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SCON2

SCON2

Instruction Manual First Edition *ME0458-1E*

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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 downloaded 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.

SCON2 Instruction Manual Configuration

Product name	Instruction manual name	Control number
SCON2	This manual	ME0458
PC Software IA-OS	IA-OS First Step Guide * For how to operate, refer to the guiding features installed in IA-OS	ME0391
Touch Panel Teaching Pendant TB-02	TB-02/02D Position Controller, ELECYLINDER Applicable Instruction Manual	ME0355
Touch Panel Teaching Pendant TB-03	TB-03/03E Position Controller, ELECYLINDER Wired Link Instruction Manual	ME0376
Serial Communication [Modbus]	Serial Communication [Modbus Version] Instruction Manual	ME0162
CC-Link	SCON2 Field Network Instruction Manual	ME0469
CC-Link IE Field		
DeviceNet		
EtherCAT		
EtherNet/IP		
MECHATROLINK-III (Standard I/O Profile)		
PROFINET IO		
EtherCAT (CiA401 Drive Profile)	EtherCAT Motion Network Instruction Manual	ME0472
MECHATROLINK-III (Standard Servo Profile)	MECHATROLINK-III Motion Network Applicable Controllers Instruction Manual	ME0471
RCON Connection Type	RCON System Instruction Manual	ME0384
Functional Safety Unit	Functional Safety Unit Instruction Manual	ME0459

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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. Make sure to follow the usage condition, environment and specification range of the product.
   In case it is not secured, it may cause a drop in performance or malfunction of the product.

2. Use the correct teaching tool.
   Refer to [2.1.2 Teaching Tools] for the PC software and teaching pendant that can be used with this controller, and use the applicable tools.

3. Back up data in order to be prepared for a breakdown.
   Non-volatile memory is used for backup memory of this controller. Registered position data and parameters are written in this memory and backed up. Therefore, these data will normally not be lost even if the power is turned off. However, be sure to save the latest data to enable a quick recovery process in case this controller needs to be replaced with a substitute due to breakdown, etc.

   How to save
   (1) Save to an external memory or a hard disk using PC software
   (2) Record position table and parameters in writing

4. Set the operation patterns.
   This controller is capable for 9 types of control logics (including 8 types of PIO patterns and pulse train control) and meet various ways of usage and changes the role of each PIO signal following the selected control logic.
   The setup can be performed by using the parameter No.25 “PIO pattern selection”.
   Refer to [Chapter 4 Operation] and [Chapter 6 Parameter].
   The PIO pattern is set to “0” (Standard Type) when the unit is delivered. Set the operation pattern setting to the logic that suits to your use after the power is turned on.

Warning

- It is dangerous if operation settings of the control sequence and field network are not matched, as it will not only prevent normal operation but can also lead to unpredictable operation.

5. Calendar function time setting
   Gateway alarm 069 “Real Time Clock Oscillation Stop Detected” may occur when turning the power on for the first time after delivery. In that case, set the current time with the teaching tool. When fully charged, time data can be retained approximately 10 days after the power is turned OFF.
   At shipment, time will be set but the unit will not be fully charged. Therefore, even if the above-mentioned number of days has not passed from shipment, the time data may be lost.

6. Regarding Serial Communication in Pulse Train Control Mode
   In pulse train control mode, actuator operation is unavailable through serial communication.
   In the pulse train control mode, the actuator operation is unavailable through serial communication. (The field network specification does not meet the pulse train control mode.)
   However, it is possible to monitor the current status.

7. Attempt not to exceed the actuator specifications in the pulse train control mode.
   In Pulse Train Control Mode, the operation is performed corresponding to the input pulse.
   - Input Pulse Value → Moving Distance
   - Input Pulse Frequency → Velocity
   - Change in Input Pulse Frequency → Velocity Change and Acceleration/Deceleration

   Do not use the actuator above the specifications (for stroke, maximum velocity, maximum acceleration/deceleration) for the commands of the movement amount, velocity and acceleration/deceleration from the host controller (PLC). Doing so may cause an error or malfunction.
   The pressing operation velocity should be set to the rated pressing velocity when it is to conduct the pressing operation. Pressing with velocity not at the rated pressing velocity could end up with pressing force different from that shown in [10.3.2 Push Force and Current limit Value]. Also, operation in velocity higher than the rated pressing velocity could cause an error or malfunction.

   Refer to [10.3 List of Specifications of Connectable Actuators] or model code for the specifications and rated pressing velocity for each actuator.

8 Actuator would not operate without Servo-ON and pause signals.

(1) Servo ON Signal (SON)

Servo ON signal (SON) is selectable from “Enable” or “Disable” by using a parameter.
It is settable by parameter No. 21 “Select enable/disable servo ON input”.
If it is set to “Enable”, the actuator would not operate unless turning this signal ON.
If parameter No. 21 is set to “1”, SON is made disable.
If it is set to “Disable”, the servo becomes ON and the actuator operation becomes enabled as soon as the power supply to the controller is turned on and the emergency stop signal is cancelled.
This parameter is set to “0” (Enable) at delivery. Have the setting that suits to the desirable control logic.

(2) Pause Signal (*STP)

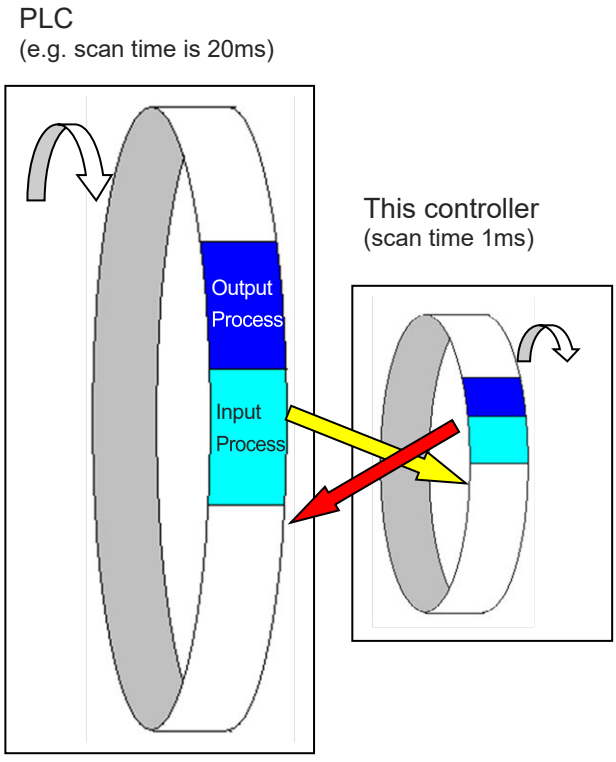
The input signal of the pause signal (*STP) is always ON considering the safety. Therefore, in general, the actuator would not operate if this signal is not ON.
It is available to make this signal to “Disable”, if this signal is undesirable.
It is settable by parameter No.15 “Select enable/disable pause input”.
If parameter No. 15 is set to “1” (Disable), the actuator can operate even if this signal is not ON.
This parameter is set to “0” (Enable) at delivery.

9. Note that there are some frictions and/or torsions in through-hole of rotary actuator when it is used.
When using rotary actuator with a through hole in the center of the revolution and using the hole to put cables through, have a treatment to prevent wear from rubbing or wire break due to the cables getting twisted.
Take particular note on actuators of 360-degree specification because they can be rotated infinitely in a single direction.

10. Limitations on operation of rotary actuator in index mode.
    Rotary actuators of 360-degree specification can select the normal mode for finite rotations or the index mode enabling multi-rotation control by using parameter No.79 “Rotary axis mode selection”.

    The following limitations are applied to the index mode:
    1. Controllers of absolute specification cannot select the index mode. If selected, alarm code 0A1 “parameter data error” is issued.
    2. Index Mode cannot be selected in Pulse Train Control Mode. It will generate Alarm Code 0A1 “Parameter data Error”.
    3. The command range in the jog operation with PC software, teaching pendant or PIO signal is 0 to 360.00°.
    4. Pressing operation is unavailable. The pressing torque can only be set to 0.
    5. Do not issue positioning command around 0° repeatedly during movement near 0°. Failure to follow this may cause the actuator to rotate in the direction reverse to the specified rotation direction or operate indefinitely.
    6. Software limit is invalid in the index mode. Parameters No. 3 and 4 cannot be changed.

11. According to Sequence Program Creation
    Please note the following things when creating a sequence program.
    When data transfer is necessary between two devices that have a different scan time from each other, duration more than the longer scan time is required to certainly read the signal. (It is recommended to have at least twice of the longer scan time for the timer setting to conduct the reading process on the PLC side safely.)



● Operation Image

As shown in the diagram, the input and output timings of two devices that have different scan time do not match, of course, when transferring a signal. There is no guarantee that PLC would read the signal as soon as this controller signal turns ON. In such a case, make the setting to read the signal after a certain time that is longer than the longer scan time to ensure the reading process to succeed on the PLC side.
It is the same in the case this controller side reads the signal.
In such a case, it is recommended to ensure 2 to 4 times of the scan time for the timer setting margin. It is risky to have the setting below the scan time since the timer is also processed in the scan process.
In the diagram, PLC can only read the input once in 20ms even though this controller output once in 1ms.

Because PLC only conducts output process once in 20ms, this controller identifies the same output status for that while.
Also, if one tries to read the signal that is being re-written by the other, the signal may be read wrongly. Make sure to read the signal after the rewriting is complete. (It is recommended to have more than 2 scan periods to wait.) Make sure not to have the output side to change the output until the other side completes the reading. Also, a setting is made on the input area not to receive the signal less than a certain time to prevent a wrong reading of noise. This duration also needs to be considered.

12. PLC Timer Setting

Do not have the PLC timer setting to be done with the minimum setting.
Setting to “1” for 100ms timer turns ON at the timing from 0 to 100ms while 10msec timer from 0 to 10ms for some PLC.
Therefore, the same process as when the timer is not set is held and may cause a failure such as the actuator cannot get positioned to the indicated position number in Positioner Mode.
Set “2” as the minimum value for the setting of 10msec timer and when setting to 100ms, use 10ms timer and set to “10”.

13. Handling of Built-in Drive Cutoff Relay and Cautions in Caution in Handling

The product equips a built-in drive cutoff relay, and it is necessary to be careful in handling.
Use the product with narrow understanding to the following notes.

- The drive cutoff relay built in our controllers is designed under assumption of limited frequency of use such as a case to require emergency stop of a system, and frequent operation is not considered. Therefore, in a condition to require high frequency of use of the drive cutoff relay such as a case to turn ON/OFF the driving source in every setup change, the life of the relay may reach to the end in early stage.
- The relay itself may not meet a sufficient safety demand level when it is used in a system that prioritizes safety in the drive cutoff system. It is necessary to construct a system to meet the safety demand level in a circuit that a customer prepares.
- IAI products equip a built-in drive cutoff relay considering customer’s usage. However, as described above, whether it can be used or not relies on such facts as the safety demand level and frequency of drive cutoff. Please use it in limitation to the way to use as described below.
  - Do not expect reliability of the drive cutoff relay (Anything can do as long as driving source can be cut off.)
  - Thermistor type (which the resistance gets high and restrains in-rush current in low temperature, and resistance gets low and reduce loss in high temperature) in-rush current limiter circuit is equipped. Therefore, to keep the thermistor temperature as low as possible when turning the power on is a key point to make degradation slower on such components as the drive cutoff relay.

14. Regarding Battery-less Absolute Type Actuator
    1. Make sure to have a home-return operation (absolute reset) after detaching the motor unit from the actuator for motor replacement purpose and so on.
    2. For those models with 131072 pulse/rev for the number of encoder pulse such as ISB, the electric gear ratio setting may exceed the upper limit of the internal arithmetic. In such a case, adjust the unit movement amount to appropriate.
       Also, contact IAI if the usage condition of wish cannot be satisfied.
    3. There is the manufacturing number of the connectable actuator printed on the front panel of the controller. Make sure to connect without mistake. The error will occur if the connection is wrong.

15. Startup Time of Controller
    Have 1s or more as an initializing time at the power on (startup).

16. Functional Safety Unit
    The “Functional Safety Units” described in this manual are the option modules to be used by connecting to a controller. Use of a module with linking to this controller should expand the safety features. For change in wiring and parameters about a functional safety unit, refer to “Functional Safety Unit Instruction Manual (ME0459)”.

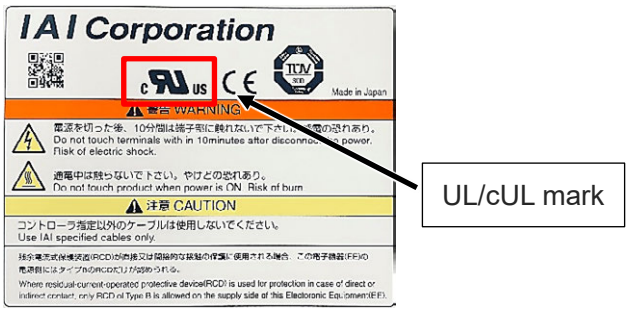
International Standard Compliance

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

○: Applicable　×: Not Applicable

Controller		RoHS3 Directive	CE Directive	UL
SCON2-CG	60W to 750W	○	○	○ (Note 1)

Note 1　It is applicable only for those with UL/cUL mark shown in the warning sticker.
(There is a mark on those produced in April 2024 and later.)



Actuator Coordinate System

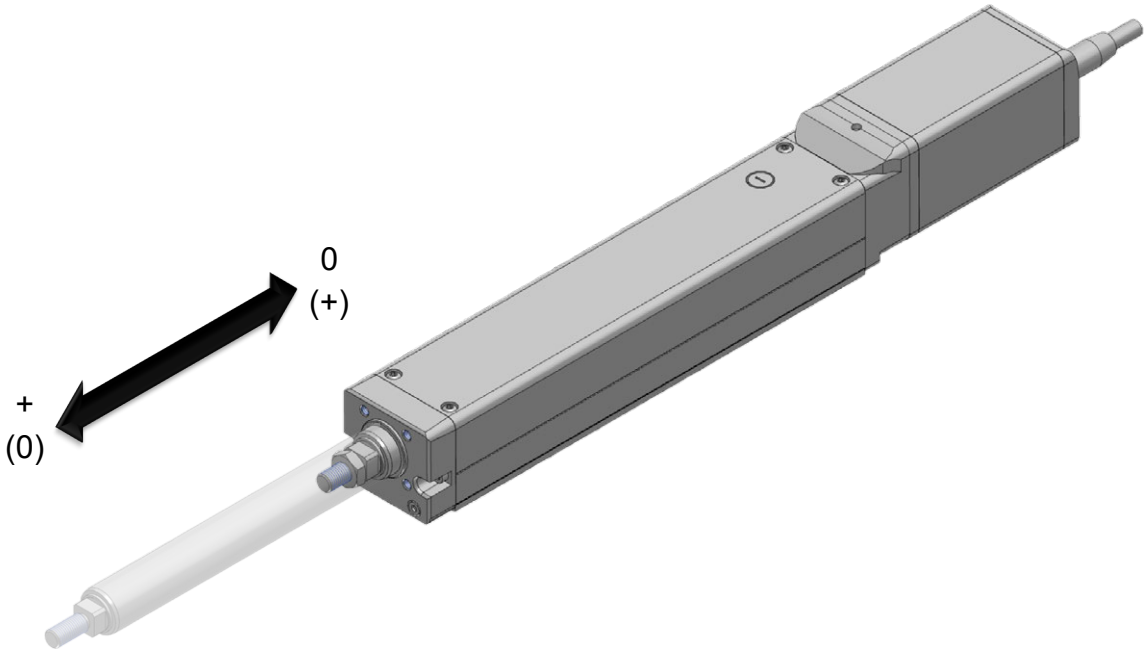
Unless indicated as home reverse specification (option), the direction of home return for the linear axis is on the motor side, the rotary axis is on the counterclockwise direction, DD(A), RS is clockwise, and the gripper is on the outside (open side).

Caution

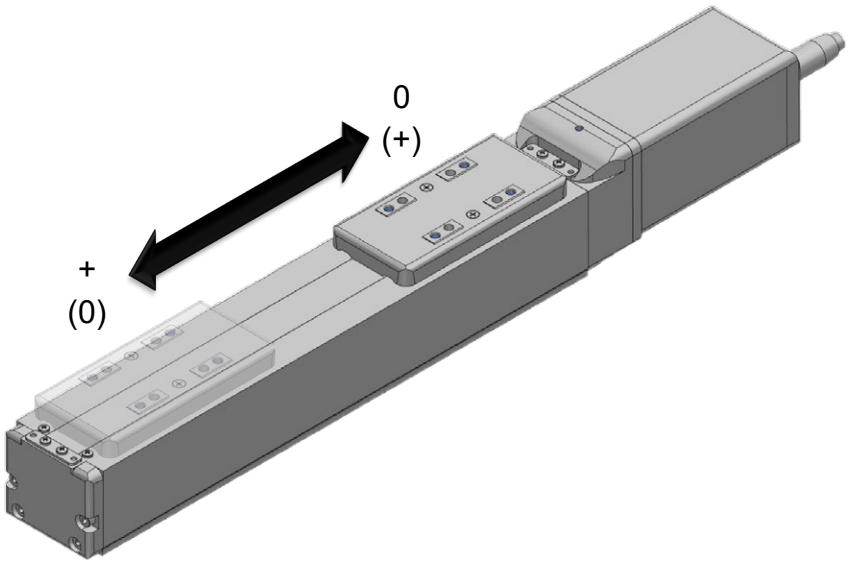
- Homing direction cannot be changed with some models.
- If it becomes necessary to reverse the homing direction after assembly to equipment, check the model of the applicable actuator to ensure that the homing direction is changeable.
- For models with which change is not possible, the actuator must be replaced. Contact IAI if anything is unclear.

The "0" in the figure below shows home. The parentheses show home reverse specification.

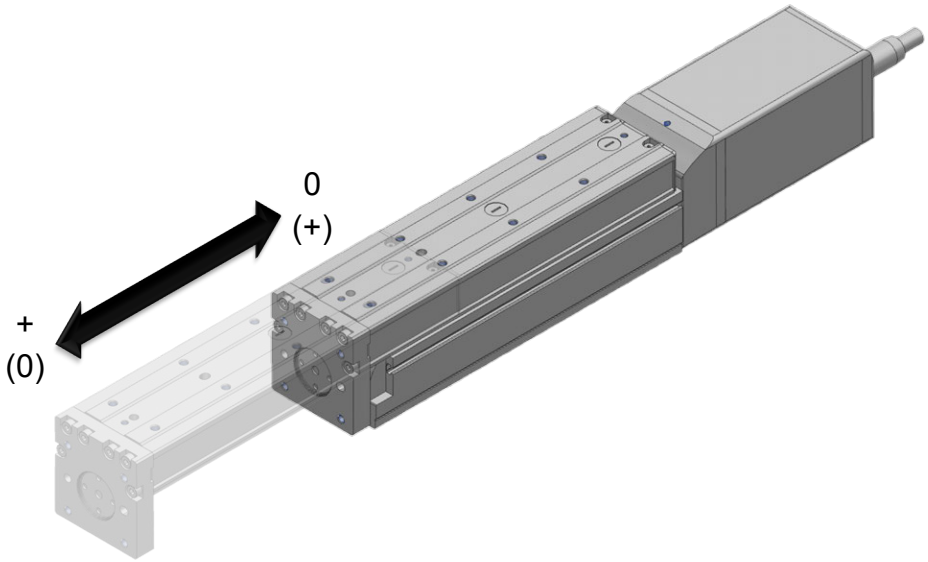
(1) Rod type



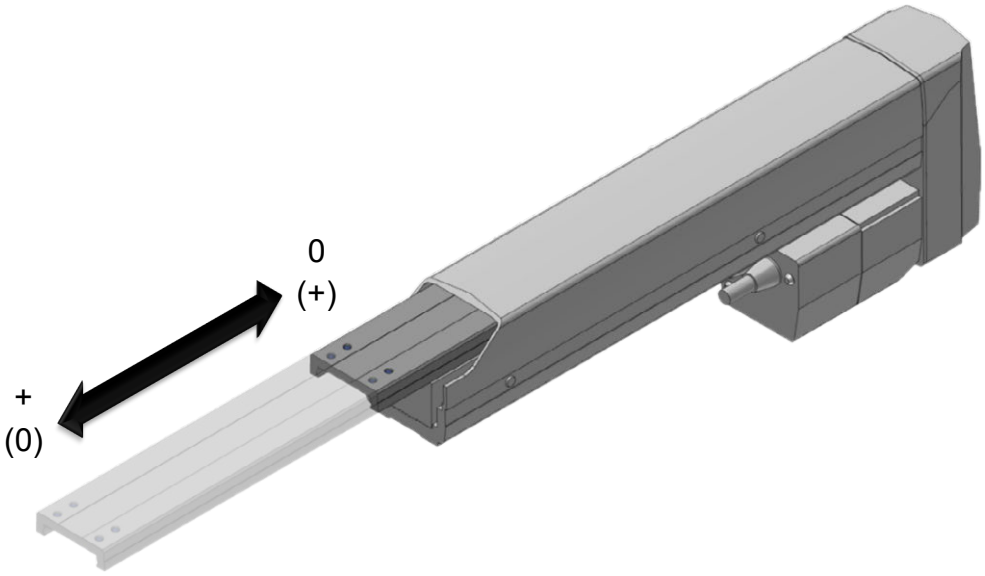
(2) Slider type



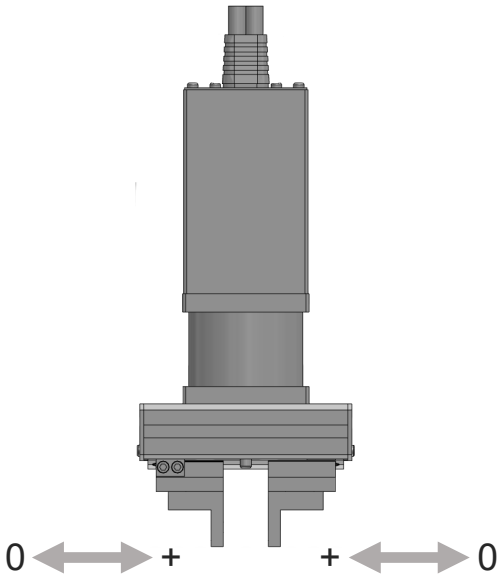
(3) Table type



(4) Arm type



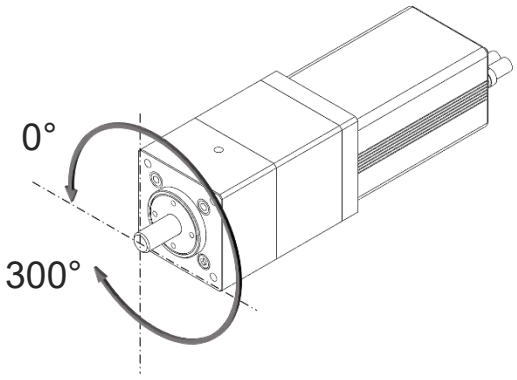
(5) Gripper type



Note: The finger attachment is not an accessory for the actuator. It is to be prepared by the customer.

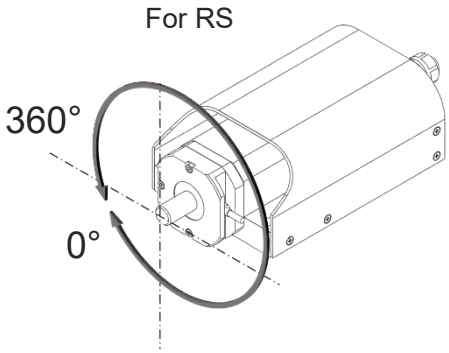
(6) Rotary Type

(300° Rotation Specification)

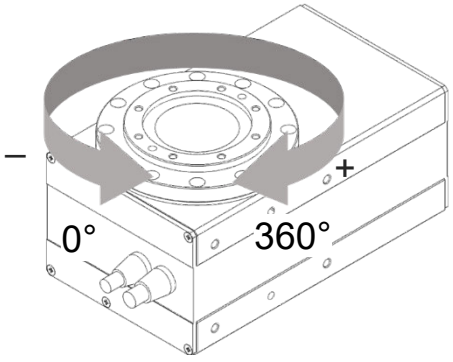


(360° Rotation Specification)

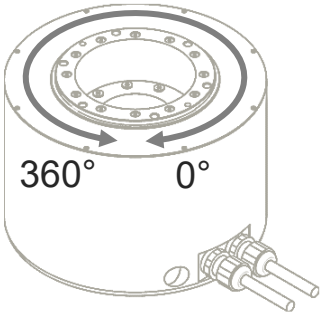
For RS



(360° Rotation Specification)



For DD (A)



For Multiple Rotation Type with the origin reversed type, the directions of + and – are the other way around.

SCON2-CG

Chapter 1

Controller Overview

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1.2 System Configuration ····· 1-2

1.3 Name for Each Parts and Their Functions ····· 1-3

1.4 Starting Procedures ····· 1-8

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Step 2 Installation ····· 1-9

Step 3 Wiring ····· 1-10

Step 4 Operation Ready ····· 1-11

Step 5 Operate Unit ····· 1-12

1.1 Overview

This product is a controller dedicated for the AC servo motor specifications actuators, and which follows the foot prints of the existing SCON controllers in the features, but also has applied some new features to improve convenience and safety further more.

The main characteristics and the features are as follows:

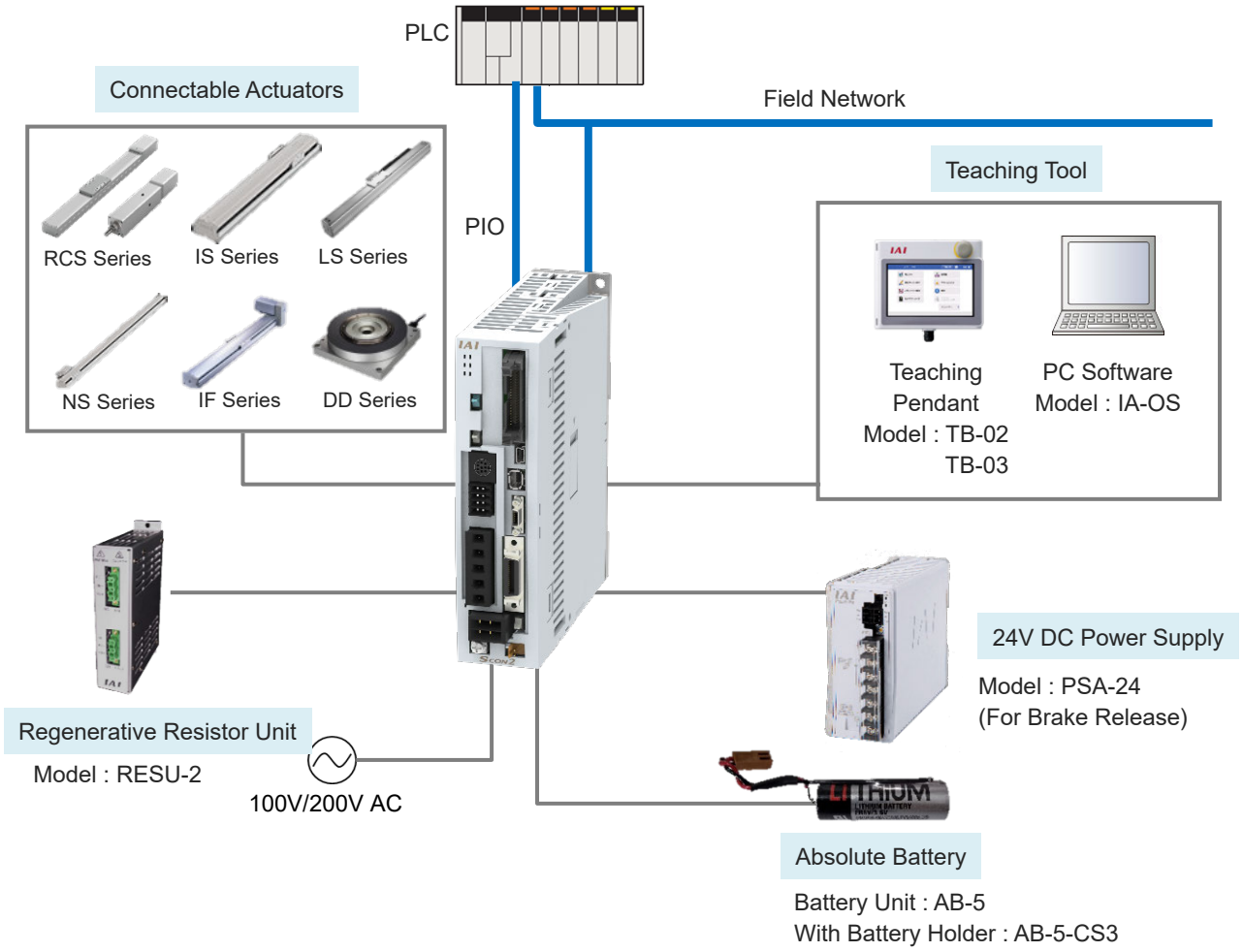
- Battery-less absolute encoder supported in standard
- Zone output boundary setup for each position table
- Individual setup of acceleration and deceleration
- Limit feeding speed at trial run adjustment
- Auto servo OFF
- Predictive Maintenance and Protective Maintenance
- Drive recorder function

In the actual situation of starting up equipment or any case of trouble, check instruction manuals of an actuator, teaching pendant and PC teaching software at the same as checking this manual. It is impossible to state everything including unexpected phenomena such as a complicated signal change at a critical timing which are out of the normal operation. Therefore, take the things that are not described in this manual as an “impossible” thing.

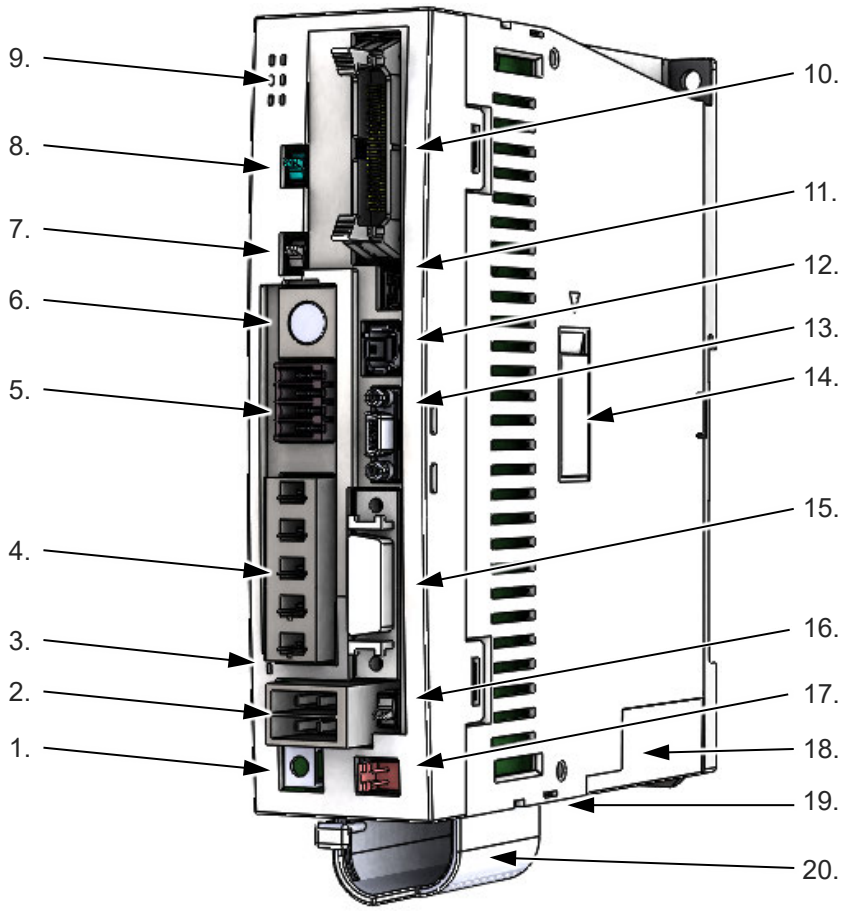
* Keep this manual to a place easy to access when necessary to read again.
* The contents in this manual should cover everything considerable, however, please contact IAI in case of any awareness to mistakes or consideration.

1.2 System Configuration

The following shows the system configuration.



1.3 Name for Each Parts and Their Functions



● PIO type / field network type

1. Ground Screw
   It is the terminal for the connection of ground cable to prevent electric shock and noise. It is connected with the PE of the power connector in the controller. Refer to [2.8 Noise Elimination and Mounting Method]

2. Motor Connector (MOT)
   It is the connector to connect the actuator's motor cable.
   Refer to [3.3.3 Connection to Actuator]

3. Charge Status Display LED (CHARGE)
   It shows the status of electric charge in the controller.

Caution

- While this LED lamp is on, do not attempt to touch controller or regenerative resistor units to prevent electric shock.

4. Power Supply Connector (PWR)
   It is the connector to supply the power to the controller and to the control board.
   Refer to [3.3.1 Wiring of Power Circuit]

5. System I/O Connector (SYS)
   This connector is used to connect with the stop switch, enable switch and brake power supply.
   Refer to [3.3.2 Wiring for Emergency Stop Circuit (System I/O)]

6. SIO Connector (SIO)
   The SIO connector is used to connect the controller with a teaching tool such as PC software or a R-unit through a proper communication cable.
   Refer to [3.3.6 SIO Connector Connection]

7. Operation Mode Setting Switch (MANU/AUTO)
   The switch for interlock.

Setting to switch	Function
AUTO	Allows auto operation by PIO signals. The teaching tool can only operate the monitor.
MANU	It is available to make manual operations from a teaching tool.

8. Jog Switch
   Set the switch towards JOG+ side and the JOG operation should be made towards the positive direction, and set it towards JOG- side and towards the negative direction.

9. Status Indicator LEDs (PWR, SV, ALM, WRG, STOP, SAFE)
   Following show the controller operation status:

LED	Status
PWR (Green)	Controller in normal startup
SV (Green)	Servo ON (Blinking in auto servo-OFF state)
ALM (Orange)	Alarm being generated
WRG (Orange)	Warning being generated
STOP (Red)	Emergency stop
SAFE (Red)	Safety stop

10. PIO Connector (PIO)
    The PIO connector is used for control I/O signals.
    Refer to [3.3.4 Connection of PIO]
    For the field network type, the interface should the one for each network.

11. USB connector
    This connector is used to connect with the PC software.

12. IO connector for safety function (SAFE)
    It is a connector to join the safety circuit when using the safety function. Once the safety command gets input, the SS1-t operation of hardware should be executed and proceed to the safety status.
    Refer to [Chapter 9 Construction of Safety Circuit]

13. Multi-Function Connector (MF)
    This connector is used for pulse string input, feedback pulse output, and analog output of load cell load data. Refer to [3.3.7 Pulse Train Signal Input and Feedback Pulse Output]

14. Functional Safety Unit Connector
    It is a connector to attach a functional safety unit.
    Refer to [Functional Safety Unit Instruction Manual]

15. Encoder Connector (PG)
    This connector is used to connect the encoder cable of the actuator.
    Refer to [3.3.3 Connection to Actuator]

16. Brake Release Switch (BK RLS/NOM)
    For the actuator equipped with a brake, the switch is used to release the brake forcibly.
    Even without the control power being supplied, by supplying 24V DC to BK+/BK- on the system I/O connector (refer to [3.3.2 Wiring for Emergency Stop Circuit (System I/O]) and operating this switch, a brake can be compulsorily released.

Caution

- Always set the switch to “NOM” in normal operation.
  The brake would not work even with the servo OFF condition if the switch is on the RLS side. The moving part may fall with its own weight when installed in the vertical orientation, which may cause injury or damage a workpiece.

17. Absolute Battery Connector
    In the absolute specification, the connector is connected with the absolute battery.

18. Fan Unit
    It is a controller compulsory cooling unit.

19. Regenerative Resistor Unit Connector
    It is a connector to connecting regenerative resistor unit.
    Refer to [3.2.3 [7] Circuit of Regenerative Resistor Units]

20. Absolute Battery Holder
    This is the holder of the absolute battery. Enclosed in the absolute specification.

● RCON Connection Type

The interface is basically the same as normal SCON2. However, following switches and connectors should be inactivated due to the specifications of the product.

Inactivated Switch / Connector	Restrictions
6. SIO Connector	A teaching tool should be connected via SIO connector on RCON gateway unit. TP adapter (RCB-LB-TGS) should also be connected to the gateway unit.
7. Operation Mode Setting Switch	The operation mode should be switched over on the operation mode setting switch in RCON gateway unit.
11. USB Connector	Teaching is to be conducted via SIO connector of RCON gateway unit.
13. Multi-function Connector	The pulse train control is not available for use in the RCON connection type.

1.4 Starting Procedures

Step 1 Confirm all the necessary things are prepared

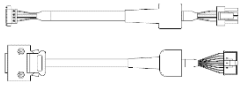
Refer to the section [2.1 Product Check] in this manual for more detail.

☆ Controller (SCON2-CG)

* Check also enclosed parts [Refer to Section 2.1.1]

☆ Actuator and Connection Cable

(The cable differs depending on the actuator type. Refer to [Step 3])



☆ Teaching Tool

- PC software (IA-OS)
- Teaching pendant (TB-02/TB-03)

☆ Field Network Setting File (e.g. EDS File)

* For field network type, please download from the IAI website. www.iai-robot.co.jp/knowledge/support/network/index.html

☆ Instruction Manual

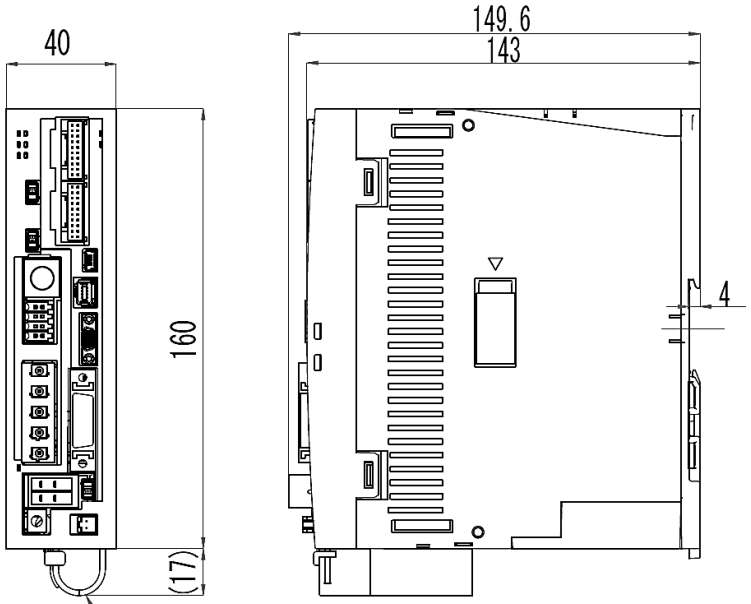
Refer to [SCON2 Instruction Manual Configuration (Previous page of table of contents)]

1. SCON2 Instruction Manual (this manual)
2. Touch Panel Teaching Pendant TB-02 Instruction Manual (ME0355)
3. Touch Panel Teaching Pendant TB-03 Instruction Manual (ME0376)
4. SCON2 Field Network Instruction Manual (ME0469)
5. SCON2 Motion Field Network Instruction Manual MECHATROLINK-III Section (ME0471)
6. SCON2 Motion Field Network Instruction Manual EtherCAT Section (ME0472)
7. Instruction Manual of the Each Actuator

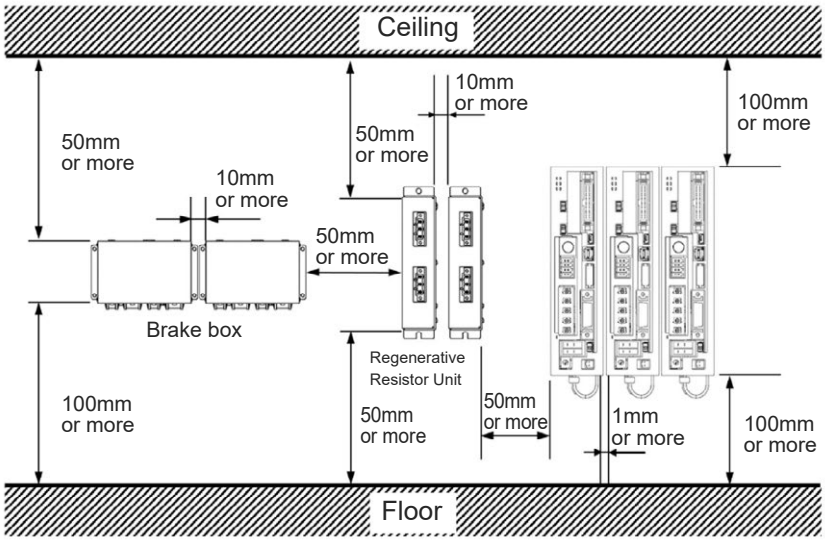
Check the operation modes and control methods available on the controller you have purchased.
It can be defined on the controller model code shown on the label in the side of the controller.

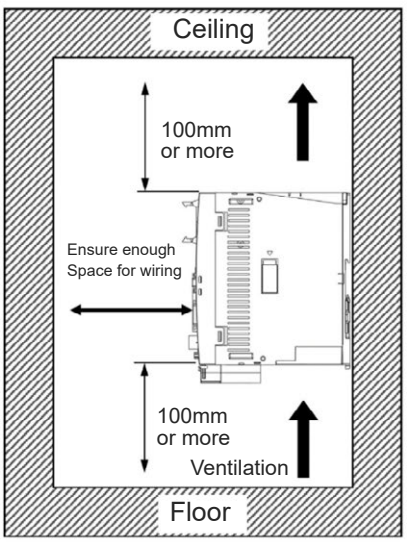
Step 2 Installation

• External Dimensions Refer to [2.4 Appearance]



- Heat Radiation and Installation
  Keep the ambient temperature of the controller at 60°C or less.
  To fix the units in the control box, use the attachment holes on top and bottom.
  Install in the orientation shown in the figure below for heat radiation.



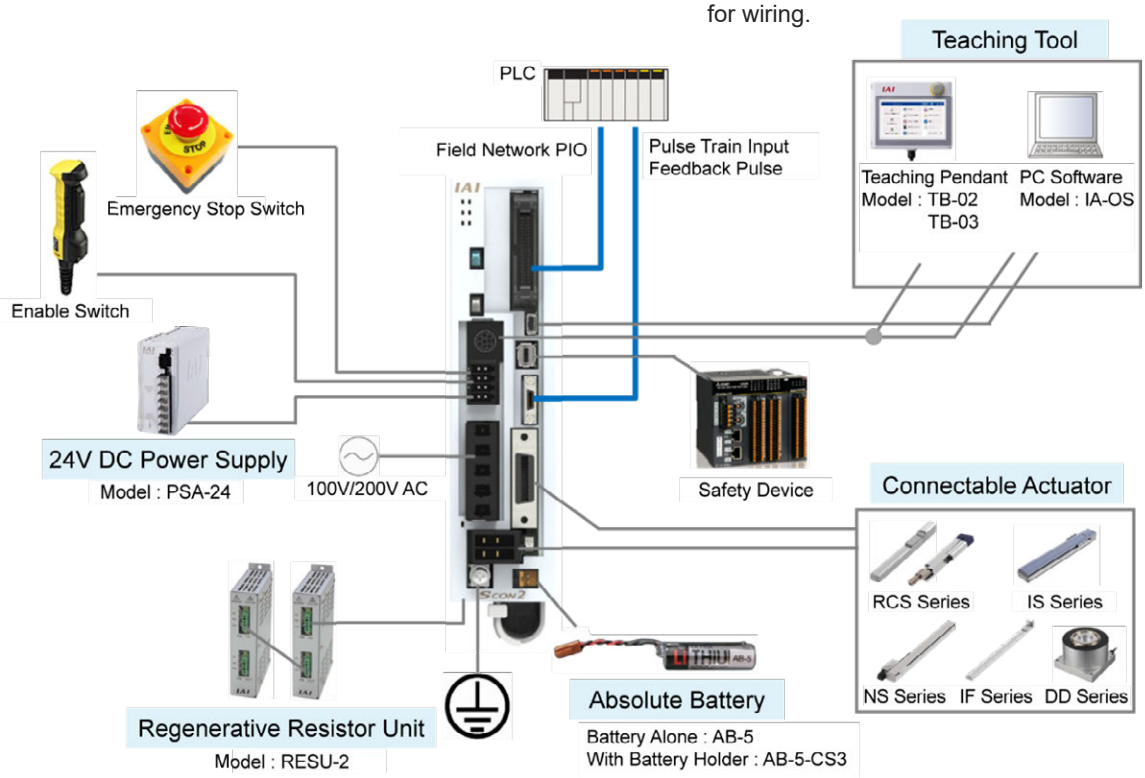


Step 3 Wiring

[Positioner Operation] Refer to Sections [3.1] and [3.5]
[Pulse Train Control] Refer to Sections [3.3] and [3.5]
[Field Network Type] Refer to Section [3.7]

* Refer to [3.1.3 [5]] and [3.2.3 [5]] for wiring layout as the signals/features differ for each PIO pattern (selected in Parameter No. 25) in PIO.
* For Field Network Type, refer to the [SCON2 Field Network Instruction Manual (ME0469)] for wiring.

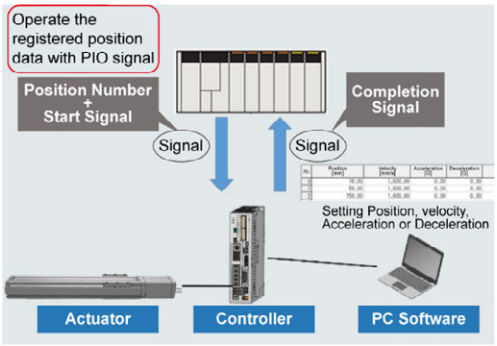
• Example for Basic Connection



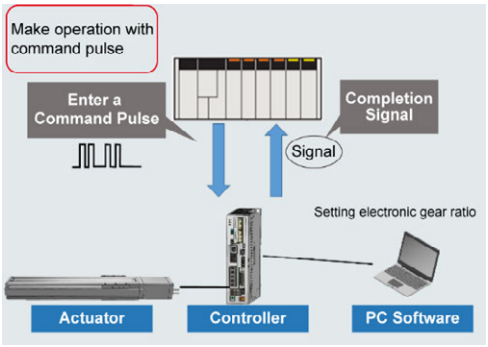
Step 4 Operation Ready

The operation modes and control methods will defer depending on the type you have purchased.

☆ What is Positioner Operation

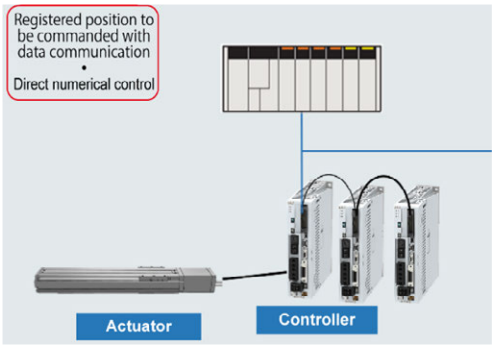


☆ What is Pulse Train Control



☆ What is Field Network Control

Field Network communication is used instead of connected with and controlled by PIO. Without using position data, operation can also be made by inputting numbers directly.



☆ What is RCON Connection Type

This can be used as a driver unit that operates SCON2 with commands from RCON Gateway.
Refer to [3.5 Connection to R-Unit] and [RCON System Instruction Manual (ME0384)] for details.

Step 5 Operate Unit

How you should look in the instruction manuals will differ depending on the operation modes and control methods you choose.

Establish the settings for your operation needs.

● For Positioner Operation	Basic Operation Methods ⇒ 4.2 Operation in Positioner Mode
● For Pulse Train Control	Basic Operation Methods ⇒ 4.3 Pulse Train Control Mode
● For Field Network Type	Instruction Manual for SCON2 Field Network
● For Motion Type	Instruction Manual for SCON2 Motion Control
● For RCON Connection Type	RCON System Instruction Manual (ME0384)

This controller is equipped with a safety velocity function to make the operation in low speed compulsorily.
It is recommended to have this function activated in the first operation.

⚠Caution: Set it away from the mechanical end or peripherals as much as the moving parts possible when turning the servo ON. It may generate an alarm if it hits to the mechanical end or peripherals. Also, when an actuator is installed in the vertical orientation and the servo gets turned on and off repeatedly at the same position, the moving part may fall with its own weight, which may cause injury or damage a workpiece.

⚠Caution: Make sure to have the brake release switch equipped on the front panel of this controller set to the MOM side in the normal operation. When an actuator is installed in the vertical orientation and it gets released compulsorily, the moving part may fall with its own weight, which may cause injury or damage a workpiece.

SCON2-CG

Chapter 2

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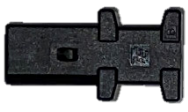
2.1 Product Check

2.1.1 Parts

Shown in the table below are the product structures in the NPN types.
Check the accessories in the packaging details. If you find any fault in the contained model or any missing parts, contact us or our distributor.

Part Name	Shape	Remarks
Controller		Model code should be described in [2.1.4 How to Read the Model]
I/O Flat cable	CB-PAC-PIO□□□ (Example) □□□ : 020 = 2 [m] 	It should not be enclosed to the field network type.
System I/O connector	B2CF 3.50/08/180 SN BK BX (Supplier : Weidmuller) 	Applicable cable size 1.25 to 0.5mm^2 (AWG16 to 20)
AC power supply connector	MPS 7S/05 S F3 TN B B (Supplier : Weidmuller) 	Applicable cable size control : 0.75mm^2 (AWG18) Motor : 2.0mm^2 (AWG14)
Absolute battery	AB-5 	Enclosed for Absolute Type
Dummy plug	DP-5 	
Dummy plug	DP-6 	

Part Name	Shape	Remarks
For Between RCON and SCON2 or Between SCON2 and SCON2 Connection cable	CB-RE-CTL002 (0.2m) 	Enclosed for RCON Connection Type
Safety Guide		Shown in the figure is an image.
First Step Guide		Shown in the figure is an image.

