occurred while the product was in use for an appropriate purpose under the operating conditions and operating environment specified in the instruction manual and catalog.
- (4) The breakdown or malfunction in question was caused by a specification defect, malfunction, or poor product quality.

Note that breakdowns due to any of the following reasons are excluded from the scope of warranty:

- Anything other than our product
- Modification or repair performed by a party other than IAI (unless approved by IAI)
- Anything that could not be easily predicted with the level of science and technology available at the time of shipment from IAI
- Natural disaster, unnatural disaster, incident or accident for which we are not liable
- Natural fading of paint or other symptoms of aging
- Wear, depletion or other expected results of use
- Operation noise, vibration or other subjective sensations not affecting function or maintenance

Note that the warranty only covers our product as delivered and that any secondary loss arising from a breakdown of our product is excluded from the scope of warranty.

7.3 Honoring the warranty

As a rule, the product must be consigned to IAI for repair under warranty.

7.4 Limited liability

- (1) We assume no liability for any special damage, consequential loss or passive loss such as a loss of expected profit arising from or in connection with our product.
- (2) We assume no liability for any program or control method created by the customer to operate our product or for the results of any such program or control method.

7.5 Conformance with applicable standards/regulations, etc., and application conditions

- (1) If our product is combined with another product or any system, equipment, etc., used by the customer, the customer must first check the applicable standards, regulations and/or rules. The customer is also responsible for confirming that such combination with our product conforms to the applicable standards, etc.
In such a case we assume no liability for the conformance of our product with the applicable standards, etc.
- (2) Our product is for general industrial use. It is not intended or designed for the applications specified below, which require a high level of safety. Accordingly, as a rule our product cannot be used in these applications.

Contact IAI if you must use our product for any of these applications:

- Medical equipment used to maintain, control or otherwise affect human life or physical health
 - Mechanisms and machinery designed for the purpose of moving or transporting people (vehicles, railway facilities, aviation facilities etc.)
 - Machinery components essential for safety (safety devices etc.)
 - Equipment used to handle cultural assets, art or other irreplaceable items
- (3) Contact IAI in advance if our product is to be used in any condition or environment that differs from that specified in the catalog or instruction manual.

7.6 Other items excluded from warranty

The price of the product delivered to you does not include expenses associated with programming, the dispatch of engineers, etc. Accordingly, a separate fee will be charged in the following cases even during the warranty period:

- Guidance for mounting/adjustment and witnessing of test operation
- Maintenance and inspection
- Technical guidance and education on operating/wiring methods, etc.
- Technical guidance and education on programming and other items related to programs

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Revision history

Revision date	Revised content
2025.03	First Edition
2025.06	1B Edition Applied to UL/cUL international standard compliance 2.6.4 Added tightening torque for outer wire end attachment screw.
2025.07	1C Edition International Standard Compliance UL/cUL (Note 1), (Note 2) contents and model code label changed 1.1.2 Wire Controller content changed 1.2.1 [2] Actuator Specifications Note added regarding “While Pressing”, “When Not in Pressing Operation”, “During Return with Backward End Spring” in * [3] Rod Tip Load Explanation added 2.3.1, 2.4.1 Mounting orientation Ceiling mount installation added



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