2.1.2 Teaching Tool

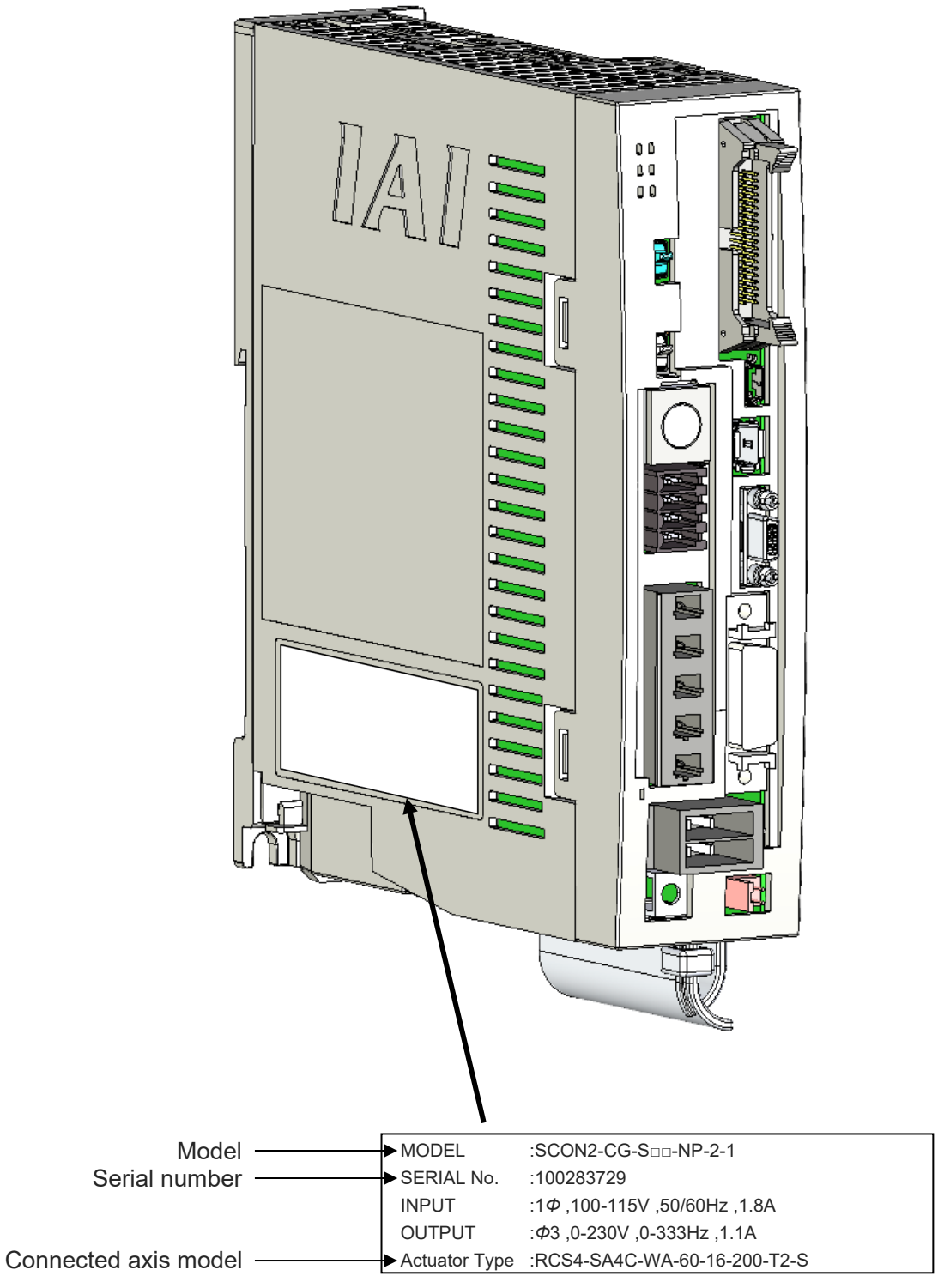
Refer to the following instruction manuals for how to operate a PC software and a teaching pendant. The instruction manual (first step guide) for IA-OS introduces only the way to install and launch. For how to operate, follow the instructions in a window on IA-OS or help guidances.

Part Name	Model	Applicable Version	Instruction Manual
PC software	IA-OS	V13.00.00.00 or later	ME0391
Touch Panel Teaching Pendant	TB-03 Wired Link	V4.10 or later	ME0376
	TB-02		ME0355

Instruction Manual is available for download in our website.
The latest version of IA-OS (update) is available to download in our website.

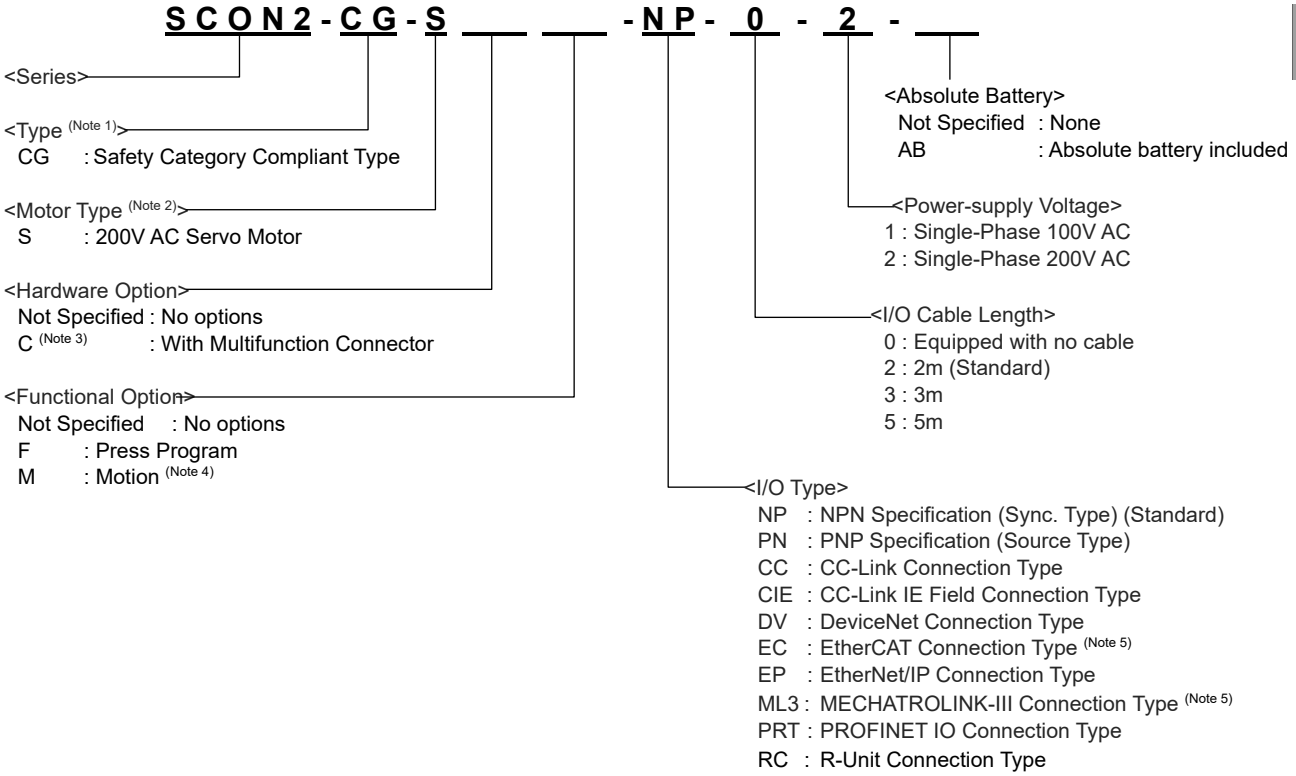
2.1.3 How to Read the Model Plate

The places to attach the model code plates on this product and how to read them are as shown below.



2.1.4 How to Read the Model

Shown below is how to read the model codes.



Note 1 Safety category compatible type only.

Note 2 Compatible motor wattage is 60W to 750W.

Note 3 Select this when it is necessary to conduct the pulse train control.

Note 4 Selectable when I/O type is EC or ML3.

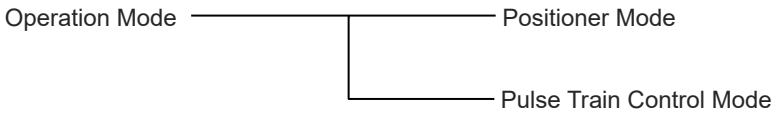
Note 5 It should be the remote I/O specification when “no description” or Press Program “F” is selected in the feature option column and should be the motion specification when Motion “M” is selected.

2.2 Operation Modes and Functions

The controller is compatible with 10 types of operation patterns to support various applications.
The operation pattern setting should be established in Parameter No. 25 “PIO pattern selection”.

2.2.1 Operation Mode of Controller

There are two types of operation modes equipped in this product.



There are eight types of control methods in the positioner mode. Also in Pulse Train Control Mode, there are two types of control systems.
The operation mode is to be switched over in IA-OS or a teaching pendant.

List of PIO patterns

Type	Value set in parameter No. 25	Operation mode	Control mode
PIO Pattern 0	0	Positioner Mode	Positioning mode (Standard type)
PIO Pattern 1	1		Teaching mode
PIO Pattern 2	2		256-point mode (Number of positioning points : 256-point)
PIO Pattern 3	3		384-point mode (Number of positioning points : 384-point)
PIO Pattern 4	4		Solenoid Valve Mode 1 (Number of positioning points : 7-point)
PIO Pattern 5	5		Solenoid Valve Mode 2 (Number of positioning points : 3-point)
PIO Pattern 6 (Note 1)	6		Force Sensor Used Pressing Mode 1
PIO Pattern 7 (Note 1)	7		Force Sensor Used Pressing Mode 2
PIO Pattern 0	0	Pulse Train Control Mode	Pulse train control mode for incremental
PIO Pattern 1	1		Pulse train control mode for absolute

Note 1 It should not be used on an actuator not equipped with a loadcell.

2.2.2 Positioner Mode

Refer to [3.1.3 [5], 3.2.3 [5] PIO Circuit] for wiring for each PIO pattern and [4.2 Operation in Positioner Mode] for details of how to operate and the main features.

[1] PIO Patterns in Positioner Mode

Type	Value set in parameter No. 25	Mode	Overview
PIO Pattern 0	0 (at the delivery)	Positioning Mode (Standard Type)	• Number of positioning points : 64 points • Position command : binary code • Zone signal output : 1 point (Note 2) • Position zone signal output : 1 point (Note 2)
PIO Pattern 1	1	Teaching mode (Teaching type)	• Number of positioning points : 64 points • Position command : binary code • Position zone signal output : 1 point (Note 2) • Jog operation enabled by PIO signal • Writing current position data to position table enabled by PIO signal
PIO Pattern 2	2	256-point mode (Number of positioning points : 256-point type)	• Number of positioning points : 256 points • Position command : binary code • Position zone signal output : 1 point (Note 2)
PIO Pattern 3	3	384-point mode (Number of positioning points : 384-point type)	• Number of positioning points : 384 points • Position command : binary code • Zone signal output : None
PIO Pattern 4	4	Solenoid Valve Mode 1 (7-point type)	• Number of positioning points : 7 points • Position command : Individual number signal ON • Zone signal output : 1 point (Note 2) • Position zone signal output : 1 point (Note 2)
PIO Pattern 5	5	Solenoid Valve Mode 2 (3-point type)	• Number of positioning points : 3 points • Position command : Individual number signal ON • Completion signal : Signal equivalent to LS (limit switch) enabled • Zone signal output : 1 point (Note 2) • Position zone signal output : 1 point (Note 2)
PIO Pattern 6 (Note 1)	6	Force Sensor Used Pressing Mode 1	• Number of positioning points : 32 points • Position command : binary code • Position zone signal output : 1 point (Note 2) • Available for pressing force judgment
PIO Pattern 7 (Note 1)	7	Force Sensor Used Pressing Mode 2	• Number of positioning points : 5 points • Position command : Individual number signal ON • Position zone signal output : 1 point (Note 2) • Available for pressing force judgment

Note 1 It should not be used on an actuator not equipped with a loadcell.

Note 2 Position Zone Signal can be switched over to Zone Signal with the setting of Parameter No.149.

[2] List of Main Features in Each PIO Pattern

○ : Valid function

PIO Pattern (Parameter No.25)		0	1	2	3	4	5	6	7
Mode		Positioning mode	Teaching mode	256-point mode	384-point mode	Solenoid Valve Mode 1	Solenoid Valve Mode 2	Force Sensor Used Pressing Mode 1	Force Sensor Used Pressing Mode 2
Main function	Number of positioning points	64	64	256	384	7	3	32	5
	Operation with the Position No. Input	○	○	○	○	×	×	○	×
	Position No. direct command operation	×	×	×	×	○	○	×	○
	Positioning	○	○	○	○	○	○	○	○
	Velocity change during the movement	○	○	○	○	×	×	○	×
	Pressing (tension)	○	○	○	○	○	×	Δ (Note 2)	Δ (Note 2)
	Force Sensor Used Pressing	×	×	×	×	×	×	○	○
	Pitch Feeding (relative moving feed)	○	○	○	○	○	×	○	○
	Home return signal input	○	○	○	○	○	×	○	○
	Pause	○	○	○	○	○	Δ (Note 1)	○	○
	Jog moving signal	×	○	×	×	×	×	×	×
	Teaching input (Current Position Writing)	×	○	×	×	×	×	×	×
	Brake release signal input	○	×	○	○	○	○	○	○
	Moving Signal Output	○	○	×	×	×	×	×	×
	Zone signal output (Note 3)	○	○	○	×	○	○	○	○
	Position zone signal output (Note 4)	○	○	○	×	○	○	○	○
	Position detection feedback pulse output	○	○	○	○	○	○	○	○
	Vibration control	○	○	○	○	○	○	○	○

Note 1 The pause signal is not provided. Refer to [4.2.6 [5]].

Note 2 Tensile operation is not allowed.

Note 3 The zone range is set to the Parameters No.1 and 2 or No.23 and 24, and becomes always effective after the home return is complete.

Note 4 It is a signal turns on when the current position is within the range set in the indicated position number during a move to the position.

2.2.3 Pulse Train Control Mode

There are two types of control systems in the pulse train control mode. Set the most suitable for the actuator specifications PIO patte22--99rn in Parameter No. 25 “PIO pattern selection”.

Refer to [Chapter 3 Wiring] for wiring in the pulse train control and [4.3 Pulse Train Control Mode] for details of how to operate and the main features.

[1] PIO Patterns in Pulse Train Control Mode

Pattern type	Value set in Parameter No.25	Mode	Feature of PIO pattern
PIO pattern 0	0	Pulse train control mode for incremental	• Differential pulse input (MAX.200kpps) • Home return function • Zone signal output: 2 points
PIO Pattern 1	1	Pulse train control mode for absolute	• Setting the datum point (1 places) • Differential pulse input (MAX.200kpps) • Home return function • Zone signal output: 2 points

Caution

- When using the pulse train control, select the hardware option “C: Equipped with Multiple Function Connector” and the I/O type “NP (Sink Type) (Standard)” or “PN (Source Type)”.

2.2.4 Field Network Operation Modes and Features

In the field network, there are following operation modes available to select from and used for operation. (Motion network excluded)

Data necessary for operation (e.g. target position, velocity, acceleration and pressing current) should be written in the determined addresses from PLC connected to the host and make operation can be made.

[1] Operation Modes and Functions

The field network type should make operation by selecting a mode from the following ten operation modes.

Key function	Remote I/O mode	Position/ simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2	Position/ simple direct mode 2	Half direct mode 2	Remote I/O mode 3	Half direct mode 3
Number of occupied bytes	2	8	16	32	12	8	16	12	16
Operation by position data specification	×	○(Note 1)	○	○	×	○(Note 1)	○	×	○
Direct speed/acceleration specification	×	×	○	○	×	×	○	×	○
Push-motion operation	○	○	○	○	○	○	○	○	○
Current position read	×	○	○	○	○	○	○	○	○
Position number current speed read	×	×	○	○	×	×	○	×	○
Operation by position number specification	○	○	×	×	○	○	×	○	×
Completed position number read	○	○	×	×	○	○	×	○	×
Maximum position table size	384	384	Not used	Not used	384	384	Not used	384	Not used
Force Control	Δ (Note 2)	×	×	○	Δ (Note 2)	○	○	Δ (Note 2)	×

Note 1 The actuator is operated by specifying all position data, other than positions, using position numbers.

Note 2 It is available for use in the when 6 or 7 is set in PIO Pattern.

[2] List of Applicable Field Networks

Applicable for the field network shown in the list below.

Except for RS-485 (Modbus), it is the option which can be selected when purchasing. It cannot be changed after the product is delivered.

Also, for the field network other than RS-485, PIO cannot be equipped. And Pulse Train Control Mode cannot be operated.

Field Network Name	Description	Details
CC-Link	Control of the actuator is available with I/O communication using the control signals same as those for PIO or the numerical data communication.	Separate volume ME0469
CC-Link IE Field		
DeviceNet		
EtherCAT		
EtherNet/IP		
MECHATROLINK-III (Standard IO Profile)		
PROFINET I/O		
EtherCAT (CiA401 Drive Profile)	Synchronized control of several actuators in constant periodicity is available.	Separate volume ME0472
MECHATROLINK-III (Standard Servo Profile)		Separate volume ME0471
RS-485	Actuator is controlled with using a general protocol “Modbus” communication.	Separate volume ME0162

Note 1 SCON2-CG are the slave units (slave stations).
For the instruction of the field network, the instruction manual is provided separately. Use the manual together with this manual.
Refer to the instruction manual of the master unit of each supplier and PLC to be mounted for the details of each network.

2.3 Basic Specifications

2.3.1 List of Basic Specifications

Item			SCON2-CG
Corresponding Motor Capacity	Power-supply Voltage 100V AC		60 to 200W
	Power-supply Voltage 200V AC		60 to 750W
Power-supply Voltage			Single-Phase 100 to 115V AC Single-Phase 200 to 230V AC (Power supply fluctuation ± Within 10%)
Rush Current	Power-supply Voltage 100V AC		Control side: 30A (to 25°C), 70A (to 60°C) (Note 1) Drive side: 30A (to 25°C), 80A (to 60°C) (Note 1)
	Power-supply Voltage 200V AC		Control side: 30A (to 25°C), 60A (to 60°C) (Note 1) Drive side: 30A (to 25°C), 70A (to 60°C) (Note 1)
Leakage Current (Note 2) (Primary side when noise filter is connected to power supply line)			3.5mA
Load Capacity and Heat Generation			Refer to [2.3.2 Power Capacity and Heat Generation]
Power Supply Frequency			50/60Hz
PIO Power Supply (Note 3)			24V DC ±10%
Power Supply for Electromagnetic Brake (for actuator equipped with brake)			24V DC ±10% 1A (MAX.) (supplied from external equipment)
Transient Power Cutoff Durability			20ms (50Hz), 16ms (60Hz)
Motor Control System			Sine Wave PWM Vector Current Control
Corresponding Encoder			Incremental Serial Encoder Absolute Serial Encoder Battery-less Absolute Encoder ABZ (UVW) Parallel Encoder
Actuator Cable Length			MAX. 20m
Serial Communication Interface	SIO Connector		RS-485: 1CH (based on Modbus Protocol RTU/ASCII) Speed: 9.6 to 230.4Kbps Control available with serial communication in the modes other than the pulse train
	USB Connector		Communication protocol: USB 2.0, Speed: 12MHz, Connector: miniB
External Interface	PIO Type		Signal I/O dedicated for 24V DC (selected from NPN/PNP) … Input 16 points max., output 16 points max.
	Field Network Type		CC-Link, CC-Link IE Field, DeviceNet, EtherCAT, EtherNet/IP, PROFINET IO, MECHATROLINK-III
	Other		R-Unit Connection Type
	Multi-Function Connector	Input Pulse Frequency	Differential system (Line Driver System): MAX. 2.5Mpps Open Collector System: MAX. 200Kpps (AK-04 when option was used) Command Pulse Multiplying Factor (Electrical Gear: A/B) Setting Range of A and B (set to parameter): 1 to 99,999,999
		Feedback Pulse	Differential system (Line Driver System): MAX. 2.5Mpps Open Collector System: MAX. 500Kpps (JM-08 when option was used)
		Analog Output	1 System (Load data) 4 to 20mA Current output (±1%) Load resistor 10 to 600Ω
Data Setting and Input			PC Software, Touch Panel Teaching, Teaching Pendant
Data Retention Memory			Saves position data and parameters to non-volatile memory (There is no limitation in number of writing.)

Item		SCON2-CG
Cable Length	PIO	Up to 10m
	RS-485	Total cable length 100m or less.
	Field Network	Refer to each Field Network specification
Operation Mode		Positioner Mode / Pulse Train Control Mode / Press Program / Motion
Number of Positions in Positioner Mode		Standard 64 points, MAX. 384 points (PIO Type, Field Network Type) (Note) Number of positions differs depending on the selection in PIO pattern and field network operation mode.
LED Display (Mounted on Front Panel)		PWR (green) : Normal Controller Start SV (green) : Servo ON ALM (orange) : Alarm Generated WRG (orange) : Warning being generated STOP (Red) : Stopped SAFE (Red) : Safety stop
Electromagnetic Brake Compulsory Release Switch (Mounted on Front Panel)		Switching NOM (standard) /BK RLS (compulsory release)
Insulation Resistance (Between Secondary-FG)		500V DC 10MΩ or more
Insulation Strength (Between Primary-FG)		1500V AC for 1 min. (Note) Withstand voltage of pressing operation using force sensor loadcell is 50V DC
Environment	Surrounding air temperature	0 to 60°C
	Surrounding humidity	5% RH to 85% RH (Should be no-condensing or freezing)
	Surrounding environment	Refer to [2.7 Installation and Storage Environment]
	Surrounding storage temperature	-20 to 70°C (Should be no-condensing or freezing)
	Surrounding storage humidity	5% RH to 85% RH (Should be no-condensing or freezing)
	Vibration Resistance	Frequency: 10 to 57Hz / Amplitude: 0.035mm (Continuous), 0.075 (Intermittently) Frequency: 57 to 150Hz / Acceleration: 4.9m/s^2 (Continuous), 9.8m/s^2 (Intermittently) XYZ Each direction Sweep Time: 10min. Number of Sweep Times: 10 times
	Impact Resistance	Operation: Half Sine Wave Amplitude / Duration: 50m/s^2 (5G) / 30ms
	Altitude	1,000m above sea level or less
	Overvoltage Category	III
	Pollution Degree	2
Mass [g]		Approx. 800
Method Cooling		Forced Air Cooling
External Dimensions [mm]		W40 × H160 × D143

Note 1 In-rush current will flow for approximately 20ms after the power is turned ON.
Note that the value of in-rush current differs depending on the impedance and the internal element temperature (thermistor type in-rush current control circuit) of the power supply line.

Note 2 Leak current varies depending on the capacity of connected motor, cable length and the surrounding environment. Measure the leak current at the point where a ground fault circuit interrupter is to be installed when leakage protection is conducted.
A ground fault circuit interrupter needs to be selected carefully considering the purposes of prevention of fire and protection of human.
Use the harmonic type (for inverter) for the ground fault circuit interrupter.

Note 3 It is not necessary to supply power to PIO, SIO Converter without using PIO. In this case, set the parameter No.74 “PIO power supply supervision” to “1” (Invalid). It will generate the alarm 0CF “I/O 24V Power Supply Error” if the setting is not done.

R-Unit Connection Type Interface Specifications

Item	Contents
Number of Controlled Axes	Max. 16 Axes * Total number of connection including A/P/D/SC Drivers and ELECYLINDER
Connector	PC Board Side : S20B-PUDSS-1 (JST) Cable Side : PUDP-20V-S (JST)
Cable Length	Total Cable Length: Up to 10m Length of Cables between Devices: Up to 3.0m
Cycle Time	1.0 / 2.0 / 3.0 / 4.0 ms
Power Voltage (Physical Layer)	24V ±10%
Input Current (Physical Layer)	About 80mA
Driver Control Communication	
Communication System	Total Frame System
Baud Rate	3.0Mbps
Transmitted Bytes	Max. 1024 bytes (64 bytes × 16 Axes)
Tool Communication (Note)	
Communication System	Modbus System
Baud Rate	3.0 Mbps
Transmitted Bytes	256 bytes

(Note) The serial communication interface of SCON2 cannot be used in the R-Unit connection specification.
Refer to [each instruction manual] for the master unit of R-Unit.

2.3.2 Power Capacity and Heat Generation

Rated Power Capacity = Motor Power Capacity + Control Power Capacity

Peek Max. Power Capacity = Peek Max. Motor Power Capacity + Control Power Capacity

Actuator Motor Wattage	Motor Power Capacity [VA]	Peek Max. Motor Power Capacity [VA]	Control Power Capacity [VA]	Rated Power Capacity [VA]	Peek Max. Power Capacity [VA]	Heat Generation [W]
30 (for RS)	138	414	48	186	462	33
60	138	414		186	462	33
60 (RCS3-CTZ5)	197	591		245	639	32
100	234	702		282	750	35
100 (LSA)	283	851		331	899	36
150	328	984		376	1,032	37
200	421	1,263		469	1,311	38
200 (DD)	503	1,509		551	1,557	36
200 (Excluding LSA(S)-N15H)	486	1,458		534	1,506	38
200S (LSA(S)-N15H)	773	2,319		821	2,367	56
300 (LSA)	662	1,986		710	2,034	40
400	920	2,760		968	2,808	45
400 (RCS3-CT8)	1,230	3,690		1,278	3,738	47
600	1,164	2,328		1,212	2,376	56
600 (DD)	1,462	4,386		1,510	4,434	49
750	1,521	3,042		1,569	3,090	58
750 (RCS2-RA13R With load cell)	1,521	4,563		1,569	4,611	58

RS : Rotary Shaft, LSA : Linear Actuator, DD : Direct Drive Motor

2.3.3 Selection of Circuit Breaker

For the selection of the circuit breaker, perform it according to the following items.

- 3 times of the maximum rated current flows to the controller during the acceleration/deceleration. Select an interrupter that does not trip with this value of current. If a trip occurs, select an interrupter that possesses the rated current of one grade higher. (Check the operation characteristics curves in the product catalog.)
- Select an interrupter that does not trip with the in-rush current. (Check the operation characteristics curves in the product catalog.)
- Consider the current that enables to cutoff the current even when a short circuit current is flown for the rated cutoff current.
  Rated Interrupting Current > Short Circuit Current = Primary Power Capacity / Power Voltage

- Consider margin for the rated current on the circuit breaker.

Rated Current for Circuit Breaker >
(Rated Motor Power Capacity [VA] + Control Power Capacity [VA]) / AC Input Voltage × Safety Margin (reference 1.2 to 1.4 times)

2.3.4 Selection of Leak Current Breaker

- A leak current breaker needs to be selected carefully considering the purposes of prevention of fire and protection of human.
- Leak current varies depending on the capacity of connected motor, cable length and the surrounding environment. Measure the leak current at the point where a leak current breaker is to be installed when leakage protection is conducted.
- Use the harmonic type (for inverter) for the leak current breaker.

Reference: Test Conditions When Safety Certificate Acquired

The leakage breaker was confirmed normal operation under the following conditions.

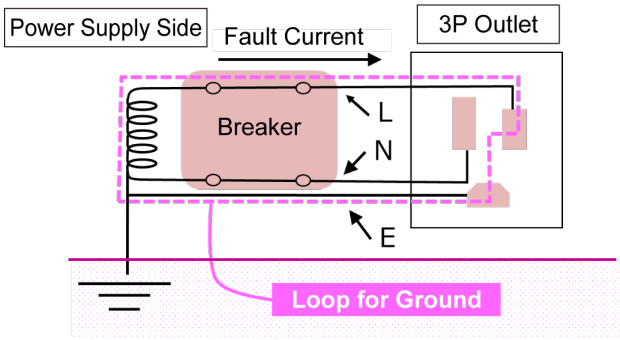
For TN System

Protection Device			System Voltage	Fault Loop Impedance
Model Name	Rated Current	Rated Sensitivity Current [IΔn]		
Fuji Electric EW32AAG-2P010B	10A	30mA	110-115V 200-230V	3Ω or less

For TT System

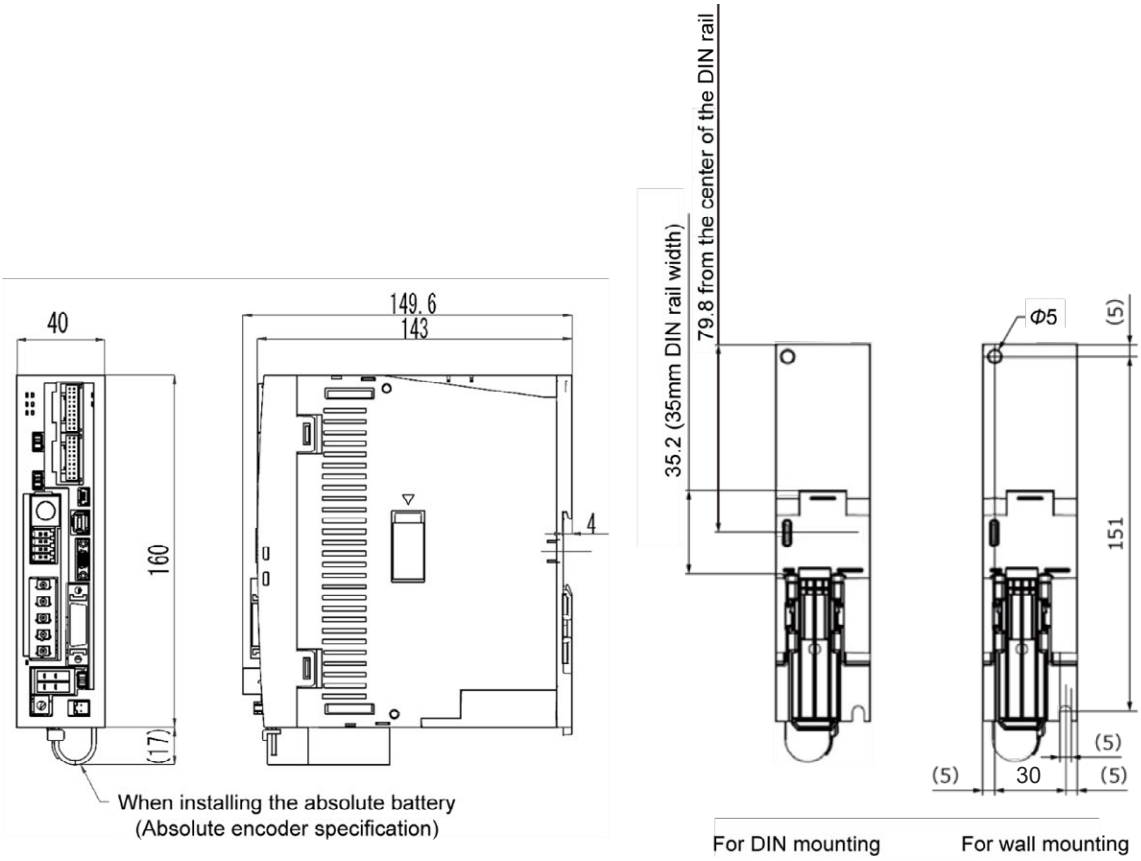
Protection Device			System Voltage	Fault Loop Impedance
Model Name	Rated Current	Rated Sensitivity Current [IΔn]		
Fuji Electric EW32AAG-2P010B	10A	30mA	110-115V 200-230V	100Ω or less

* As the setting of the sensitivity current may differ for each country, follow the authorities.
* The fault loop impedance represents all the impedance in the loop of line - ground.

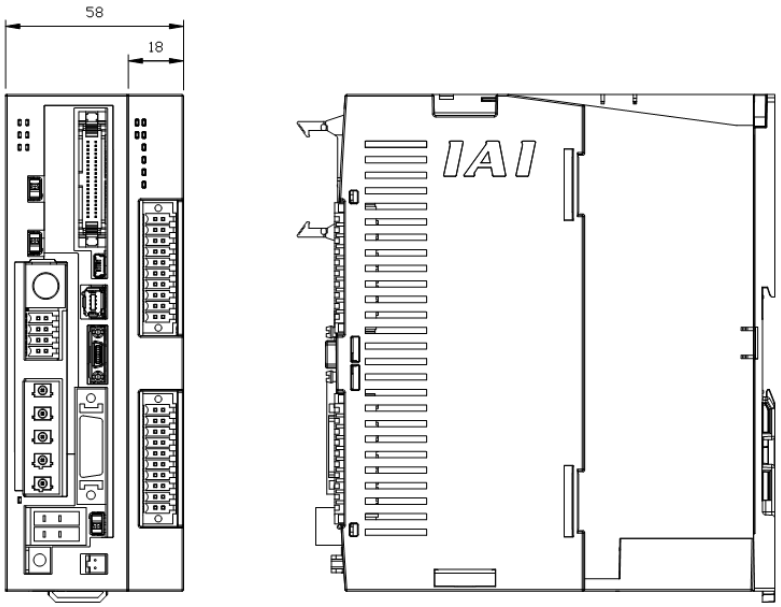


2.4 Appearance

2.4.1 SCON2

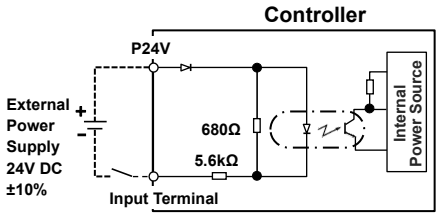
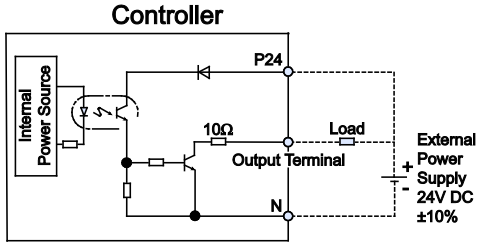
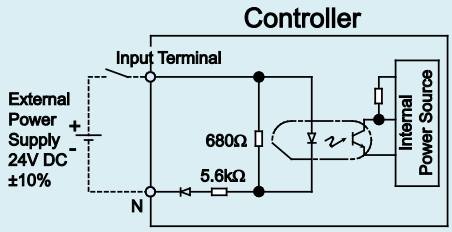
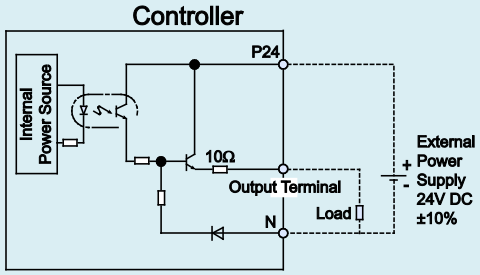


2.4.2 SCON2 + Functional Safety Unit

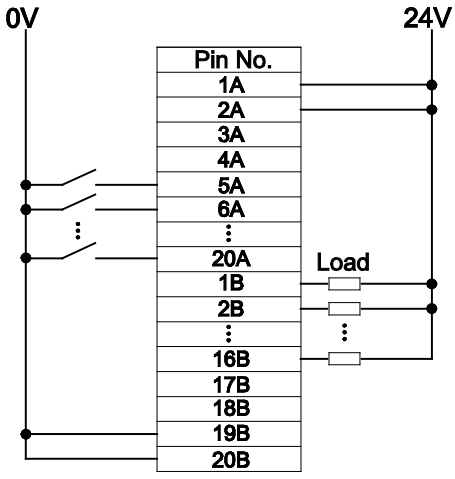


2.5 I/O Specifications

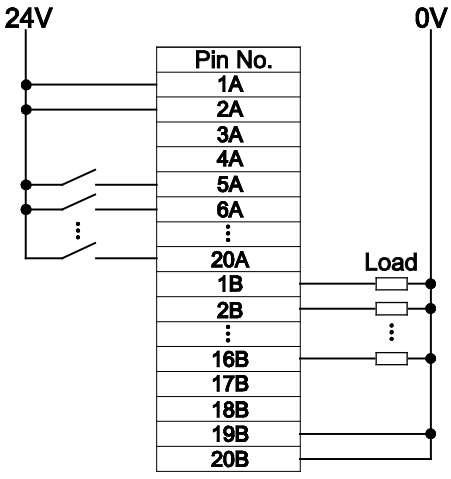
2.5.1 PIO Input and Output Interface

	Input Section		Output Section	
Specification	Input Voltage	24V DC ±10%	Load Voltage	24V DC
	Input Current	4mA 1 circuit	Peak Load Electric Current	50mA 1 circuit
	ON/OFF Voltage	ON Voltage MIN. 18V DC OFF Voltage MAX. 6V DC	Leakage Current	MAX. 0.1mA/1point
	Insulation	Insulation with Photocoupler		
NPN				
PNP				
I/O Cable	Refer to [3.1.3 [5] PIO Circuit]			

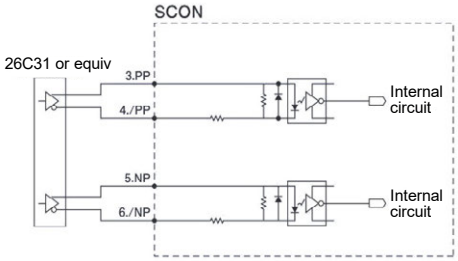
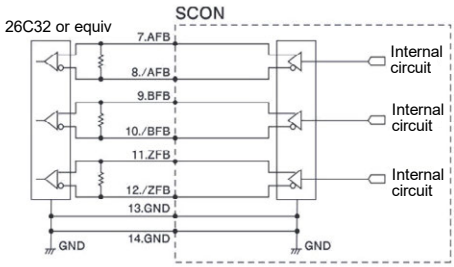
NPN Type



PNP Type



2.5.2 Pulse Train Input and Output Interface

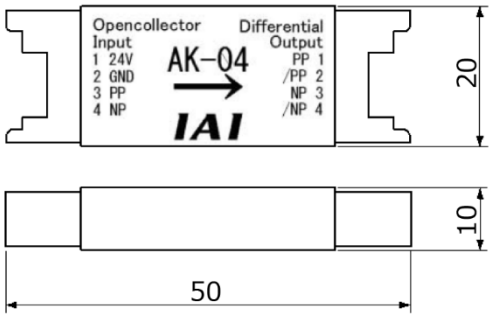
	Line Driver Input	Output
Specification	Input pulse equivalent to Line Driver 26C31 (differential voltage: approx. 4V) 	Output pulse equivalent to Line Receiver 26C32 (differential voltage: approx. 4V) 
Pulse Train Form	Including active high and active low	

2.6 Options

2.6.1 Pulse Converter (Model : AK-04)

The pulse converter converts command pulses in the open collector mode to those in the differential mode.
Use this converter if the host controller sends output pulses in the open collector mode.

Item	Specification
Input Power Supply	24V DC ±10% (MAX. 50mA)
Input Pulse	O/C (Collector current MAX. 12mA)
Input Frequency	200KHz or less
Output Pulse	Differential output equivalent to 26C31 (MAX. 10mA)
Mass	10g or less (excluding cable connector)
Accessories	37104-3122-000FL (e-CON Connector) 2 Units Cover Color : YW Applicable wire AWG 24 to 26 (Less than 0.14 to 0.3mm^2, finished O.D. Φ1.0 to 1.2mm)



Caution

- Use the pulse converter in the ambient temperature range between 0 to 40°C.
- The temperature increase of about 30°C occurs during operation. Accordingly, neither install several pulse converters in close contact nor install them within a duct. Do not install the pulse converter near other heating devices.
- If more than one pulse converter is installed, set a pulse converter apart from another by 10mm or more.

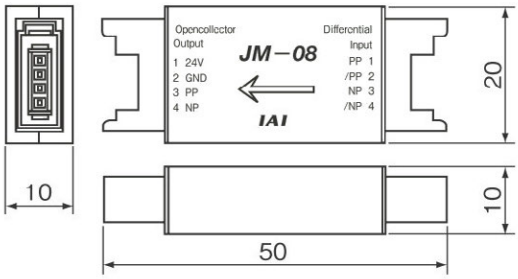
2.6.2 Pulse Converter (Model : JM-08)

The pulse converter converts feedback pulses in the differential mode into those in the open collector mode.

Use this converter if the host controller sends input pulses in the open collector mode.

[Specification]

Item	Specification
Input Power Supply	24V DC ±10% (MAX. 50mA)
Input Pulse	Differential output equivalent to 26C32 (MAX. 10mA)
Input Frequency	500KHz or less
Output Pulse	24V DC O/C (Collector current MAX. 25mA)
Mass	10g or less (excluding cable connector)
Accessories	37104-3122-000FL (e-CON Connector) 2 Units Applicable wire AWG No.24 to 26 (Less than 0.14 to 0.3mm^2, finished O.D. Φ1.0 to 1.2mm)



Caution

- Use the pulse converter in the ambient temperature range between 0°C to 40°C.
- The temperature increase of about 30°C occurs during operation. Accordingly, neither install several pulse converters in close contact nor install them within a duct. Do not install the pulse converter near other heating devices.
- If more than one pulse converter is installed, set a pulse converter apart from another by 10mm or more.

2.6.3 Regenerative Resistor Unit

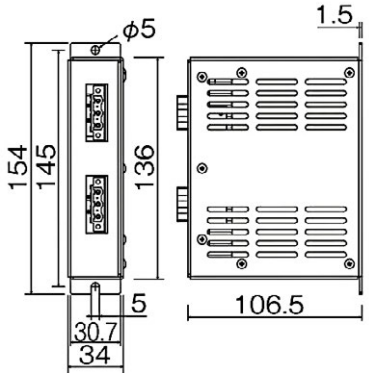
This is a unit that converts the regenerative current to heat when the motor decelerates.
Refer to [3.3.5 Connectable Regenerative Resistor Units] for the number of connectable units.

Model Codes			Specifications of Enclosed Items
First Unit	Screw attachment small type	RESU-2	SCON controller connection Cable (Model code CB-SC-REU010) 1m enclosed
	DIN rail attachment small type	RESUD-2	
2nd unit	Screw attachment small type	RESU-1	Regenerative resistor unit connection cable (Model code CB-ST-REU010) 1m enclosed
	DIN rail attachment small type	RESUD-1	

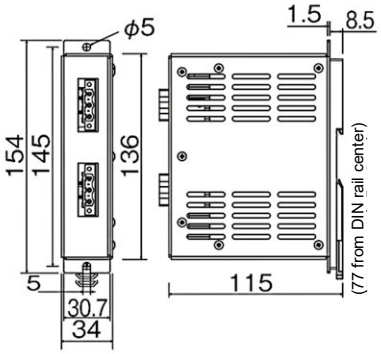
[Specification]

	RESU-1, RESU-2	RESUD-1, RESUD-2
Body Size [mm]	W34×H154×D106.5	W34×H158×D115
Body Mass [kg]	Approx. 0.4	
Internal Regenerative Resistor	235Ω 80W	
Max. Heat Radiation	32W	

[External Dimensions]



RESU-1, RESU-2 (Screw attachment small type)



RESUD-1, RESUD-2 (DIN rail attachment small type)

Caution

- The temperature for the external regenerative resistor units get high.
- Do not attempt to install the unit near a flammable object.
- Do not attempt to touch them.
- It is recommended that the cables to be used should possess high performance in the heat resistance. Also, pay attention to have the cables not to touch the external regenerative resistor units.

2.6.4 Brake Box

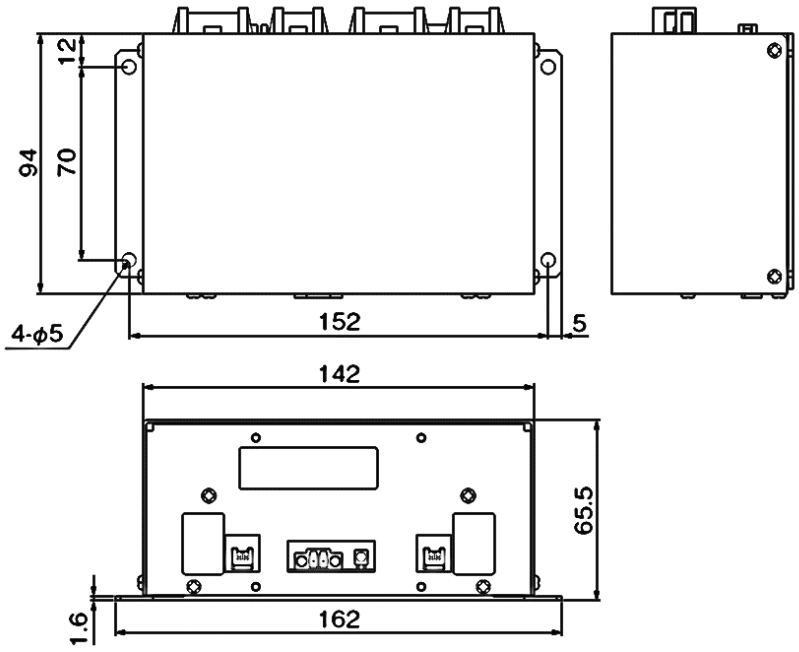
[1] RCB-110-RA13-0

1 unit of Brake Box possesses brakes for 2 shafts. This is necessary when connecting an actuator with indication to connect a brake box.

[Specification]

Item	Specification
Body Size	162 × 94 × 65.5mm
Power Voltage and Current	24V DC ±10%　1A
Connection Cable	Encoder Cable (Model Code CB-RCS2-PLA010) 1m
Number of Controlled Axes	2

[External Dimensions]



[24V Power Supply Connector]

Connector on Cable Side (Enclosed in standard package)	MC1.5/2-STF-3.5 (Phoenix Contact)		
Applicable Cable	AWG28 to 16		
Terminal Assignment	**Pin No.**	**Signal**	**Explanation**
	1	0V	Power Supply Grounding for Terminal Brake Excitation
	2	24VIN	For Brake Excitation and 24V Power Supply

[Connectors 1 and 2 for external brake release switch connection]

Short circuit of pin No. 1 and 2 of this connector releases the brake compulsorily.

Same as the brake release switch ON controller unit, it is possible to release the brake.

Do not keep the compulsory release condition while in automatic operation.

Connected Equipment	Brake Release Switch		
Connector on Cable Side (Please prepare separately)	XAP-02V-1 (Contact BXA-001T-P0.6) (JST)		
Switch Rating	30V DC Minimum Current 1.5mA		
Terminal Assignment	**Pin No.**	**Signal**	**Explanation**
	1	BKMRL	Brake Release Switch Input
	2	COM	Power Supply Output for Brake Release Switch Input

[2] IA-110-DD-4

The following actuator is required for the brake-equipped type.

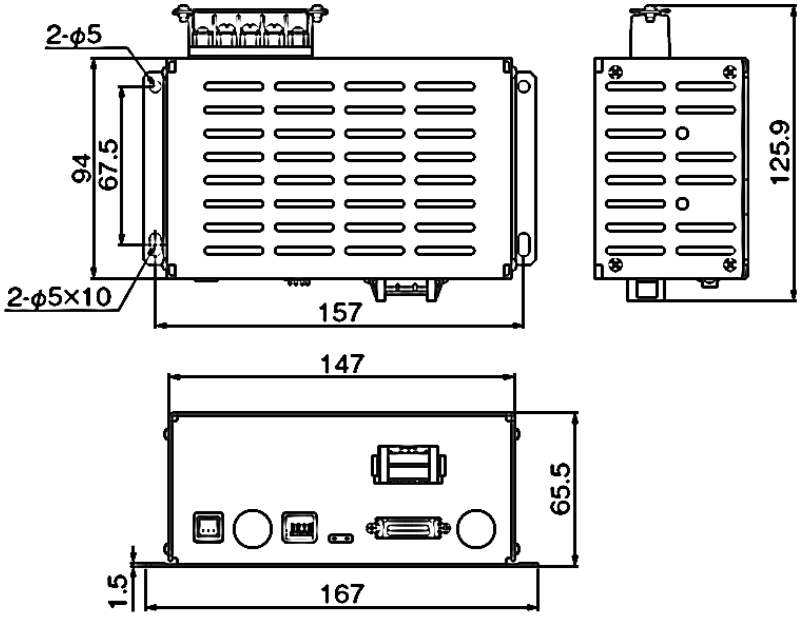
• DDA

* Brake control for one axis should be available with one unit of a brake box.

[Specification]

Item		Specification
Input power supply voltage		100-240V AC ±10%
Input power Supply current	Rated excitation	100V AC: 0.25A / 200V AC: 0.15A
	Overexcitation	100V AC: 0.6A / 200V AC: 0.3A
Generated heat		6.0W (Rated excitation) / 10.0W (Overexcitation)
Overexcitation duration		1.2s ±0.2s
Connection cable		Encoder cable (Model number CB-RCS2-PLA010) 1m
Environment	Surrounding air temperature	0 to 40°C
	Surrounding humidity	85% RH or less (Non-condensing)
	Surrounding environment	(Refer to the Installation environment)
	Surrounding storage temperature	-20 to 70°C
	Surrounding storage humidity	85% RH or less (Non-condensing)
	Degree of protection	IP20
	Pollution degree	Pollution Degree 2
External dimensions		147 × 94 × 65.5mm (Attachment portion excluded)
Mass		Approx.0.4kg

[External Dimensions]



2.6.5 Loadcell

This is the pressing force detection unit that is used for the pressing operation using force sensor. This is used by connecting to the actuator corresponding to the pressing operation using force sensor.
In addition, the connectable actuator differs depending on the rated capacity of the loadcell.

[Specification]

Item	Specification			
Loadcell system	Strain Gauge			
Rated capacity [N]	600	2,000	6,000	20,000
Allowable oberload [%F.S.*]	200			
Lordcell accuracy [%R.C*]	±1.0			
Ambient temperature range [°C]	0 to 40			
Dielectric strength voltage [V]	50 DC			

* R.C. : Rated capacity, F.S. : Withstand Load (Full Scale)

[Installation Drawing]

Installed on RCS2-RA13R

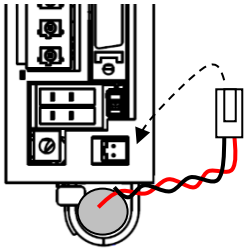
Check the Instruction Manual for details of how to attach and the dimensions.

Caution

- Do not give excess shock (caused by dropping it, etc.) to the loadcell. Failure to follow it may cause the loadcell to be damaged.

2.6.6 Absolute Battery

An absolute battery is enclosed with the absolute type controller.
The absolute battery is used to backup power source the absolute data.
Connect the battery to the absolute battery connector on the front panel of the controller.



Absolute Encoder Backup Specifications

Item		Specifications
Battery classification		Thionyl chloride lithium batteries
Battery manufacturer's name		TOSHIBA LIFESTYLE PRODUCTS Or, Maxell, Ltd.
Battery model (IAI model)		AB-5
Battery nominal voltage		3.6V
Current standard capacity		2,000mAh
Reference for battery replacing timing (Note 1) (Ambient temperature 40°C)		2 years after use (if left unused without power supply to controller)
		4 years after use (if 50% of time with power supply to controller)
Error detection (*1)	Output of voltage drop alert signal *ALML	3.1V (Reference value)
	Output of Alarm output *ALM	2.5V (Reference value)
	Warning → Reference for time suspended after alert till alarm	7 days if the controller is operated continuously at 20°C.
		2.5 days if the controller is operated continuously at 40°C.
Absolute data retaining duration at battery replacement		15 minutes (Have the replacing work done within this time.)

Note 1 Replace the battery regularly.

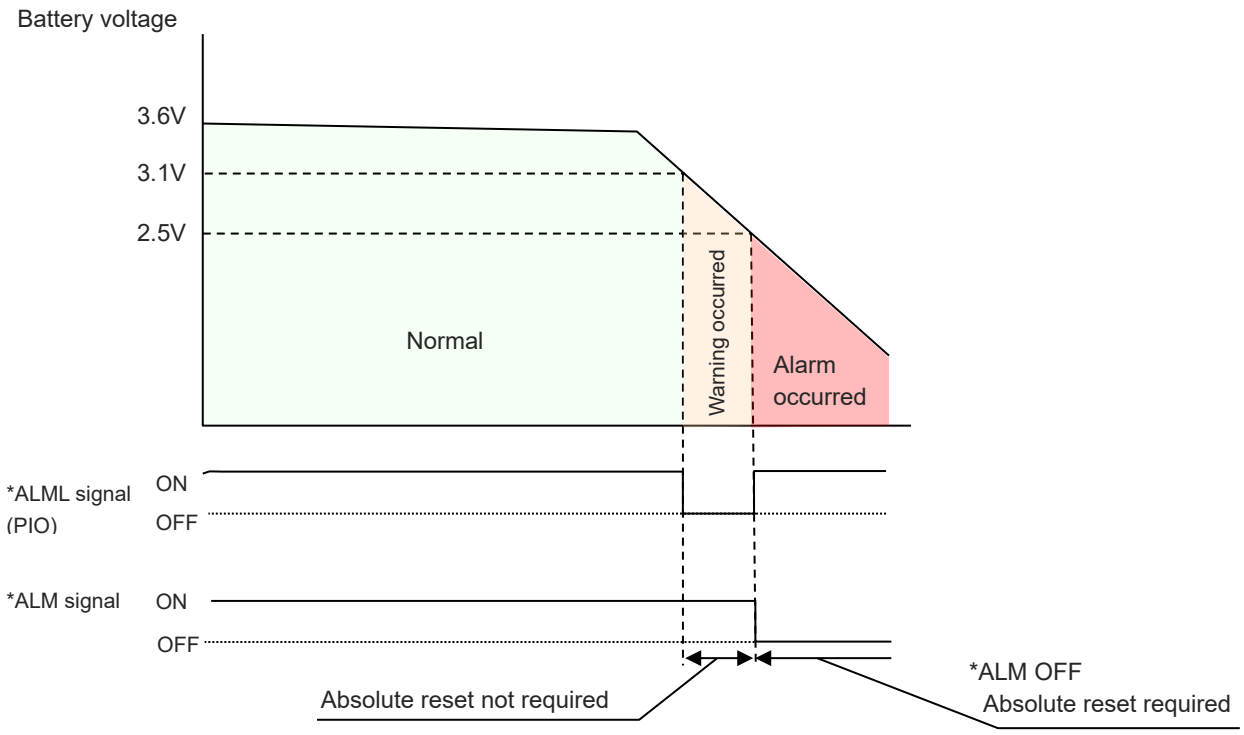
*1 Error detection : If the voltage of the absolute battery is dropped, the error detection responding to the voltage is held.

Absolute Battery (without holder) Type : AB-5
(with holder) Type : AB-5-CS3

Voltage	PIO Signals	Alarm
3.1V (Reference value)	Voltage drop alert signal *ALML (Note 2) OFF	–
2.5V (Reference value)	Alarm signal *ALM (Note 2) OFF	OEE "Absolute Encoder Error Detection 2"

Note 2 *ALML and *ALM are the signals of active low.

Turns ON when normal after the controller is turned on, and turns OFF when an error is detected.
Replace the battery before alarm is generated due to the lamp display by *ALML signal of PLC.
If the alarm is generated, it will be necessary to absolute reset after the battery replacement.



2.7 Installation and Storage Environment

This product is capable for use in the environment of pollution degree 2[*1] or equivalent.

*1 Pollution Degree 2 : Environment that may cause non-conductive pollution or transient conductive pollution by frost (IEC60664-1)

2.7.1 Installation Environment

Do not use this product in the following environment.

- Location where the surrounding air temperature exceeds the range of 0 to 60°C
- Location where condensation occurs due to abrupt temperature changes
- Location where relative humidity is out of the range between 5%RH and 85%RH
- Location exposed to corrosive gases or combustible gases
- Location exposed to significant amount of dust, salt or iron powder
- Location subject to direct vibration or impact
- Location exposed to direct sunlight
- Location where the product may come in contact with water, oil or chemical droplets
- Environment that blocks the air vent
- Location with altitude higher than 1,000m

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

- Location subject to electrostatic noise
- Location where high electrical or magnetic field is present
- Location with the mains or power lines passing nearby

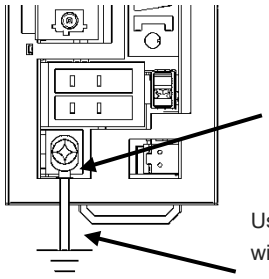
2.7.2 Storage and Preservation Environment

Storage and preservation environment follows the installation environment. Especially in a long-term storage, consider to avoid condensation of surrounding air.
Unless specially specified, moisture absorbency protection is not included in the package when the machine is delivered. In the case that the machine is to be stored in an environment where dew condensation is anticipated, take the condensation preventive measures from outside of the entire package, or directly after opening the package

2.8 Noise Elimination and Mounting Method

2.8.1 Noise Elimination

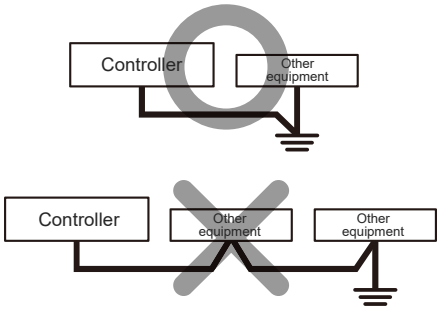
(1) Noise Elimination Grounding (Frame Ground)



Connect using FG connection terminal on the main unit.

Use green/yellow copper wire cable with its width 2.0mm^2 (AWG14) or more with rated temperature 60°C or more for wiring.

Earth Terminal
Class D for grounding class
(Grounding No. 3 in old standard:
Grounding resistance at 100Ω or less)



Do not share the ground wire with or connect to other equipment.
Ground each controller.

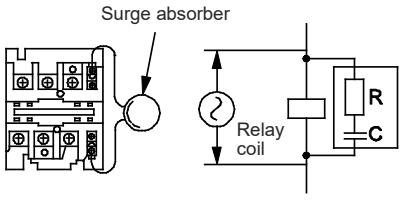
(2) Precautions regarding wiring method

1. Wire is to be twisted for the 24V DC power supply.
2. Separate the signal and encoder lines from the power supply and power lines.
3. Set the tightening torque for the ground screw to 1.0 to 1.2N•m.

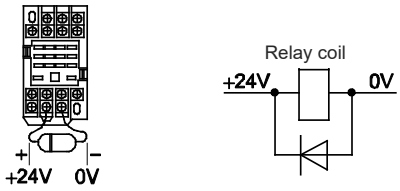
(3) Noise Sources and Elimination

Carry out noise elimination measures for electrical devices on the same power path and in the same equipment.
The following are examples of measures to eliminate noise sources.

1. AC solenoid valves, magnet switches and relays
   [Measure] Install a Surge absorber parallel with the coil.



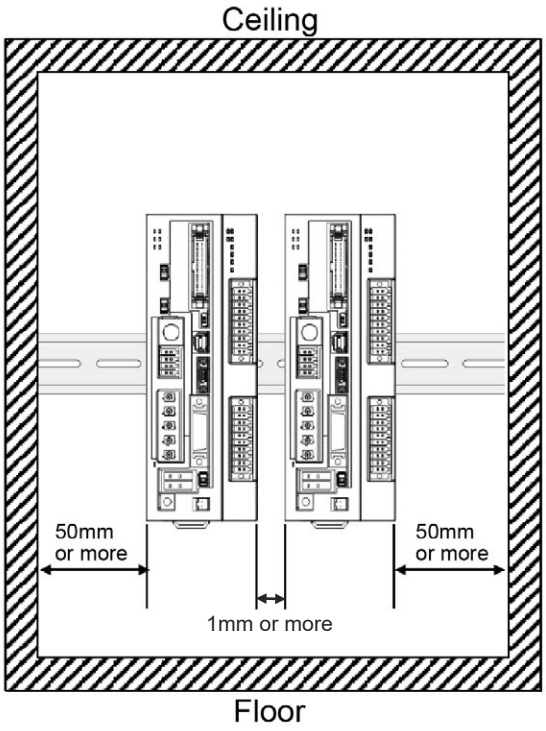
2. DC solenoid valves, magnet switches and relays
   [Measure] Mount the windings and diodes in parallel. Select a diode built-in type for the DC relay.

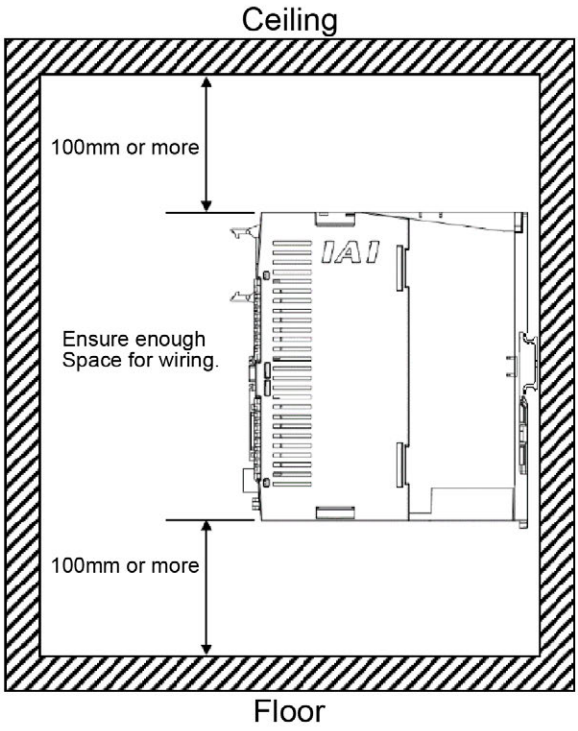


2.8.2 Installation and Mounting

Consider such facts as size of control panel, layout of a controller and cooling performance in design and setup so the ambient temperature falls into the range from 0 to 60°C.

Item		
Installation	Installed Orientation	Vertical Orientation (Exhaust Upward)
	Installation Method	Screw Affixing, or DIN Rail Mount
	Installing Condition	Refer to Fig. Installing Condition and Notes for Installing Condition
Ground		Mandatory (Incomplete grounding may cause electric shock)

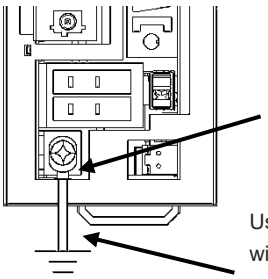




* The clearance below the controller bottom is a space considering operation easiness. Secure 50mm or more when operation easiness is not to be considered.

2.8.3 Installation

- Make sure to conduct grounding in order to avoid electric shock.
- Make sure to perform grounding work for the ground terminal on the AC power supply cable in the controller and the grounding plate in the control panel. For safety grounding, use a green/yellow copper-conducting cable with its width 2.0mm^2 (AWG14) or more.
- For grounding, conduct a work of Class D (former Class 3, ground resistance 100Ω or less) grounding.



Connect using FG connection terminal on the main unit.

Use green/yellow copper wire cable with its width 2.0mm^2 (AWG14) or more with rated temperature 60deg or more for wiring.

Earth Terminal
Class D for grounding class
(Grounding No. 3 in old standard:
Grounding resistance at 100Ω or less)

SCON2-CG

Chapter 3

Wiring

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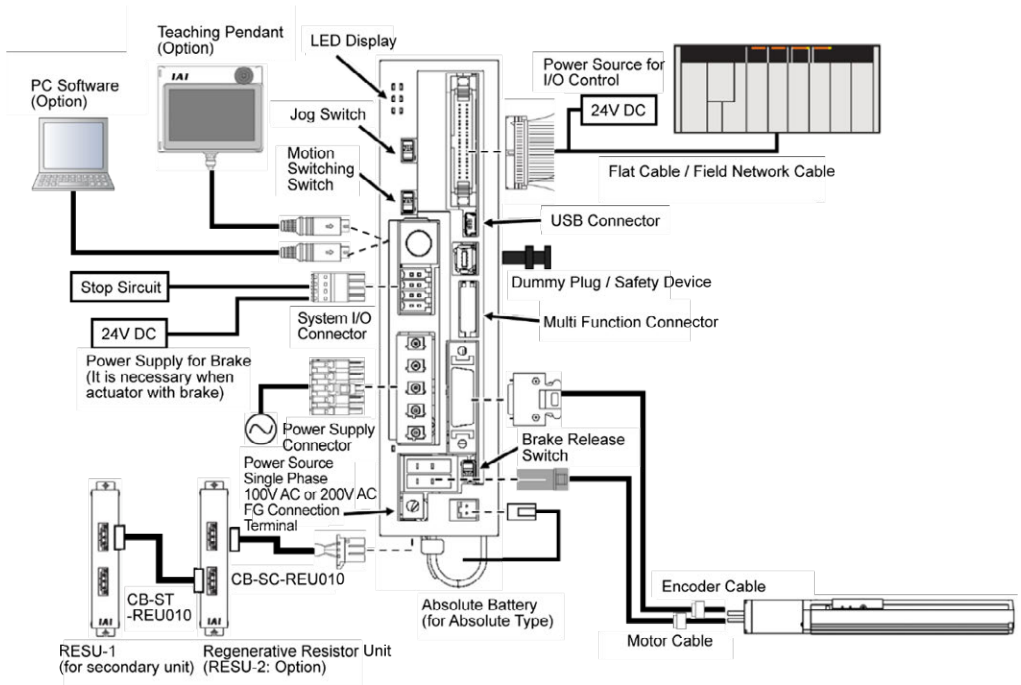
3.1 Positioner Mode (PIO Control)

3.1.1 Wiring Diagram (Connection of Construction Devices)

[1] Basic Wiring Diagram



If using RCS2-RA13R, DDA or NS Type (Note 1) for the actuator and the option shown in the table is applied, the wiring between the actuator and the controller will differ from the basic wiring layout. Shown in the table is the relation of the option and wiring layout.

○ : Equipped × : Not Equipped

Model Name	Option		Wiring Layout between Actuator and Controller
	Brake	Loadcell	
RCS2-RA13R	○	×	1
	×	○	Basic Wiring Diagram
	○	○	2
	×	×	Basic Wiring Diagram
NS (Note 1)	○	-	1
	×	-	Basic Wiring Diagram
DDA	○	-	3
	×	-	Basic Wiring Diagram

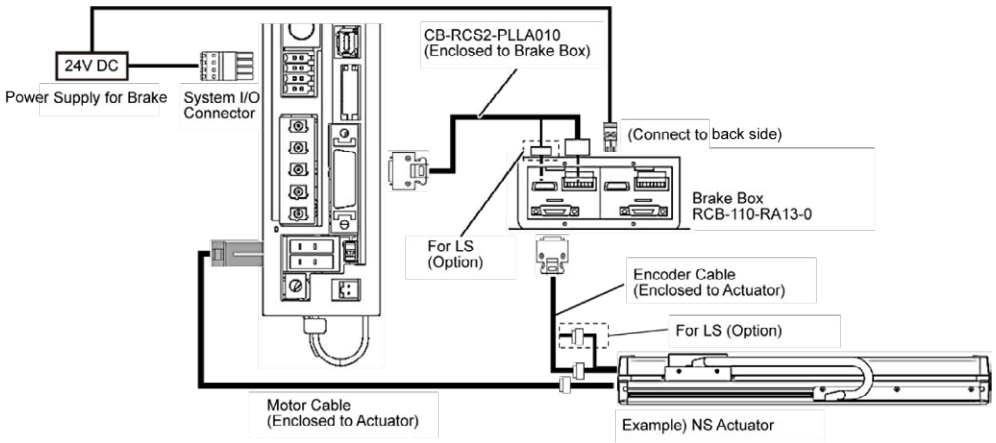
Note 1 Excluding NS-S type.

Caution

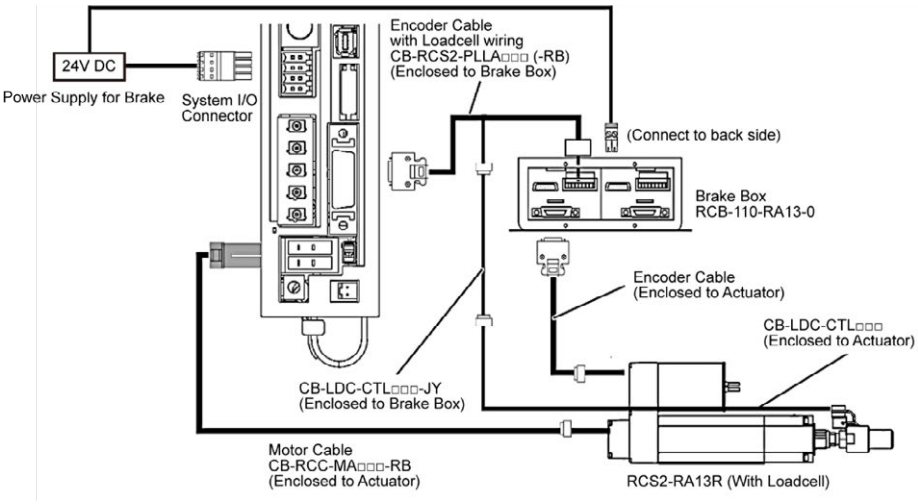
- Make sure to turn the power to the controller OFF when inserting or removing the connector that connects the PC software or touch panel teaching to the controller. Inserting or removing the connector while the power is turned ON causes a controller failure.

[2] Wiring Layout for RCS2-RA13R or NS Type with Option (between actuator and controller)

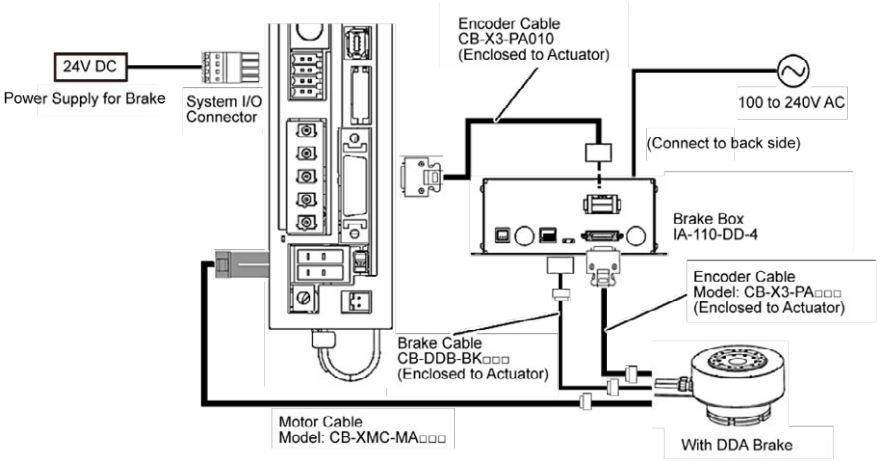
1. RCS2-RA13R Equipped with Brake, with no Loadcell, or NS Actuators with Brake type



2. RCS2-RA13R equipped with Brake and Loadcell



3. For DDA with brake type



3.1.2 PIO Pattern Selection and PIO Signal

[1] PIO Pattern (Control Pattern) Selection

Possesses 8 types of control logics, PIO Patterns 0 to 7. Set the most suitable PIO pattern with the actual use to Parameter No. 25 “PIO pattern selection”.

Refer to [4.2 Operation in Positioner Mode] for the details of PIO patterns.

Selectable PIO Patterns

Type	Value set in parameter No. 25	Mode	Overview
PIO Pattern 0	0 (at the delivery)	Positioning Mode (Standard Type)	• Number of positioning points : 64 points • Position command : binary code • Zone signal output (* 1) : 1 point • Position zone signal output (* 2) : 1 point
PIO Pattern 1	1	Teaching mode (Teaching type)	• Number of positioning points : 64 points • Position command : binary code • Position zone signal output (* 2) : 1 point • Jog operation enabled by PIO signal • Writing current position data to position table enabled by PIO signal
PIO Pattern 2	2	256-point mode (Number of positioning points : 256-point type)	• Number of positioning points : 256 points • Position command : binary code • Position zone signal output (* 2) : 1 point
PIO Pattern 3	3	384-point mode (Number of positioning points : 384-point type)	• Number of positioning points : 384 points • Position command : binary code • Zone signal output : None
PIO Pattern 4	4	Solenoid Valve Mode 1 (7-point type)	• Number of positioning points : 7 points • Position command : Individual number signal ON • Zone signal output (* 1) : 1 point • Position zone signal output (* 2) : 1 point
PIO Pattern 5	5	Solenoid Valve Mode 2 (3-point type)	• Number of positioning points : 3 points • Position command : Individual number signal ON • Zone signal output (* 1) : 1 point • Position zone signal output (* 2) : 1 point
PIO Pattern 6	6	Pressing Operation Using Force Sensor Mode 1	• Number of positioning points : 32 points • Position command : binary code • Position zone signal output (* 2) : 1 point • Judgment of pressing force enabled
PIO Pattern 7	7	Pressing Operation Using Force Sensor Mode 2	• Number of positioning points : 5 points • Position command: Individual No. signal ON • Position zone signal output (* 2): 1 point • Judgment of pressing force enabled

*1 Zone signal output:

Set the zone range in parameter No.1 and 2. The signal is always effective after home return is completed.

*2 Position zone signal output:

This feature is associated with the specified position number. The zone range is set in the position table. The zone range is enabled only when the position is specified but disabled if another position is specified. Position Zone Signal can be changed to Zone Signal in Parameter No.149.

[2] PIO Patterns and Signal Assignment

The signal assignment of I/O flat cable by the PIO pattern is as shown below. Follow the following table to connect the external equipment (such as PLC).

Pin No.	Category	PIO Functions	Parameter No.25 "PIO pattern selection"			
			0	1	2	3
			Positioning Mode	Teaching mode	256-point mode	384-point mode
	Input	Number of Positioning Points	64 points	64 points	256 points	384 points
		Home Return Signal	○	○	○	○
		Jog Signal	×	○	×	×
		Teaching Signal (Current Position Writing)	×	○	×	×
		Brake Release	○	×	○	○
	Output	Moving Signal	○	○	×	×
		Zone Signal	○	Δ (Note1)	Δ (Note1)	×
		Position Zone Signal	○	○	○	×
1A	24V	P24				
2A	24V	P24				
3A	–	–				
4A	–	–				
5A	Input	IN0	PC1	PC1	PC1	PC1
6A		IN1	PC2	PC2	PC2	PC2
7A		IN2	PC4	PC4	PC4	PC4
8A		IN3	PC8	PC8	PC8	PC8
9A		IN4	PC16	PC16	PC16	PC16
10A		IN5	PC32	PC32	PC32	PC32
11A		IN6	–	MODE	PC64	PC64
12A		IN7	–	JISL	PC128	P128
13A		IN8	–	JOG+	–	PC256
14A		IN9	BKRL	JOG–	BKRL	BKRL
15A		IN10	RMOD	RMOD	RMOD	RMOD
16A		IN11	HOME	HOME	HOME	HOME
17A		IN12	*STP	*STP	*STP	*STP
18A		IN13	CSTR	CSTR/PWRT	CSTR	CSTR
19A		IN14	RES	RES	RES	RES
20A		IN15	SON	SON	SON	SON
1B	Output	OUT0	PM1 (ALM1)	PM1 (ALM1)	PM1 (ALM1)	PM1 (ALM1)
2B		OUT1	PM2 (ALM2)	PM2 (ALM2)	PM2 (ALM2)	PM2 (ALM2)
3B		OUT2	PM4 (ALM4)	PM4 (ALM4)	PM4 (ALM4)	PM4 (ALM4)
4B		OUT3	PM8 (ALM8)	PM8 (ALM8)	PM8 (ALM8)	PM8 (ALM8)
5B		OUT4	PM16	PM16	PM16	PM16
6B		OUT5	PM32	PM32	PM32	PM32
7B		OUT6	MOVE	MOVE	PM64	PM64
8B		OUT7	ZONE1	MODES	PM128	PM128
9B		OUT8 (Note1)	PZONE/ZONE2	PZONE/ZONE1	PZONE/ZONE1	PM256
10B		OUT9	RMDS	RMDS	RMDS	RMDS
11B		OUT10	HEND	HEND	HEND	HEND
12B		OUT11	PEND	PEND/WEND	PEND	PEND
13B		OUT12	SV	SV	SV	SV
14B		OUT13	*EMGS	*EMGS	*EMGS	*EMGS
15B		OUT14	*ALM	*ALM	*ALM	*ALM
16B		OUT15	*ALML	*ALML	*ALML	*ALML
17B	–	–				
18B	–	–				
19B	0V	N				
20B	0V	N				

Note 1 The mode can be switched over to PZONE with the setting of Parameter No.149 except for PIO Pattern 3.

Pin No.	Category	PIO Functions	Parameter No.25 "PIO pattern selection"			
			4	5	6	7
			Solenoid valve mode 1	Solenoid valve mode 2	Pressing operation using force sensor mode 1	Pressing operation using force sensor mode 2
	Input	Number of Positioning Points	7 points	3 points	32 points	5 points
		Home Return Signal	○	×	○	○
		Jog Signal	×	×	×	×
		Teaching Signal (Current Position Writing)	×	×	×	×
		Brake Release	○	○	○	○
	Output	Moving Signal	×	×	×	×
		Zone Signal	○	○	○ (Note1)	○ (Note1)
		Position Zone Signal	○	○	○	○
1A	24V	P24				
2A	24V	P24				
3A	Pulse Input	–				
4A		–				
5A	Input	IN0	ST0	ST0	PC1	ST0
6A		IN1	ST1	ST1 (JOG+)	PC2	ST1
7A		IN2	ST2	ST2 (Note2)	PC4	ST2
8A		IN3	ST3	–	PC8	ST3
9A		IN4	ST4	–	PC16	ST4
10A		IN5	ST5	–	–	–
11A		IN6	ST6	–	–	–
12A		IN7	–	–	–	–
13A		IN8	–	–	CLBR	CLBR
14A		IN9	BKRL	BKRL	BKRL	BKRL
15A		IN10	RMOD	RMOD	RMOD	RMOD
16A		IN11	HOME	–	HOME	HOME
17A		IN12	*STP	–	*STP	*STP
18A		IN13	–	–	CSTR	–
19A		IN14	RES	RES	RES	RES
20A		IN15	SON	SON	SON	SON
1B	Output	OUT0	PE0	LS0	PM1 (ALM1)	PE0
2B		OUT1	PE1	LS1 (TRQS)	PM2 (ALM2)	PE1
3B		OUT2	PE2	LS2 (Note2)	PM4 (ALM4)	PE2
4B		OUT3	PE3	–	PM8 (ALM8)	PE3
5B		OUT4	PE4	–	PM16	PE4
6B		OUT5	PE5	–	TRQS	TRQS
7B		OUT6	PE6	–	LOAD	LOAD
8B		OUT7	ZONE1	ZONE1	CEND	CEND
9B		OUT8 (Note1)	PZONE/ZONE2	PZONE/ZONE2	PZONE/ZONE1	PZONE/ZONE1
10B		OUT9	RMDS	RMDS	RMDS	RMDS
11B		OUT10	HEND	HEND	HEND	HEND
12B		OUT11	PEND	–	PEND	PEND
13B		OUT12	SV	SV	SV	SV
14B		OUT13	*EMGS	*EMGS	*EMGS	*EMGS
15B		OUT14	*ALM	*ALM	*ALM	*ALM
16B		OUT15	*ALML	*ALML	*ALML	*ALML
17B	Pulse Input	–				
18B		–				
19B	0V	N				
20B	0V	N				

Note "*" in codes above shows the signal of the active low. It should be on in normal condition and off when a signal is output.
PM1 to PM8 indicate the alarm binary code output signal when an alarm is generated.
Refer to [4.2.3 [7] Binary Output of Alarm Data Output]

Note 1 The mode can be switched over to PZONE with the setting of Parameter No.149 except for PIO Pattern 3.

Note 2 It is invalid before home-return operation.

[3] List of PIO Signals

The table below lists the functions of PIO signals.

Refer to the section shown in Relevant Sections for the details of the control of each signal.

Category	Signal Abbreviation	Signal Name	Function Description	Relevant Sections
Input	CSTR	PTP Strobe (Start Signal)	The actuator will start to move to the position set by the command position number.	4.2.4
	PC1 to PC256	Command Position Number	Input (in binary) a number of the position that is desired to move.	4.2.3
	BKRL	Brake Forcible Release	The brake will forcibly be released.	4.2.3
	RMOD	Operation Mode Changeover	The operating mode is selectable when the MODE switch of the controller is set to AUTO. (The setting is AUTO when signal is OFF, and MANU when ON.)	4.2.3
	*STP	Pause	When this signal turns OFF while the actuator is moving, the actuator will decelerate to stop. The remaining movement is in a hold while the actuator is stopped and will resume when the signal turns back ON.	4.2.4 4.2.5
	RES	Reset	An alarm will be reset when this signal is turned ON. Also, when it is turned ON in the pause mode (*STP is turned OFF), the remaining movement amount can be cancelled.	4.2.3 4.2.4 4.2.5 4.2.6
	SON	Servo ON	The servo remains ON while this signal is ON, or OFF while this signal is OFF.	4.2.3
	HOME	Home Return	The controller will perform home return operation when this signal is turned ON	4.2.3
	MODE	Teaching Mode	The operating mode will change to the teaching mode when this signal is turned ON. The mode will not be switched over unless CSTR, JOG+ and JOG- are all OFF and the actuator operation is stopped.	4.2.4
	JISL	Jog/inching Selector	Jog Operation can be performed with JOG+ and JOG- while this signal is OFF. Inching Operation is performed with JOG+ and JOG- when it is ON.	4.2.4
	JOG+ JOG–	Jog	Jog Operation is performed to positive direction by detecting ON edge of JOG+ signal and to negative direction by JOG- signal while JISL signal is OFF. The actuator will decelerate and stop if OFF edge is detected while in each Operation. Inching Operation is performed while JISL signal is ON.	4.2.4
	PWRT	Current Position Write	When the write position is specified in the teaching mode and this signal has remained ON for 26ms or longer, the controller will write the current position in the specified position field.	4.2.4
	CLBR	Loadcell Calibration Command	Turn this signal ON for more than 20ms to perform calibration of loadcell.	4.2.7
	ST0 to ST6	Start Signal	The actuator moves to the commanded position with this signal ON during the electromagnetic valve mode.	4.2.5 4.2.6

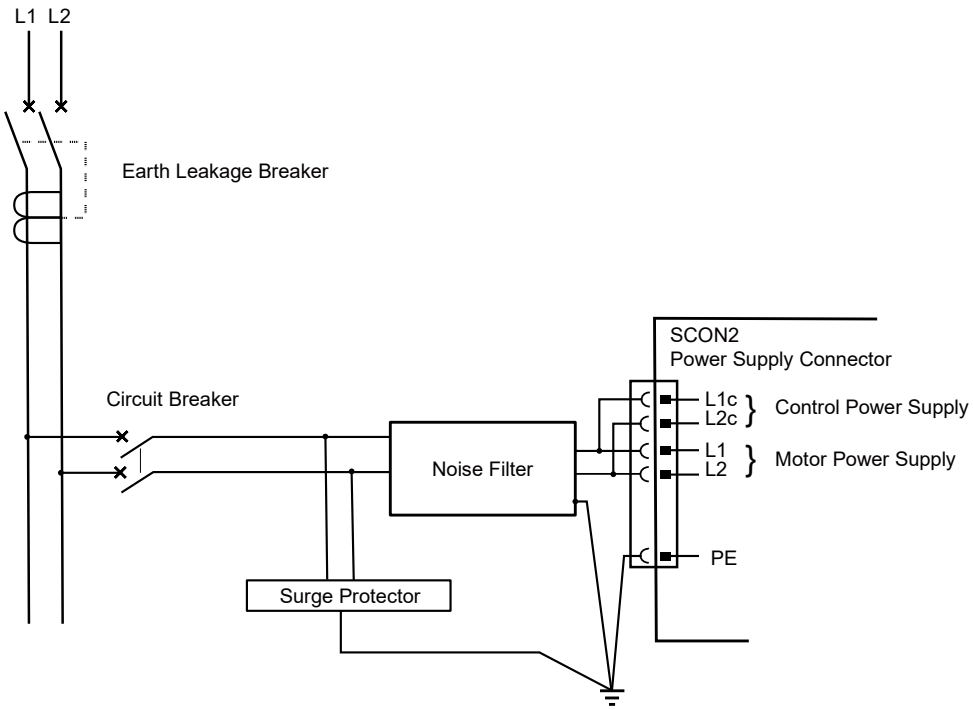
Signal with "*" expresses the signal of active low. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

Category	Signal Abbreviation	Signal Name	Function Description	Relevant Sections
Output	PEND/INP	Position Complete	Turns ON in the positioning band range after actuator operation. The INP signal will turn OFF if the position deviation exceeds the in-position range. PEND and INP can be switched over by the parameter.	4.2.3 4.2.4 4.2.5
	PM1 to PM256	Completion Position No.	The position No. reached after the positioning completion, is output (binary output).	4.2.4
	HEND	Home Return Completion	This signal will turn ON when home return has been completed. It will be kept ON unless the home position is lost.	4.2.3 4.2.6
	ZONE1 ZONE2	Zone	Turns ON if the current actuator position is within the range set to the parameter.	4.2.3
	PZONE	Position Zone	This signal will turn ON when the current actuator position enters the range specified the position data after position movement. Even though it can be used together with ZONE1, PZONE will become only available for operation by the set position number.	4.2.3
	RMDS	Operation Mode Status Output	Outputs the operation mode status. It turns on when the controller is on Manual Mode.	4.2.3
	*ALM	Alarm	Turns ON when the controller is in normal condition, and turns OFF when an alarm is generated.	4.2.3
	MOVE	Moving	Turns ON during the actuator is moving (including home-return operation and pressing operation).	4.2.3 4.2.4
	SV	Servo ON	This signal will remain ON while the servo is ON.	4.2.3
	*EMGS	Emergency Stop Output	This signal remains ON while the controller is under the emergency stop reset condition and turns OFF when the emergency stop condition is enabled. (Regardless of alarms.)	4.2.3
	MODES	Teaching Mode Output	This signal will turn ON while the teaching mode is enabled by the input of the mode signal and will turn OFF when the mode changes to the normal mode.	4.2.4
	WEND	Writing Complete	It is OFF during the teaching mode and turns ON when the writing by PWRT Signal is complete. It turns OFF when PWRT Signal turns OFF.	4.2.4
	PE0 to PE6	Current Position Number	In the electromagnetic valve mode, this signal will turn ON when the actuator completes moving to the target position.	4.2.5
	LS0 to LS2	Limit Switch Output	Turns ON when the current actuator position is within the range of positioning band (+/-) of the target position. It is output even before the movement command and the servo is OFF if the home-return operation is completed.	4.2.6
	CEND	Loadcell Calibration Complete	Turns ON after loadcell calibration is complete. This signal turns OFF if CLBR signal is turned OFF.	4.2.7
	*ALML	Light Error Alarm	When parameter No. 151 is set to 0, it turns OFF when the following alarms occur. • Battery voltage drop • Overload warning • Fan rotation speed drop When parameter No. 151 is 1, it is turned off when a message level is generated in addition to the upper level.	2.6.6
	LOAD	Load Output judgment status	It turns ON when the pressing current exceeds the current set in “Threshold” in the position data for a certain period of time when the actuator in the pressing operation range and also in the range of “Zone +” and “Zone -“ in the position data. Utilize this signal for a judgment of a press-fitting process being properly performed.	4.2.4
	TRQS	Torque level status	Outputs when current of motor reaches the value set to “threshold” by the slider (or rod) being hit to an obstacle during the pressing movement (and before home-return operation in PIO Pattern 5).	4.2.4

Signal with “*” expresses the signal of active low. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

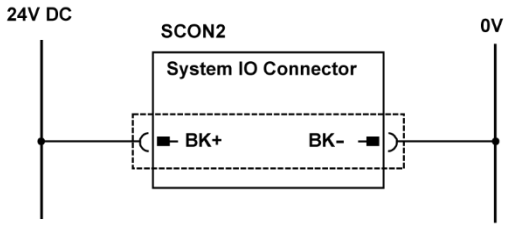
3.1.3 Wiring

[1] Main Power Circuit



(Note) The power voltage of the controller (100V AC or 200V AC) cannot be changed.

[2] Brake Power Supply Circuit



(Note) Supply 24V DC if the used actuator is equipped with a brake.

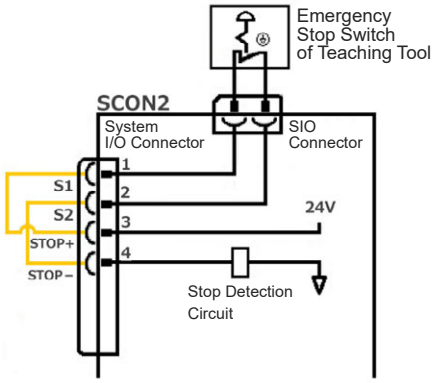
[3] Actuator emergency stop circuit (System I/O Connector)

As an example of a circuit, the following 3 conditions are shown.

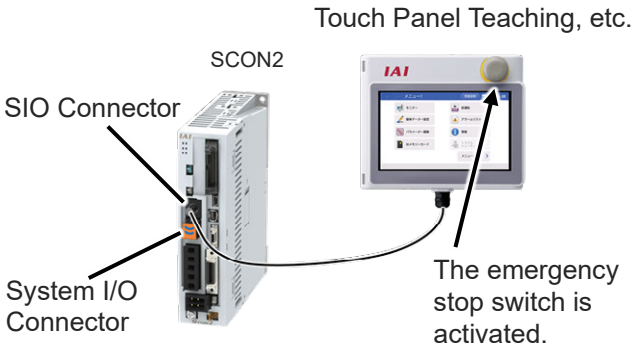
1. Operate the actuator using only the emergency stop input on the teaching tool
2. Operate the actuator by making the emergency stop input (STOP-) on the equipment and teaching tool activated
3. Stop supplying external motor power at emergency stop input

1. Operate the actuator using only the emergency stop input on the teaching tool

● Circuit Example

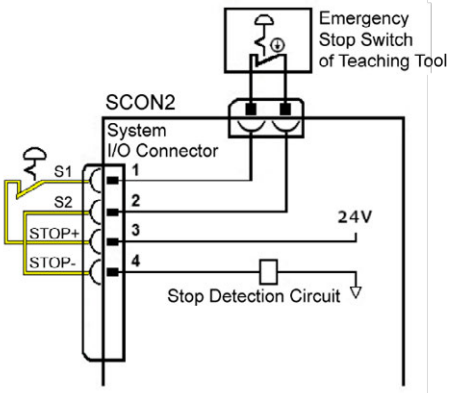


● Wiring Image

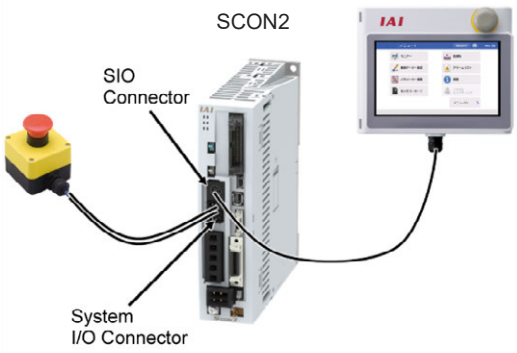


2. Operate the actuator by making the emergency stop input (STOP) on the equipment and teaching tool activated

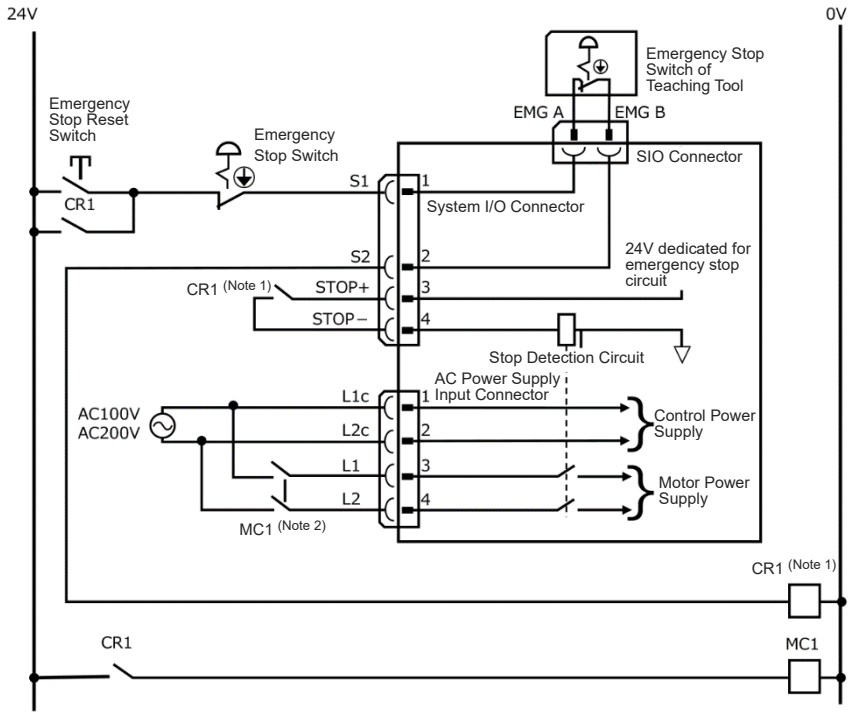
● Circuit Example



● Wiring Image



3. Stop supplying external motor power at emergency stop input



Note 1 The power rating of the motor power-off relay turning ON/OFF with contact CR1 is 30V DC and 100mA or less.

Note 2 Connect such as a connector to L1/L2 terminals when cutting off the motor power source externally.

Note 3 This controller are not equipped with a relay to enable to automatically identify a teaching tool was inserted and switch the wiring layout. When a teaching tool is not in use, connect the dummy plug (DP-5) to the SIO connector.

Note 4 When using this controller, the time from pressing the emergency stop switch until the drive source is cut off must be within the time set by the “timer value for monitoring the welding of the drive source cutoff relay” in parameter No. 72. For more information on parameters, see [6.1.2 Detail Explanation of Parameters [55]].

* If the time is exceeded, an alarm 0CD “drive source cutoff relay welding detection error” occurs.

[4] Motor • Encoder Circuit

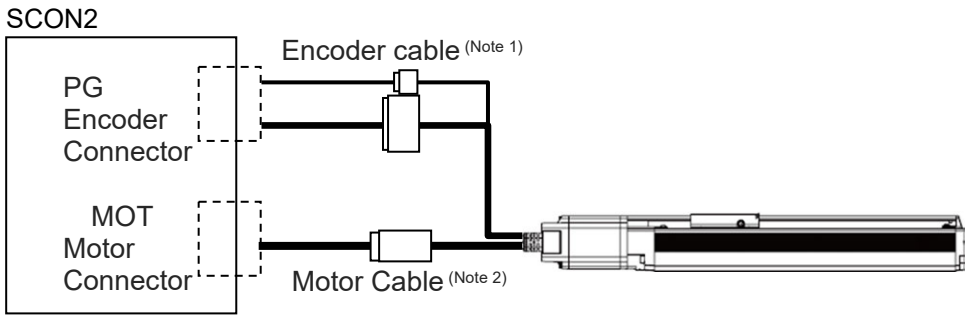
Applicable Encoder Cable types □□□ : cable length Example) 030 = 3m

No.	Actuator			Connection Cable	
	Series		Type	Encoder Cable	Encoder Robot Cable
1)	RCS4(CR)			-	CB-X1-PA□□□
2)	RCS3(P)(CR)		CTZ5C / CT8C	-	CB-X1-PA□□□
3)			RA6R / RA7R / RA8R	CB-RCS2-PLDA□□□	CB-RCS2-PLDA□□□-RB
4)			Other than 2) and 3)	CB-RCS2-PA□□□	CB-X3-PA□□□
5)	RCS2(CR)(W)		RTC□L / RT6	CB-RCS2-PA□□□	CB-X2-PLA□□□
6)			Other than 5)	CB-RCS2-PA□□□	CB-X3-PA□□□
7)	RCS2	Wth no loadcell	RA13R	CB-RCS2-PA□□□	CB-X2-PLA□□□
8)			RA13R With brake (With brake box)	[Actuator to Brake box] CB-RCS2-PLA□□□ [Brake box to Controller] CB-RCS2-PLA□□□	[Actuator to Brake box] CB-X2-PLA□□□ [Brake box to Controller] CB-X2-PLA□□□
9)			RA13R With brake (With no brake box)	[Actuator to Brake box] CB-RCS2-PLA□□□	[Actuator to Brake box] CB-X2-PLA□□□
10)		With loadcell	RA13R With brake (With brake box)	CB-RCS2-PLA□□□ * CB-RCS2-PLLA□□□ between controller and brake * CB-LDC-CTL□□□-JY between loadcell and controller	CB-X2-PLA□□□ * CB-RCS2-PLLA□□□-RB between controller and brake
11)			RA13R With brake (With no brake box)	CB-RCS2-PLLA□□□	CB-RCS2-PLLA□□□-RB
12)	IS(P)B / IS(P)DB(CR)		Other than 13)	-	CB-X1-PA□□□ * For cable length 21m or more CB-X1-PA□□□-AWG24
13)			With LS	-	CB-X1-PLA□□□ * For cable length 21m or more CB-X1-PLA□□□ -AWG24
14)	IS(P)A / IS(P)DA(CR) / SSPA / SSPDACR / IF / IFA / FS / RS		Other than 15)	-	CB-X1-PA□□□
15)			With LS	-	CB-X1-PLA□□□
16)	NSA			-	CB-X1-PA□□□
17)	NS		Other than 18)	-	CB-X3-PA□□□
18)			With LS	-	CB-X2-PLA□□□
19)	DD(CR)(W) / DDA(CR)		T18 / LT18	-	CB-X3-PA□□□
20)			H18 / LH18	-	CB-X3-PA□□□
21)	LSA		W	-	CB-X2-PLA□□□
22)			Other than 21)	-	CB-X3-PA□□□
23)	LSAS			-	CB-X1-PA□□□
24)	IS(P)WA			-	CB-X1-PA□□□-WC

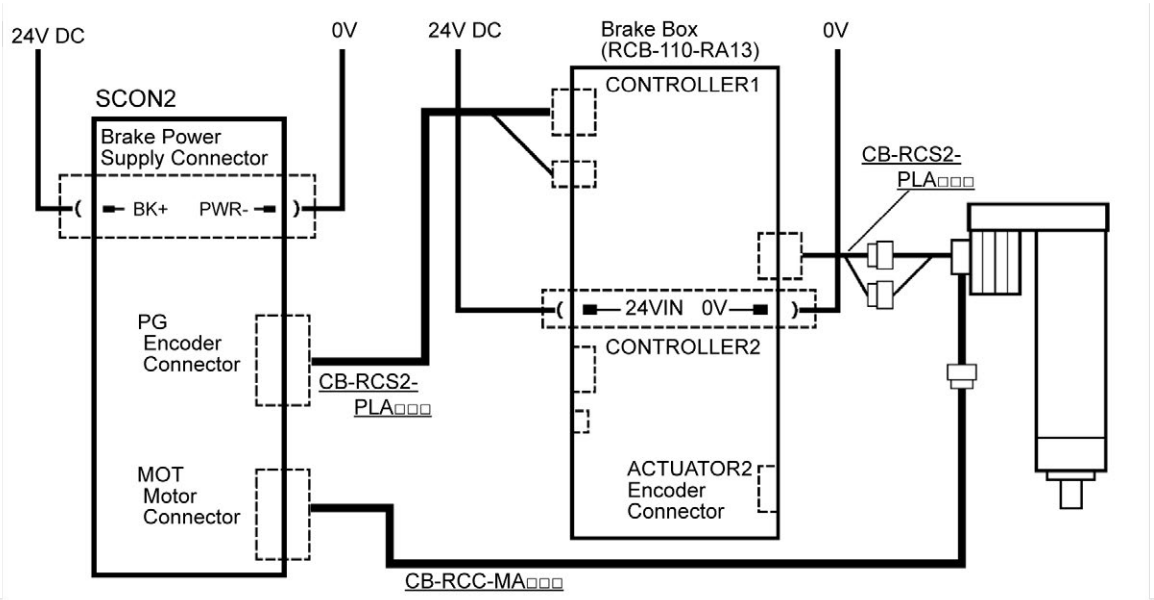
Note 2 Applicable Encoder Cable types □□□ : cable length Example) 030 = 3m

Actuator Type	Cable
Single Axis Robot	CB-X2-MA□□□
DD, DDA high torque type, LSA large type	CB-XMC1-MA□□□
RCS series	CB-RCC1-MA□□□
RCS series (robot cable)	CB-X2-MA□□□
ISWA	CB-XEU1-MA□□□

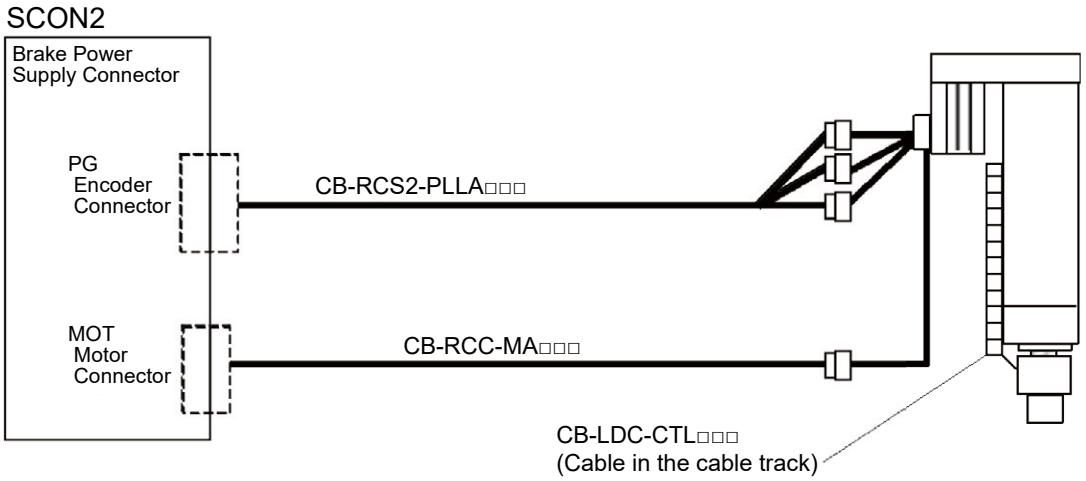
1. Connection of Short-Axis Robot (excluding RCS2-RA13R equipped with brake/loadcell and NS Series equipped with brake)



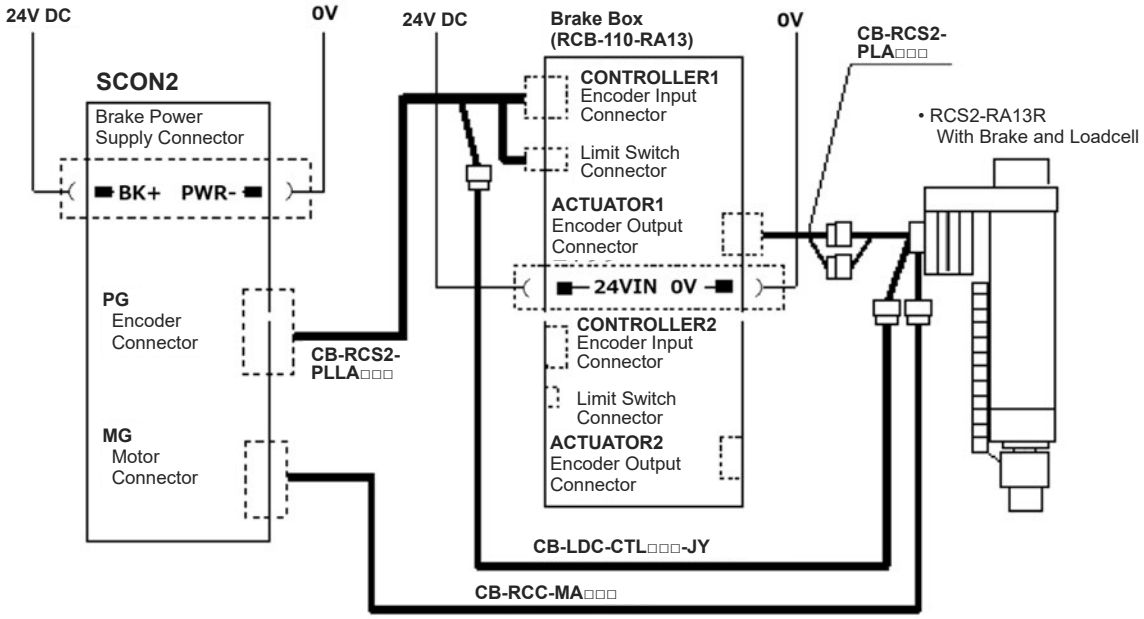
2. Connection of RCS2-RA13R or NS-type equipped with brake



1. Connection when RCS2-RA13R with loadcell (with no brake)



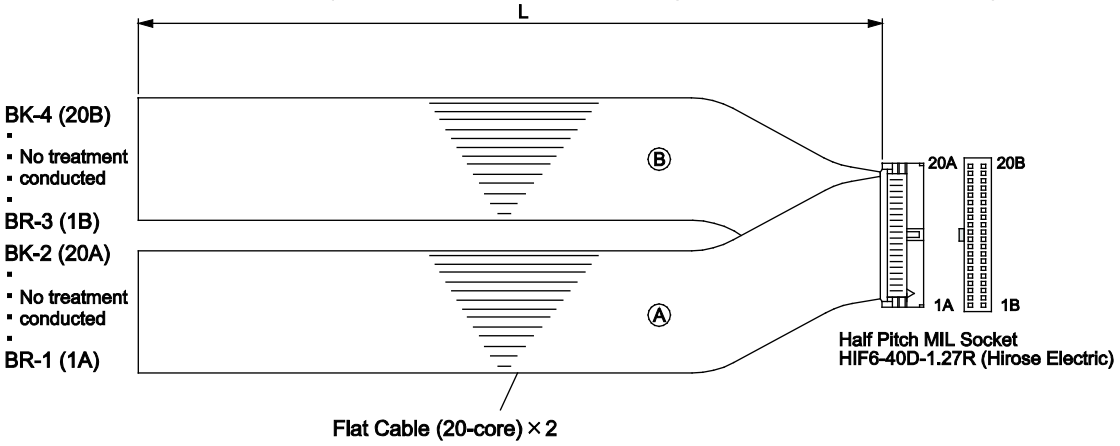
2. Connection When RCS2-RA13R is Equipped with Loadcell or Brake



[5] PIO Circuit

Use the attached cable for the I/O connection.

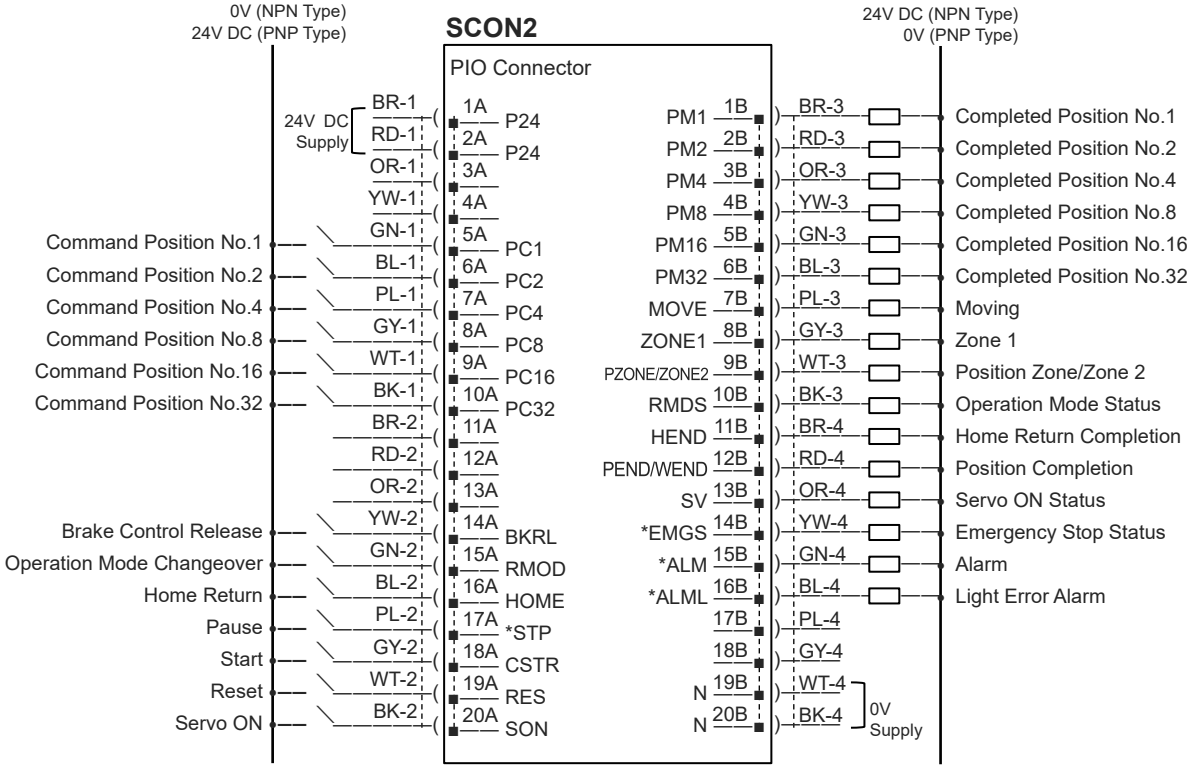
Model : CB-PAC-PIO□□□ (□□□ indicates the cable length L. Example. 020 = 2m)



Caution

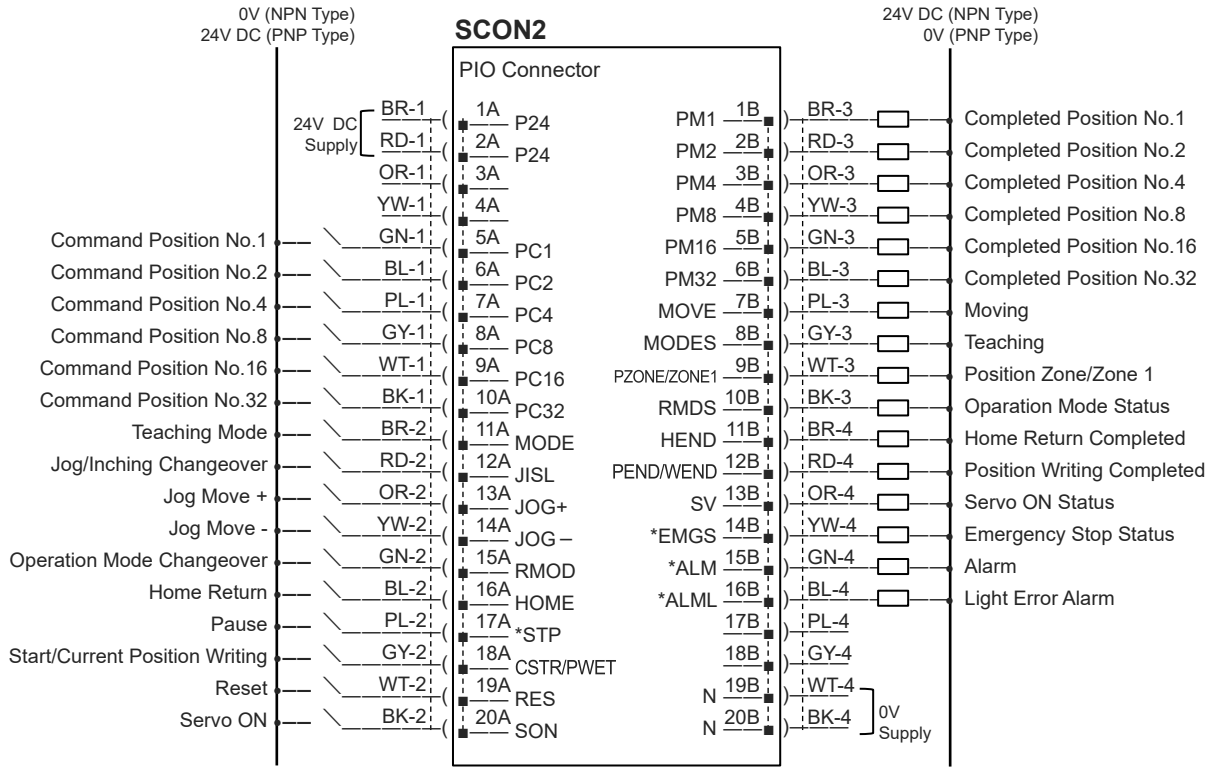
- When having a conduction check on the flat cable, make sure not to spread out the inside of the connector female pins. It may cause a contact error and may disable normal operation.

1. PIO Pattern 0 ·····Positioning Mode (Standard Type)



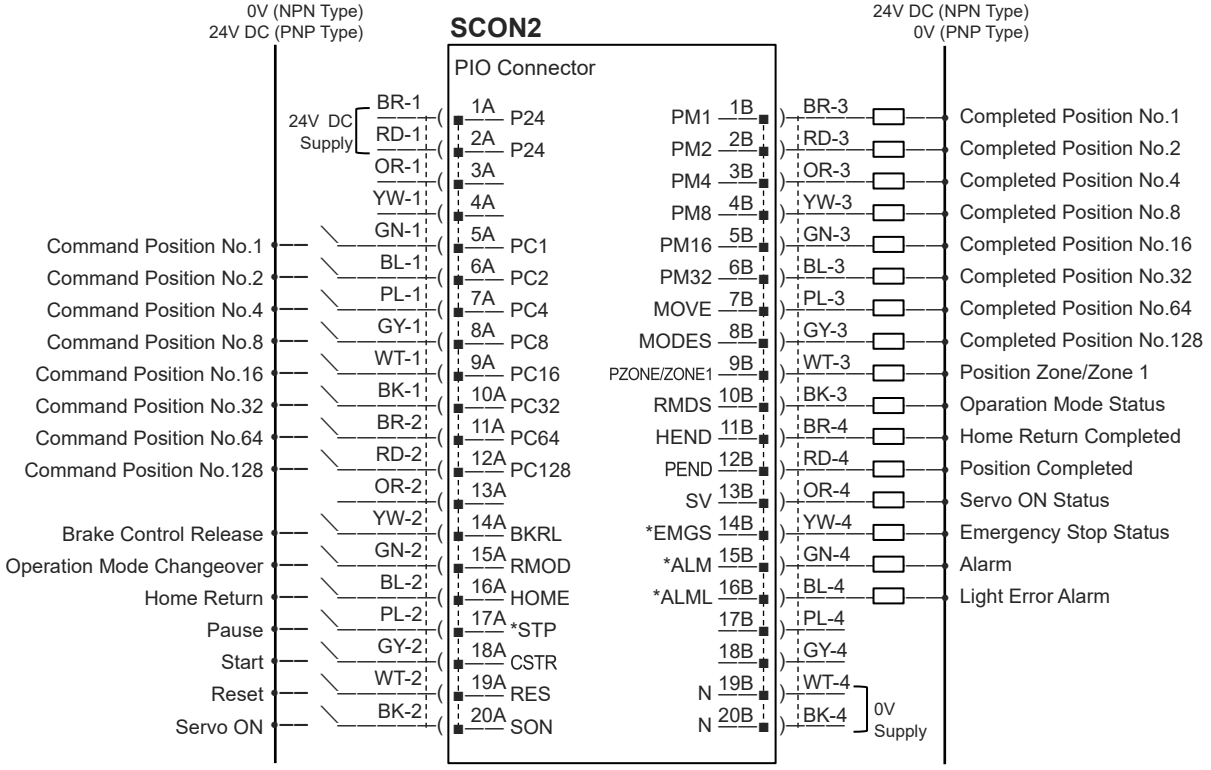
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

2. PIO Pattern 1 ·····Teaching mode (Teaching type)



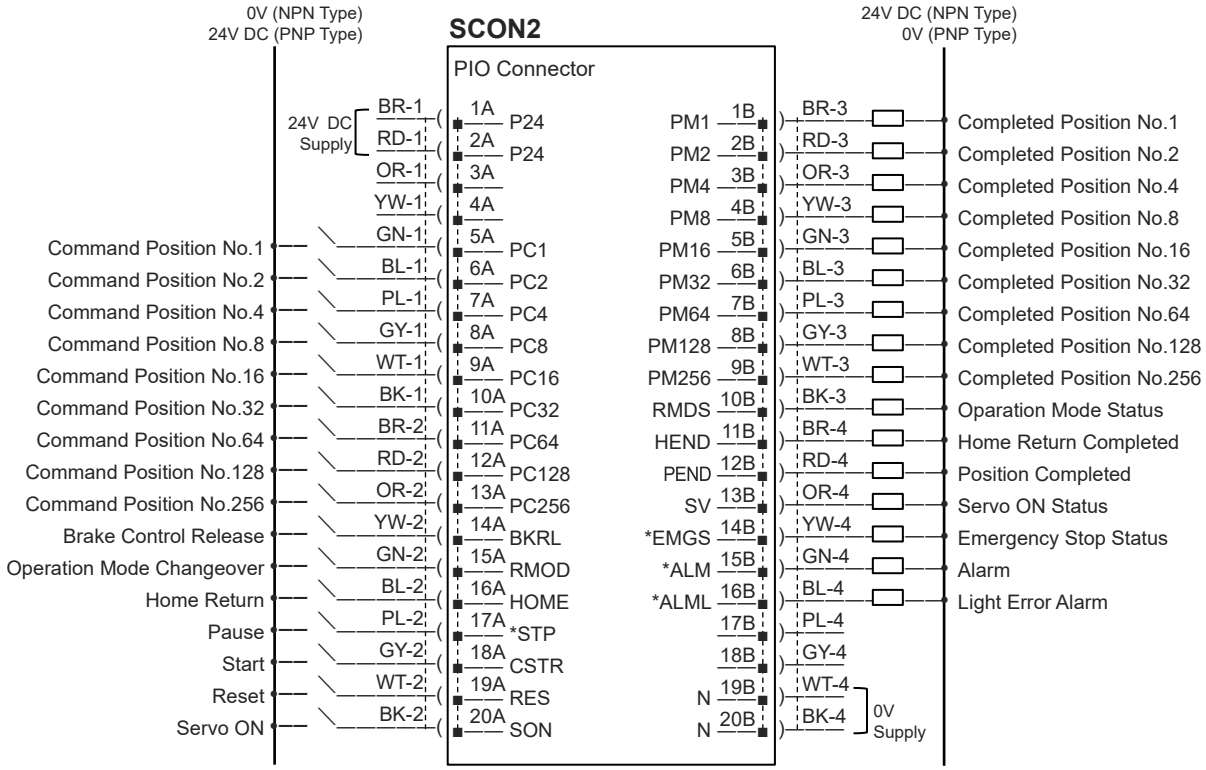
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

3. PIO Pattern 2 ·····256-point mode (Number of positioning points : 256-point type)



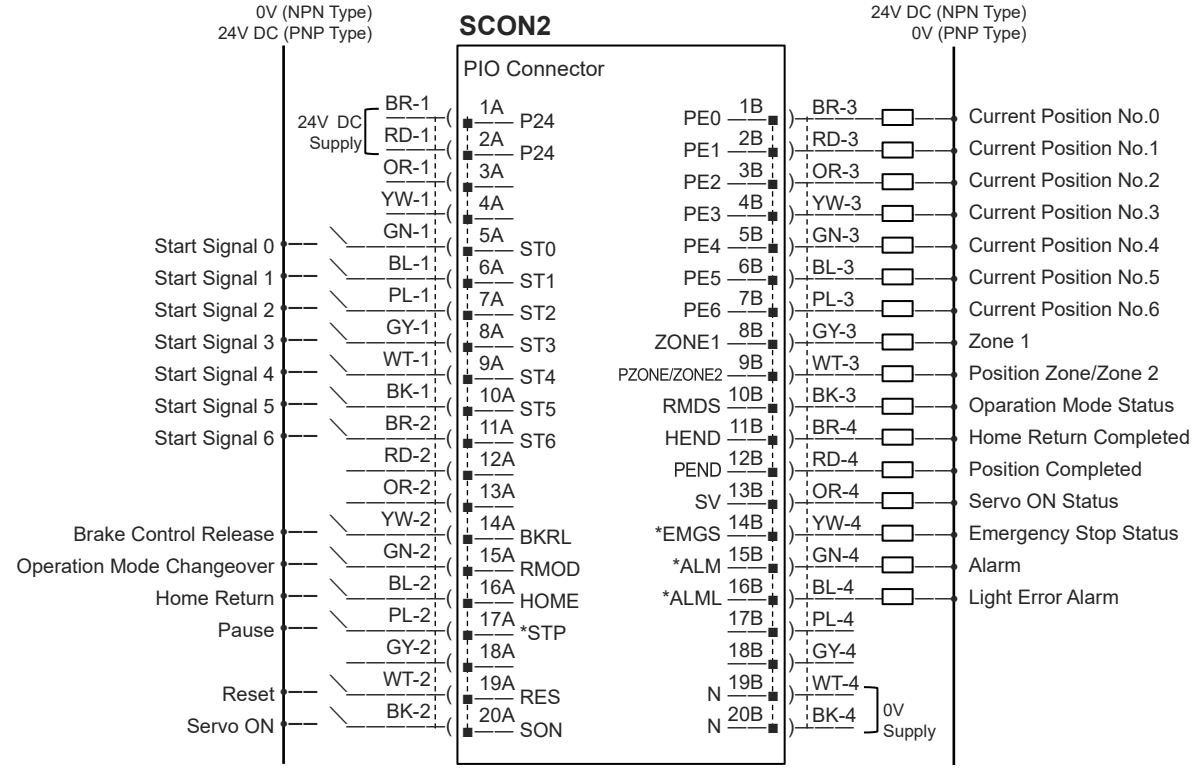
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

4. PIO Pattern 3·····384-point mode (Number of positioning points : 384-point type)



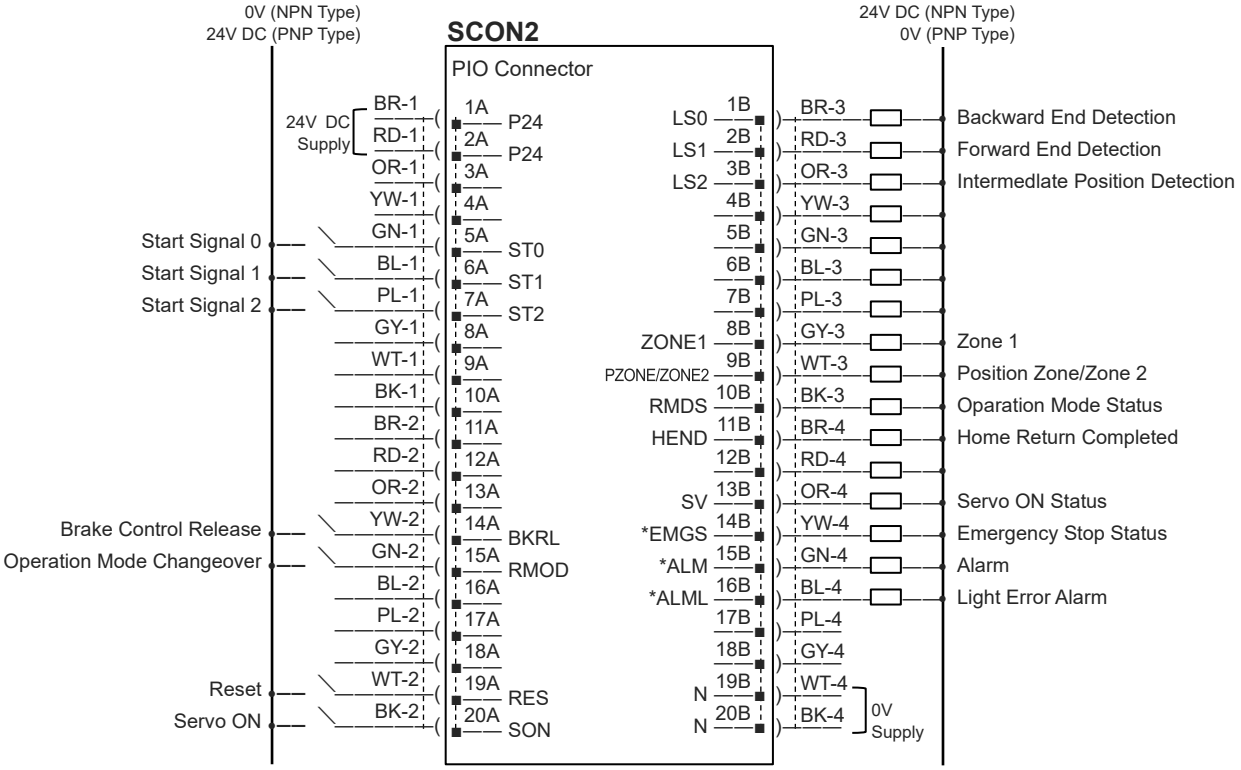
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

5. PIO Pattern 4·····Solenoid Valve Mode 1 (7-point type)



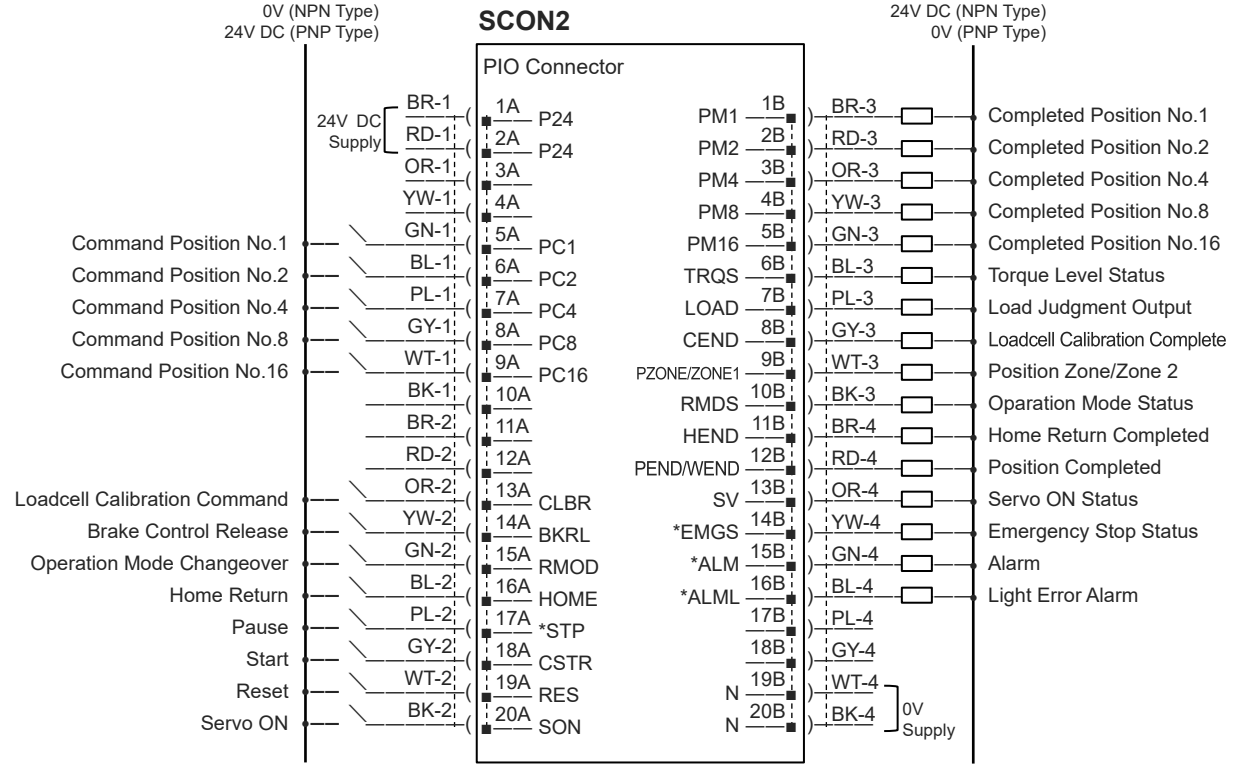
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

6. PIO Pattern 5·····Solenoid Valve Mode 2 (3-point type)



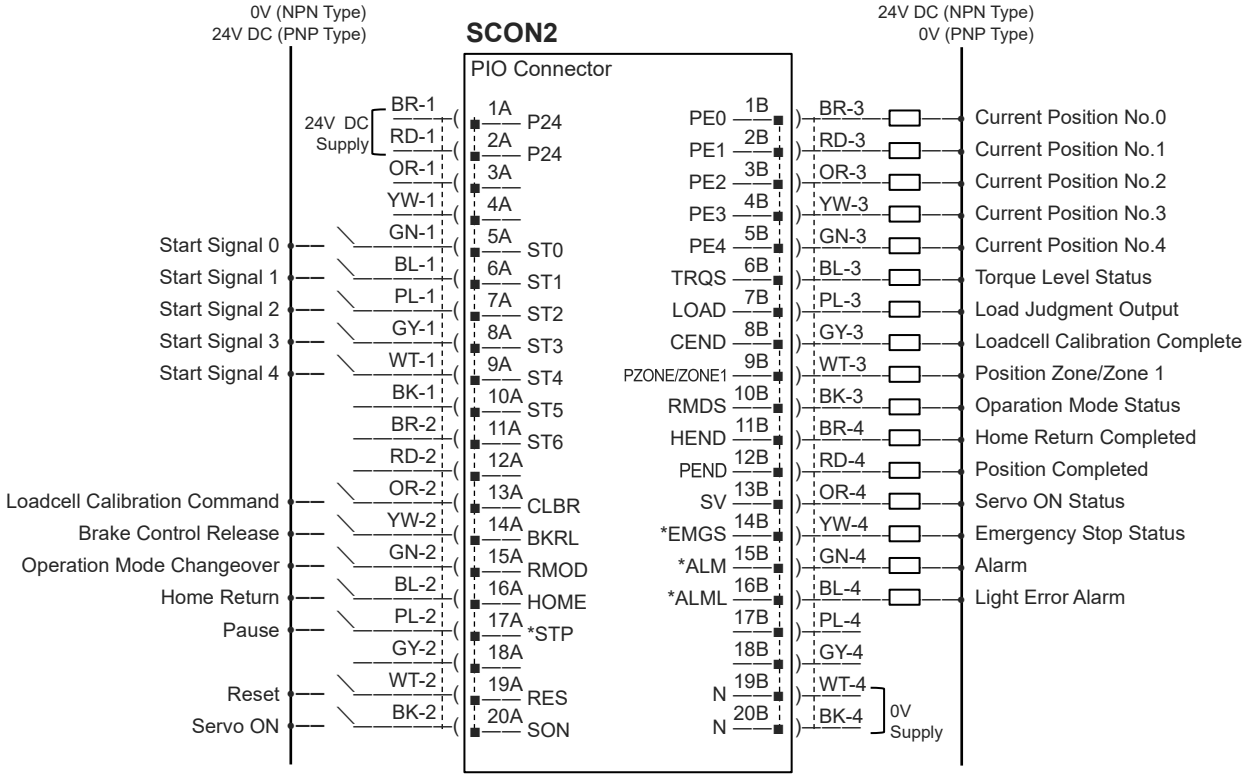
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

7. PIO Pattern 6·····Pressing Operation Using Force Sensor Mode 1 (Standard type)



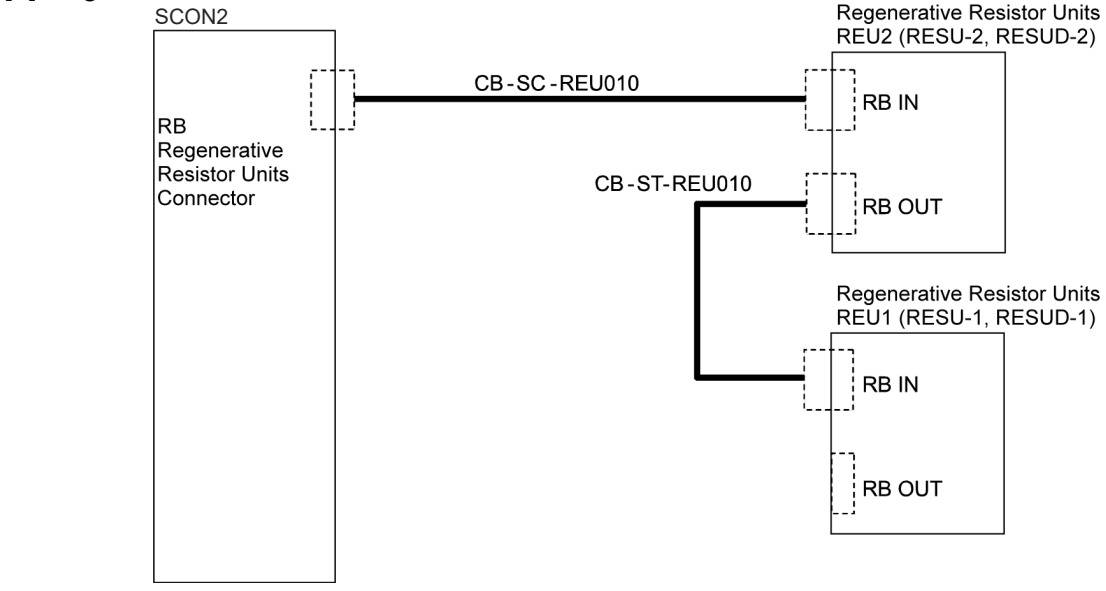
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

8. PIO Pattern 7 ·····Pressing Operation Using Force Sensor Mode 2 (Solenoid valve type)



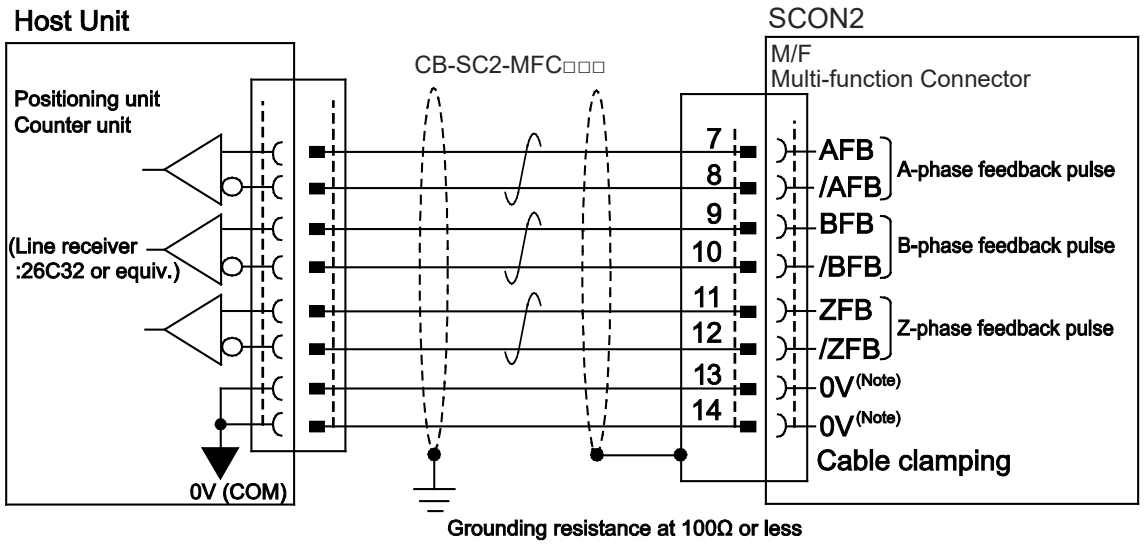
"*" in codes above shows the signal of the active low. Processing occurs when an input signal of the type is turned OFF. An output signal of the type is normally ON in the power-on status and turned OFF at signal output.

[6] Regenerative Resistor Units Circuit



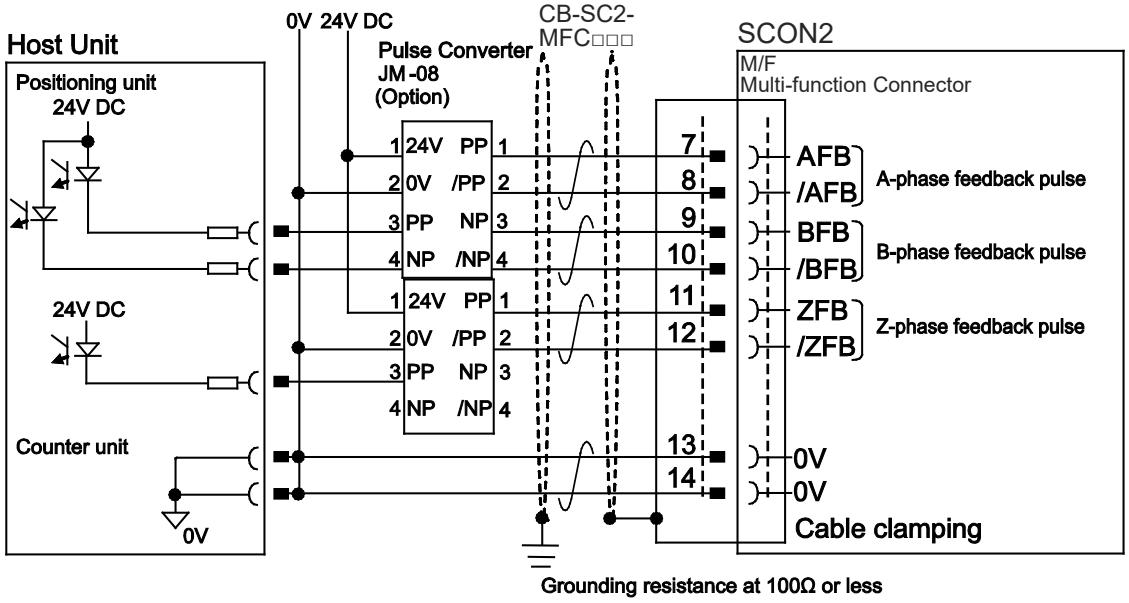
[7] Feedback Pulse Readout Circuit

- When Host Unit in Differential System



(Note) Connect cable also to 0V if there is 0V (COM) on the host unit.

- When Host Unit in Open Connector System JM-08 (option) is necessary.



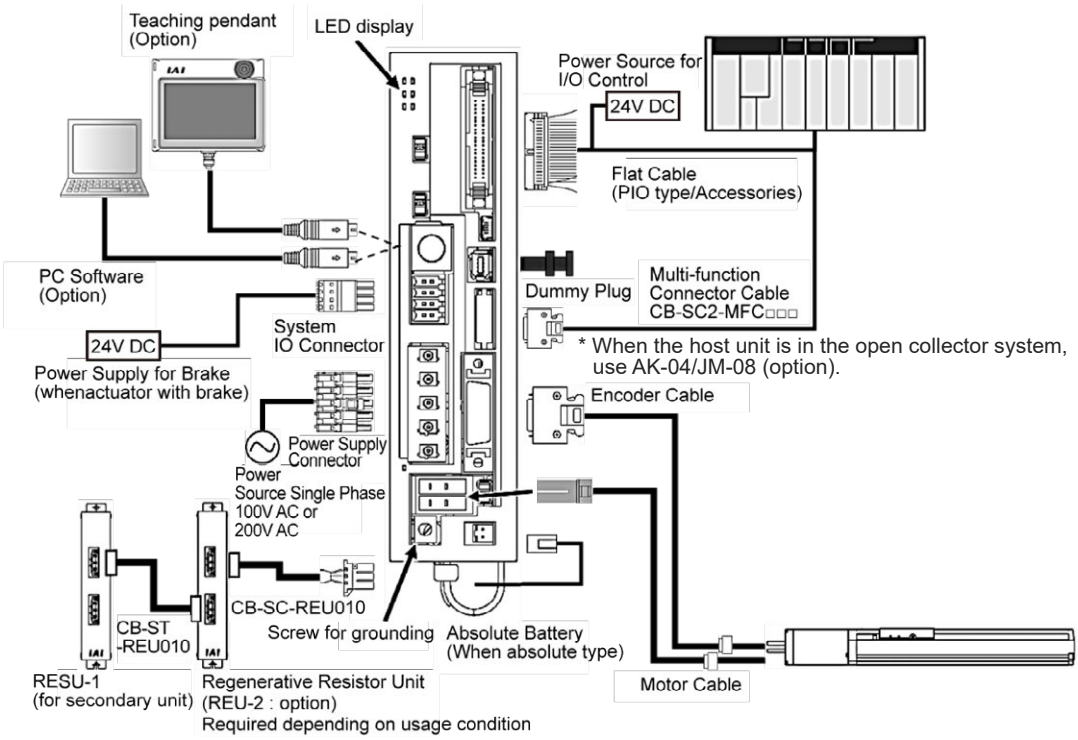
Caution

- Use the same power source for the positioning unit of the host and JM-08.

3.2 Pulse Train Control Mode

3.2.1 Wiring Diagram (Connection of Construction Devices)

[1] Basic Wiring Diagram



(Note) Pulse Train Control Mode is not available to use in the field network type.

If using RCS2-RA13R or NS Type for the actuator and the option shown in the table is applied, the wiring between the actuator and the controller will differ from the basic wiring layout. Shown in the table is the relation of the option and wiring layout. Loadcell cannot be equipped in pulse train control.

○ : Equipped, × : Not Equipped

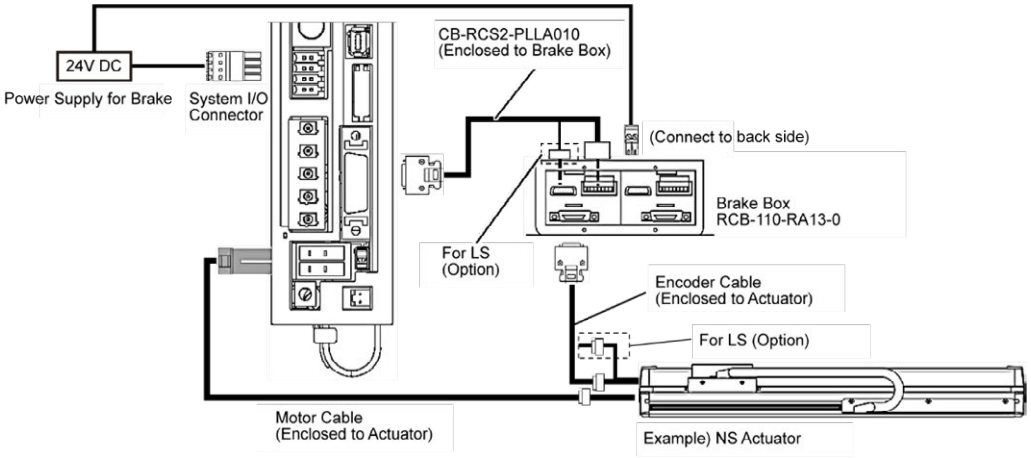
Model Name	Option		Wiring Layout between Actuator and Controller
	Brake	Loadcell	
RCS2-RA13R	○	×	1
	×	×	Basic Wiring Diagram
NS	○	-	1
	×	-	Basic Wiring Diagram
DDA	○	-	2
	×	-	Basic Wiring Diagram

Caution

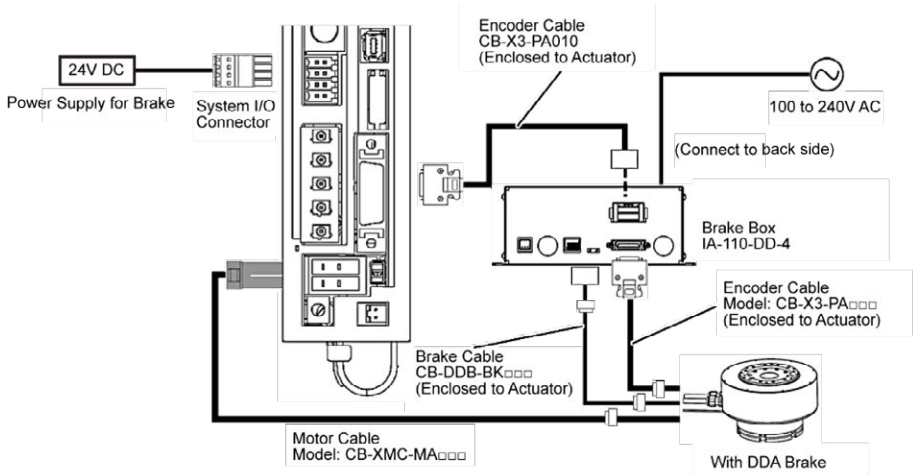
- Make sure to turn the power to the controller OFF when inserting or removing the connector that connects the PC software or touch panel teaching.
  Inserting or removing the connector while the power is turned ON causes a controller failure.

[2] Wiring Layout for RCS2-RA13R, DDA or NS Type with Option
(between actuator and controller)

1. For RCS2-RA13R Equipped with Brake, with no Loadcell, or NS Actuators with Brake type



2. For DDA with brake type



3.2.2 I/O Signals and Each Functions in Pulse Train Control Mode

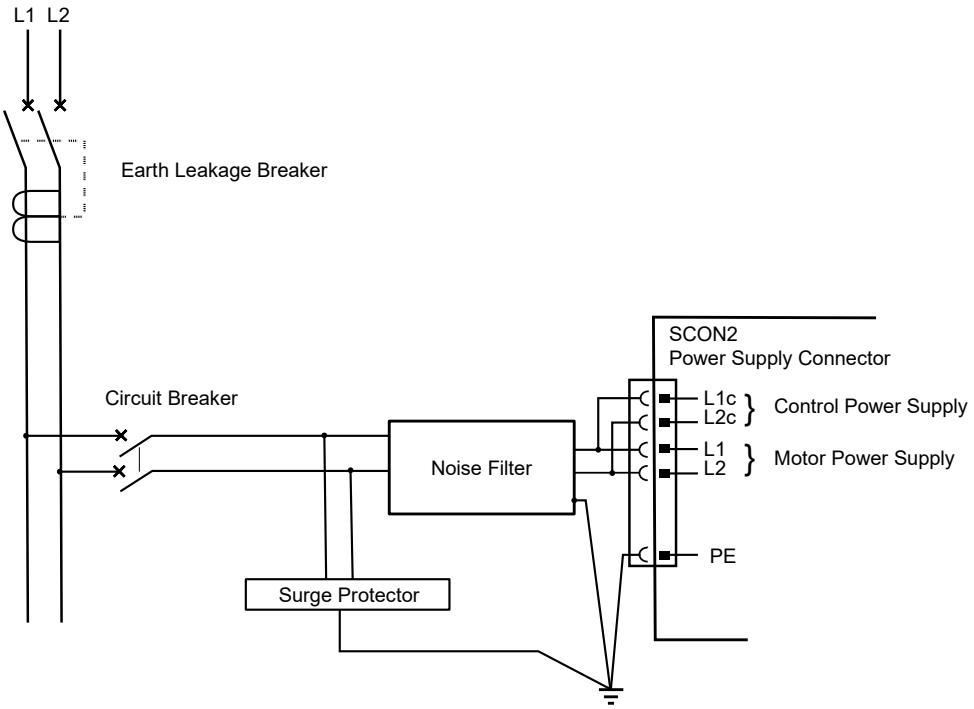
The table below shows the signal assignment of the flat cable in the pulse train control mode.
Have the PIO Pattern setting revised considering the actuator specifications (Incremental/Absolute)
Follow the following table to connect the external equipment (such as PLC). ○ : Available, × : Unavailable

PIO Pattern 0 (Incremental)	PIO Pattern 1 (Absolute)	Pin No.	Category	I/O No.	Signal Abbreviation	Signal Name	Function Description	Relevant Sections
○	○	1A	24V		P24	Power Supply	Power Supply for I/O +24V	-
		2A	24V		P24	Power Supply	Power Supply for I/O +24V	-
		3A	-		NC	-	Not used	-
		4A	-		NC	-	Not used	-
		5A	Input	IN0	SON	Servo ON	The servo remains ON while this signal is ON, or OFF while this signal is OFF.	4.3.2 [5]
		6A		IN1	RES	Reset	Turn the signal ON to reset the alarm.	4.3.2 [9]
		7A		IN2	HOME	Home Return	The controller will perform home return operation when this signal is turned ON.	4.3.2 [6]
		8A		IN3	TL	Torque Limit Select	Puts torque limitation to the motor with the signal ON and the value set to the parameter.	4.3.3 [3]
○	○	9A		IN4	CSTP	Compulsory Stop	Turning it ON continuously for more than 10ms compulsorily stops the actuator. The actuator decelerates then stops with the torque set in the controller and then turns the servo OFF.	4.3.2 [4]
		10A		IN5	DCLR	Deviation Counter Clear	Clears the deviation counter.	4.3.3 [4]
		11A		IN6	BKRL	Brake Forcible Release	The brake will forcibly be released.	4.3.2 [11]
		12A		IN7	RMOD	Operation Mode Changeover	The operating mode is selectable when the MODE switch of the controller is set to AUTO. (The setting is AUTO when signal is OFF, and MANU when ON.)	4.3.2 [3]
×		13A		IN8	RSTR	Datum Position Movement Command	Movement is made to the position set in Parameter No. 167 when the signal is turned ON.	4.3.2 [7]
		14A		IN9	NC	-	Not used	-
		15A		IN10	NC	-	Not used	-
		16A		IN11	NC	-	Not used	-
		17A		IN12	NC	-	Not used	-
		18A		IN13	NC	-	Not used	-
		19A		IN14	NC	-	Not used	-
		20A		IN15	NC	-	Not used	-
		1B	Output	OUT0	PWR	System Ready	This signal turns ON if SCON is controllable after main power ON.	4.3.2 [1]
		2B		OUT1	SV	Servo ON Status	This signal will remain ON while the servo is ON.	4.3.2 [5]
		3B		OUT2	INP	Position Complete	Turned ON when the remaining moving pulses in the deviation counter enters within the positioning band.	4.3.3 [2]
		4B		OUT3	HEND	Home return completion	This signal will turn ON when home return has been completed.	4.3.2 [6]
		5B		OUT4	TLR	Torque Under Control	Turns ON if the torque reaches the limit value during torque limit.	4.3.3 [3]
		6B		OUT5	*ALM	Controller Alarm Status	Turns ON when controller in normal condition, and OFF when alarm is generated.	4.3.2 [9] 4.3.2 [10]
○		7B		OUT6	*EMGS	Emergency Stop Status	Turns ON when the controller emergency stop is cancelled, and OFF during the emergency stop.	4.3.2 [2]
	○	8B		OUT7	RMDS	Operation Mode Status	The operating mode status will be output. It turns ON when the controller is on Manual Mode.	4.3.2 [3]
		9B		OUT8	ALM1	Alarm Code Output Signal	The alarm code is output together with the alarm signal output. Refer to Alarm List for details.	4.3.2 [10]
		10B		OUT9	ALM2			
		11B		OUT10	ALM4			
		12B		OUT11	ALM8			
		13B		OUT12	*ALML	Light Error Alarm	Turns off at battery voltage drop, overload warning and fan revolution drop. When parameter No. 151 is 1, it is turned off when a message level is generated in addition to the upper level.	-
×		14B		OUT13	REND	Datum Position Movement Complete	Turns ON when movement to the datum position set in Parameter No. 167 is finished.	4.3.2 [7]
○		15B		OUT14	ZONE1	Zone Signal 1	This signal will turn ON when the current actuator position enters the range set by the parameters.	4.3.2 [8]
		16B		OUT15	ZONE2	Zone Signal 2		
		17B	-		NC	-	Not used	-
		18B	-		NC	-	Not used	-
○	○	19B	0V		N	Power Supply	Power Supply for I/O 0V	-
		20B	0V		N	Power Supply	Power Supply for I/O 0V	-

Signal with "*" expresses the signal of active low. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

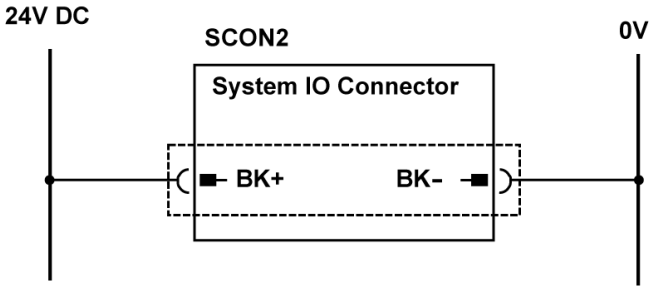
3.2.3 Wiring

[1] Main Power Circuit



(Note) The power voltage of the controller (100V AC or 200V AC) cannot be changed.

[2] Brake Power Supply Circuit



(Note) Supply 24V DC if the used actuator is equipped with a brake.

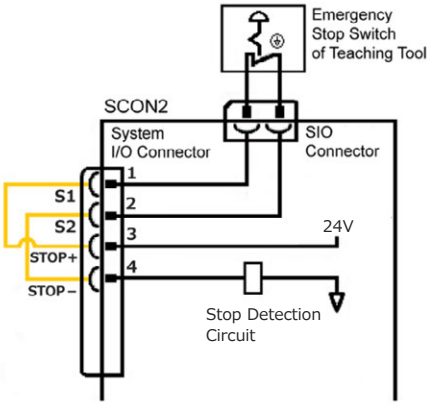
[3] Actuator emergency stop circuit (System I/O Connector)

As an example of a circuit, cases of 4 conditions are shown.

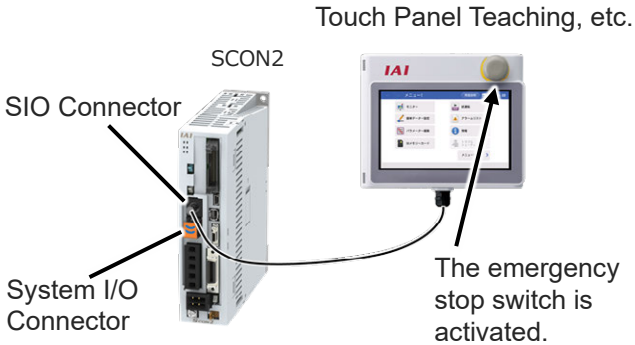
1. Operate the actuator using only the emergency stop input on the teaching tool
2. Operate the actuator by making the emergency stop input (EMG-) on the equipment and teaching tool activated
3. Stop supplying external motor power at emergency stop input

1. Operate the actuator using only the emergency stop input on the teaching tool

● Circuit Example

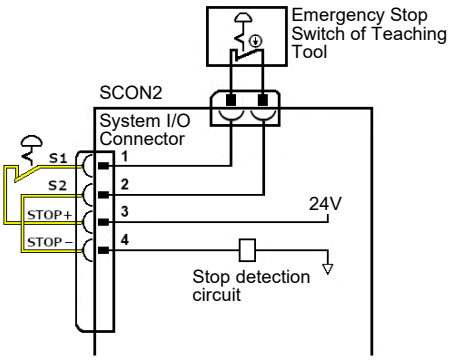


● Wiring Image

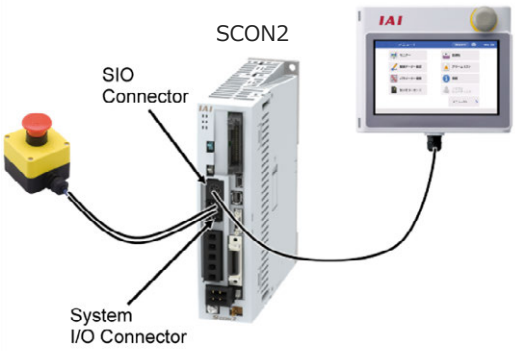


2. Operate the actuator by making the emergency stop input (EMG-) on the equipment and teaching tool activated

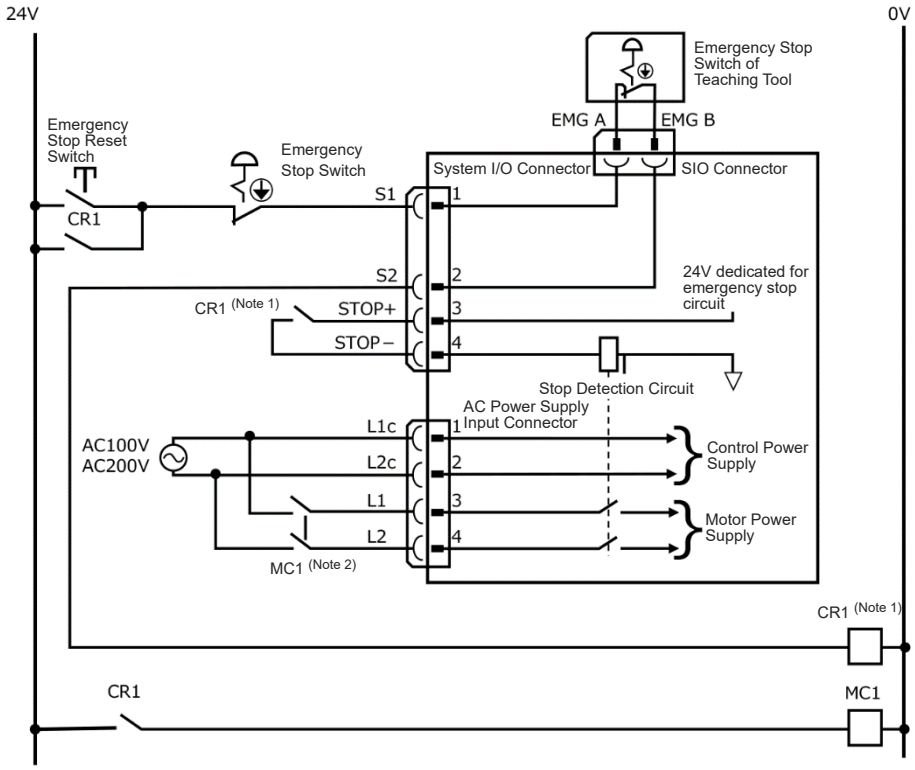
● Circuit Example



● Wiring Image



3. Stop supplying external motor power at emergency stop input



Note 1 The power rating of the motor power-off relay turning ON/OFF with contact CR1 is 30V DC and 100mA or less.

Note 2 Connect such as a connector to L1/L2 terminals when cutting off the motor power source externally.

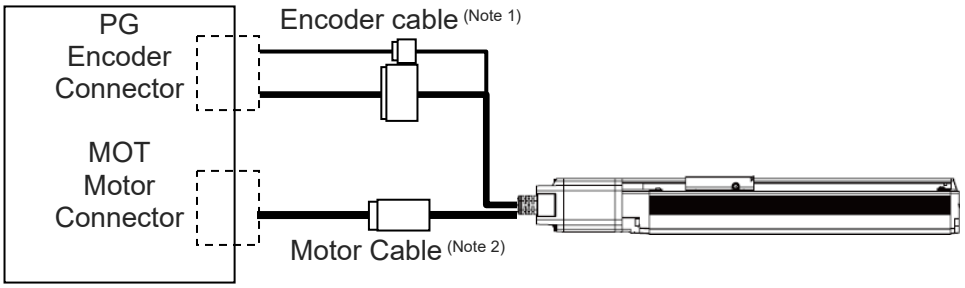
Note 3 This controller are not equipped with a relay to enable to automatically identify a teaching tool was inserted and switch the wiring layout. When a teaching tool is not in use, connect the dummy plug (DP-5) to the SIO connector.

Note 4 When using this controller, the time from pressing the emergency stop switch until the drive source is cut off must be within the time set by the “timer value for monitoring the welding of the drive source cutoff relay” in parameter No. 72. For more information on parameters, see [6.1.2 Detail Explanation of Parameters [55].

* If the time is exceeded, an alarm 0CD “rive source cutoff relay welding detection error” occurs.

[4] Motor • Encoder Circuit

1. Connection of Short-Axis Robot (excluding RCS2-RA13R equipped with brake/loadcell and NS Series equipped with brake)



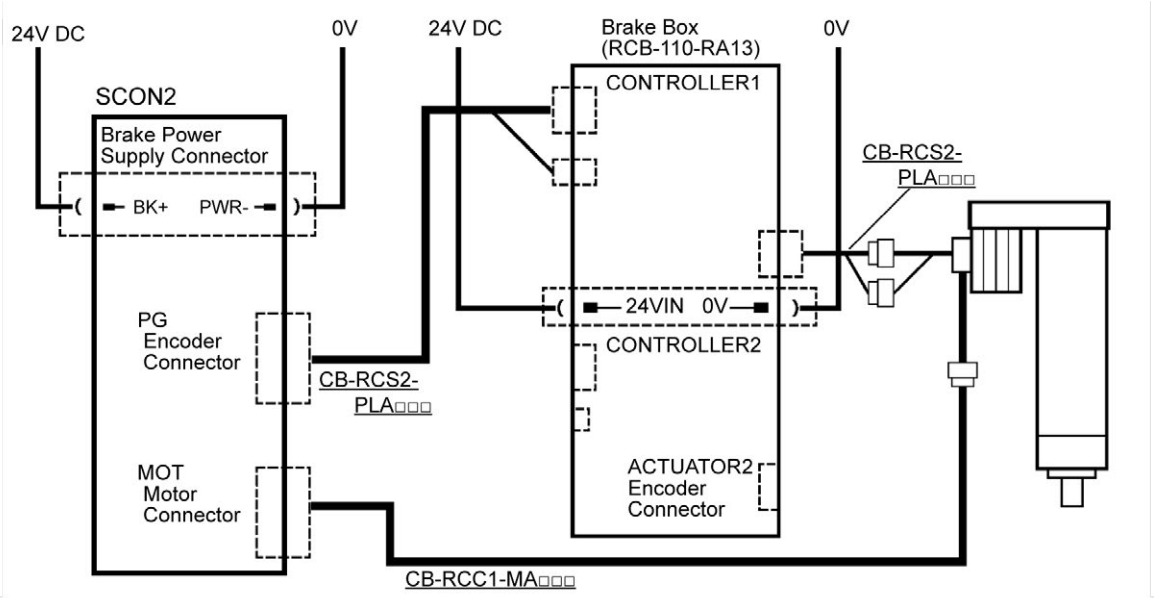
Note 1 Applicable Encoder Cable types □□□ : cable length Example) 030 = 3m

Actuator Type	Cable
Single Axis Robot	CB-X1-PA□□□
Single Axis Robot with LS type	CB-X1-PLA□□□
ISWA	CB-X1-PA□□□-WC
NS / Linear Servo / RCS2	CB-X3-PA□□□
NS / Linear Servo / RCS2 equipped with LS	CB-X2-PLA□□□
RCS2	CB-RCS2-PA□□□
RCS2-RT/RA13R	CB-RCS2-PLA□□□
RCS3 equipped with loadcell	CB-RCS2-PLDA□□□
RCS3 equipped with loadcell (robot cable)	CB-RCS2-PLDA□□□-RB
RCS2-RA13R equipped with loadcell	CB-RCS2-PLLA□□□
RCS2-RA13R equipped with loadcell (robot cable)	CB-RCS2-PLLA□□□-RB

Note 2 Applicable Motor Cable types □□□ : cable length Example) 030 = 3m

Actuator Type	Cable
Single Axis Robot	CB-X1-MA□□□
DD, DDA high torque type	CB-XMC1-MA□□□
RCS series	CB-RCC1-MA□□□
RCS series (robot cable)	CB-X2-MA□□□
ISWA	CB-XEU1-MA□□□

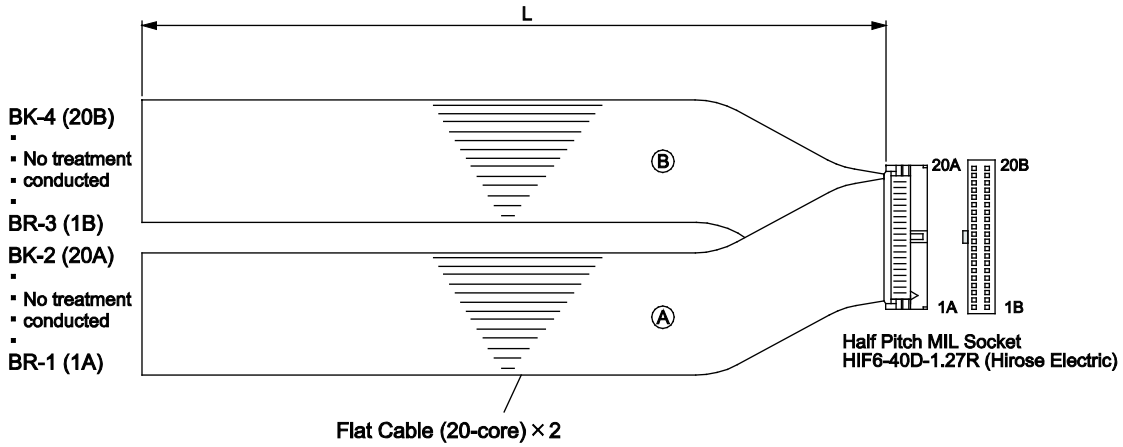
2. Connection of RCS2-RA13R or NS-type equipped with brake



[5] PIO Circuit

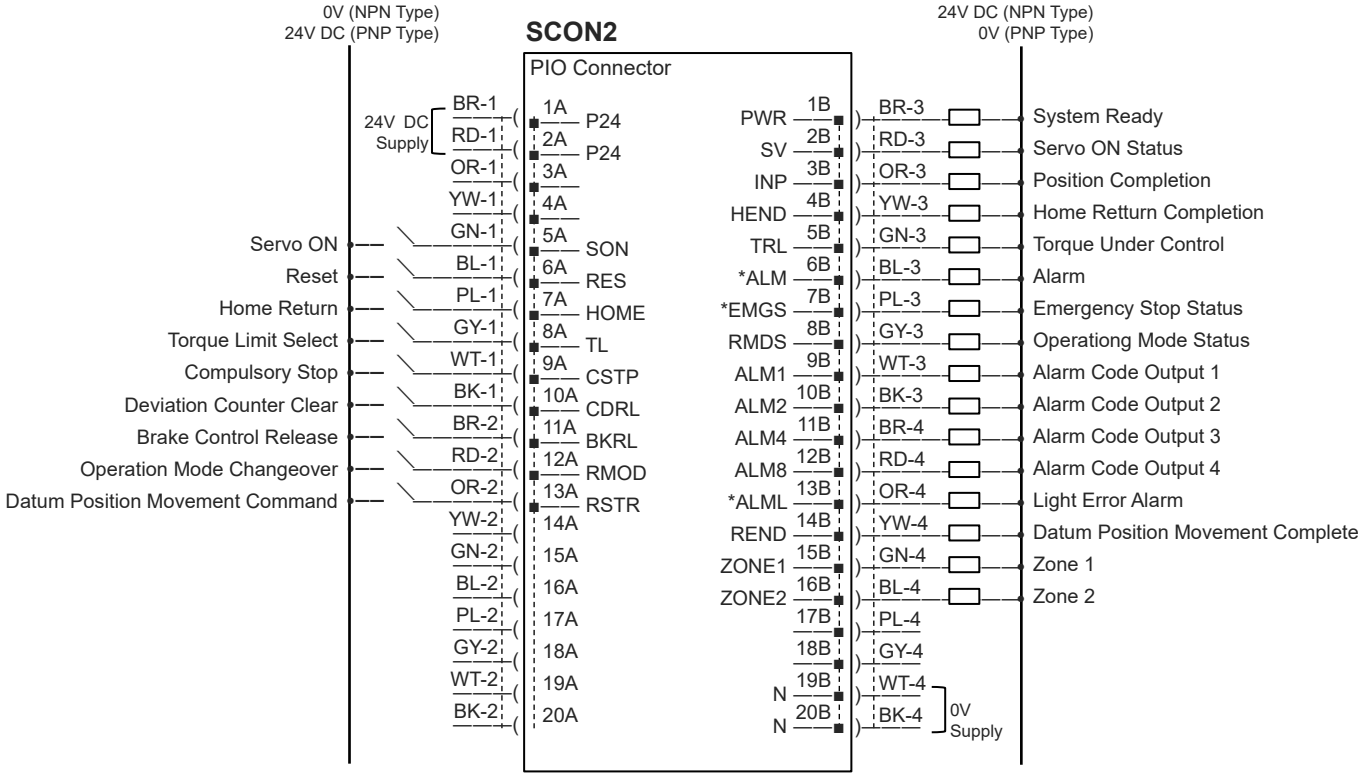
● Use the attached cable for the I/O connection.

Model : CB-PAC-PIO□□□ (□□□ indicates the cable length. Example. 020 = 2m)



Caution

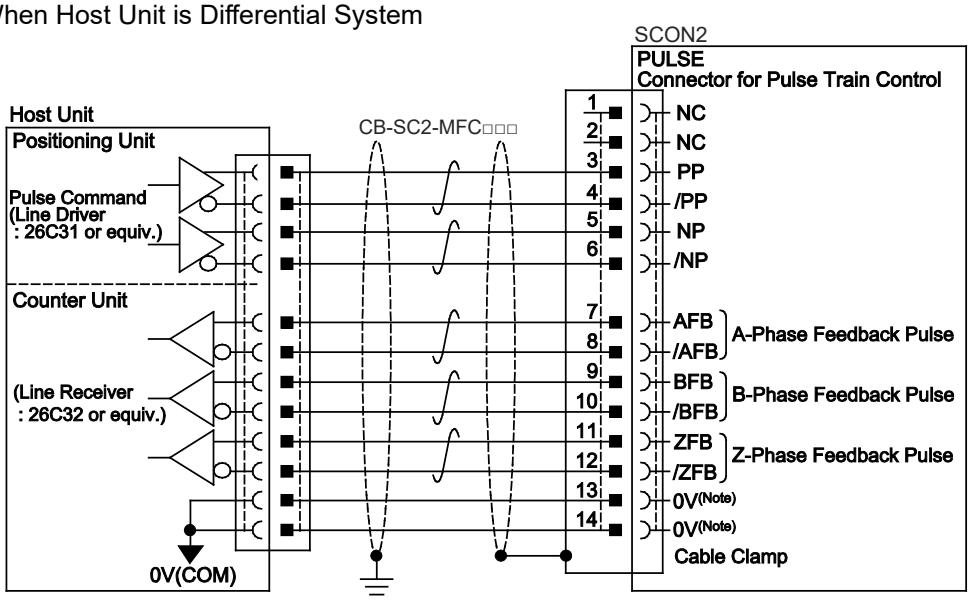
- When having a conduction check on the flat cable, make sure not to spread out the inside of the connector female pins. It may cause a contact error and may disable normal operation.



Signal with "*" expresses the signal of active low. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

[6] Circuits for Pulse Train Control

● When Host Unit is Differential System

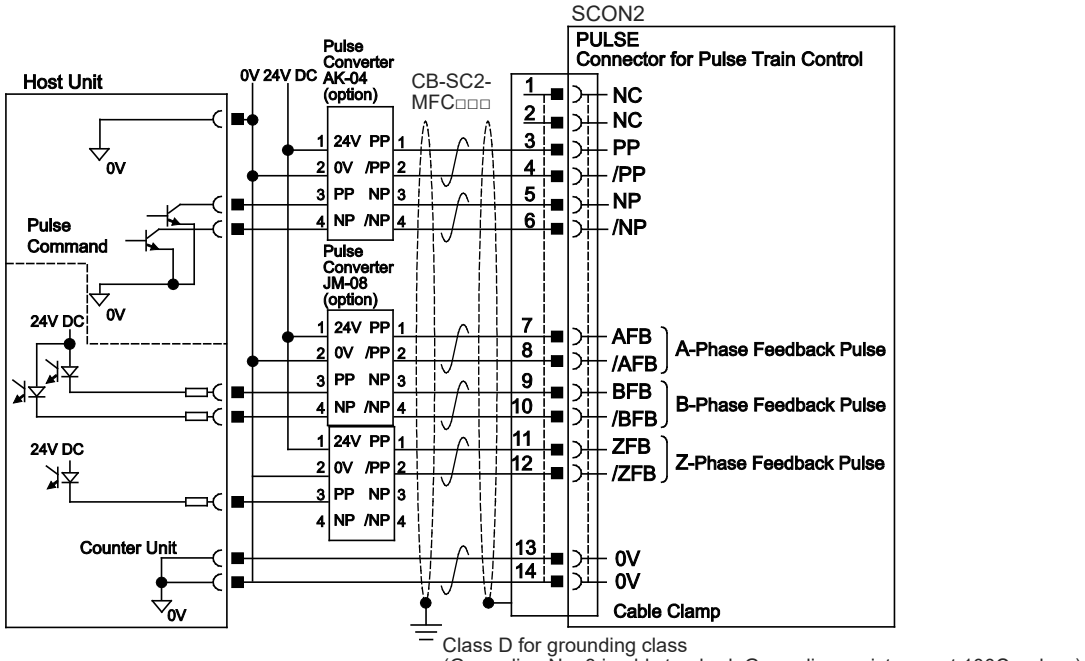


Class D for grounding class
(Grounding No. 3 in old standard: Grounding resistance at 100Ω or less)

(Note) Lay out also 0V (COM) if it exists on the host unit.

● When Host Unit is Open Collector System

AK-04 (option) is required for pulse train input. JM-08 (option) is required for pulse train output.

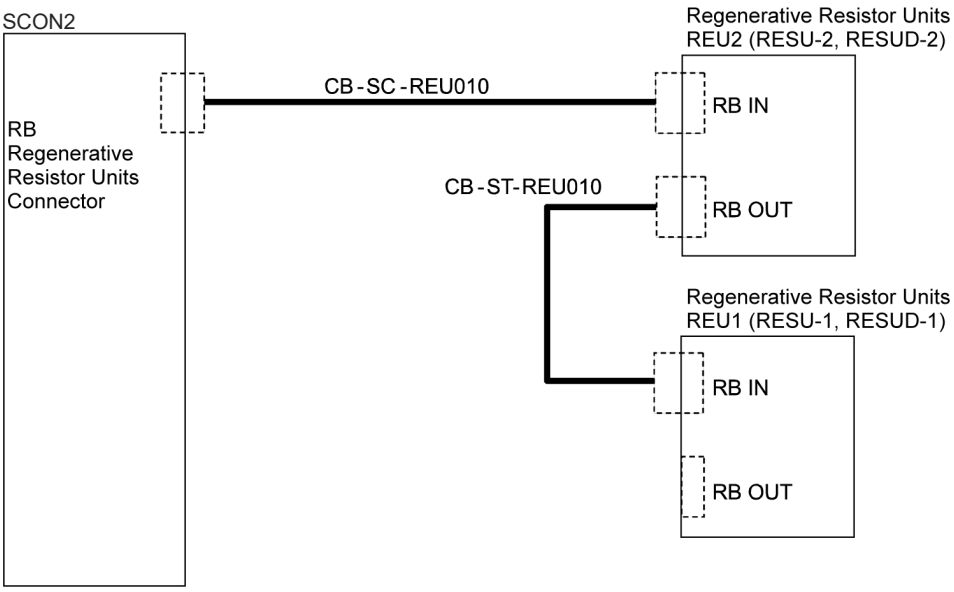


Class D for grounding class
(Grounding No. 3 in old standard: Grounding resistance at 100Ω or less)

Caution

- Use the same power source for the host open collector input and output, AK-04 and JM-08.

[7] Circuit of Regenerative Resistor Units



3.3 Wiring Method

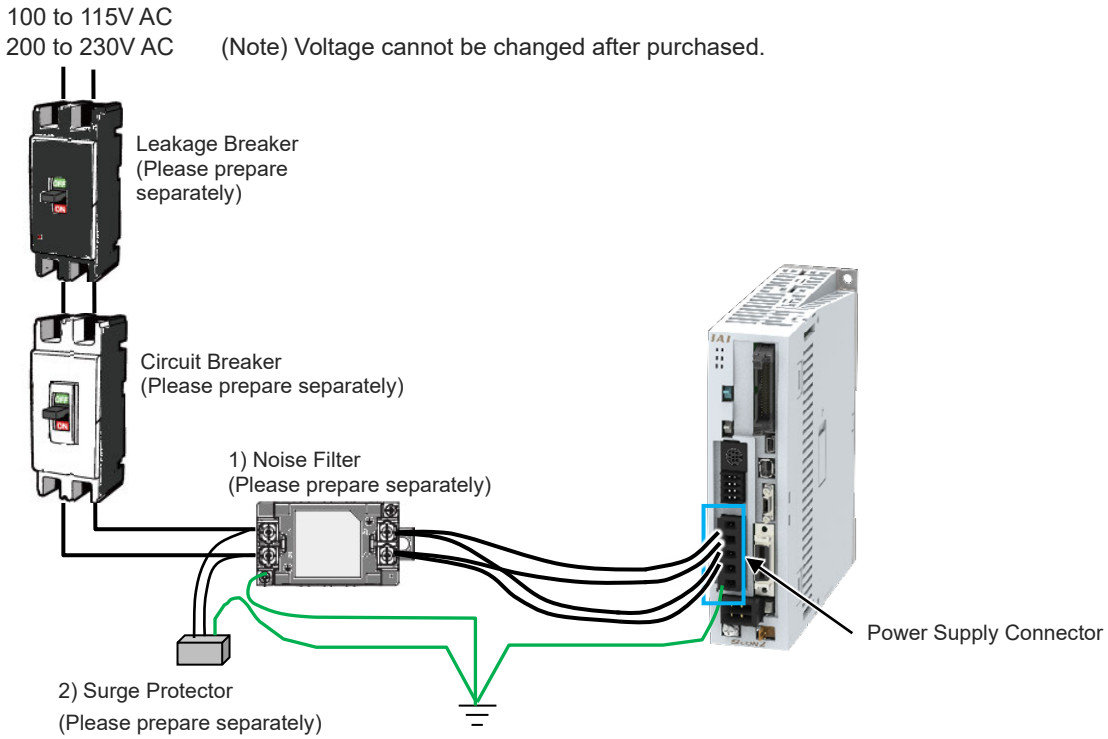
3.3.1 Wiring of Power Circuit

Power Supply Type	Specifications
Motor Power Supply	100V Specification : 100 to 115V AC ±10% 50/60Hz 200V Specification : 200 to 230V AC ±10% 50/60Hz
Control Power Supply	

[1] Main Power Supply Circuit (Power Supply Connector)

Supply the appropriate power from the following considering the controller type.
Loaded current may differ depending on the connected actuators. Select a circuit breaker and leakage breaker that can apply to the specifications. Refer to [2.3.3 to 2.3.4]

● Wiring Image



Parts Name		Model	Supplier	Position to attach
1)	Noise Filter	NAC-10-472 (Note)	COSEL	Attach in range of 300mm or less from controller
		NF2010A-UP (Note)	SOSHIN ELECTRIC CO, LTD	
2)	Surge Protector	R•A•V-781BWZ-2A	Okaya ELECTRIC CO, LTD	Attach at the input terminal of noise filter

Note: It is the model code when one unit of noise filter is connected to one unit of SCON2.

Caution

- For the noise filter in 1), it is recommended to have one unit connected to one unit of Controller.
- When connecting several units of Controller to one unit of noise filter, make sure that each device in the equipment would not get any influence of noise. Also, considering the case that they get influence of noise, ensure space so noise filters or noise prevention component can be additionally allocated.

[Reference] Caution When Selecting Noise Filter

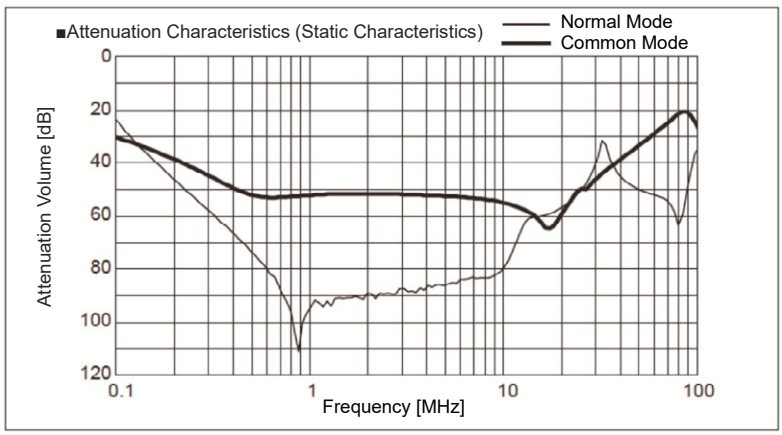
Consider two points as stated below when you select a noise filter.
Please check the supplier of each noise filter for details.

1. Allowable Current : The power current (Note 1) of the controller should be in the range of the allowable current of the noise filter.

◆ Allowable Current of Noise Filter > Rated Current Amperage of Connected Controller

Note 1 : Rated Current Amperage of SCON2 = Motor Current Amperage + Control Current Amperage
As the rated current amperage differs depending on the connected actuator (motor), it is required to check in the [2.3.2 Power Capacity and Heat Generation] for the necessary current value.

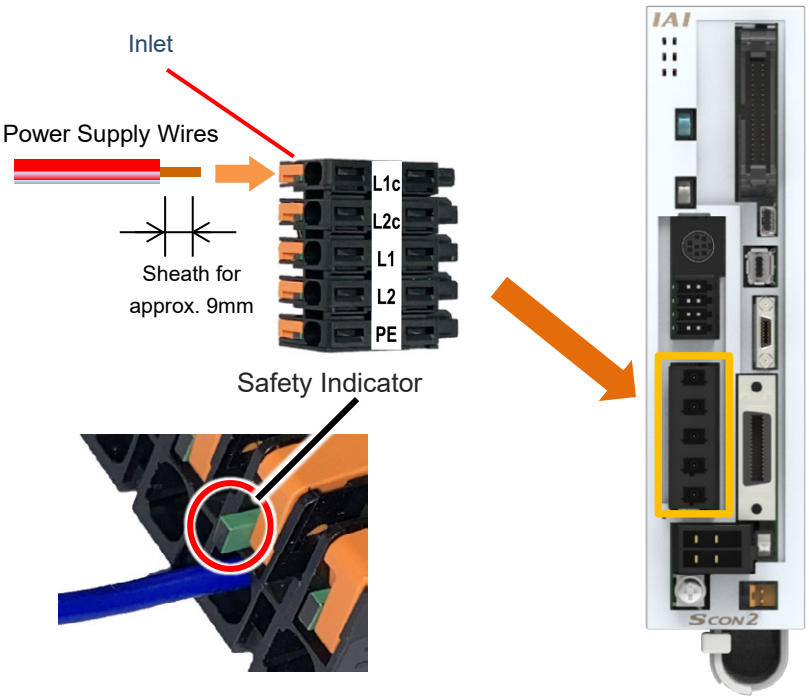
2. Attenuation Characteristics : A noise filter which possesses the similar attenuation characteristics to the noise filter code stated in the previous page should be selected.
For example, shown below is the graph of the attenuation characteristics of NAC-10-472 that IAI recommends.



● Wiring Method

Connect the power supply to the enclosed connector (Model code: MPS_7S/05_S_F3_TN_B_B: Weidmuller). See below for how to lay out the power supply wires.

1) Select a cable complies with the applicable cable diameter in the table below, strip it for approximately 9mm, and insert it to the inlet till it makes a “click” noise. The safety indicator should appear from the connector and the green side should be able to be seen.
2) Pull the cable softly to confirm that it is firmly fixed.
3) Connect all the wires in the same manner and insert the enclosed connector to the power connector.



Power Supply Connector (PWR)

Pin No.	Signal Name	Contents	Applicable cable diameter
1	L1c	Control AC Power Input	0.75mm^2 (AWG18)
2	L2c		
3	L1	Motor AC Power Input	2.0mm^2 (AWG14)
4	L2		
5	PE	Protective Ground Line	2.0mm^2 (AWG14)

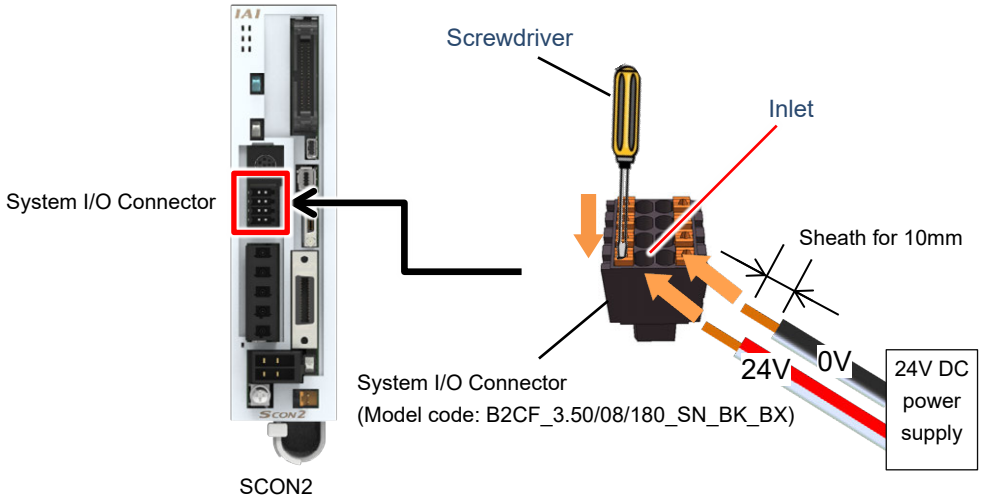
[2] Brake Power Supply (Power Supply Connector)

Supply 24V DC ±10% and 1A max. when using an actuator equipped with a brake.

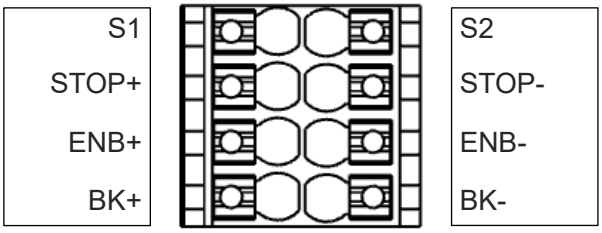
● Wiring Method

Connect the power supply to the system I/O connector (Model code: B2CF_3.50/08/180_SN_BK_BX: Weidmuller). See below for how to lay out the power supply wires.

1) Push in the protruded portion on the terminal with a tool such a tool as a slotted screwdriver to open up the inlet.
2) Reveal the sheath for 10mm on the cable that satisfies the cable diameter complies the specification shown in the table below and put it in the inlet.
3) Put the tool such as a slotted screwdriver away from the protruded portion on the terminal. (The inlet closes and affixes the wire)
4) Connect all the wires in the same manner and insert the enclosed connector to the system I/O connector.



The pin assignment of the system I/O connector should be as shown below.



Signal Name	Contents	Applicable cable diameter
BK+	Brake Power Supply Input + side	1.25 to 0.5mm^2 (AWG16 to 20)
BK-	Brake Power Supply Input - side	

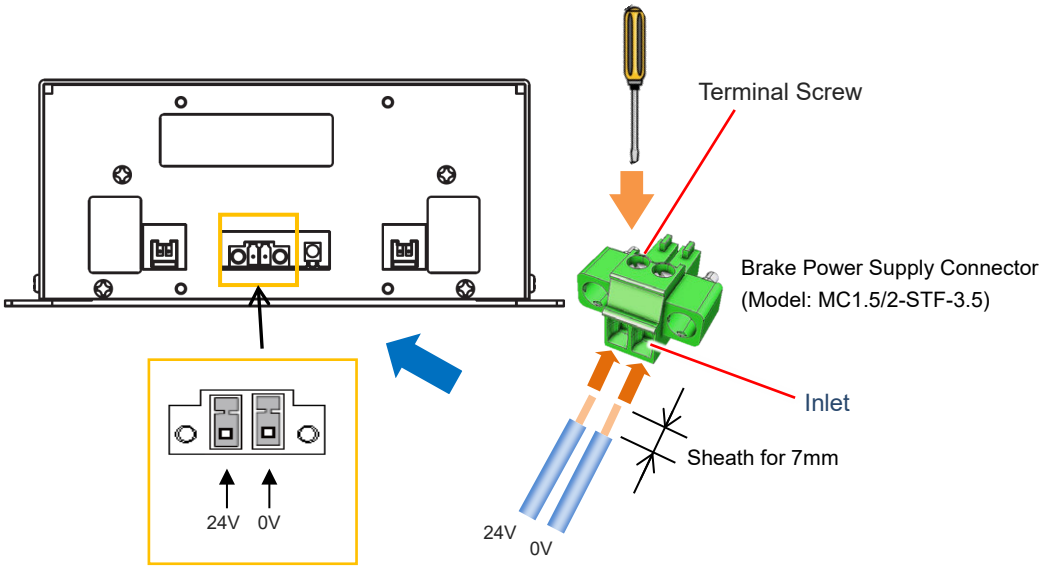
● For Actuators Necessary to Have Brake Box

When connecting RCS2-RA13R with brake, it is necessary to have a brake box (RCB-110-RA13-0) connected.

Refer to [2.6.4 Brake Box] for details.

Supply 24V and 1A max. as the power supply for the brake box.

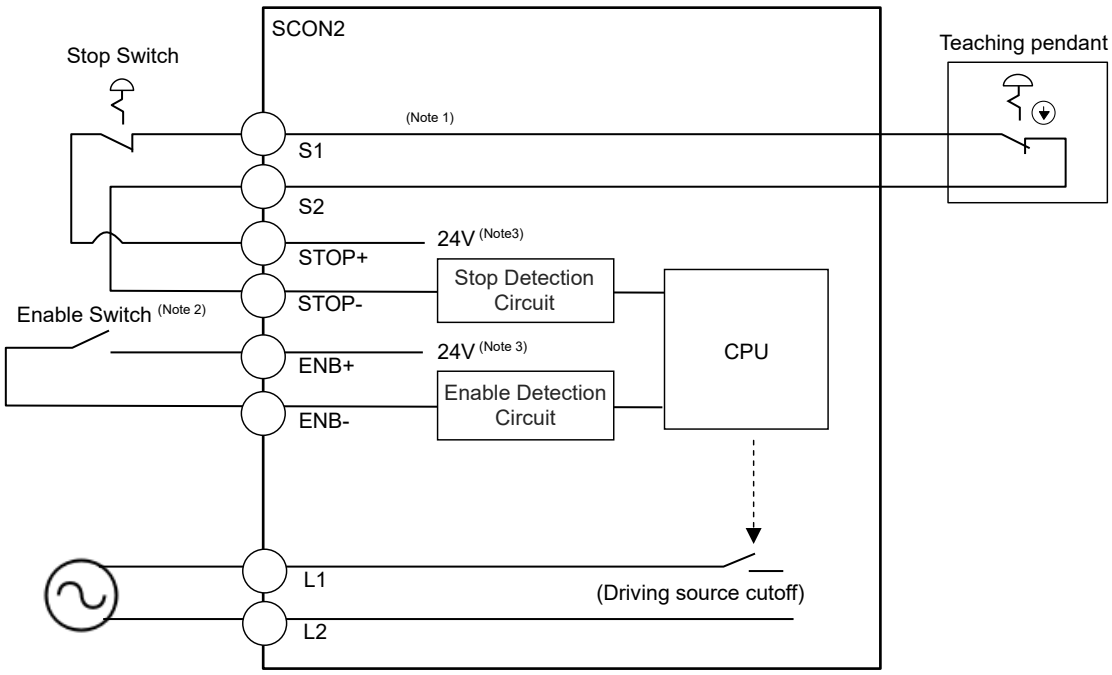
1) Loosen the terminal screw with using such as a slotted screwdriver to open up the inlet.
2) Reveal the sheath for 7mm on the cable that satisfies the cable diameter complies the specification shown in the table below and put it in the inlet.
3) Tighten the terminal screw with using such as a slotted screwdriver. (The inlet closes and affixes the wire)
4) Connect all the wires in the same manner and insert the enclosed connector to the power connector.



3.3.2 Wiring for Emergency Stop Circuit (System I/O)

Make sure to construct the wiring of the emergency stop circuit considering the suitability to the Safety Category of the whole system.

● Wiring Image



Note 1 This controller are not equipped with a relay to enable to automatically identify a teaching tool was inserted and switch the wiring layout. (It does not get short-circuited between S1 and S2 terminals even if not connected.)

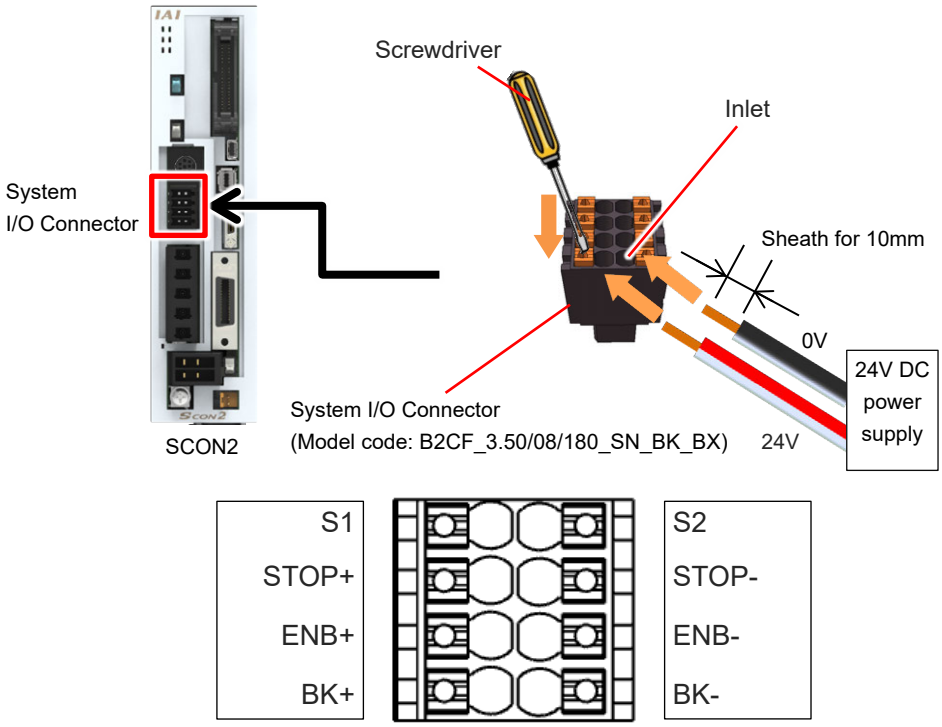
Note 2 Construct the circuit considering the safety category of the whole equipment.

Note 3 Make sure to construct the emergency stop circuit using the built-in 24V (STOP+, ENB+ Terminal) output for STOP- and ENB- Terminal.

● Wiring Method

Connect the wires for operation stop (System I/O Connector) to the enclosed connector (Model code: B2CF_3.50/08/180_SN_BK_BX: Weidmuller). See below for how to lay out the power supply wires.

1) Push in the protruded portion on the terminal with a tool such a tool as a slotted screwdriver to open up the inlet.
2) Reveal the sheath for 10mm on the cable that satisfies the cable diameter complies the specification shown in the table below and put it in the inlet.
3) Put the tool such as a slotted screwdriver away from the protruded portion on the terminal. (The inlet closes and affixes the wire)
4) Conduct wiring for all in the same process and insert the connector to the system I/O connector on the controller side.

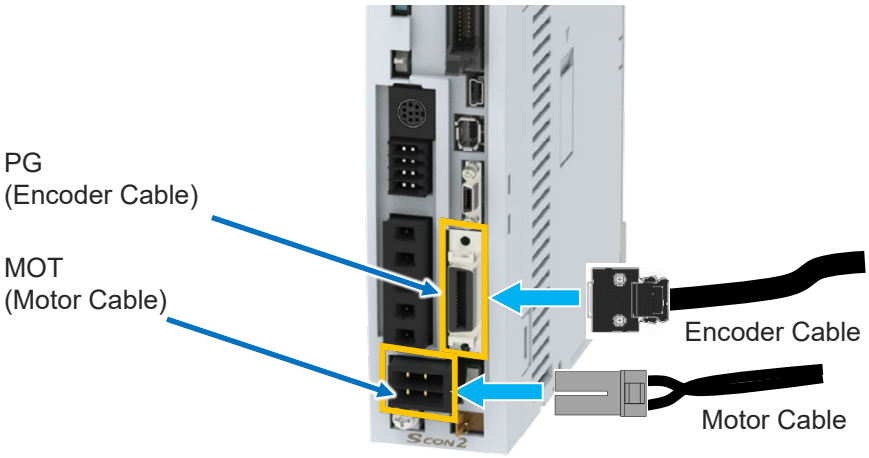


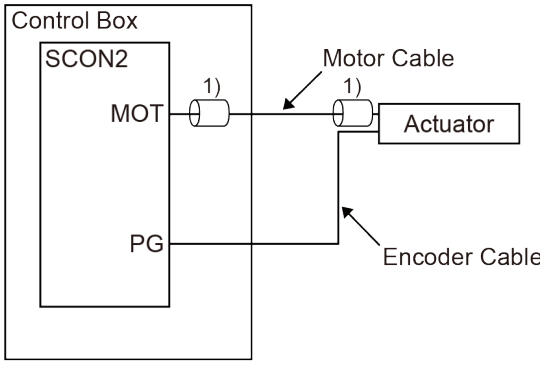
System I/O Connector

Pin No.	Signal Name	Contents	Applicable cable diameter
1	S1	Operation Stop Switch Contact	1.25 to 0.5mm^2 (AWG16 to 20)
2	S2	Operation Stop Switch Contact	
3	STOP+	Stop Dedicated Power Output	
4	STOP-	Stop Input Signal	
5	ENB+	Enable Output	
6	ENB-	Enable Input	
7	BK+	Brake Power Supply Input + side	
8	BK-	Brake Power Supply Input - side	

3.3.3 Connection to Actuator

Connect the motor cable to the MOT connector.
Connect the encoder cable to the PG connector.
Connect the brake box if using RCS2-RA13R, NS Type or DDA equipped with brake.
Refer to [2.6.4 Brake Box]





Attach a clamp filter to the motor cable if necessary considering the noise environment.

Parts Name	Model	Supplier	Position to attach
Clamp Filter	ZCAT3035-1330	TDK	• Near SCON2 • Near Actuator

Motor Connector (MOT)

	Model	Remarks
Cable Side	F35FDC-04V-K	
Controller Side	SC04B-F35DK-GGR	

Pin No.	Signal Name	Contents	Applicable cable diameter
A1	W	Motor drive phase W	Cable dedicated for IAI actuators
A2	PE	Protective ground	
B1	U	Motor drive phase U	
B2	V	Motor drive phase V	

Encoder Connector (PG)

	Model	Remarks
Cable Side	10126-3000VE	
Controller Side	10226-6202JL	

Pin No.	Signal Name	Contents	Applicable cable diameter
1	A+	Phase A Difference + Input (Phase U+)	Cable dedicated for IAI encoders
2	A-	Phase A Difference - Input (Phase U-)	
3	B+	Phase B Difference + Input (Phase V+)	
4	B-	Phase B Difference - Input (Phase V-)	
5	Z+	Phase Z Difference + Input (Phase W+)	
6	Z-	Phase Z Difference - Input (Phase W-)	
7	SRD+	Send/Receive Difference + (Pulse/Magnetic Pole Changeover +)	
8	SRD-	Send/Receive Difference - (Pulse/Magnetic Pole Changeover -)	
9	LC_SRD+	Loadcell Communication +	
10	LC_SRD-	Loadcell Communication -	
11	NC	Unconnected	
12	24V	Sensor Power Output	
13	0V	24V Power Supply GND	
14	BAT+	Backup Battery Power Supply	
15	BAT-	Battery Ground	
16	VCC	Encoder Power	
17	0V	GND	
18	LC_VCC	Loadcell Power +	
19	LC_GND	Loadcell Power -	
20	BK-	Brake Release Output Signal - (COM : Common to All Axes)	
21	BK+	Brake Release Output Signal +	
22	NC	Unconnected	
23	RSV	Sensor Input (Reserve)	
24	OT	Sensor Input (Over Travel)	
25	CREEP	Sensor Input (Creep sensor)	
26	LS	Sensor Input (limit switch)	

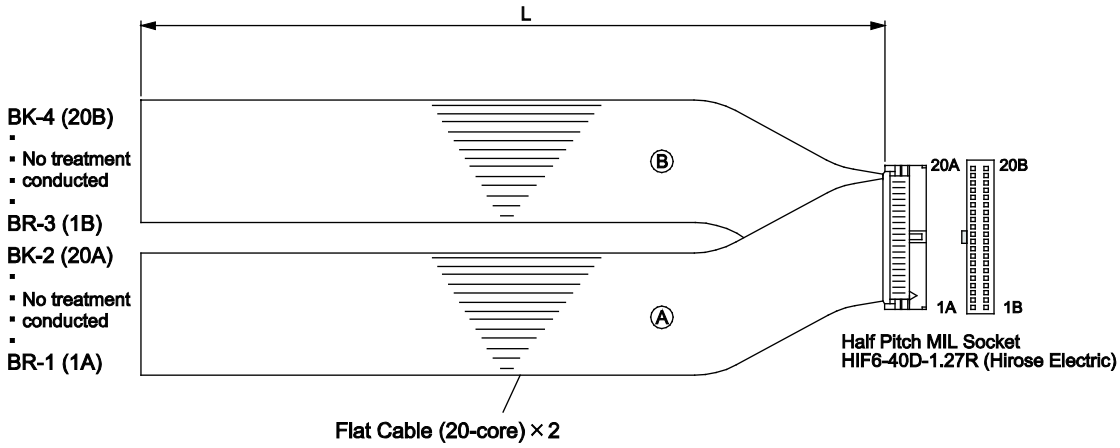
3.3.4 Connection of PIO

Conduct the connection of I/O to the controller is to be carried out using the dedicated I/O cable. Cable length is to be indicated in the controller model code. Please check the controller model code.

A desired I/O cable can be selected from 2m (standard), 3m, and 5m cables. Up to 10m I/O cables are sold separately. Refer to [2.1.4 How to Read the Model] for details.

Also, the end of the cable is left untreated without any process for free wiring to the host controller (eg. PLC).

Model : CB-PAC-PIO□□□ (□□□ indicates the cable length L Example: 020=2m)



No.	Cable Color	Wiring	No.	Cable Color	Wiring
1A	BR-1	Flat Cable Ⓐ (Press Welding) AWG28	1B	BR-3	Flat Cable Ⓑ (Press Welding) AWG28
2A	RD-1		2B	RD-3	
3A	OR-1		3B	OR-3	
4A	YW-1		4B	YW-3	
5A	GN-1		5B	GN-3	
6A	BL-1		6B	BL-3	
7A	PL-1		7B	PL-3	
8A	GY-1		8B	GY-3	
9A	WT-1		9B	WT-3	
10A	BK-1		10B	BK-3	
11A	BR-2		11B	BR-4	
12A	RD-2		12B	RD-4	
13A	OR-2		13B	OR-4	
14A	YW-2		14B	YW-4	
15A	GN-2		15B	GN-4	
16A	BL-2		16B	BL-4	
17A	PL-2		17B	PL-4	
18A	GY-2		18B	GY-4	
19A	WT-2		19B	WT-4	
20A	BK-2		20B	BK-4	

For the signal assignment of each wire, refer to the following considering the operation mode.

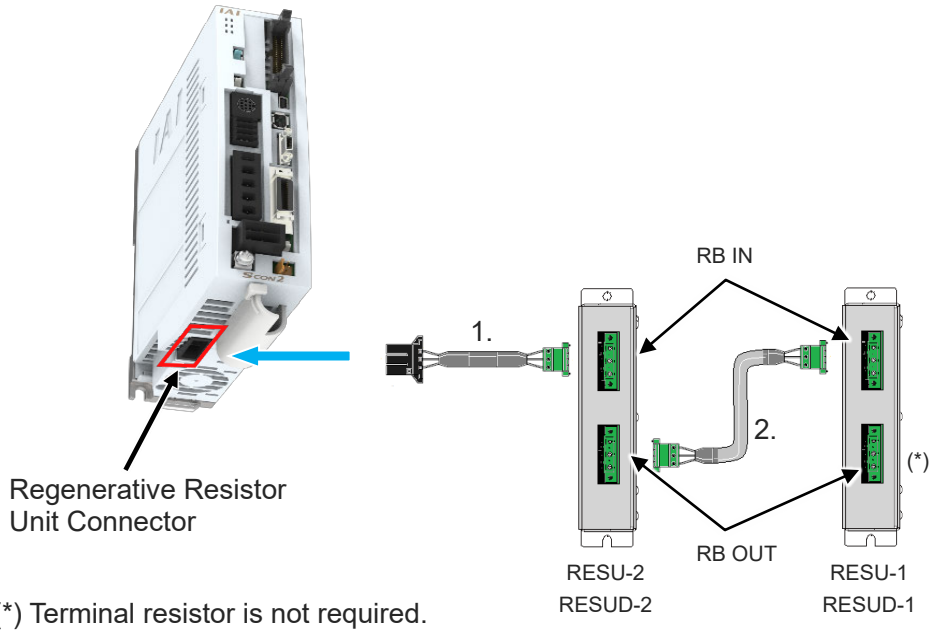
1. Positioner Mode ····· [3.1.3 [5] PIO Circuit]
2. Pulse Train Control Mode ····· [3.2.3 [5] PIO Circuit]

3.3.5 Connectable Regenerative Resistor Units

Connect regenerative resistor unit (s) with attached cables as shown in the figure below.

1. When connecting 1 unit : Connect with enclosed cable (CB-SC-REU)
2. When connecting 2 or more units : Connect with enclosed cable (CB-ST-REU)

● Wiring Image



(*) Terminal resistor is not required.

● Specification of connector for connecting regenerative resistor unit

Item	Contents and Model
Connector Name and Model	Regenerative Resistor Unit Connector (RB)
Cable Side	1-178128-3
Controller Side	1-178138-5

Signal Name	Contents	Applicable cable diameter
RB+	Regeneration Resistor + (Motor drive DC voltage)	Dedicated cable is enclosed to regenerative resistor unit
RB-	Regeneration Resistor -	
PE	Ground Terminal	

● Reference number of connectable unit (Excluding RCS2-RA13R)

Motor Output		Connectable Number of Regenerative Resistor Units
Horizontal Mount /Vertical Mount	to 200W (Note)	Not Required
	to 400W	1
	to 750W	2

(Note) One unit is necessary for LSA/LSAS-N10S Types.

● Reference number of connectable unit (RCS2-RA13R)

Motor Output		Connectable Number of Regenerative Resistor Units
Horizontal Mount	Lead 1.25	Not Required
	Lead 2.5	1
Vertical Mount	Lead 1.25	1
	Lead 2.5	1

● Reference number of connectable unit (DDA)

Series	Type	Connectable Number of Regenerative Resistor Units
DDA	LT18□	1
	LH18□	2

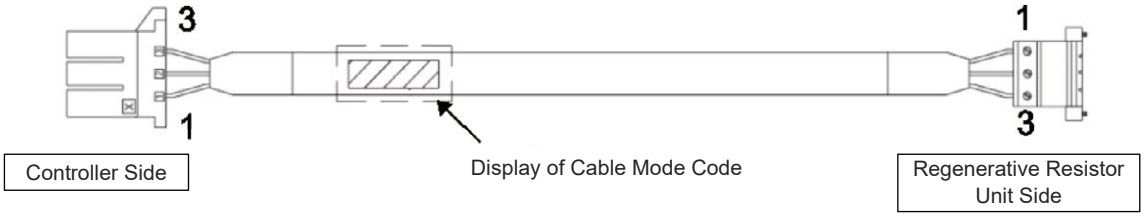
Caution

- The reference table for the number of connected units a reference assuming back and forth operation is made in rated acceleration/deceleration speed with rated load for 1,000mm stroke with the actuator operation duty 50%.
- Regenerative energy is absorbed inside the controller and when it exceeds the limit, Alarm 0CA “Overheat Error” is generated. Add an external regenerative resistor unit if this occurs.
  More units of regenerative resistor unit than referred in the table for the number of connected units are required if the operation duty is higher than 50%. The maximum quantity of the regenerative resistor units that can be connected is 4 units.
  (Never attempt to connect more than described above since it may cause a malfunction.)

● Controller Link Cable

1. Regenerative resistance connection cable for SCON (CB-SC-REU□□□)

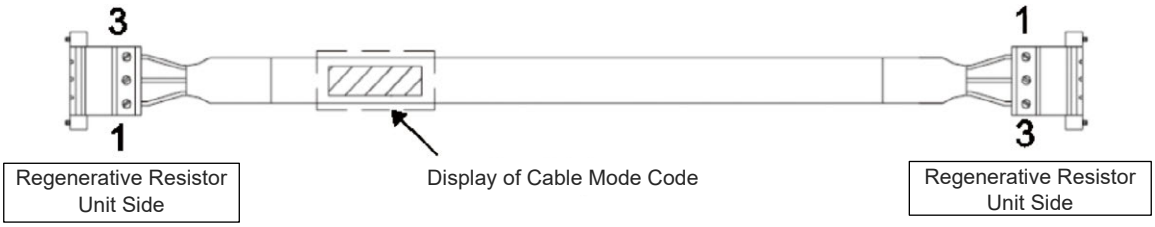
□□□ indicates the cable length (Example) 010 = 1m



Wiring	Color	Signal	No.		No.	Signal	Color	Wiring
KIV 1.0mm² (AWG17)	Light Blue	RB+	1		1	RB+	Light Blue	KIV 1.0mm² (AWG17)
	Brown	RB-	2		2	RB –	Brown	
	Green/Yellow	PE	3		3	PE	Green/Yellow	

2. Regenerative resistance connection cable (CB-ST-REU□□□)

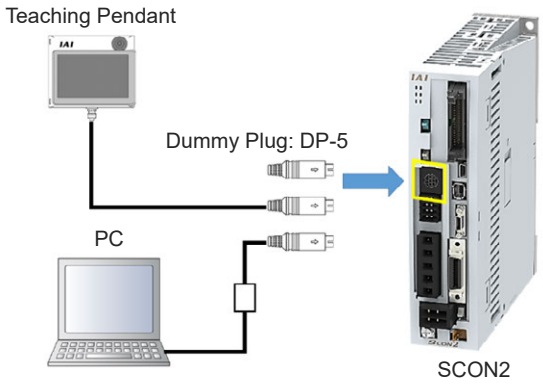
□□□ indicates the cable length (Example) 010 = 1m



Wiring	Color	Signal	No.		No.	Signal	Color	Wiring
KIV 1.0mm² (AWG17)	Light Blue	RB+	1		1	RB+	Light Blue	KIV 1.0mm² (AWG17)
	Brown	RB-	2		2	RB-	Brown	
	Green/Yellow	PE	3		3	PE	Green/Yellow	

3.3.6 SIO Connecter Connection

SIO connector can be used not only for the connection of the teaching tools, but also for the connections of the host controller (PLC, touch panel and PC).
For the operation, refer to the instruction manual of each model.



Item	Contents and Model
Connector Name	SIO Connector
Cable Side	miniDIN 8pin
Controller Side	TCS7587-0121077

Pin No.	Signal Name	Contents	Applicable cable diameter
1	SD+	Difference Signal for Teaching Tool +	Cable dedicated for IAI products
2	SD-	Difference Signal for Teaching Tool -	
3	T5V	5V Output for Teaching Tool	
4	ENB	Enable Signal Input	
5	STOPA	Stop Line A	
6	T24V	24V Output for Teaching Tool	
7	0V	0V	
8	STOPB	Stop Line B	
Shell	0V	0V	

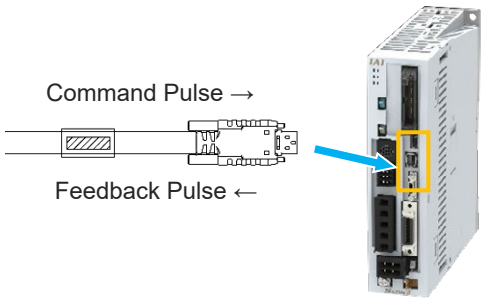
Caution

- Set the operation mode setting switch to the MANU side when connecting a teaching tool and setting up a controller.
- Removing the teaching pendant while the power is ON causes a transient emergency stop. Thus, the devices such as the actuator which are in operation will stop.
  Do not disconnect the teaching pendant during the operation.
- In case the teaching tool is not used, make sure to insert the dummy plug “DP-5” to SIO connectors.

3.3.7 Pulse Train Signal Input and Feedback Pulse Output

Implement the wiring layout to the multi-function connector when it is necessary to read the feedback pulse and to send the command pulse in pulse train control mode.

● Wiring Image



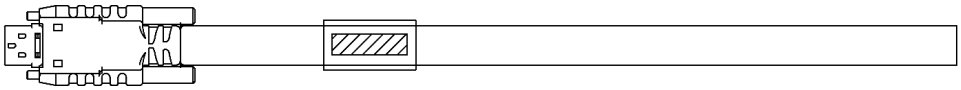
● Multi-function Connector Cable (Option)

Model : CB-SC2-MFC□□□ □□□ is cable length : e.g. 020 = 2m

Cable length: If the upper side is differential system, MAX. 10m

For open collector, MAX. 2m

(Note) There is no connector equipped on the host controller (PLC, etc.) side. Make an appropriate treatment that suits the host controller (PLC, etc.). Also, to prevent the noise influence as much as possible, make the cable as short as possible.



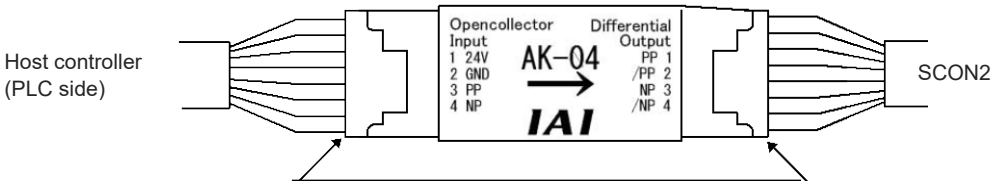
No.	Signal	Description	Color	Wiring
1	IOUT	Output load data detected by loadcell as analog data (current)	Orange/Red 1*1	Disconnecting (AWG28)
2	GND		Orange/Black 1*1	
3	PP	Command pulse train inputs (PP)	Light Gray/Red 1	
4	PG	Command pulse train inputs (/PP)	Light Gray/Black 1	
5	NP	Command pulse train inputs (NP)	White/Red 1	
6	NG	Command pulse train inputs (/NP)	White/Black 1	
7	AFB	Feeldback pulse (+A)	Yellow/Red 1	
8	/AFB	Feeldback pulse (-A)	Yellow/Black 1	
9	BFB	Feeldback pulse (+B)	Pink/RED 1	
10	/BFB	Feeldback pulse (-B)	Pink/Black 1	
11	ZFB	Feeldback pulse (+Z)	Orange/Red 2	
12	/ZFB	Feeldback pulse (-Z)	Orange/Black 2	
13	GND	0V	Light Gray/Red 2	
14	GND	0V	Light Gray/Black 2	
Shield is connected to the cable clamp			Shield	

* This signal line is covered with foil for shield.

● Pulse Converter : AK-04

The pulse converter converts command pulses in the open collector mode to those in the differential mode.

Use this converter if the host controller sends output pulses in the open collector mode.



e-CON Connector (Enclosed)

Connector Color	Applicable cable diameter	Model (Manufactured by 3M)
Body Black, Cover Yellow	AWG24 to 26	37104-3122-000FL

* When the multiple functional cable is to be used, it is necessary to prepare the following connector.

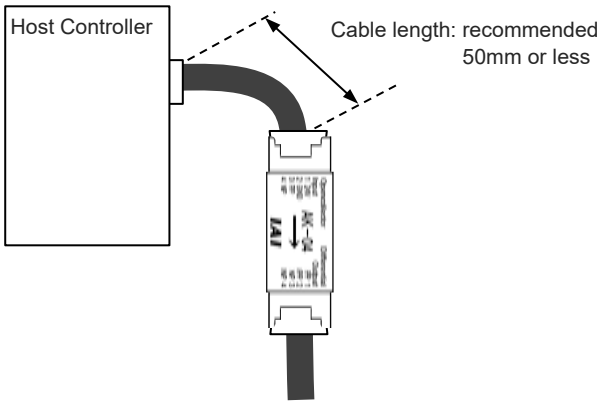
Connector Color	Applicable cable diameter	Model (Manufactured by 3M)
Body Gray, Cover Red	AWG26 to 28	37104-4101-G00FL

Caution

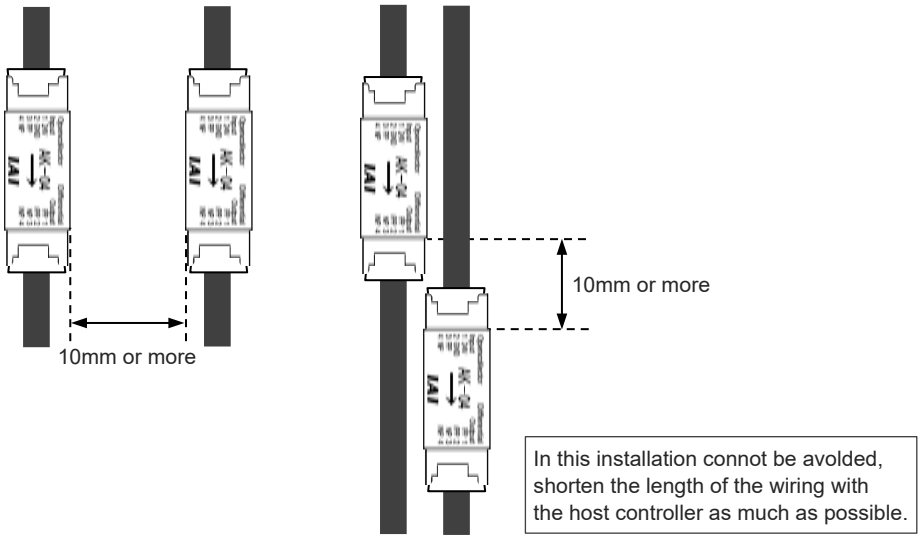
- Pay attention not to insert wrongly because it is the same e-CON connector as input and output. Putting the power on with the insertion being wrong will burn AK-04.
- Use the pulse converter in the ambient temperature range between 0 and 40°C.
- The temperature increase of about 30°C occurs during operation. Accordingly, neither install several pulse converters in close contact nor install them within a duct. Do not install the pulse converter near other heating devices.
- If more than one pulse converters are installed, set a pulse converter apart from another by 10mm or more.
- Make the wiring between the host controller (PLC, etc.) and AK-04 as short as possible. Long wires make it easy to pick up noise. Also make the wiring between AK-04 to this controller as short as possible. Place AK-04 close to the host controller.

A recommended installation sample is shown in the figure below.

• Make the wiring between the host controller and the pulse converter as short as possible.



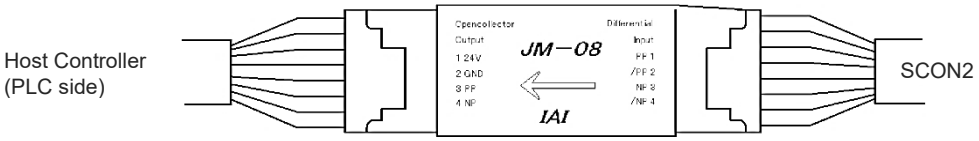
• Allocate them 10mm or more away from each other in multiple use.



● Pulse Converter : JM-08

The pulse converter converts command pulses in the those in the differential mode to open collector mode.

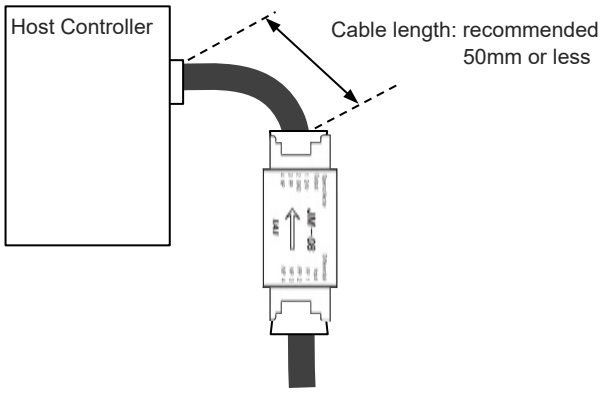
Use this converter if the host controller sends output pulses in the applicable for open collector (24V type).



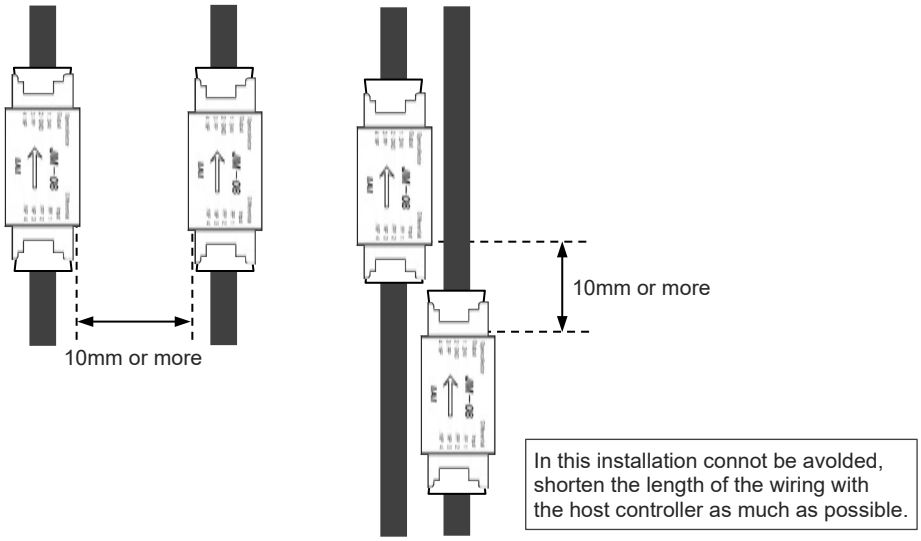
Caution

- Pay attention not to insert wrongly because it is the same e-CON connector as input and output. Putting the power on with the insertion being wrong will burn JM-08.
- Use the pulse converter in the ambient temperature range between 0 and 40°C.
- The temperature increase of about 30°C occurs during operation. Accordingly, neither install several pulse converters in close contact nor install them within a duct. Do not install the pulse converter near other heating devices.
- If more than one pulse converters are installed, set a pulse converter apart from another by 10mm or more.
- Make the wiring between the host controller (PLC, etc.) and JM-08 as short as possible. Long wires make it easy to pick up noise. Also make the wiring between JM-08 to this controller as short as possible. Place JM-08 close to the host controller.

A recommended installation sample is shown in the figure below.



• Keep pulse converters separated for 10mm or more from each other.



3.4 Field Network Connector Connection

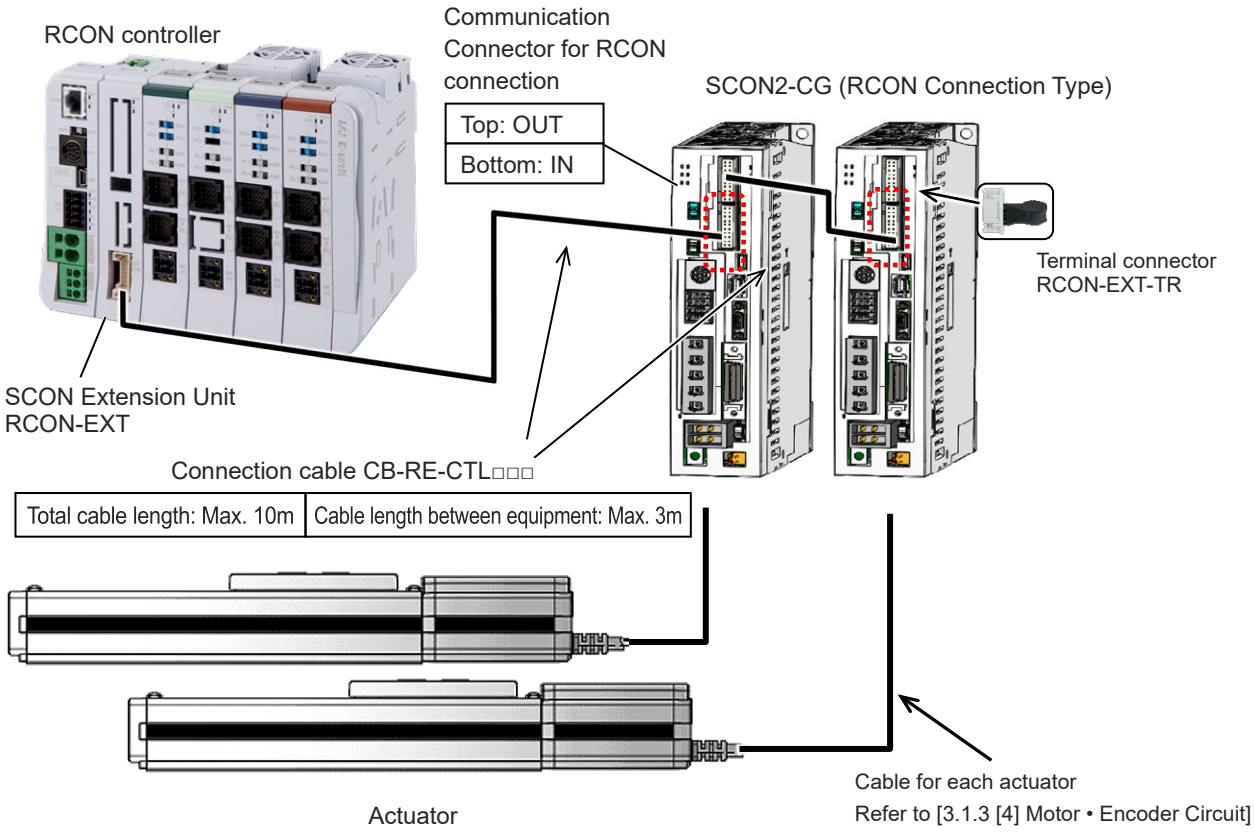
For how to lay out cables for each field network, refer to the following instruction manuals to proceed the work.

Field Network Name	Description	Details
CC-Link	Control of the actuator is available with I/O communication using the control signals same as those for PIO or the numerical data communication.	Refer to the other ME0469
CC-Link IE Field		
DeviceNet		
EtherCAT		
EtherNet/IP		
MECHATROLINK-III (Standard I/O Profile)		
PROFINET IO		
EtherCAT (CiA401 Drive Profile)	Synchronized control of several actuators in highly constant periodicity is available.	Refer to the other ME0472
MECHATROLINK-III (Standard Servo Profile)		Refer to the other ME0471
RS-485	Actuator is controlled with using a general protocol “Modbus” communication.	Refer to the other ME0162
Modbus/TCP	It is a Modbus communication using TCP/IP. It can be used when the EtherNet/IP specification is selected.	Refer to the other ME0469 or ME0162

Note This controller are the slave units (slave stations). Check the instruction manual of the master unit of each supplier and PLC to be mounted for the details of each network. For the instruction of the field network, the instruction manual is provided separately. Use the manual together with this manual.

3.5 Connection to R-Unit

The SCON extension unit and the SCON2 are connected with a dedicated cable (model: CB-RE-CTL□□□). When connecting two or more SCON2, connect the SCON2 units together with a dedicated cable. Up to 16 axes can be controlled by combining with a driver unit and the connected axis.



* In RCON System, it is available to connect only either the SCON extension units or PIO/SIO/SCON extension units.

SCON2-CG

Chapter 4

Operation

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4.1 Basic Operation

Caution

- Refer to [RCON System Instruction Manual] for how to operate R-Unit Connection Type.

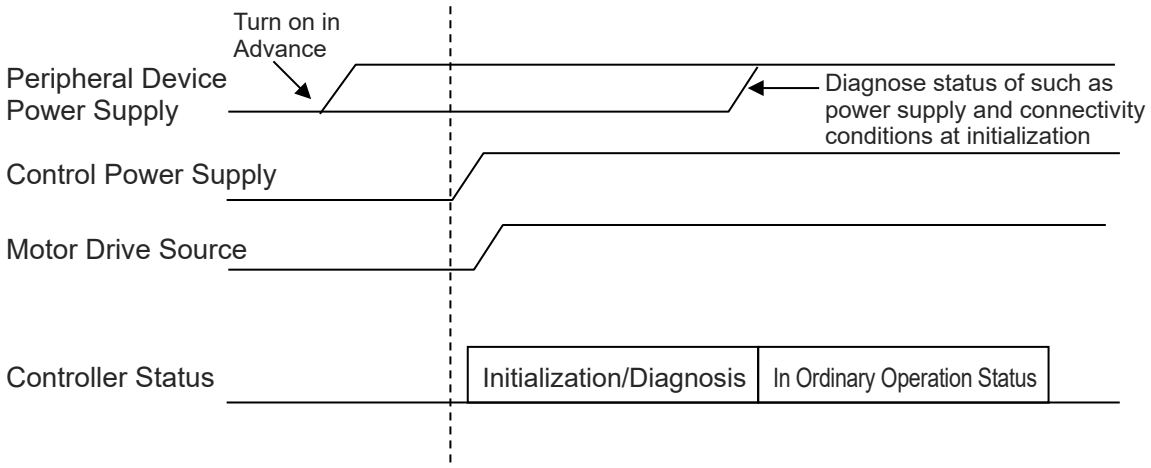
4.1.1 Power on and off

The process below shows the case that the parameters are kept as they are on delivery and there has been no error occurred and it is not in the status of emergency stop.

[1] How to Turn on Power

The process how to turn the power on is as shown below.

1) Check that the wiring is performed correctly and supply power to the peripheral devices (24V power supply for PIO, brake power supply and field network).
2) Turn on the control power supply.
3) Turn on the power supply to the motor drive source.



Note Turn on the control power supply and the motor drive source at the same time, or turn the control power supply on first.

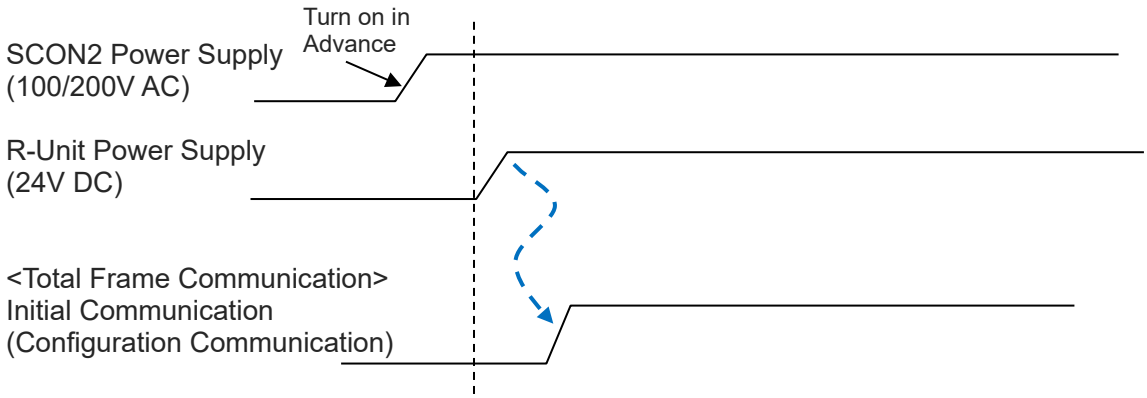
[2] How to Turn off Power

Turn the powers off in the reversed order of turning them on.

Note There may be a case that the Alarm 0CE “Control power supply voltage drop” gets generated when the control power supply is turned off. Be aware that it is not an error.

[3] Timing to Supply Power for R-Unit Connection Type

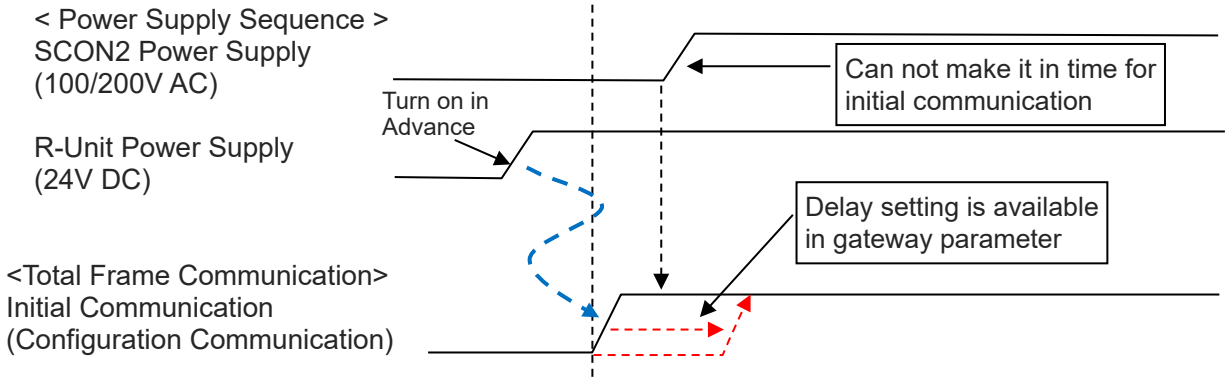
Supply power to R-Unit after power is supplied to SCON2.



[4] Timing to Supply Power for R-Unit Connection Type (when not in time for initial communication)

When the power supply to SCON2 gets late (cannot make on time for initial communication), set up the start latency for the initial communication in the gateway parameter setting tool.

* When the startup of SCON2 could not be made in time for initial communication, in consistency in number of axes (gateway error) could occur.



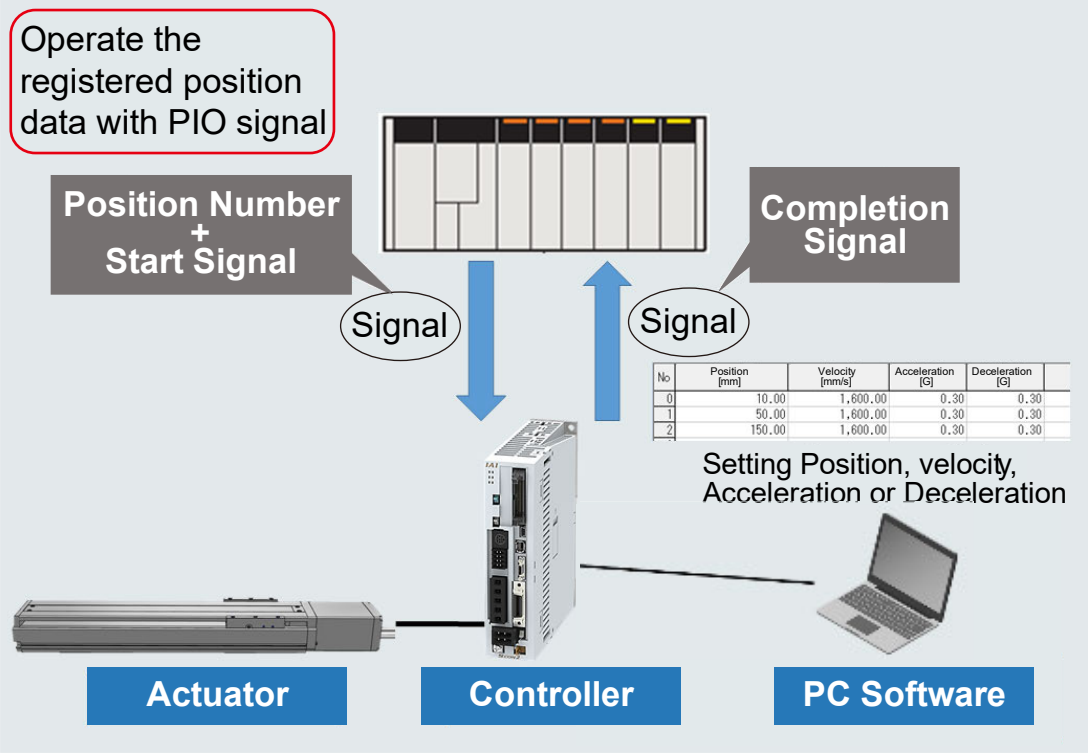
<Setting item> Refer to [RCON System Instruction Manual 3.9 Gateway Parameter Setting Tool]

Category	Name	Value [ms]	
		Initial Value	Input Range
Gateway Parameters (3)	Standby Time for Initial Internal Communication	0	0 to 65535

4.1.2 Basic Operation Methods

There are two types, Positioner Mode and Pulse Train Control Mode, for the operation. Select the suitable one considering the system function. (Types for 3000W and above should not be equipped with Pulse Train Control Mode)
There are various types of actuators including slider, rod, rotary and gripper types. The same operation control method is applicable unless particular descriptions are contained in this manual.

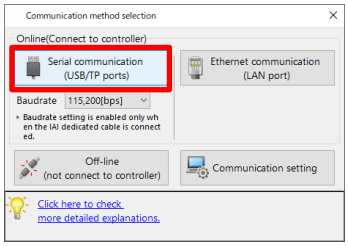
[1] Positioner Mode



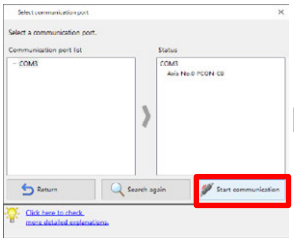
● Operation Ready・・・・Resistration of Position Data (Example of Registration IA-OS)

• Procedure 1 : Turn on the power to the controller.

• Procedure 2 : Start up the IA-OS and establish the connection to the controller.

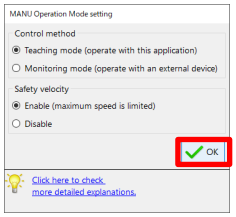


Select the communication system (online)

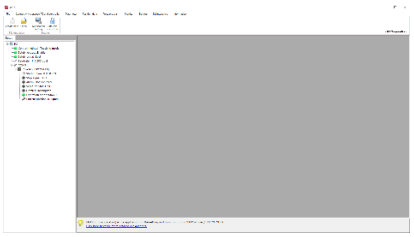


Select a controller to connect with and press “Start communication”.

Press” Yes”
(Safety circuit confirmation)

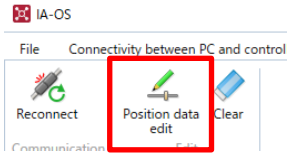


Select “Teaching Mode” and “Enable”, and then press

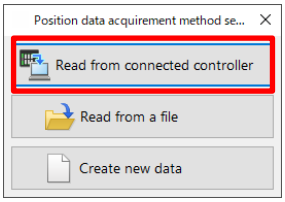


Startup IA-OS

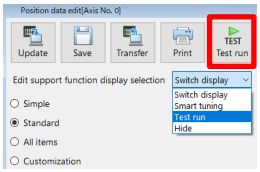
• Procedure 3: Turn the servo ON, and have a home-return operation.



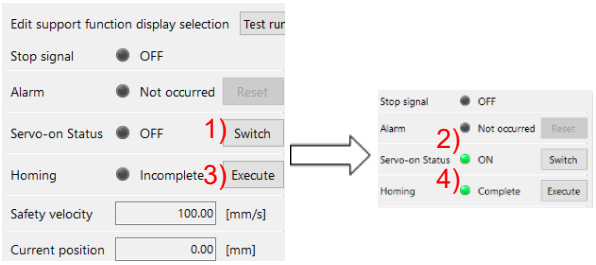
Select “Position Data” → “Position data edit” in the menu



Select “Read from connected controller”



Press “TEST Test run”
Or select “Test run”
from Display Switch



1) Press “Switch” in Servo-on Status
2) Servo lamp turns on
3) “Execute” homing operation
4) Homing complete lamp turns on
(after actuator is stopped)

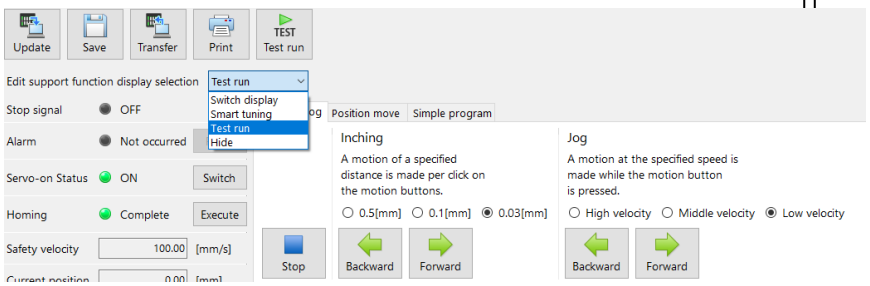
• Procedure 4 : Define the destination (position) of the slider or rod of the actuator.
The destination can be defined by using the following two methods:
1. Read out the coordinate values from such a tool as CAD.
2. Drive the slider or rod with the JOG operation to the destination, and set the position data directly.

• Procedure 5 : Type the destination in the column of Position in Position Table. Writing the position should allow the automatic input of the setting as parameters in the velocity and acceleration/deceleration columns.

No.	Position [mm]	Velocity [mm/s]	Acceleration [G]
0			
1			
2			

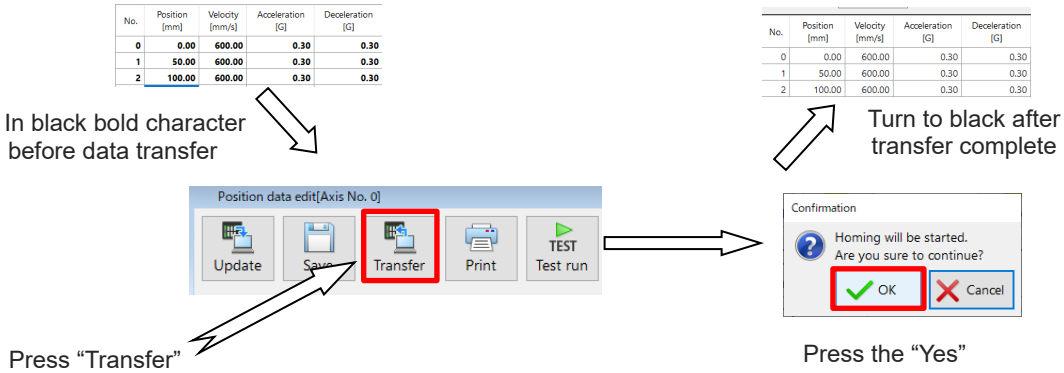
No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]
0	**0.00**	**600.00**	**0.30**	**0.30**
1	**50.00**	**600.00**	**0.30**	**0.30**
2	**100.00**	**600.00**	**0.30**	**0.30**

☆ Set position directly with JOG operation



Press “TEST Test run” or select “Test run” in the edit support feature display select to move the slider or rod with inching/jog operation.

• Procedure 6 : Transfer the information such as Position that is written in Position Table to the controller.



● Operation・・・・Example for Parameters (PIO Patterns 0) at Delivery

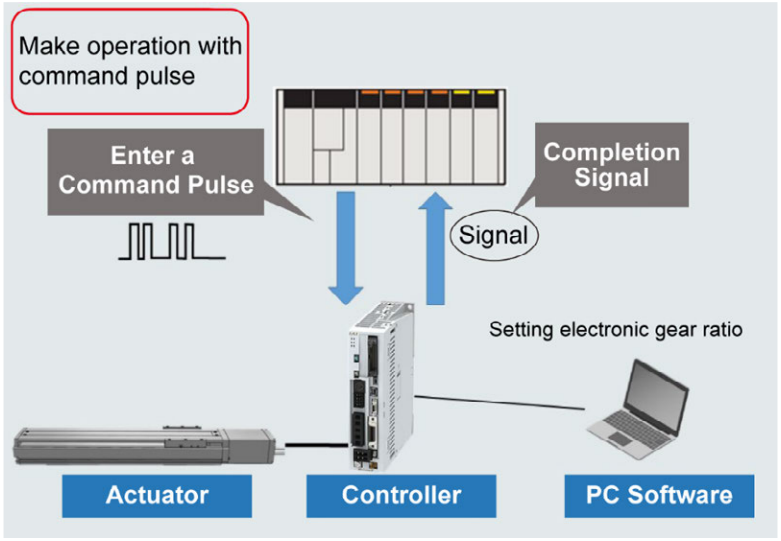
• Procedure 1 : Input the position number at which positioning is desired to be performed in the binary data (PC1 to PC32) from a tool such as the host controller, and then turn the start signal (CSTR) ON.

• Procedure 2 : The actuator is placed at the proper coordinate value (destination) according to the positioning information in the specified position number.

• Procedure 3 : If the positioning is completed, the binary data (PM1 to PM32) of the position number is output. The completion signal (PEND) is also output.

The above procedure describes the basic operation method in the “Positioner mode”.

[2] Pulse Train Control Mode



● Operation・・・・Example for When the Parameter Settings at Delivery

• Procedure 1 : Establish the settings for the pulse train form and electronic gear ratio (to determine how many millimeters the actuator moves when 1 pulse is given) to the controller parameters by using a teaching tool such as IA-OS.

63	Command pulse input mode	1
64	Command pulse input mode polarity [0:Plus/1:Minus]	0
65	Electronic gear numerator	2048
66	Electronic gear denominator	125

Movement direction indication mode by signal
Positive-Logic Pulse Input

Electronic Gear Ratio = 2048/125 ≒ 16.4 times
(Operation made in Unit movement amount per pulse × 16.4)

• Procedure 2 : Send the pulse corresponding to the movement amount of the actuator to the controller from a tool such as the host controller (positioning unit).

• Procedure 3 : The controller calculates the movement amount by multiplying the electronic gear ratio to the number of the pulse input to the controller. Operation made in the movement amount from the current position.
The speed fluctuates in response to the speed of the pulse (frequency) to be input.

• Procedure 4 : Once the positioning is complete, the completion signal (INP) is output.

The above procedure describes the basic operation method in the “Pulse train control mode”.

4.1.3 Parameter Settings

Parameter data should be set to be suited to the system or application. Parameters are variables to be set to meet the use of the controller in the similar way as settings of the ringtone and silent mode of a cell phone and settings of clocks and calendars.

(Example for Parameter Setting)

Soft Stroke Limit	:	Set a proper operation range for definition of the stroke end, prevention of interferences with peripherals and safety.
Zone Output	:	Set to require signal outputs in an arbitrary position zone within the operation zone.

Parameters should be set to meet the use of the controller prior to operation. Once set, they may not set every operation.

Refer to [Chapter 6 Parameter] for the parameter types and the details.

4.2 Operation in Positioner Mode

In the positioner mode, the following 8 types of PIO pattern can be selected with a proper parameter.

The PIO Pattern cannot be switched over after the system is finished to be established or during the actuator operation. Choose the optimum pattern beforehand considering the system operation specifications and prepare the cables and sequence design.

[1] PIO Pattern Selection and Main Functions

○ : Shows Effective Feature

PIO Pattern (Parameter No.25)		0	1	2	3	4	5	6	7
Mode		Positioning mode	Teaching mode	256-point mode	384-point mode	Solenoid valve mode 1	Solenoid valve mode 2	Force Sensor Used Pressing Mode 1	Force Sensor Used Pressing Mode 2
Main function	Number of Positioning Points	64	64	256	384	7	3	32	5
	Operation with the Position No. Input	○	○	○	○	×	×	○	×
	Position No. Direct Command Operation	×	×	×	×	○	○	×	○
	Positioning	○	○	○	○	○	○	○	○
	Velocity Change During the Movement	○	○	○	○	×	×	○	×
	Pressing (Tension)	○	○	○	○	○	×	△ (*2)	△ (*2)
	Force Sensor Used Pressing	×	×	×	×	×	×	○	○
	Pitch Feeding (Relative Moving Feed)	○	○	○	○	○	×	○	○
	Home Return Signal Input	○	○	○	○	○	×	○	○
	Pause	○	○	○	○	○	△ (*1)	○	○
	Jog Moving Signal	×	○	×	×	×	×	×	×
	Teaching Signal Input (Current Position Writing)	×	○	×	×	×	×	×	×
	Brake Release Signal Input	○	×	○	○	○	○	○	○
	Moving Signal Output	○	○	×	×	×	×	×	×
	Zone Signal Output	○	○	○	×	○	○	○	○
	Position Zone Signal Output	○	○	○	×	○	○	○	○
	Vibration Control	○	○	○	○	○	○	○	○

*1 The pause signal is not provided. How to pause refer to [4.2.6 [5]].

*2 Tensile operation is not allowed.

(Reference)

Zone signal output signal : The zone range is set to the Parameters No.1 and 2 and becomes always effective after the home return is complete.

Position zone signal : This feature is associated with the specified position number. The zone range is set in the position table. The zone range is enabled only when the position is specified but disabled if another position is specified.

[2] Overview of Main function

Main function	Description
Number of Positioning Points	Number of positioning points which can be set in the position table.
Operation with the Position No. Input	Normal operation started by turning the start signal ON after position No. is entered with binary data.
Position No. Direct Command Operation	Operation by turning ON the signal directly corresponding to a position number
Positioning	Positioning at an arbitrary position by the data set in the position table
Velocity Change During the Movement	Velocity change by activating another position number during movement
Pressing (Tension)	Operation by an arbitrary pressing (tensile) force set in the position table
Force Sensor Used Pressing	Pressing operation with high precision to be performed by measuring the current pressing force on the force sensor (loadcell) and control the force
Pitch Feeding (Relative Moving Feed)	Pitch feed by an arbitrary moving distance set in the position table
Home Return Signal Input	Input signal exclusively used for home return. Set to ON to start home return
Pause Input	The operation can be interrupted or continued by setting this signal to ON or OFF, respectively.
Jog Moving Input	The actuator moves while the input is set to ON only
Teaching Signal Input (Current Position Writing)	Setting the input signal to ON allows the coordinate value in the stop state to be written to the position table.
Brake Release Signal Input	The brake (option) is to be released while the input is set to on only
Moving Signal Output	The output signal is set to ON while the actuator is moved.
Zone Signal Output	The output signal is set to ON while the actuator is entered within the zone defined by the coordinate values set as parameters.
Position Zone Signal Output	The output signal is set to ON while the actuator is entered within the zone defined by the coordinate values set in the position table.
Position Detection Feedback Pulse Output	A feedback pulse from an encoder is to be output differentially. Refer to [4.3 Pulse Train Control Mode] for details.
Vibration Control	Vibrations of the load installed on the actuator can be suppressed. However, this is invalid in the home return and pressing operations.

[3] Operation Modes of Rotary Actuator in Multiple Rotation Mode and Command Limitations

An actuator of multi-rotation specification includes two operation modes, the normal mode enabling only a limited number of rotations and the index mode (Note 1) enabling a number of rotations.

A specific operation mode can be selected by parameter No.79 “Rotary axis mode selection”. Parameter No.80 “Rotary axis shortcut selection” allows the shortcut to be made valid or invalid.

Note 1 There are limitations in operation in Index Mode for Rotary Actuator. Refer to [Caution in Handling in the preliminaries]

The table below lists the settings of parameters and the operation specification in each mode.

Rotary axis mode selection Parameter No.79	Rotary axis shortcut selection Parameter No.80	Current position indication (Note 3)	Absolute position command zone (Note 3)	Relative position command zone	Soft Limit Enabled/Disabled
0 (Normal Mode)	0 (Disabled)	-9,999.99 to 9,999.99 (Note 2)	-0.15 to 9,999.15 (Note 2)	-9,999.30 to 9,999.30 (Note 2)	Enabled
1 (Index Mode)	0 (Disabled)	0 to 359.99	0 to 359.99	-360.00 to 360.00	Disabled
	1 (Enabled)				

Note 2 It is limited within the range of the software limit.

Note 3 The minimum resolution of DD motor is 0.001deg.

4.2.1 Set of Position Table

The values in the position table can be set as shown below. For only positioning, only the position data may be written if specifying the speed, acceleration, and deceleration is not required. The speed, acceleration, and deceleration are automatically set to the data defined by the relevant parameters.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force [N])	Load current threshold [N]	Positioning band [mm] /pressing band [mm]	Zone + side [mm]	Zone - side [mm]	Acceleration /deceleration mode	Stop position specification method	Gain set No.	Stop mode	Vibration suppress control No.	Link No.	Standby tyme [s]	Comment
0																	
1																	
2																	

Caution

- The input value is treated as the angle for the rotary actuator.

  [mm] → [deg] ····· 1.2 = 1.2deg

  [mm/s] → [deg/s] ···· 100 = 100deg/s

  Note that the notation is [mm] on the screen of the teaching tool such as IA-OS.

(1) Position No. :

The number is specified by PLC at start.

Caution

- Do not use position No.0 if available positions remains enough.
  At the first servo ON after power ON, the completed position No. output is 0 even if the actuator is not located at position No.0. The actuator enters into the same state as that at positioning to position No.0. The completed position No. output is 0 during movement of the actuator. To use position No.0, get the command history by using the sequence program to check completed position No.0 based on the history.

(2) Position [mm] :

Positioning coordinate value. Enter it as the distance from the home position.
For pitch feed (relative movement = incremental feed), enter the pitch width.
A value with – indicates that the actuator moves toward the home position. A value without – (negative) indicates that the actuator moves to be away from the home position.

Caution

- Set the coordinate value on the single finger basis, in the case of a Gripper Type. Set the moving distance of a single finger from the home. In the model, the stroke indicates the total moving distance of both fingers.
  Thus the actual effective stroke is a half of the value in the model.
- Set the coordinate value by an angle from the home, in the case of a Rotary Type.

(3) Velocity [mm/s] :

Set the velocity in the operation.
Do not attempt to input a value below the minimum velocity (Note).

Note The minimum velocity differs depending on the type of the actuator. Refer to the instruction manual of each actuator.

(4) Acceleration [G] :

Set the acceleration at start.

(5) Deceleration [G] :

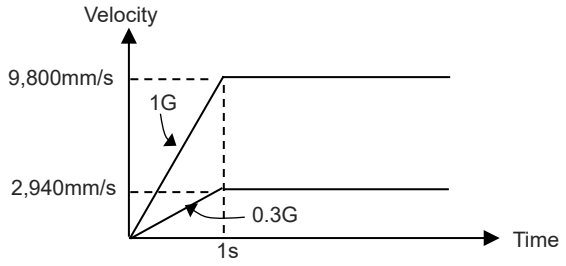
Set the deceleration at stop.

Caution

- Set the velocity, acceleration and deceleration so that they do not exceed the rating values described in the brochure or the instruction manual of the actuator. Failure to follow this may cause the life of the actuator to be shortened extremely.
- If shocks and/or vibrations appear on the actuator and/or the work, lower the acceleration and/or the deceleration. Do not continue the use of the actuator, otherwise the product life may be shortened extremely fast.
- If the payload is extremely lighter than the rated payload, increase accel..., acceleration/deceleration to larger than their rated values to shorten the tact time. Check the specifications in the catalog or an instruction manual of the actuator.
- For the actuator of gripper type, set the velocity, acceleration and deceleration on the single finger basis. That the relative velocity, acceleration and deceleration between both the fingers are as twice as the setting values.

Reference

- How to set the acceleration is described below. The same idea can be applied to the deceleration.
  1G = 9,800mm/s^2: Accelerated to 9,800mm/s per second
  0.3G: Accelerated to 9,800mm/s × 0.3 = 2,940mm/s per second



(6) Pressing [%] :

Setting proper data here allows pressing to be done. Set a pressing torque (limit current value) in percent [%]. If the value is set to 0, the normal positioning operation is performed. The speed for the pressing operation is set in Parameter No. 34.
If the setting of (3) is lower than the pressing velocity, the pressing process will be conducted with the velocity of (3).

For pressing operation using force sensor, set the pressing force by ratio of the base thrust (Note1) in pressing operation using force sensor. Set up the target pressing force in [N] or [%].

$$\text{Setting [\%]} = \frac{\text{Target Pressing Force [N]}}{\text{Max. Pressing Force [N]}^{(\text{Note 1})}} \times \text{Max. Pressing Current Limit [\%]}^{(\text{Note 1})}$$

Note 1 The maximum pressing force [N] when the force sensor is used and the maximum pressing current limit [%] should differ depending on models. Shown in the table below is the values for each model.

Actuator		Max. pressing force [N]	Max. pressing current limit [%]	Base thrust in pressing operation using force sensor [N]
RCS3-RA6R		600	100	600
RCS3-RA7R		1,200	140	857
RCS3-RA8R		2,000	140	1,429
RCS3-RA10R		6,000	200	3,000
RCS2-RA13R	1t Type	9,800	200	4,900
	2t Type	19,600	200	9,800

Caution

- If the pressing velocity is changed, the pressing force may differ from that specified in [10.3 List of Specifications of Connectable Actuators].
  When the pressing velocity is changed, make sure to measure the actual pressing force before start using.
- Using the force sensor used pressing and the pressing force should be constant even in different pressing velocity.

(7) Threshold [%] :

Set the threshold value of the pressing torque in percent [%]. If the torque (load current) becomes larger than this setting value during pressing, the detection signal is output. This feature is used to monitor the load current and judge whether the operation is good or not in such an operation as press fitting in pressing. The threshold during the force control can be set in [N] unit as well as the pressing.

(8) Positioning width [mm] :

For positioning in PIO patterns (Note 1) 0 to 4, 6 or 7, the positioning complete signal is output if the remaining moving distance is entered within the zone set here. The unit is parameter No.207 “Position data unit” set in.

In the pressing operation, an actuator should move in the set velocity and acceleration/deceleration same as the normal positioning until it get to the position set in (2), and then pressing operation will be performed for the distance set in this section.

For PIO pattern 5, this item is not the complete signal output range against positioning command. Just as it does in detection with a sensor, the applicable output signal (LS*) should turn ON once the actuator gets in the range of the setting values regardless of the indicated position number. PIO pattern 5 does not correspond to the pressing operation.

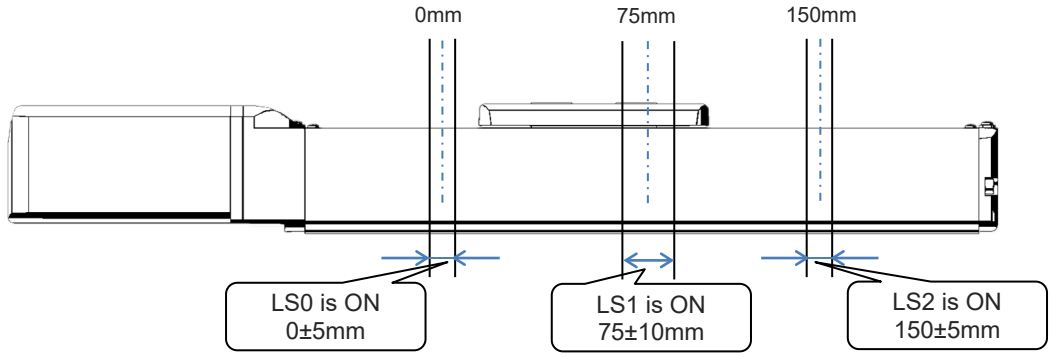
Note 1 PIO pattern: This is the operation pattern of Positioner mode.
Refer to [2.2.2 [1] PIO Patterns in Positioner Mode]

Reference

- Output Range of LS Signal (Example of PIO pattern 5)

  The figure below shows the position table and the position at which each of the LS signals is turned ON. If the actuator passes any of the positioning bands in the operation by another position number or manual operation in the servo-off state, the relevant LS signal is always turned ON.

No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Load current threshold[%]	Positioning band[mm] / pressing band[mm]	Zone + side [mm]	Zone - side [mm]	Acceleration/deceleration mode
0	0.00	100.00	0.30	0.30	Positioning	0	0.10	0.00	0.00	0:Trapezoid
1	75.00	100.00	0.30	0.30	Positioning	0	0.10	0.00	0.00	0:Trapezoid
2	150.00	100.00	0.30	0.30	Positioning	0	0.10	0.00	0.00	0:Trapezoid



(9) Zone + [mm] (Note 1) (Note 2) :

Set the coordinate value on the positive side at which position zone output signal PZONE is turned ON.

PZONE is set to ON in the zone between this value and the coordinate value on the negative side set in (10).

The feature follows the specified position number. It is valid only when the position is specified but invalid in another position operation.

(10) Zone - [mm] (Note 1) (Note 2) :

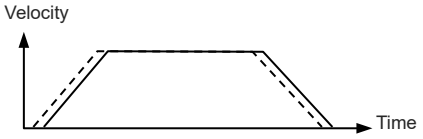
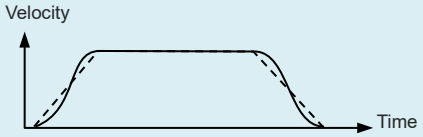
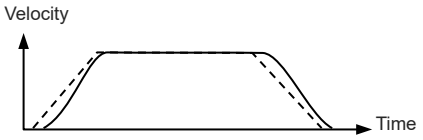
Set the coordinate value on the negative side at which position zone output signal PZONE is turned ON.

(Note 1) PZONE Signal turns ON outside the range between Zone + and Zone – when it is set to Zone + < Zone -.

(Note 2) The unit of Zone + and Zone – is parameter No.207 "Position data unit" set in.

(11) Acceleration / deceleration mode :

Select a proper acceleration/deceleration pattern depending on the load.

Set Value	Acceleration/ Deceleration Pattern	Operation
0	Trapezoid	
1	S-motion	 Set the S-motion rate with parameter No.56.
2	First-Order Delay Filter	 Set the delay time constant with parameter No.55.

Caution: Caution at S-shaped Motion

- Since it requires a speed change during the operation, even if having the position command or direct command that S-shaped motion is set while the actuator is moving, S-shaped motion control cannot be performed and will be the trapezoid control. Make sure to make a command while the actuator is stopped.
- S-shaped motion control is invalid in the index mode of the rotary actuator. It will be the trapezoid control even if S-shaped motion control is indicated.
- Do not use S-shaped motion control if the setting of the acceleration time or the deceleration time exceeds 2 seconds. It will not provide the right operation.
- Do not pause on the move during acceleration or deceleration. It will change the speed (acceleration) and may cause a danger.

Caution: Caution at First-order Delay Filter

- When the position command set with the first order delay filter or the next command during the direct numerical command is input in order to have a velocity change during operation, it compulsorily get to the trapezoid control. Make sure to make a command while the actuator is stopped.
- First-order delay filter control is invalid in the index mode of the rotary actuator. It will be the trapezoid control even if first-order delay filter control is indicated.

(12) Incremental :

Set to 1 for pitch feed (relative movement = incremental feed).
The set value for (1) indicates the pitch feed distance.
When this is set to 0, positioning to a position set in (1) withe the absolute coordinates should be performed.

Caution

- In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
  There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly.
- When solenoid valve mode 2 is selected, set this to 0. Setting this to 1 causes the position data error to occur.

(13) Gain set :

The gain set number is to be set. With the seven parameters necessary for servo gain adjustment as one set, the gain set can register four sets.
By utilizing Off Board Tuning Function (Note 1) in the IA-OS, the setting close to the optimum can be obtained.

Note 1 Refer to [10.3 List of Specifications of Connectable Actuators]
It may require the setting of the gain set dedicated for the home-return operation in the case this function is used to have the high-speed setting or the setting to apply a transported weight more than the ratings.

[Parameters included in a set]

- Servo Gain Number (Position Gain)
- Position Feed Forward gain
- Speed Loop Proportional Gain
- Speed Loop Integral Gain
- Torque Filter Time Constant
- Current Control Band Number
- Force Gain (Effective Only in Pressing with Using Force Sensor System)

It is able to establish the gain set that corresponds to the position number to be operated to the indicated gain set.

Refer to [6.2 Servo Adjustment] for each gain parameter details.

Setting	Selected parameter set	Parameter No.
0	Gain set 0	7, 71, 31 to 33, 54, 94
1	Gain set 1	120 to 125, 174
2	Gain set 2	126 to 131, 175
3	Gain set 3	132 to 137, 176

(14) Stop mode :

Automatic servo OFF is enabled after a certain period from the completion of positioning for power saving.

A proper period can be selected from three parameters.

Setting	Operation after completion of operation	Parameter No.
0	Servo ON not changed	-
1	Automatic servo OFF after certain period	36
2	Automatic servo OFF after certain period	37
3	Automatic servo OFF after certain period	38

Caution

- No retaining torque is provided in automatic servo OFF. Pay sufficient attention to the setting because the actuator may be moved by external force applied to it.
- Do not use the automatic servo OFF if the next moving command is relative distance specification (pitch feed). Failure to follow it may cause position shift to occur.
- Do not use the automatic servo OFF in pressing. If used, the pressing force is lost.
- Automatic Servo OFF would not function in the operation with teaching mode of teaching tool.
- The stop mode set in the position table would not be activated if conducting only servo-ON and not conducted positioning even for once to the position.
  Refer to [5.2 Power-saving Function (Auto Servo-motor OFF Function)] for the details.

(15) Vibration suppress No. :

Suppresses vibration (sympathetic vibration) of the load installed on the actuator. The vibration suppress No. can accept three types of vibrations. Four parameters are defined for a single vibration to form a single set. In the position table, parameter sets are defined to correspond to position numbers for which vibrations must be suppressed.
Refer to [5.1 Vibration Suppress Control Function].

Setting	Vibration suppress frequency (Natural frequency)	Parameter No.
0	Normal position control (no vibration suppress)	-
1	Vibration suppress control parameter set 1	97 to 100
2	Vibration suppress control parameter set 2	101 to 104
3	Vibration suppress control parameter set 3	105 to 108

Caution

- The natural frequency range between 0.5Hz and 30Hz can be suppressed.
- The target vibrations are those of the load induced by the actuator connected to the controller. Any other vibrations cannot be suppressed.
- Vibrations to be suppressed should be in the same direction as that in which the actuator is moved. Vibrations in any other directions cannot be suppressed.
- The function is not applied to the home return and pressing operations.
- The function is not available in the pulse train control mode.
- One or more setting vibration frequencies are rather low, the tact time may be long. With a vibration frequency being 6Hz or less, the positioning convergence time is 150ms or longer.

(16) Link No.

After completing travel, this sets the position No. to continue traveling.
If "wait time" is not set, this function will be disabled.

This function is subject to the following precautions. Be sure to check before use.

1) AUTO/MANU mode

■ This function can only be enabled in AUTO mode. When performing continuous operation with PC software, use the easy programming function.

2) Gateway operation mode

■ In simple direct mode, this function is disabled.
■ An alarm is generated when a position number exceeding the maximum number of positions according to the operation mode of the gateway unit is set as the connection destination during position linking travel.
■ An alarm is generated when the operation mode of the gateway unit is changed to a mode with fewer position numbers, if the linked position numbers are out of range during position linking travel after position data editing.

3) Position linking operation

■ If the destination is set so that the linked positions are looped, operation will continue endlessly.
For example, if a multi-rotation specification rotary actuator is set to repeat incremental movement in index mode, it continues to rotate.
■ Set appropriate wait times, etc., in order not to exceed the duty limit.
■ Also, when operating endlessly, position travel will not be completed.
In order to stop the unit, pause it by turning ON pause signal STP, then input reset signal RES and perform remaining travel distance cancel or turn OFF the servo.
■ When a travel command is issued to the linked position, the cycle time displayed on the tool is added up to the command complete signal MEND output of the travel complete position including the wait time.
Also, when looping a linked destination position, the cycle time continues to be added. When the counter upper limit value is exceeded, the count will start again from 0.000s.

(17) Standby time [s]

After completing travel, this sets the standby time until the next position No. operation starts. Enabled only when “Link No.” is set.

This function can only be enabled in AUTO mode. When performing continuous operation with PC software, use the easy programming function.

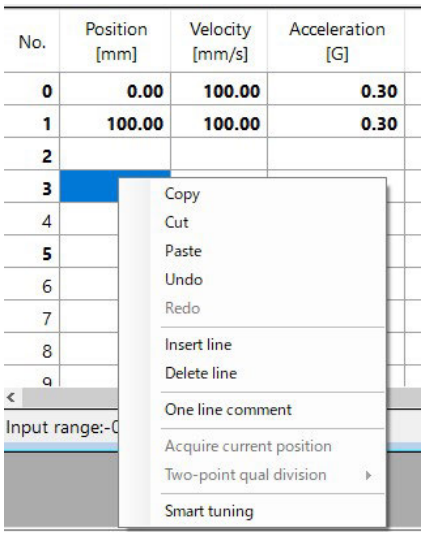
(18) Comment

Up to 20 alphanumeric characters can be input.
Input comments are saved to the controller.

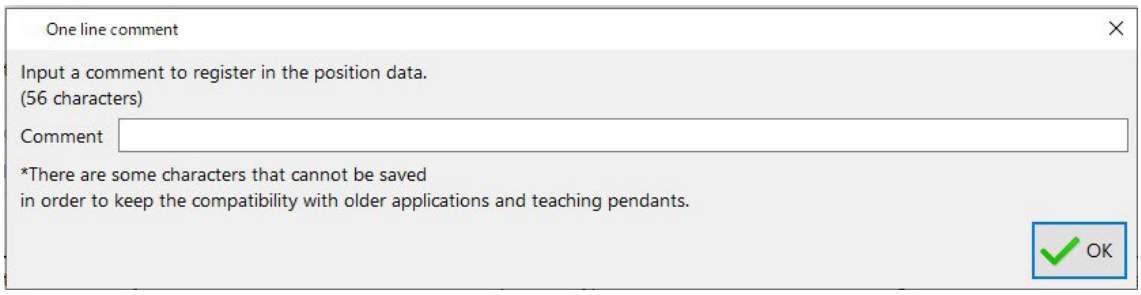
(19) One line comment

Up to 56 alphanumeric characters can be input.

Right-clicking on the position data and enabling One line comment will allow you to enter One line comments. Disabling it will clear any comment you have entered.

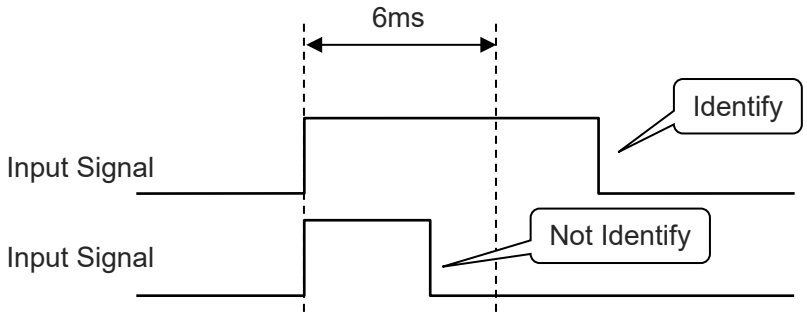


To edit a comment, type in the comment to display the setting screen. Enter a comment on the setting screen and click OK.



4.2.2 Control of Input Signal

The input signal of this controller has the input time constant of 6ms considering the prevention of wrong operation by chattering and noise.
Therefore, input each input signal for 6ms or more (Note 1) continuously. The signal cannot be identified if it is less than 6ms.



Note 1 It is necessary to input 26ms or more for PWRT Signal of PIO Pattern 1 and CLBR signal of PIO pattern 6 and 7.
Refer to [4.2.4 Operation with the Position No. Input (PIO Patterns 0 to 3 and 6)] and [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)].

4.2.3 Operation Ready and Auxiliary Signals (Common to Patterns 0 to 7)

[1] Emergency Stop Status (*EMGS)

PIO signal	Output
	*EMGS
Common to Patterns 0 to 7	○

○: Available, ×: Unavailable

1. The emergency stop status EMGS is turned ON when in normal condition and turned OFF when STOP- terminal on [3.1.3 [3] Actuator emergency stop circuit] is 0V (emergency stop condition or disconnected).
2. It turns back ON once the emergency stop condition is released and STOP- terminal goes up to 24V DC.
   Have an appropriate safety treatment such as interlock with this signal for the host controller (PLC, etc.).

Caution

- It is not an emergency stop output due to an alarm generation of the controller.

[2] Operation Mode (RMOD, RMDS)

PIO signal	Input	Output
	RMOD	RMDS
Common to Patterns 0 to 7	○	○

○: Available, ×: Unavailable

Two operation modes are provided so that the operation by PIO signals does not overlap with the operation by a teaching tool such as IA-OS through SIO communication.
The mode change is normally done by the operation mode setting switch ON the front panel of the controller.

AUTO…… Operation by PIO signals is valid.
MANU ……. Operation through SIO communication is valid.

When having the controller in link connection (Note 1) and the teaching tool such as IA-OS being connected using SIO converter, there is a case the controller and the teaching tool are placed far from each other. In such a case, the controller can be switched to the “MANU” mode by setting PIO signal RMOD ON.

Because the RMDS signal is set to ON with the “MANU” mode selected by using the signal, make the operation sequence interlocked.

The table below lists the switches ON the front panel, the modes selected by the RMOD signal and the corresponding output states of the RMDS signal.

Note 1 For the details of the link connection, refer to [10.1 Way to Set Multiple Controllers with 1 Teaching Tool].

○: Selected or set to ON, ×: Unselected or set to OFF

Condition		Status							
Teaching tool such as IA-OS	PIO Operation Invalid (Note 2)	○	○	○	○	×	×	×	×
	PIO Operation Allowed (Note 2)	×	×	×	×	○	○	○	○
Switches ON front panel	AUTO	○	○	×	×	○	○	×	×
	MANU	×	×	○	○	×	×	○	○
PIO Input	RMOD	×	○	×	○	×	○	×	○
PIO Output	RMDS	×	○	○	○	×	○	○	○
PIO valid: ◎, PIO invalid:●		◎	●	●	●	◎	◎	◎	◎

Operation by normal PIO

Note 2 “PIO Operation Allowed” or “PIO Operation Invalid” is the function to select a restriction while the teaching tool such as IA-OS is connected.

Caution

- Note that selecting “PIO Operation Allowed” by using the teaching tool such as IA-OS makes all PIO signals valid to enable operation however the states of the switches and RMOD signal input may be.
  In this status, the actuator may be started depending on the signals from PLC.
- If the teaching tool is disconnected from the controller, “PIO Operation Allowed” or “PIO Operation Invalid” holds the state selected before.
  After teaching operation or debugging is terminated, select “PIO Operation Allowed” and detach the teaching tool.

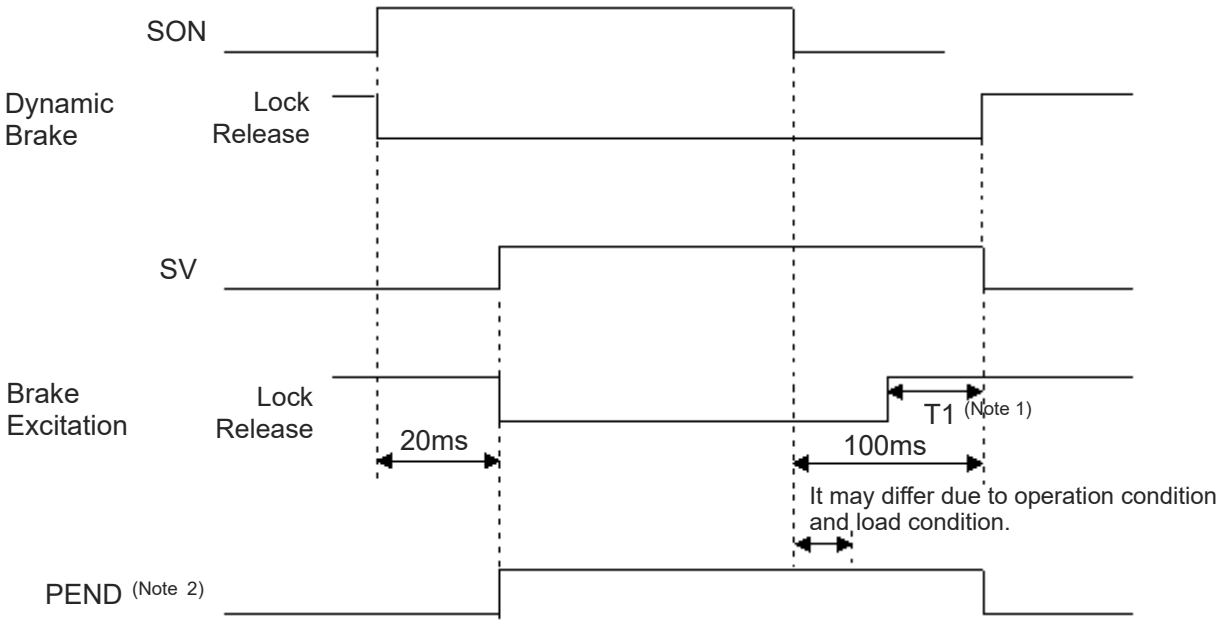
[3] Servo ON (SON, SV, PEND)

PIO signal	Input	Output	
	SON	SV	PEND
Other than pattern 5	○	○	○
Pattern 5	○	○	×

○: Available, ×: Unavailable

1. Servo ON signal SON is the input signal making the servo motor of the actuator operable.
2. If the servo-on is performed to enable operation, the SV output signal is turned ON. Concurrently positioning completion signal PEND is turned ON.
3. With the power being supplied, then controller cannot be operated while the SV signal remains OFF. If the SON signal is turned OFF under operation of the actuator, the actuator is decelerated and stopped with the rating torque. After the stop, the servo OFF occurs to enter the motor into the free running state.

The brake (option) is of release-in-excitation type. Therefore, making the excitation on will release the brake while making it off will lock the brake.



Note 1 T1 is 30ms before SV becames OFF.

Note 2 PEND would not turn ON in the pause condition.

[4] Home Return (HOME, HEND, PEND, MOVE)

PIO signal	Input	Output		
	HOME	HEND	PEND	MOVE
Patterns 0 and 1	○	○	○	○
Patterns 2 to 4	○	○	○	×
Pattern 5	×(Note 1)	○	×	×
Patterns 6 and 7	○	○	○	×

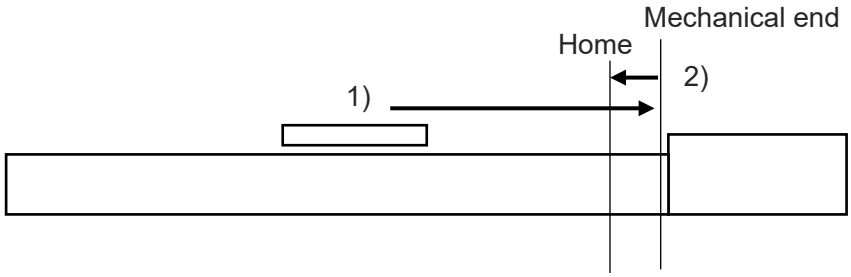
○: Available, ×: Unavailable

Note 1 For pattern 5, the home return by the HOME signal is not allowed.
Refer to [4.2.6 [1] Home return (ST0, HEND)] for how to perform a home-return operation.

The HOME signal is intended for home return. The HOME signal is caught at the rising edge (ON edge) to start the home return. At completion of the home return, home return completion signal HEND is turned ON.
Turn OFF HOME Signal after HEND turns ON. Once the home return completion signal HEND turns ON, it keeps ON even the actuator gets off the home position. (HEND turns OFF when the home position gets lost and uncertain.) Even HEND is ON, home-return operation should be performed again by turning HOME Signal ON. HEND turns OFF while the home-return operation is performed, and turns back ON when the home-return operation is completed.

Also, during the home-return operation, positioning completion signal PEND and moving signal MOVE are set to OFF and ON, respectively.

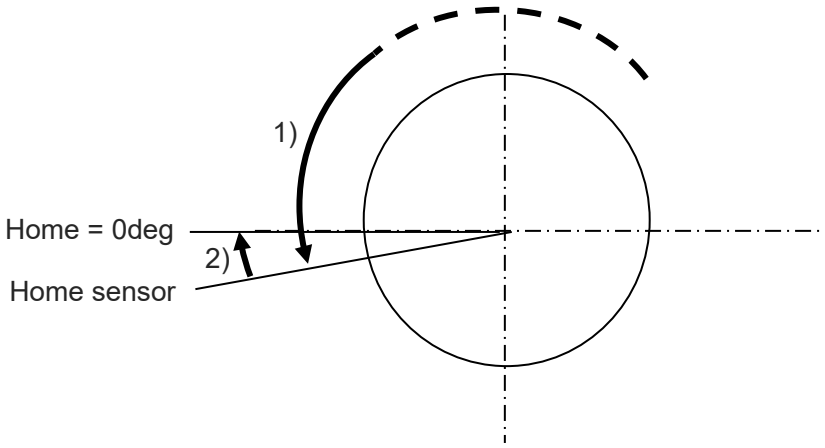
[Home Return Operation of Slider Type/Rod Type Actuator]



1) With the HOME signal being ON, the actuator moves toward the mechanical end at the home return speed.
   The moving speed is 20mm/s for most actuators but less than 20mm/s for some actuators.

2) Reversing operation from the mechanical end should be performed and it stops at the home position. The movement amount at this time should be that set in Parameter No. 22 “Home-Return Offset” after the Z-phase of the encoder is detected.

[Home Return Operation of Rotary Actuator]

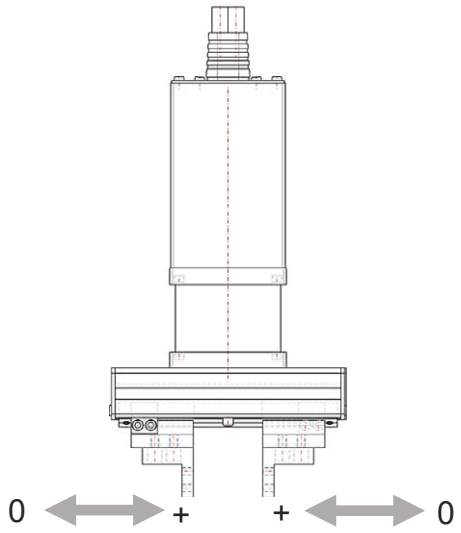


1) The actuator rotates in CCW (counterclockwise) direction from the view point of the load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)

2) At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The movement amount at this time should be that set in Parameter No. 22 “Home-Return Offset” after the Z-phase of the encoder is detected.

(Note) As there is no sensor for DD Motor and the status gets to that a sensor is detected at the start of the home-return operation, it is necessary to move for the offset amount between the Z-phase detection and the home-return operation.

[Home Return Operation of Actuator of Gripper Type]



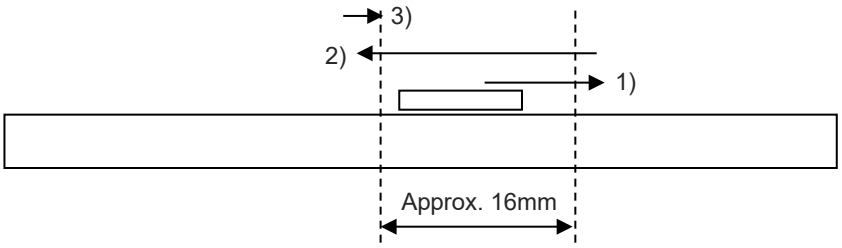
(Note 1) Finger attachment is not included in the actuator package.
Please prepare separately.

1) If the HOME signal is turned ON, the actuator moves toward the mechanical end (to end side) at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 “Home return offset level”.

Caution

- In the home reverse specification, the actuator moves in the reverse direction.
- Make sure to refer to [6.1.2 [18]] when a change to Parameter No.22 “Home return offset level” is required.

[Actuator Movement for Spurious Absolute Type]



1) With HOME Signal ON, the actuator moves towards the home-return direction set in Parameter No.5 at 5mm/s (fixed).
2) Move back and forth in approximately 16mm (to confirm the current position).
3) Home return operation is completed after the actuator confirms the current position.

Caution

- For Spurious Absolute Type, make sure to have a home return operation after the power is turned ON.
  Alarm 0B3 “Linear spurious absolute error” would be generated if there was an interrupting object in the procedure of 2) and the current position could not be detected properly.

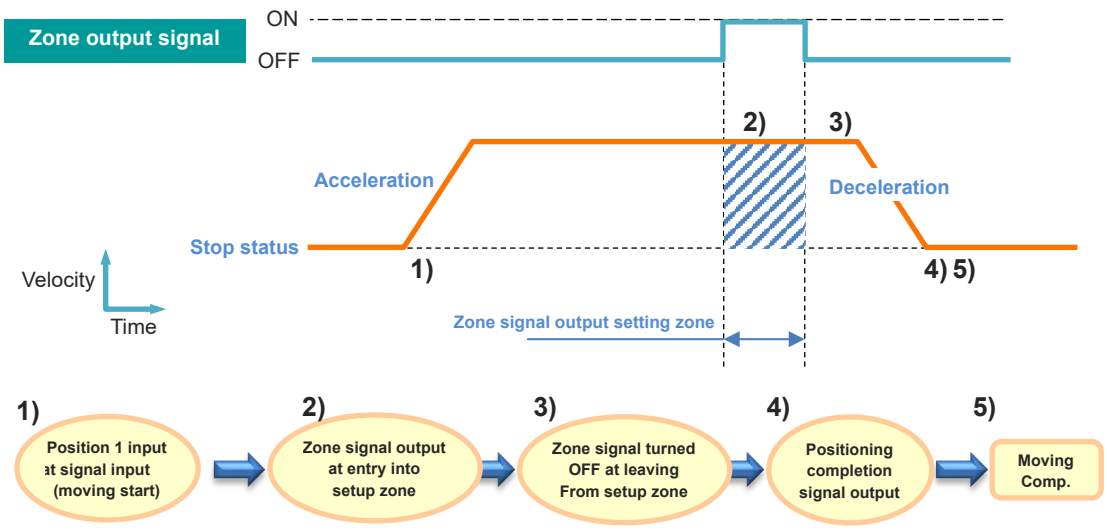
[5] Zone Signal and Position Zone Signal (ZONE1, ZONE2, PZONE)

PIO signal	Output		
	ZONE1	ZONE2	PZONE
Pattern 0 (Note 2)	○	○	○
Pattern 1 (Note 3)	○	×	○
Pattern 2 (Note 3)	○	×	○
Pattern 3 (Note 1)	×	×	×
Pattern 4 (Note 2)	○	○	○
Pattern 5 (Note 2)	○	○	○
Pattern 6 (Note 3)	○	×	○
Pattern 7 (Note 3)	○	×	○

○: Available, ×: Unavailable

Note 1 Pattern 3 does not have the zone signal output feature.
Note 2 PZONE/ZONE2 can be set in Parameter No. 149 “Zone output changeover”.
Note 3 PZONE/ZONE1 can be set in Parameter No. 149 “Zone output changeover”.

The relevant signal can be turned ON while the actuator passes or stops in the zone range in either of the following 2 types:



• Zone signal (ZONE1, ZONE2) : The output signal is turned ON at the position set by the proper parameter.
• Position zone signal (PZONE) : The output signal is turned ON at the position set in the position table.

The feature can play a role as the sensor for judging whether the completion position is good or not in pressing operation, setting the continuous operation zone in pitch feed or interlocking operations of other units in the setting zone.

(1) Zone signa (ZONE1, ZONE2)

Set the zone range to the relevant parameter.

Parameter No.1 : Zone boundary 1+
Parameter No.2 : Zone boundary 1-
Parameter No.23 : Zone boundary 2+
Parameter No.24 : Zone boundary 2-

The zone signal ZONE is kept effective also during the emergency stop unless the memory of the origin is lost due to alarm.

(2) Position zone signal (PZONE)

No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Load current threshold[%]	Positioning band[mm] / pressing band[mm]	Zone + side [mm]	Zone - side [mm]	Acceleration/deceleration mode	
0											
1	0.00	300.00	0.30	0.30	Positioning	0	0.10	50.00	30.00	0:Trapezoid	0
2	100.00	400.00	0.30	0.30	Positioning	0	0.10	70.00	60.00	0:Trapezoid	0
3	50.00	100.00	0.30	0.30	Pressing (50%)	0	20.00	60.00	65.00	0:Trapezoid	0

Setting of zone range

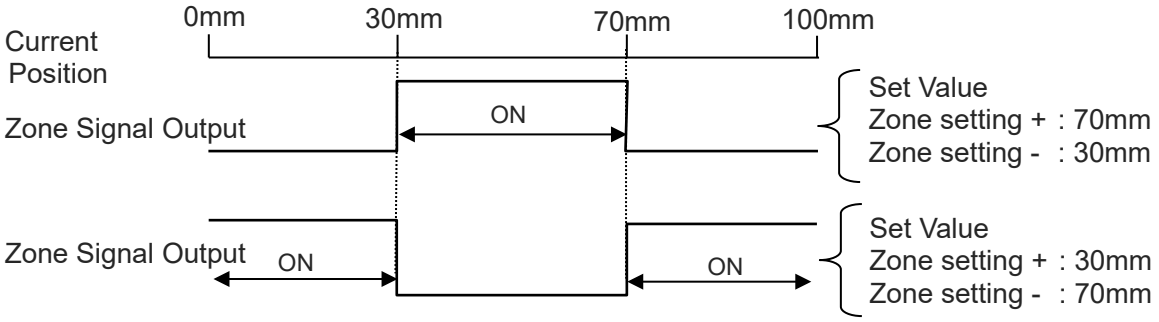
Zone ranges should be set in the position table.
While the operation corresponding to a position number is executed, the zone range set for the position number is valid. It is kept effective also during the emergency stop unless the actuator is operated or the memory of the origin is lost due to alarm.

(3) Setting values and signal output range

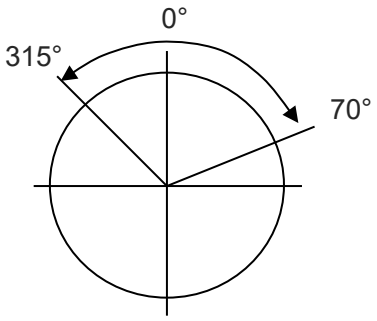
The zone output range varies depending on the difference between the value set for the positive side of the zone and that for the negative side.

Value set for positive side > value set for negative side: The output signal is set to ON in the range and OFF out of the range.
Value set for positive side < value set for negative side: The output signal is set to OFF in the range and ON out of the range.

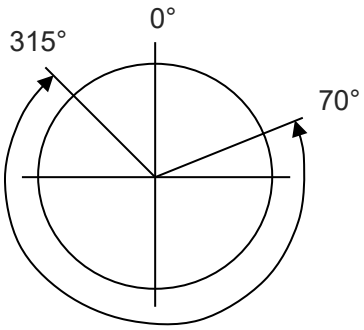
[Example of Line Axis]



[Example of rotary actuator of multi-rotation specification in index mode]



Set Value
Zone setting +: 70°
Zone setting - : 315°



Set Value
Zone setting +: 315°
Zone setting - : 70°

Caution

- Since this signal becomes effective after the coordinate system is established after the home return is completed, it would not be output just with the power turned ON.

[6] Alarm, Alarm Reset (*ALM, RES)

PIO signal	Input	Output
	RES	*ALM
Common to Patterns 0 to 7	○	○

○: Available, ×: Unavailable

1. Alarm signal *ALM is set to ON in the normal status but turned OFF at the occurrence of an alarm at a level equal to or higher than the operation release level.
2. Turning reset signal RES ON under occurrence of an alarm at the operation release level allows the alarm (Note 1) to be released. The action is taken at the rising edge (ON edge).
3. The alarm reset should be done after the cause of the alarm is confirmed and removed. If alarm reset and restart are repeated many times without removal of the cause, a severe failure such as motor burnout may occur.

Note 1 Refer to [8.3.2 Alarm Details] for details of alarms.

Caution

- Reset signal RES has two features, or alarm reset under occurrence of an alarm and operation interruption (cancellation of remaining moving distance) under temporary stop. For the operation interruption under temporary stop, refer to the description of the operation in each pattern.

[7] Binary Output of Alarm Data Output (*ALM, PM1 to 8)

PIO signal	Output	
	*ALM	PM1 to 8
Common to Patterns 0 to 3	○	○
Pattern 4 (Note 1)	○	×
Pattern 5 (Note 1)	○	×
Pattern 6	○	○
Pattern 7 (Note 1)	○	×

○: Available, ×: Unavailable

Note 1 Patterns 4, 5 and 7 do not have this function.

1. If an alarm at a level equal to or higher than the operation release level occurs, completed position number output signals PM1 to PM8 output the alarm information in the binary code format.
2. The PLC can read the binary code of alarm signal *ALM as the strobe signal to refer to alarm information.

○: ON ●: OFF

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
○	●	●	●	●	–	Normal
●	●	●	○	●	2	Software reset during servo ON (090) Position number error during teaching (091) PWRT signal detected during movement (092) PWRT signal detected before completion of home return (093)
●	●	●	○	○	3	Move command during servo OFF (080) Position command in incomplete home return (082) Absolute position move command when home return is not yet completed (083) Movement command during home return operation (084) Position No. error during movement (085) Move command while pulse train input is effective (086) Move command during loadcell calibration (087) Position command data error (0A3) Command deceleration error (0A7)
●	●	○	●	●	4	FAN error detection (0D6) Drive mode error (0DD) Field bus module not detected (0F3)
●	●	○	●	○	5	Loadcell data error (0A9) Loadcell calibration error (0E1) Loadcell communication error (0E2) Loadcell error (0E3) Field bus link error (0F1) Field bus module error (0F2)

*ALM	ALM8 (PM8)	ALM4 (PM4)	ALM2 (PM2)	ALM1 (PM1)	Binary Code	Description: Alarm code is shown in ( ).
●	●	○	○	●	6	Parameter data error (0A1) Position data error (0A2) Unsupported motor/encoder type (0A8)
●	●	○	○	○	7	Z-phase position error (0B5) Magnetic pole indeterminacy (0B7) Home sensor non-detection (0BA) Home return timeout (0BE) Creep sensor not detected (0BF)
●	○	●	●	●	8	Command speed error (0AB) Actual speed excessive (0C0) Overrun detected (0C2)
●	○	●	●	○	9	Electromagnetic brake unrelease Error (0A5) Dynamic brake not released (0A6) Estimated life over error (0AC) Overheat (0CA) Current sensor offset adjustment error (0CB) Drive source cutoff relay welding detection error (0CD) Drop in control supply voltage (0CE) I/O 24V power supply error (0CF)
●	○	●	○	○	11	Command counter overflow (0A4) Electric angling mismatching (0B4) Deviation overflow (0D8) Software stroke limit exceeded (0D9) Pressing motion range over error (0DC)
●	○	○	●	●	12	Servo error (0C1) Exceeded allowable time of exceeding torque allowing continuous pressing (0C4) Illegal control system transition command (0C5) Mismatching torque current/force feedback (0C6) Motor Power Source voltage excessive (0D2) Motor power-supply voltage low (0D3) Belt-breaking sensor detected (0D7) Overload (0E0) Driver logic error (0F0)
●	○	○	●	○	13	Spurious absolute error (0B3) Encoder send error (0E4) Encoder receipt error (0E5) Encoder count error (0E6) A-, B- and Z-phase wire breaking (0E7) Battery-less Absolute Encoder error detected (0EB) Absolute encoder error detection 2 (0EE) Absolute encoder error detection 3 (0EF)
●	○	○	○	●	14	CPU error (0FA) FPGA error (0FB) Logic error (0FC)
●	○	○	○	○	15	Nonvolatile memory write verify error (0F5) Nonvolatile memory data destroyed (0F8)

(Note) *ALM Signal is an active low signal. It is ON when the power is applied to the controller, and turns OFF when the signal is output.

[8] Brake Release (BKRL)

PIO signal	Input
	BKRL
Pattern 0	○
Pattern 1 (Note 1)	×
Patterns 2 to 7	○

○: Available, ×: Unavailable

Note 1 Pattern 1 does not have this feature.

The brake can be released while BKRL signal is set to ON. If a brake is installed in the actuator, the brake is automatically controlled by servo ON/OFF. Releasing the brake may be required to move the slider and/or the rod by hand in case of installation of the actuator in the machine or direct teach*1. This operation can be conducted with the brake release switch on the controller front panel as well as this signal.

*1 Direct teaching : This operation is intended to get coordinate values to the position by moving the slider and/or the rod by hand.

Warning

- Take sufficient care to release the brake. If you do it carelessly, the moving part may drop to cause people to be injured and/or the actuator, the work and/or the machine to be damaged.
- After the brake is released, always make the brake applied again. Any operation with the brake remaining released is extremely dangerous. The moving part may drop to cause people to be injured and/or the actuator, the work and/or the machine to be damaged.
- Make sure to turn on the power to the controller while this signal is OFF (brake activated).
- It is prohibited to switch over between AUTO and MANU while this signal is ON (brake is released).

4.2.4 Operation with the Position No. Input (PIO Patterns 0 to 3 and 6)

This section describes the methods of operations of PIO patterns 0 to 3 and PIO pattern 6. These patterns provide normal controller operation methods in which the controller is operated by turning the start signal ON after a position No. is entered.

PIO Pattern 6 is dedicated for the force sensor used pressing. It is for operation of an actuator equipped with a loadcell and is capable of pressing control with high precision. It is necessary to have the initial setting established for calibration and parameters before operation.

Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)]

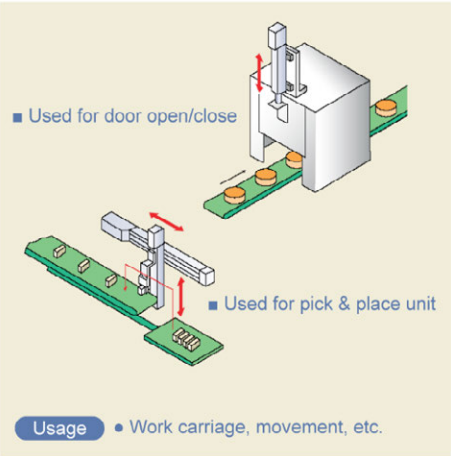
[1] Positioning [Basic] (PC1 to PC**, CSTR, PM1 to PM**, PEND, MOVE, LOAD, TRQS)

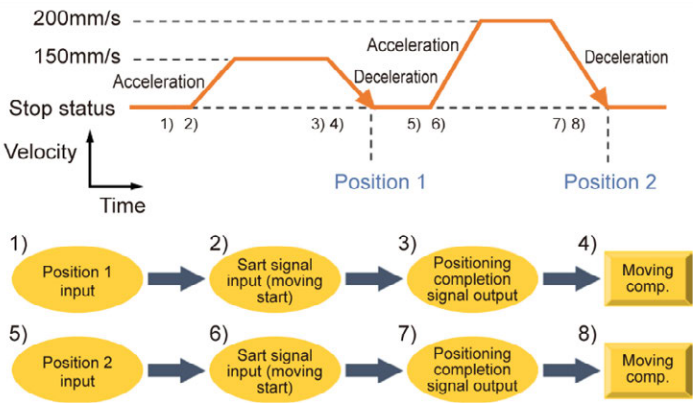
PIO signal	Input		Output				
	PC1 to PC**	CSTR	PM1 to PM**	PEND	MOVE	LOAD	TRQS
PIO pattern 0	PC1 to 32	○	PM1 to 32	○	○	×	×
PIO pattern 1	PC1 to 32	○	PM1 to 32	○	○	×	×
PIO pattern 2	PC1 to 128	○	PM1 to 128	○	×	×	×
PIO pattern 3	PC1 to 256	○	PM1 to 256	○	×	×	×
PIO pattern 6	PC1 to 16	○	PM1 to 16	○	×	○	○

○: Available, ×: Unavailable

Note For incremental type, operation without home return leads the operation based on the data of the specified position No. after automatic home return. If one or more problems are found, interlock by home return complete signal HEND is required.
In the battery-less absolute type, if it gets into a condition that the home-return operation is incomplete due to such a reason as a parameter change, operation to the indicated position number would not be performed, but only the home-return operation should be performed.

■ Sample use



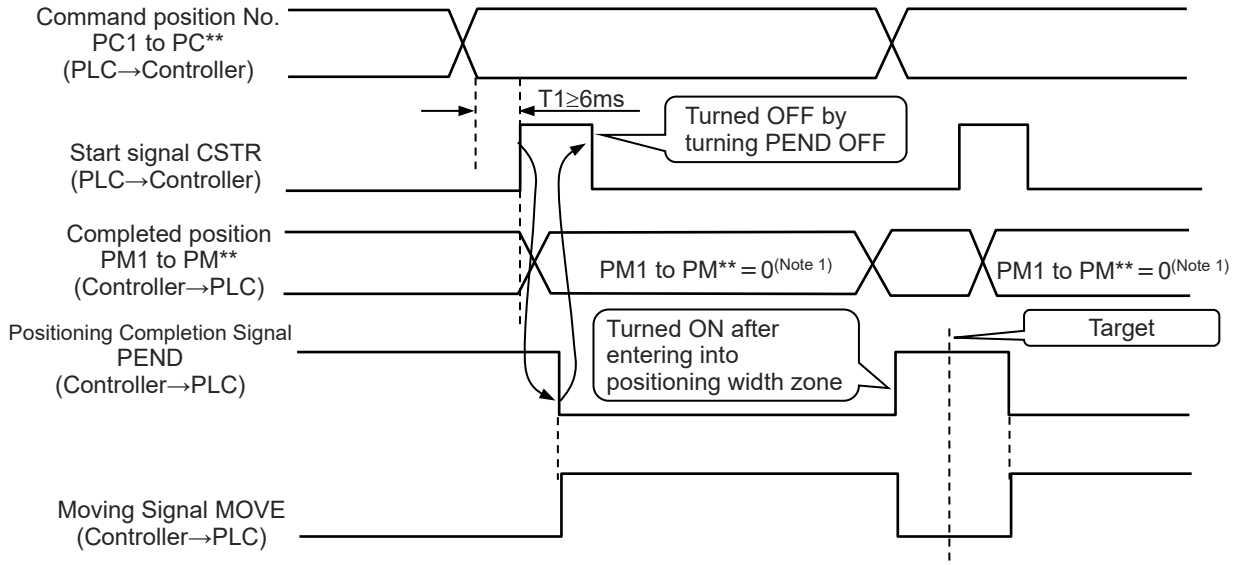


No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[N])	Positioning band[mm] / pressing band[mm]	Positioning method
0	0.000	150.00	0.30	0.30	Positioning	0.100	0:Absolute position
1	70.000	150.00	0.30	0.30	Positioning	0.100	0:Absolute position
2	150.000	200.00	0.30	0.30	Positioning	0.100	0:Absolute position
3							

■ Control method

1) First enter command position No. PC1 to PC** with binary data. Next turn start signal CSTR ON. Then the actuator starts acceleration depending on the data in the specified position table for positioning to the target position.
2) At operation start, positioning complete signal PEND is turned OFF. Always turn the start signal CSTR OFF. Without it, the completed position number is not output and the positioning complete signal is not turned ON at the completion of positioning.
3) When the positioning is completed, the positioning complete position numbers are output from complete position No.PM1 to PM** with binary data and also positioning complete signal PEND is turned ON.
4) Moving signal MOVE is turned ON as soon as the operation is started and turned OFF at the completion of positioning.
5) Positioning complete signal PEND is turned ON if the remaining moving distance enters into the positioning width. Positioning complete signal PEND will be kept ON once it is turned ON unless the start signal CSTR is turned back ON, servo is turned OFF or the actuator is out of the positioning band width range (Note1).

Note 1 It can be switched over with Parameter No.39.



Note 1 The completion position No. output is set to 0 during movement of the actuator.

Caution

- Set the period taken from entering position No. to turning the start signal CSTR ON to 6ms or larger. In spite of 6ms timer process in the PLC, commands may be input to the controller concurrently to cause positioning to another position. Take the scanning time in the PLC into account to set a period as 2 to 4 times as the scanning time. Set the value similarly if the PLC reads the complete position.
- At the completion of positioning, positioning complete signal PEND is not turned ON if start signal CSTR remains ON. If this occurs, turn start signal CSTR OFF then positioning complete signal PEND is turned ON immediately. Therefore, create the sequence program so that turning positioning complete signal PEND ON makes start signal CSTR turned OFF and the PLC waits for the state in which positioning complete signal PEND is turned ON.
- At the positioning to the position same as that specified in the stop (complete) position number, positioning complete signal PEND is turned OFF once but moving signal MOVE is not turned ON.
  Therefore, use positioning complete signal PEND to turn CSTR OFF.
- Moving signal MOVE turns on at the same time as positioning complete signal PEND turns OFF, and turns OFF when a movement command is finished or positioning complete signal PEND is turned ON. Therefore, when the positioning band setting is wide, the signal may turn OFF even in the actuator operation, and moving signal MOVE may turn off prior to positioning complete signal PEND if the positioning band setting is narrow.

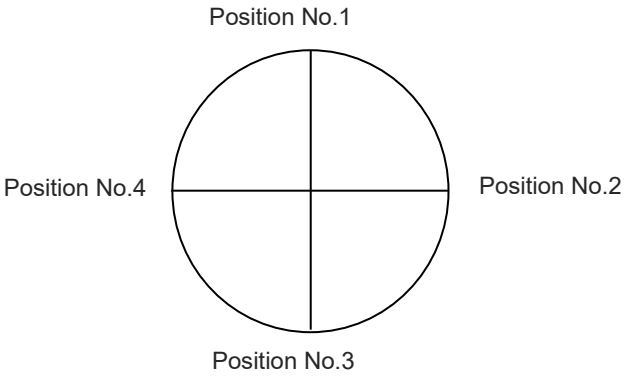
[Shortcut control of rotary actuator of multi-rotation specification]

Note The shortcut control gets available for setting when the index mode setting is activated. (When Parameter No. 79 “Rotary Axis Mode Select” is set to “1: Index Mode”) Refer to [4.2 [3] Operation Modes of Rotary Actuator in Multiple Rotation Mode and Command Limitations].

(1) Set of shortcut selection

The shortcut selection can be made valid/invalid by Parameter No.80 “Rotary axis shortcut selection”. If the shortcut selection is made valid, the actuator can be moved only in a single direction.

[Operation Examples]

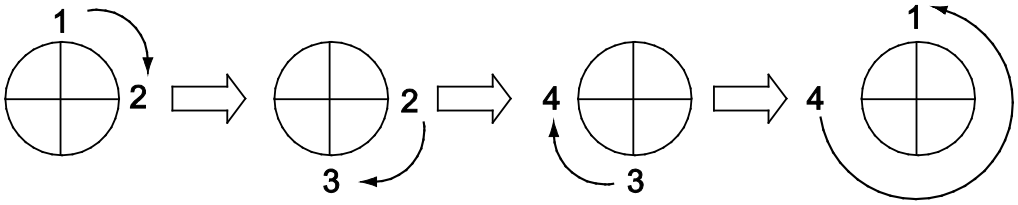


Position No.	Position
1	0
2	90
3	180
4	270

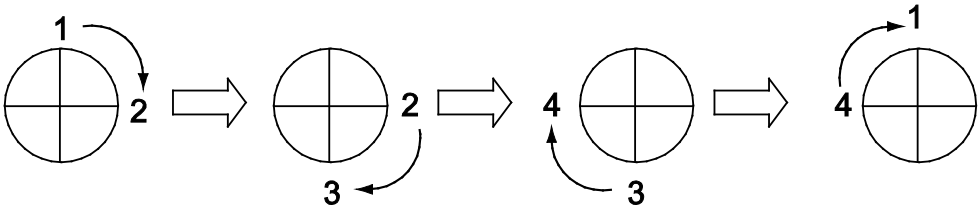
Enter pos/ition data assuming 1deg = 1mm.
(Example) 1.2 is assumed as 1.2deg.

For operation in the order of positions 1→2→3→4→1, the actuator is moved differently whether the shortcut selection is valid or invalid.

• When shortcut selection is invalid:



• When shortcut selection is valid:

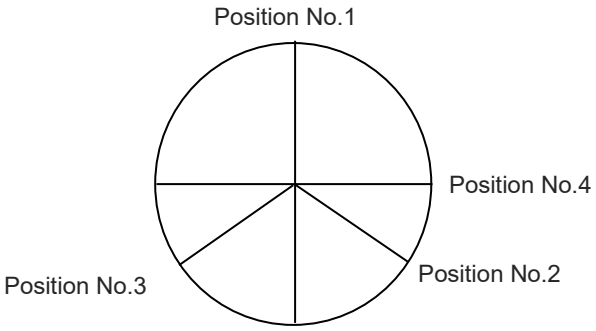


(2) Infinite Rotation Control

Making the shortcut selection valid and moving the actuator in a specific direction continuously allows the actuator to be rotated continuously as a motor. The continuous operation can be done as described below.

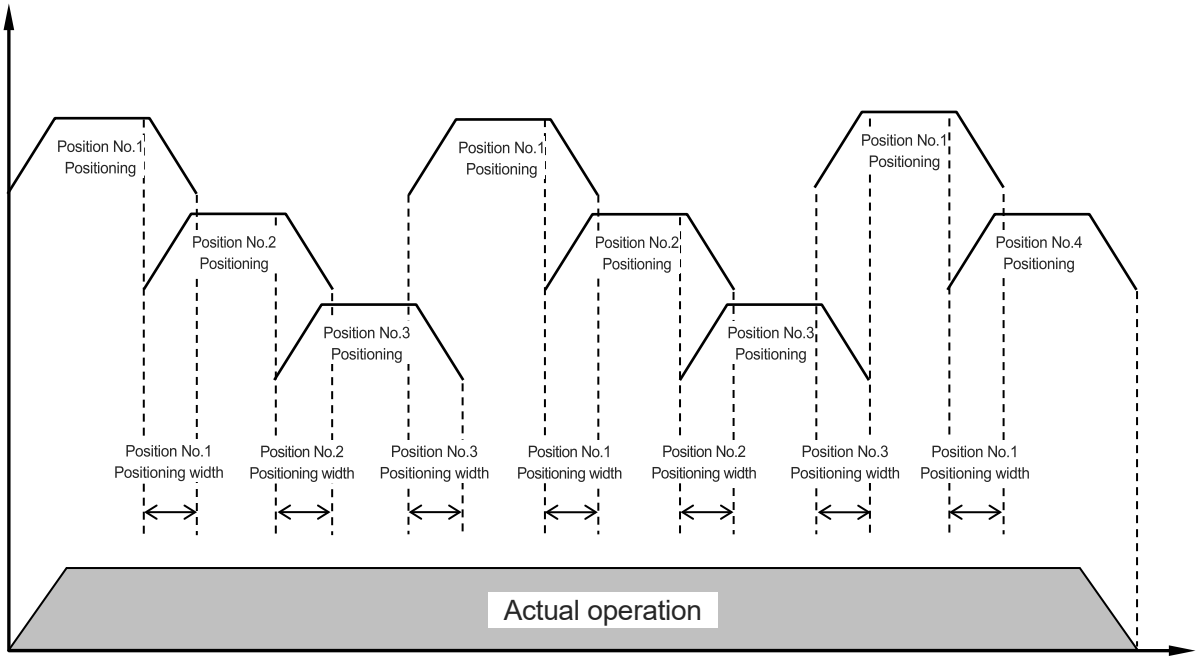
[Operation Examples]

This example rotates the actuator by 2 turns and finally stops it at position No.4.



Position No.	Position
1	0
2	120
3	240
4	90

Enter position data assuming
1deg = 1mm.
(Example) 1.2 is assumed as 1.2deg.

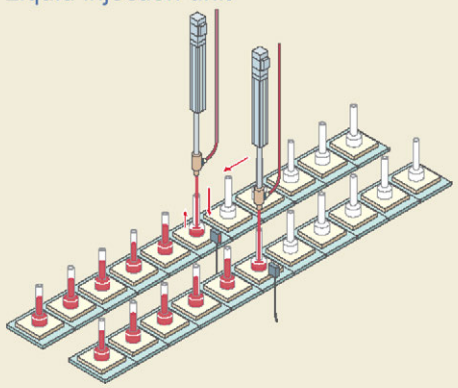


1) Widen the positioning widths of position No.1 to 3 so that they are located before the position at which deceleration is started.
2) Positioning of position No.1 makes positioning complete signal PEND turned ON before deceleration is started.
   If PEND is turned ON, positioning of position No.2 is executed. Similarly, positioning is repeated in the order of position No.3 → 1 → 2 → 3 → 4. Because the normal positioning always gives position data specified last the highest priority, the actuator can be rotated continuously.
3) If the speeds in position No.1 to 4 are set to be the same, the actuator can be rotated at the same speed. Then the actuator is stopped at the positioning set in position No.4. The number of rotations is defined by the number of repeats of position No.1 to 3.

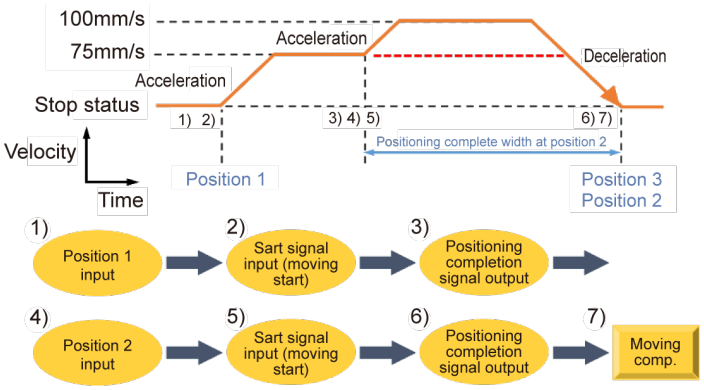
[2] Speed Change During the Movement

■ Sample use

■ Liquid injection unit



The unit inserts nozzles into containers, injects liquid, and moves the nozzles upward so that they may not be contact with the liquid surfaces.



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Load current threshold[%]	Positioning band[mm] / pressing band[mm]	Zone + side [mm]	Zone - side [mm]	Acceleration/deceleration mode	Positioning method
0											
1	150.00	200.00	0.30	0.30	Positioning	0	0.10	0.00	0.00	0:Trapezoid	0:Absolute position
2	0.00	75.00	0.30	0.30	Positioning	0	100.00	0.00	0.00	0:Trapezoid	0:Absolute position
3	0.00	100.00	0.30	0.30	Positioning	0	0.10	0.00	0.00	0:Trapezoid	0:Absolute position

■ Control method

The speed of the actuator can be changed while it moves. Positions are used by the number of speeds. The method of controlling the operation to each position is the same as that described in [1] Positioning.

The example below describes the case of 2 speeds:

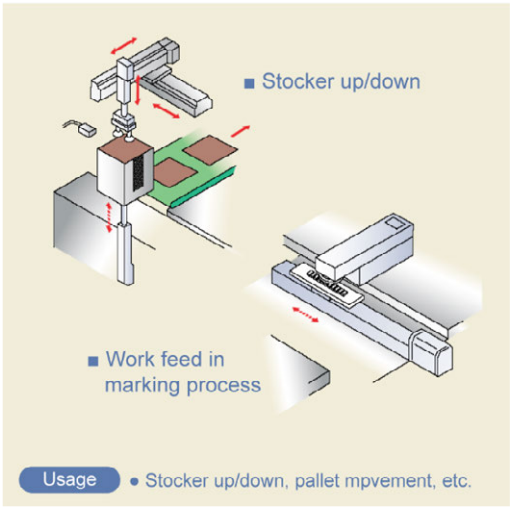
1) In this example, the speed is changed while the actuator moves from the position of 150mm to the position of 0mm. At first, set the positioning to the target position at the first speed in position No.2. In the positioning width, set the distance from the speed change position to the target position. The value is set to 100mm in the example. Thus, for position No.2, positioning complete signal PEND is turned ON at the position before the target position by 100mm.
2) Set the positioning to the target position at the second speed in position No.3.
3) Start position No.2. Then start position No.3 successively when PEND in position No.2 is turned ON. In normal positioning, position data specified later has always a priority over position data specified earlier. Thus, the operation in position No.3 is started on the way of the operation in position No.2.

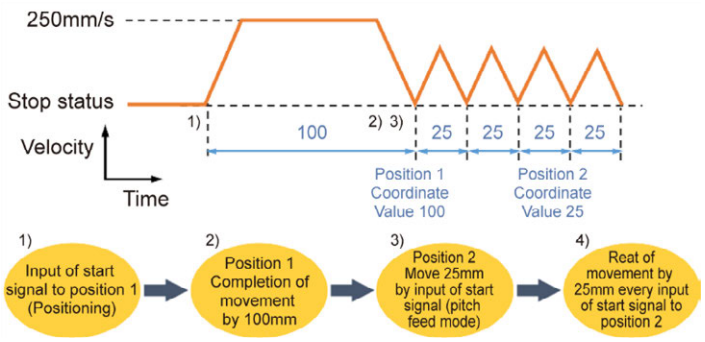
In this example, the target positions No.2 and 3 are equal with each other. They may not be the same. However, setting the target positions to be equal with each other allows the distance from the speed change position to the target position to be known easily.

To increase in the number of speed change steps, add a position number and operation sequence, set the speed change position in the positioning width and operate the actuator continuously.

[3] Pitch Feeding (Relative Movement = Incremental Feed)

■ Sample use





No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	100.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	25.00	250.00	0.30	0.30	Positioning	0.10	1:Relative position
3							

(Position No.2 sets pitch feed.)

■ Control method

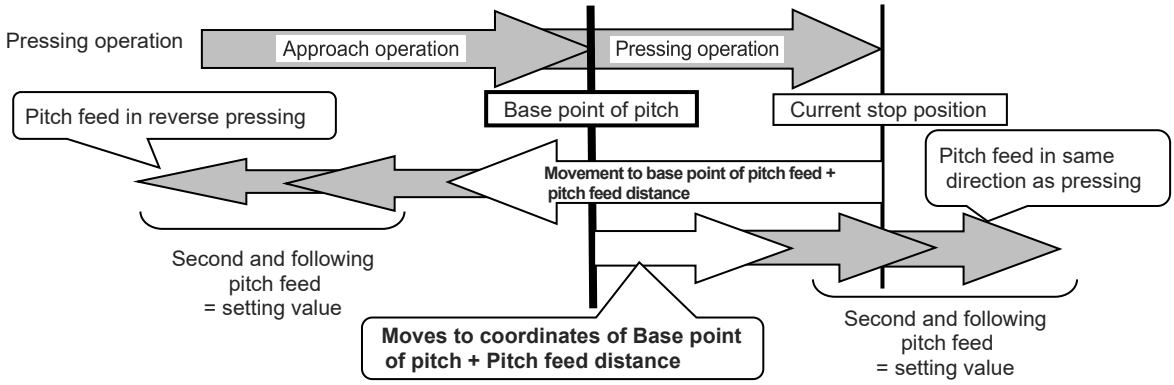
1) The method of controlling pitch feed is the same as that described in [1] Positioning except the setting of the position table. Repeat the positioning of a specific position No.
2) For pitch feed, the position set in the position table indicates the pitch. Set the pitch (relative moving distance = incremental moving distance) in column “Position”.
   If the operation command is issued, the actuator moves from the current stop position by “Position” in the position table. To perform continuous movement, repeat the operation.
   Any accumulation error does not occur because the home position (coordinate value 0) is specified as the base point.

Caution

- In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
  There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly.

Caution

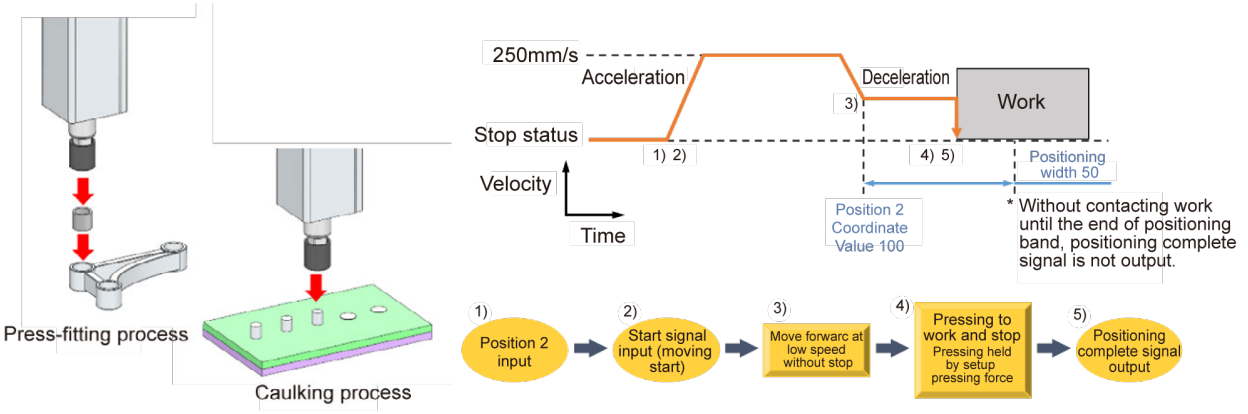
- If the actuator reaches the software limit corresponding to the stroke end in the pitch feed operation, the actuator stops at the position and positioning complete signal PEND is turned ON.
- When it is required to have pitch feed operation straight after pressing operation (condition kept in pressing), it is necessary to be cautious as the actuator moves directly to the coordinates that the pitch feed distance is added to the base point of pitch.
  Base point of pitch: the coordinate value entered in “Position” of the pressing position data



- If the position number for pitch feed is started (CSTR ON) during normal positioning, the actuator moves to the position of the coordinate resulting from adding the pitch feed distance to the target coordinate of the positioning. Repeating the start of pitch feed several times allows the pitch feed distance to be added to the target position by the number of repeats. Do not use the pitch feed function in such a way, because the PLC cannot confirm the complete position.
- Note that, if pitch feed is started (CSTR ON) repeatedly during pause, the actuator moves continuously by the distance based on the number of starts. In such a case, cancel the remaining moving distance by turning reset signal RES to ON in the pause state or take interlock so that the start signal is not turned ON during pause.
- At software limit (stroke end) in pitch feed, the actuator is decelerated to be stopped and positioning complete output PEND is output.
- MOVE is turned ON as soon as PEND is turned OFF and turned ON as soon as PEND is turned ON. Accordingly, with a large positioning width being set, MOVE may be turned OFF while the actuator is moved.
- Pressing is enabled by using the pitch feed function. However, do not make control of changing to pitch feed on the way of normal positioning (before PEND turning ON). Pressing is interrupted by using the pitch feed function as soon as start signal CSTR is turned ON. The PLC cannot manage the position of the actuator any more.

[4] Pressing Operation

■ Sample use



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	0.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	100.00	250.00	0.30	0.30	Pressing (50%)	50.00	0:Absolute position
3							

* Position No.2 sets pressing operation.

■ Control method

1) The method of controlling the pressing operation is the same as that described in [1] Positioning except the setting of the position table. Any setting of “Operation Type” in the position table allows the pressing operation to be done. “Positioning width” is assumed as pressing operation distance.

2) The actuator moves at the setting speed and with maximum torque as the upper limit to the position of the coordinate set in “Position” in the similar way as normal positioning. Then the operation changes to pressing. The moving distance in pressing is the value set in “Positioning width”. The pressing is performed with the torque (current limit value) set in percent [%] in “Pressing” of PIO patterns 0 to 3 being the upper limit.
Pressing operation using force sensor of PIO pattern 6 performs pressing by the pressing force set in percent [%] of the base thrust in pressing operation using force sensor (Note 1).

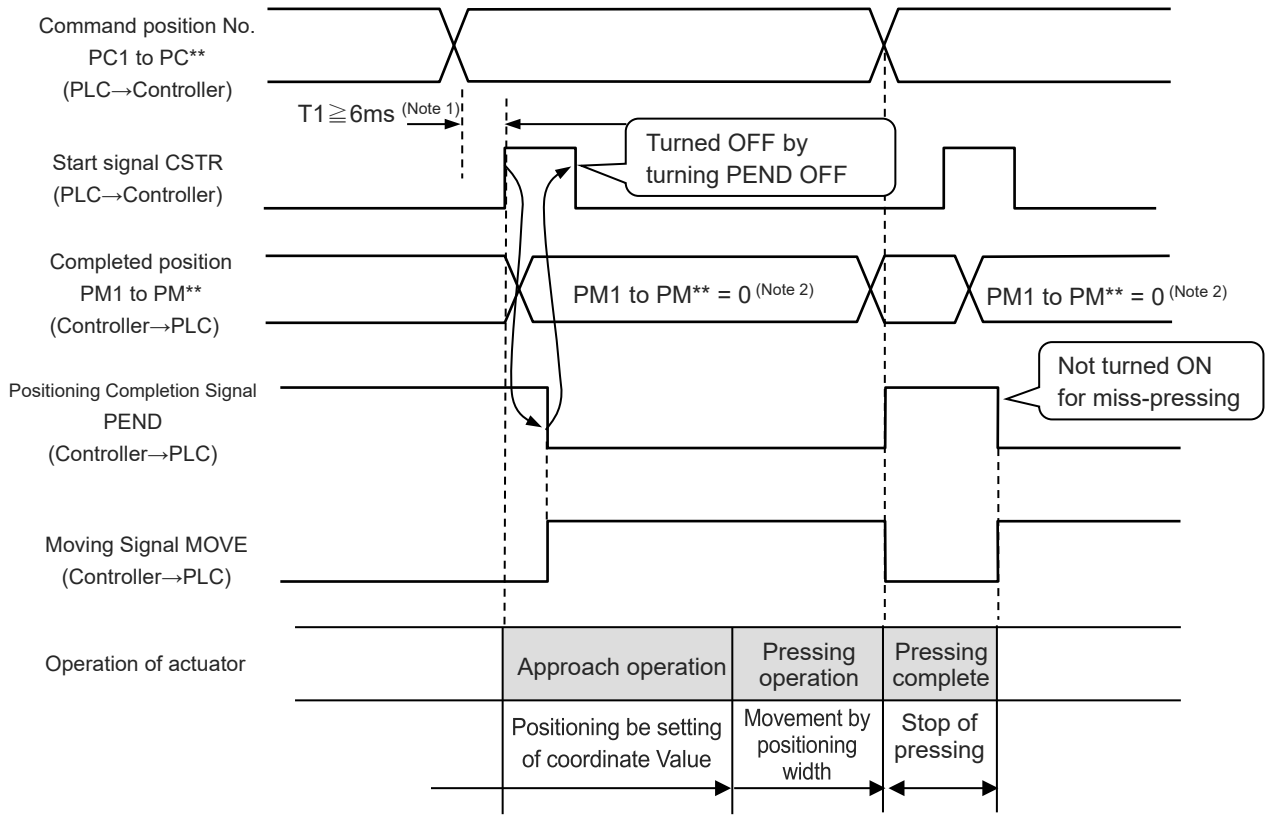
Note 1 Base thrust in pressing operation using force sensor: Converted thrust at rating motor output in pressing operation using force sensor (Pressing force at limit current value 100%)

Actuator		Base thrust in pressing operation using force sensor [N]
RCS3-RA6R		600
RCS3-RA7R		857
RCS3-RA8R		1,429
RCS3-RA10R		3,000
RCS2-RA13R	1t type	4,900
	2t type	9,800

Caution

- It is necessary to have the calibration done on the loadcell in order to perform the force sensor used pressing in PIO Pattern 6. Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)]

3) The control method is the same as that in [1] Positioning. However, the processing of positioning complete signal PEND is different from that in [1] Positioning.
PEND is output when the shaft is stopped by pressing (pressing complete). If the work is not subject to pressing (miss-pressing), the actuator moves by the value set in “Positioning width” to stop but PEND is not turned ON.

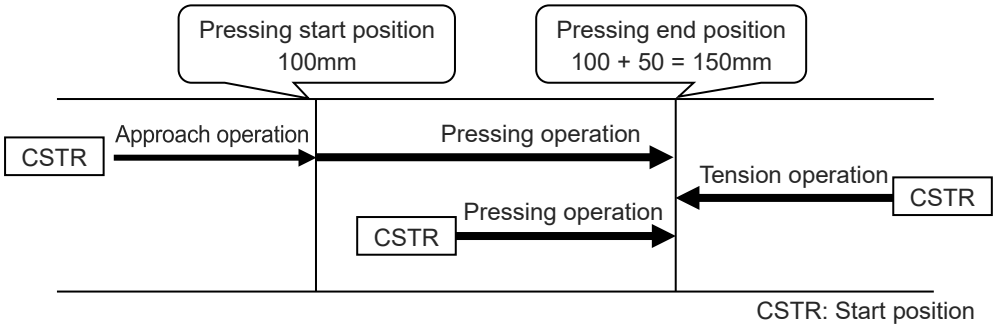


Note 1 Set the period taken from entering the position number to turning CSTR ON to 6ms or longer. Because 6ms timer process on the PLC is also entered to the controller, positioning at another position may occur. Take the PLC scan time into account.

Note 2 The completion position No. output is set to 0 during movement of the actuator.

Caution

- The speed during pressing operation is set in Parameter No.34. Check [10.3 List of Specifications of Connectable Actuators] for the pressing operation speed.
  Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the pressing speed, the pressing is performed at the setup speed.
- The approach start position of pressing should be located at or before the pressing start position (coordinate 100mm or less in the above example) If not, the moving direction varies depending on the start position to be dangerous.
  For example, pressing at coordinate larger than the pressing end position (larger than 150mm) is the tension operation in the direction from the current position to the pressing end position. Note that pressing after positioning to the position of coordinate 100mm does not take place.



- The work is pressed after the pressing is completed. The work may moves backward or forward. If the actuator is moved backward before the approach position, alarm 0DC “Pressing motion range over error” occurs to stop the actuator. In movement of the work in the pressing direction, PEND is turned OFF if the load current becomes lower than the current limit (pressing [%]). Miss-pressing occurs when the actuator moves by the pressing moving distance set in “Positioning width”. Completed Position No. PM1 to PM** keep turned on until the next movement command is made even if the work piece gets moved and pushed backward or goes further forward once they are turned on at the pressing operation complete.
- Do not make control of changing to pressing on the way of normal positioning (before PEND turning ON). Depending on the position at which start signal CSTR is turned ON, the pressing is performed improperly. Then the PLC cannot manage the position of the actuator.
- Pressing control cannot be performed with the rotary actuator. If the index mode is selected for the rotary actuator of multi-rotation specification, pressing operation cannot be set. The positioning complete signal PEND is turned ON when the actuator reaches the positioning width.
- If the actuator is pressed against the workpiece during approach operation, an alarm may occur.
- If the actuator is RCS2-RA13R, there is a limit in the duration and duty of continuous pressing. Use of the product above this limit may cause a failure occurred due to the motor heat generation. Refer to [10.3.2 Push Force and Current Limit Value]

Judging completion of pressing operation

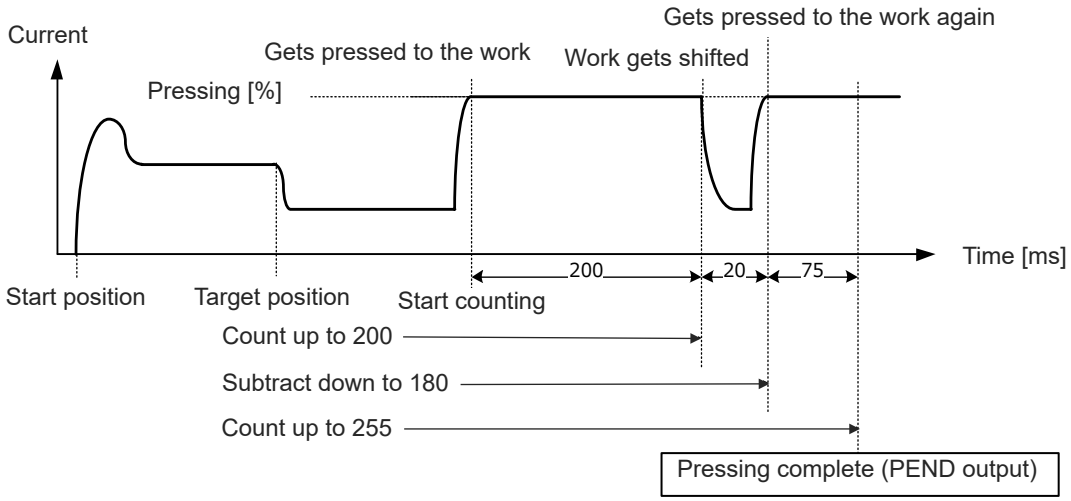
(1) For Standard (PIO Patterns 0 to 3)

The operation monitors the torque (current limit value) in percent [%] in “Pressing” of the position table and turns pressing complete signal PEND ON when the load current satisfies the condition shown below during pressing. PEND is turned ON at satisfaction of the condition if the work is not stopped.

(Accumulated time in which current reaches pressing value [%])

– (accumulated time in which current is less than pressing value [%])

≥ 255 ms (Parameter No.6)



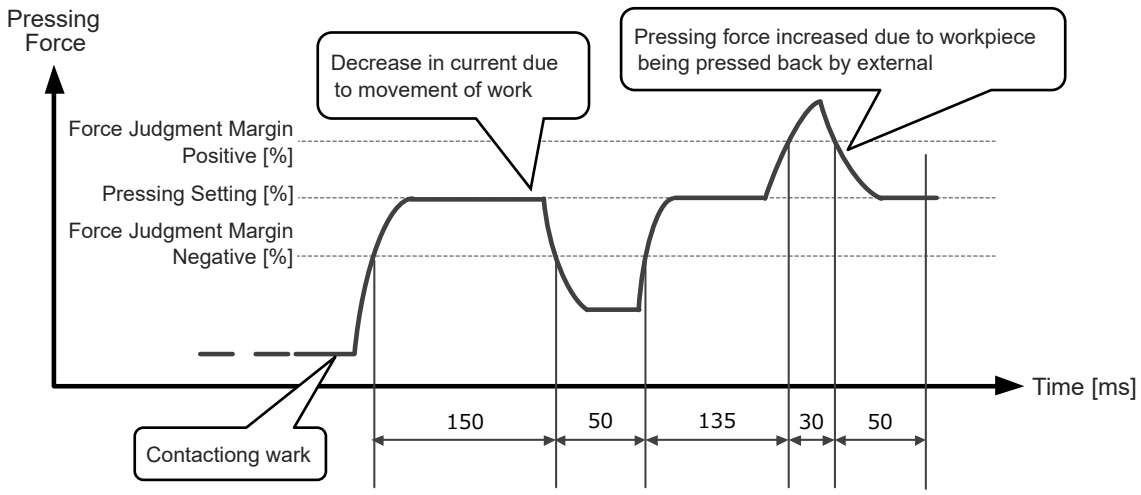
(2) For Force Sensor Used Pressing (PIO Pattern 6)

The pressing complete signal PEND should turn on when the pressing force during a pressing operation satisfies the following condition against the percent [%] of the pressing force set in "Pressing" in the position table. PEND should turn on once the condition is satisfied even if the actuator is not stopped.

● Condition

(Accumulated Time of Pressing Force being in Range of Force Judgment Margin Positive and Negative)

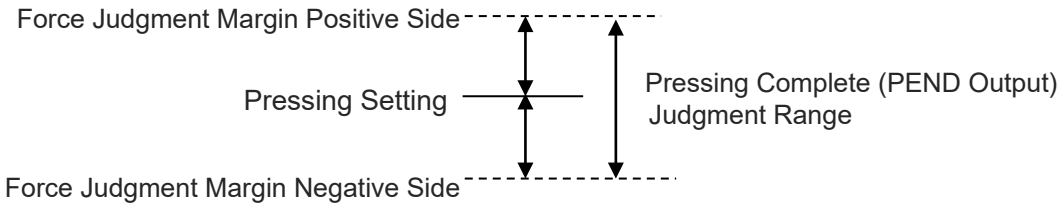
≥ 255ms (Pattern No.6)



The force judgment margin is be expressed with the base that the pressing current limit when the force sensor is used is considered as 100% (Note 1). It should be set in Parameters No. 95 and No. 96. The judgment range of the pressing complete should be determined as follows;

[Pressing Setting [%]] + [Force Judgment Margin Positive [%]] to

[Pressing Setting [%]] - [Force Judgment Margin Negative [%]]



Note 1 Base thrust in pressing operation using force sensor: Converted thrust at rating motor output in pressing operation using force sensor (Pressing force at limit current value 100%)

Actuator	Base thrust in pressing operation using force sensor [N]
RCS3-RA6R	600
RCS3-RA7R	857
RCS3-RA8R	1,429

Actuator		Base thrust in pressing operation using force sensor [N]
RCS3-RA10R		3,000
RCS2-RA13R	1t type	4,900
	2t type	9,800

[Example of Setting]

When setting is established to 150% for the pressing setting, 4% for the force judgment margin positive side and 4% for the force judgment margin negative side in 1t type:

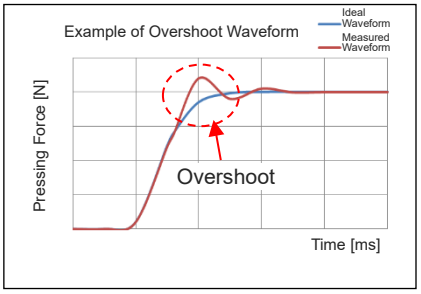
Setup pressing value: 4,900 [N] × 150% = 7,350 [N] and

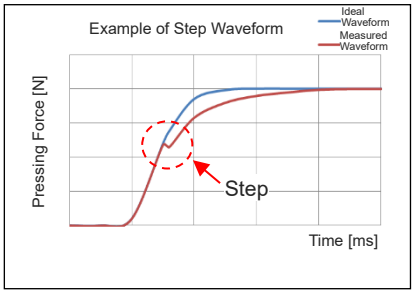
Force judgment margin + and –: 4,900 [N] × 4% = 196 [N].

Hence, the pressing complete judging range is between 7,154 to 7,546 [N].

[How to Adjust]

It is recommended to check the condition of the pressing force caused in pressing operation. Connect the IA-OS and read the current load value with servo monitoring function (Note2).
In case an overshoot or a step as shown in the graphs below is occurred in pressing force (current load value), it can be made better by adjustment following the steps stated below.





Step (1)

Try to reduce the pressing velocity when overshooting is being occurred.

The pressing velocity is determined for each actuator to be used, which should be set in Parameter No. 34.

Set the speed lower than the pressing velocity being set temporarily to the position data (Note3), and perform the pressing operation. In case the condition improves with this, revise the value in the position data to the one in Parameter No. 34 and set the velocity in the position data back to the value before.

Note 2 It is a feature equipped in the IA-OS. Refer to the IA-OS help window.

Note 3 If the velocity set in the position data is lower than setting in the pressing velocity in Parameter No. 34, the pressing velocity should follow the setting in the position data.

Step (2)

In case there is no improvement with Step (1), change the force sensor used pressing gain (Parameter No. 94). When it is necessary to change, refer to the table below and increase or decrease gradually (Note4).

Note 4 Try those values below (for each model) for the setting value in Parameter No. 94, 174, 175 and 176.

⊙ RA13R, RA10R (Default on Delivery = 1,500)

Responsiveness of Control System: High ← Responsiveness → Low	Stiffness Subject to Pressing: Hard ← Stiffness → Soft					
	1,050	2,100	4,200	8,400	16,800	33,600
	1,200	2,400	4,800	9,600	19,200	38,400
	1,350	2,700	5,400	10,800	21,600	43,200
	1,500	3,000	6,000	12,000	24,000	48,000
	1,650	3,300	6,600	13,200	26,400	52,800
	1,800	3,600	7,200	14,400	28,800	57,600
	1,950	3,900	7,800	15,600	31,200	62,400

⊙ RA8R (Default on Delivery = 3,000)

Responsiveness of Control System: High ← Responsiveness → Low	Stiffness Subject to Pressing: Hard ← Stiffness → Soft					
	2,100	4,200	8,400	16,800	33,600	67,200
	2,400	4,800	9,600	19,200	38,400	76,800
	2,700	5,400	10,800	21,600	43,200	86,400
	3,000	6,000	12,000	24,000	48,000	96,000
	3,300	6,600	13,200	26,400	52,800	105,600
	3,600	7,200	14,400	28,800	57,600	115,200
	3,900	7,800	15,600	31,200	62,400	124,800

⊙ RA7R (Default on Delivery = 5,000)

Responsiveness of Control System: High ← Responsiveness → Low	Stiffness Subject to Pressing: Hard ← Stiffness → Soft					
	3,500	7,000	14,000	28,000	56,000	112,000
	4,000	8,000	16,000	32,000	64,000	128,000
	4,500	9,000	18,000	36,000	72,000	144,000
	5,000	10,000	20,000	40,000	80,000	160,000
	5,500	11,000	22,000	44,000	88,000	176,000
	6,000	12,000	24,000	48,000	96,000	192,000
	6,500	13,000	26,000	52,000	104,000	208,000

⊙ RA6R (Default on Delivery = 10,000)

	Stiffness Subject to Pressing Hard ← Stiffness → Soft					
Responsiveness of Control System High ← Responsiveness → Low	7,000	14,000	28,000	56,000	112,000	224,000
	8,000	16,000	32,000	64,000	128,000	256,000
	9,000	18,000	36,000	72,000	144,000	288,000
	10,000	20,000	40,000	80,000	160,000	320,000
	11,000	22,000	44,000	88,000	176,000	352,000
	12,000	24,000	48,000	96,000	192,000	384,000
	13,000	26,000	52,000	104,000	208,000	416,000

Step (3)

In case there is no improvement with Step (2), change the force control transition threshold (Parameter No. 173).

When making a change, increase/decrease gradually (Note5) referring to the conditions below.

Condition 1: When overshooting is being occurred to the pressing force, set down the force control transit threshold.

Condition 2: When with a workpiece with a low rigidity, set up the force control transit threshold.

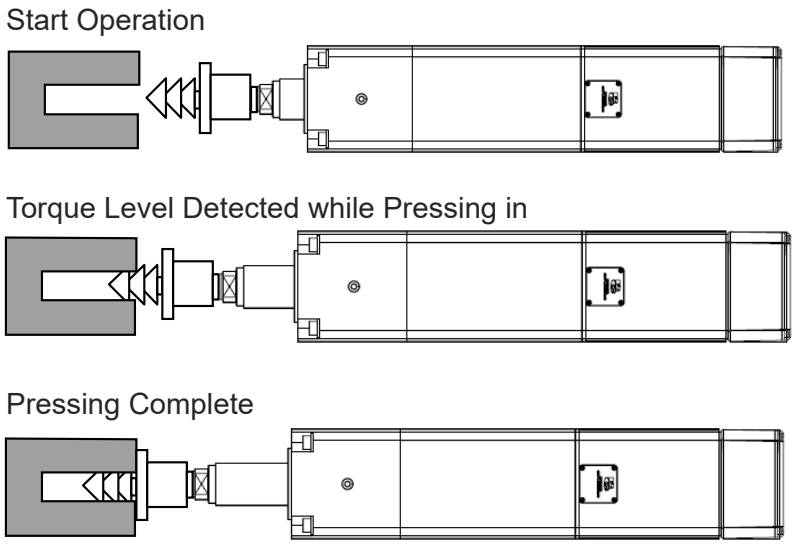
Note 5 Increase / decrease the setting in Parameter No. 173 with pitch from 5 to 10 (in range from 10 to 90).

Torque Level Detection in Press-fitting Operation

It is a signal dedicated for an actuator equipped with a loadcell.
Use this as a reference output for other actuators.

This is a function to detect whether the specified load is applied to the actuator when having a press-fitting process with the pressing operation. The load current is to be checked I the current limitation and the feedback value is to be checked in the pressing using the force sensor, and TRQS Signal should be output after the load output judgment time has passed. If there is no resistance in press-fitting, the specified load would not be applied, thus it is defined as the normal pressing is not conducted and an alarm can be issued from PLC.

■ Image diagram



■ Control method

It monitors the pressing force set in [%] in “Load Current Threshold” in the position data, and turns the torque level status signal TRQS ON when the pressing force reaches the following condition. At the same time, load output judge signal LOAD also turns ON if it is in the position zone.

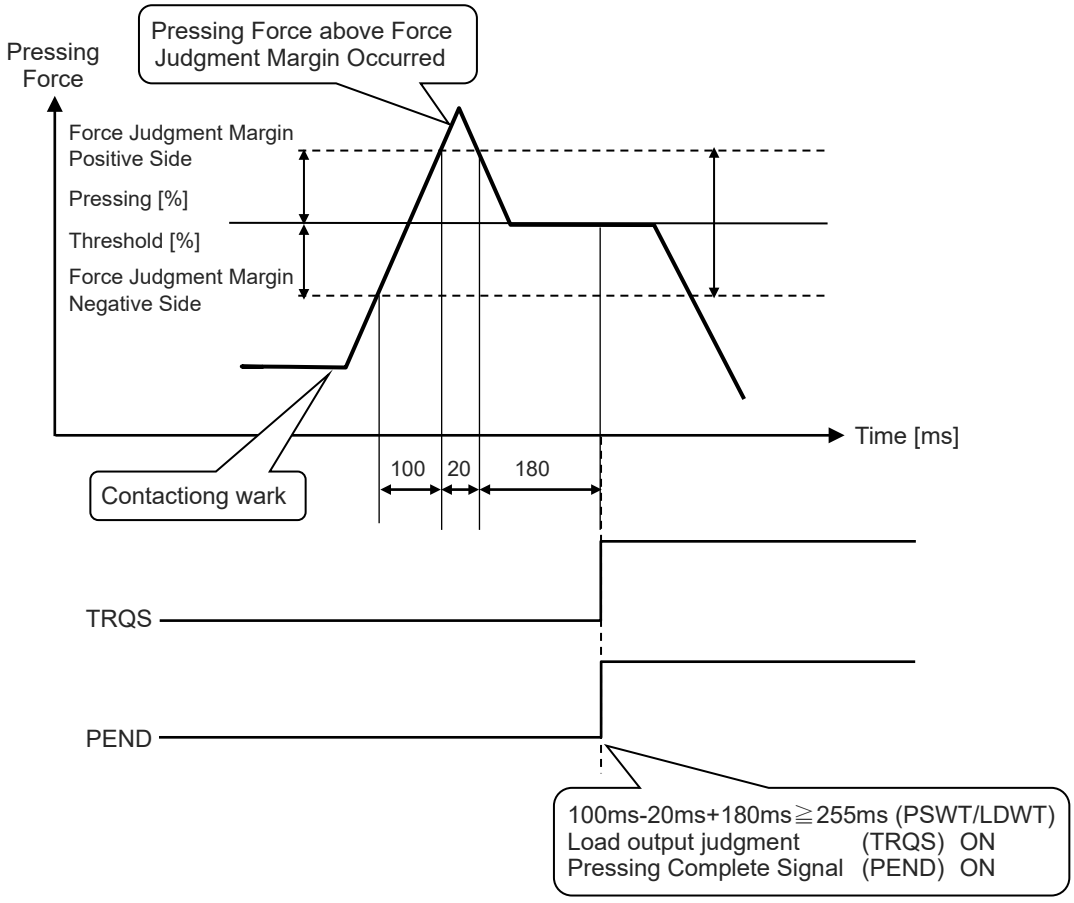
This signal turns OFF either when a movement command to another position is issued or the servo is turned OFF. This signal is kept ON once it is turned ON until the next movement command.

● Condition

(Accumulated Time of Pressing Force being in Range of Force Judgment Margin)

– (Accumulated Time of Pressing Force outside the Force Judgment Margin)

≥ 255ms (Pattern No.50)

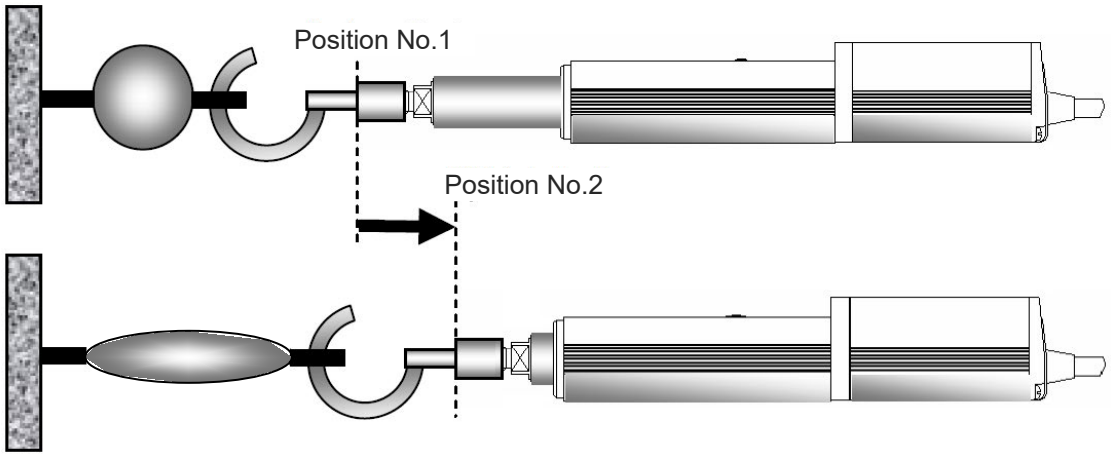


[5] Tension Operation

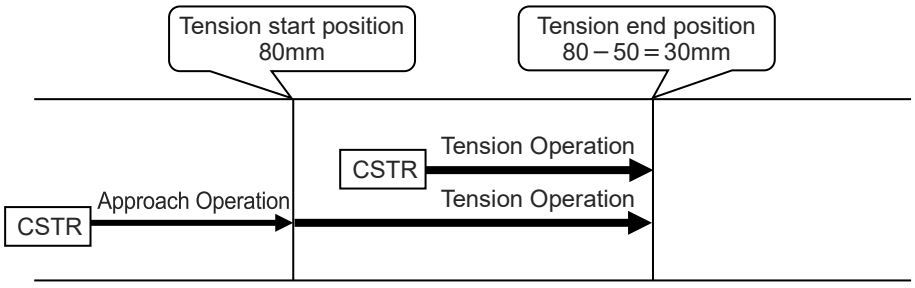
Warning

- Do not perform tension operation by pressing operation using force sensor.
  The pressing operation using force sensor requires an actuator applicable for dedicated loadcell and pressing operation using force sensor.
  The tension operation by using an actuation equipped with loadcell causes the loadcell to be damaged.

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	100.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	80.00	100.00	0.30	0.30	Pressing (50%)	-50.00	0:Absolute position
3							



CSTR : Start position

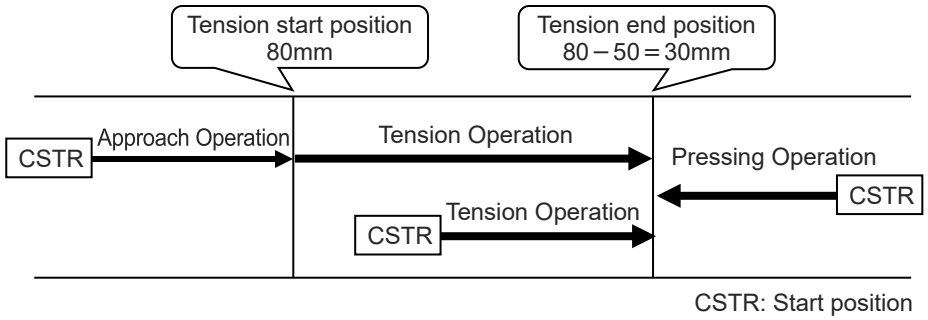
■ Control method

The method of controlling the tension operation is the same as that described in [4] Pressing operation. The control method is explained below by using the sample position table shown above.

1) Position No.2 indicates the settings of tension operation. The settings of “Position” and “Positioning width” show the tension start position and the tension quantity, respectively. Attach – (negative) to the tension quantity. Specify the upper limit of the torque required for tension in [%] (limited current value) in “Pressing”. The speed, acceleration, and deceleration are the conditions of positioning to the coordinate value (80mm) set in “Position”.
2) Position No.1 indicates the tension start preparation position. Specify a value larger than the coordinate value at which the tension provided by position No.2 ends (80 – 50 = 30mm) in “Position”.
3) First define the positioning in position No.1. Next, the operation in position No.2 moves the actuator to the position of 80mm at the setting speed and rating torque and change to the tension operation. The actuator moves by 50mm in the negative direction in the tension operation. The upper limit of the tensile force is the torque set in [%].
4) In the similar way as pressing, the positioning complete signal is output when the shaft is stopped by tension (pressing complete). If the actuator cannot be stopped during movement within the setting positioning width (miss-pressing), it moves by the setting distance to stop but PEND is not turned ON.

Caution

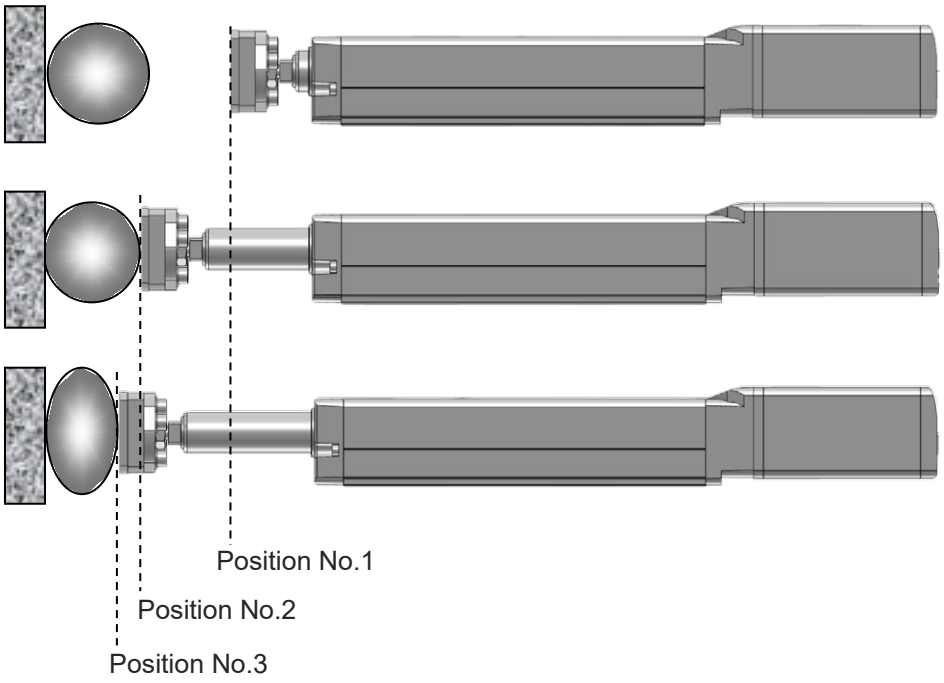
- The speed during tension operation is set in Parameter No.34. Refer to [10.3 List of Specifications of Connectable Actuators] for the pressing speed. The speed for pulling operation is same as that for pressing operation.
  Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the tension speed, the tension operation is performed at the setup speed.
- The tension ready position should be the tension start position or forward. If not, the moving direction varies depending on the start position to be dangerous.
  The tension operation from a coordinate (coordinate of 80 – 50 = 30mm in example) located before the end position (30mm or less) changes to the pressing operation from the current position to the tension end position. Note that the tension operation after positioning to the position of 80mm does not take place.



- The work is pulled also after completion of the tension. The work is drawn back or pulled further if the work is moved. When the work is drawn back before the approach position, alarm 0DC “pressing operation range error” occurs to stop the work. When the work is moved in the tension direction and the load current becomes less than the current limit value (pressing in [%]), PEND is turned OFF. Naturally, the work reaches the tension moving distance set in “Positioning width” to cause miss-pressing.
- Do not make control of changing to tension operation on the way of normal positioning (before PEND turning ON). Depending on the position at which start signal is turned ON, the tension operation is performed improperly. Then the PLC cannot manage the position of the actuator.
- Pulling operation cannot be performed with the rotary actuator.
- If the actuator is RCS2-RA13R, there is a limit in the continuous tension time (= continuous pressing time) and the duty of continuous pressing. Use of the product above this limit may cause a failure occurred due to the motor heat generation. Refer to [10.3.2 Push Force and Current Limit Value]

[6] Multi-step Pressing

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method	
0								
1	0.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position	
2	50.00	250.00	0.30	0.30	Pressing (30%)	20.00	0:Absolute position	
3	50.00	250.00	0.30	0.30	Pressing (50%)	20.00	0:Absolute position	
4								

■ Control method

After pressing, the pressing pressure can only be changed in the pressing state.
The method of controlling multi-step pressing is the same as that described in [4] Pressing operation. The control method is explained below by using the sample position table shown above.

1) Set the weak pressing (30%) in position No.2 and perform the pressing operation.
2) If pressing complete signal PEND is turned ON, start the pressing operation with pressing pressure (50%) greater than the first pressure set in position No.3.
   The position data in position No.3 should be the same as that in position No.2 except the setting in “Pressing”.
3) To add a pressing step with another pressing pressure, add a sequence consisting of a position number and a pressing operation.

[7] Teaching by PIO (MODE, MODES, PWRT, WEND, JISL, JOG+, JOG-)

PIO signal	Input					Output	
	MODE	JISL	JOG+	JOG–	PWRT	MODES	WEND
Other than pattern 1	×	×	×	×	×	×	×
Pattern 1	○	○	○	○	○	○	○

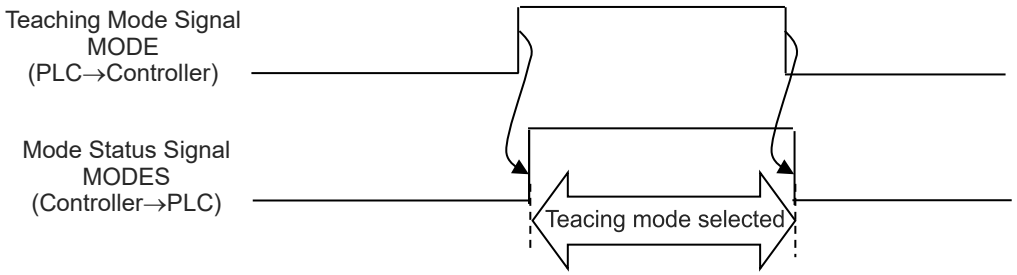
○: Existence of signal, ×: No signal

Note The feature is limited to PIO pattern 1.

Teaching by PIO is enabled.
It is possible to select the teaching mode, move the actuator to the target position with jog or inching operation, and write the coordinate value into any position number.

(1) Teaching Mode Selecting

1) To select the teaching mode, set teaching mode signal MODE to ON. If the teaching mode is selected, mode status signal MODES is turned ON.
   - While the actuator is operating, MODE signal input is invalid. Therefore, after the operation is completed, the MODES signal is turned ON.
   - With the MODES signal being ON, the CSTR signal is changed to teaching signal PWRT. Therefore, it is not possible to operate the actuator by specifying a position No.
2) To cancel the teaching mode to return to the normal operation mode, set the MODE signal to OFF. If the MODE signal is turned OFF, the MODES signal is turned OFF to return to the normal operation mode.



(2) Jog/inching switch and jog input

1) Jog/inching switching signal JISL indicates whether the jog operation*1 or inching operation*2 is performed by the jog input signal.
   JISL signal OFF : Jog operation
   JISL signal ON : Inching operation
2) There are two jog input signals, or JOG+ for operation in the positive direction and JOG- for operation in the negative direction.

*1 Jog operation: The actuator is moved while the jog input signal is set to ON.
- JOG+ ·····While JOG+ is set to ON, the actuator is moved in the positive direction. If JOG+ is turned OFF, the actuator is decelerated and then stopped.
- JOG- ·····While JOG- is set to ON, the actuator is moved in the negative direction. If JOG- is turned OFF, the actuator is decelerated and then stopped.
- Velocity ·····Value set in Parameter No.26 “PIO jog velocity”.
- Acceleration/Deceleration ····· Rating acceleration/deceleration of actuator
- Pause Signal *STP····· Enabled

*2 Inching operation: Once the jog input signal is turned ON, the actuator is moved by a certain distance.
- JOG+ ····· Once JOG+ is turned ON, the actuator is moved by a certain distance in the positive direction.
- JOG- ····· Once JOG- is turned ON, the actuator is moved by a certain distance in the negative direction.
- Moving distance····· Value set in Parameter No.48 “PIO inching distance”.
- Velocity ····· Value set in Parameter No.26 “PIO jog velocity”.
- Acceleration/Deceleration ····· Rating acceleration/deceleration of actuator
- Pause Signal *STP····· Enabled

Warning

- In home return incomplete state, software limit cannot stop the actuator. Take interlock and prohibit the operation or perform the operation carefully.
- If the JISL signal is changed during inching operation, the inching being operated is continued. If JISL is changed during job operation, the jog is stopped.

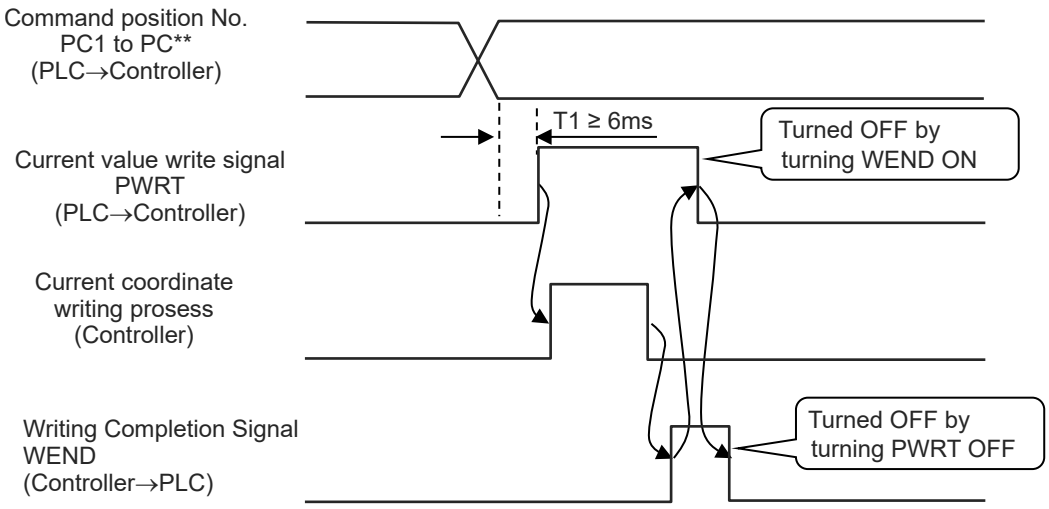
(3) Writing current data to position table

1) The feature is valid only when the teaching mode is selected (with the MODES signal being ON).
2) Specify the position number to which the current data is written in the binary data format in command position No.PC1 to PC32. Turn current value writing signal PWRT ON.
3) The coordinate value of the current position is written into the position table for the controller. If position data is written previously, only the coordinate value in “Position” is only rewritten. If nothing is written, the values set in the parameters below are written as the speed, acceleration/deceleration, positioning width, acceleration/deceleration mode and stop mode. Other data is set to “0”.

- Velocity ····· Parameter No.8 “Default speed”
- Acceleration ····· Parameter No.9 “Default acceleration/deceleration”
- Deceleration ····· Parameter No.9 “Default acceleration/deceleration”
- Positioning width ····· Parameter No.10 “Default positioning width (in-position)”
- Acceleration/deceleration mode ·· Parameter No.52 “Default acceleration/deceleration mode”
- Stop mode ····· Parameter No.53 “Default stop mode”

4) At the completion of writing, controller write complete signal WEND is output. Then turn the PWRT signal OFF.

5) When the PWRT signal is turned “OFF” the WEND signal is also turned “OFF”.
Turn OFF PWRT after confirming WEND is turned ON.
Turning it OFF before turning ON disturbs the proper data writing.



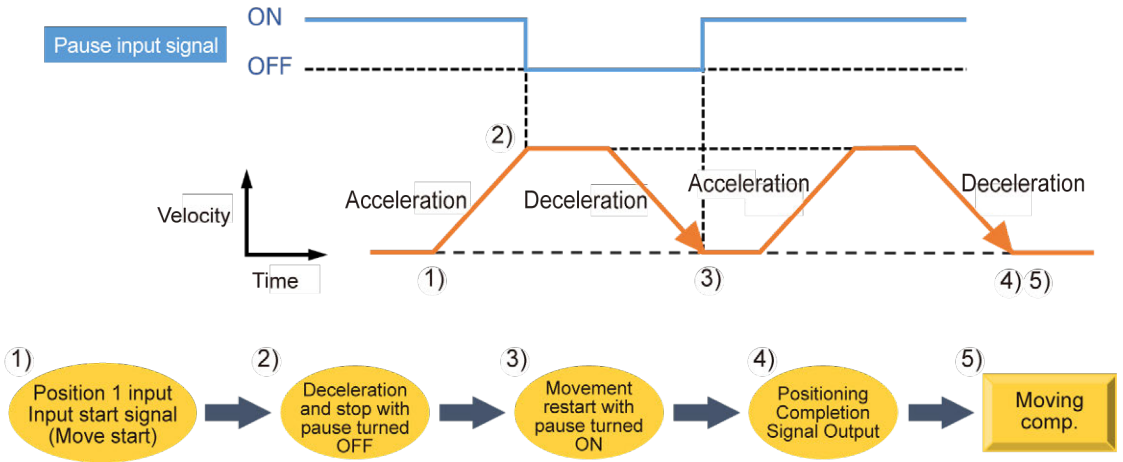
Caution

- Set the period taken from entering position No. to turning the PWRT ON to 6ms or longer. In spite of 6ms timer process in the PLC, commands may be input to the controller concurrently to cause writing to another position. Take the scanning time in the PLC into account, set a period as 2 to 4 times as the scanning time.
- Turning the PWRT signal ON in the state in which home return is not completed (the HEND signal is set to ON) causes alarm “093: PWRT signal detected before completion of home return” to occur.
- Turning PWRT signal OFF before turning WEND signal ON disturbs the proper data writing.
- Writing processing with position table screen remaining open on a teaching tool such as PC software cannot lead the data on the screen to be updated. To update and confirm writing data, take the following actions. Refer to the relevant Instruction Manual for details of operation.
  1. IA-OS : Left-click the button.
  2. Teaching Pendant : Change to user adjustment screen, input “4” in adjustment N O and return to the position table screen after software reset.

[8] Pause and Operation Interruption (*STP, RES, PEND, MOVE)

PIO signal	Input		Output	
	*STP	RES	PEND	MOVE
Patterns 0 to 1	○	○	○	○
Patterns 2 to 3 and 6	○	○	○	×

○: Existence of signal, ×: No signal



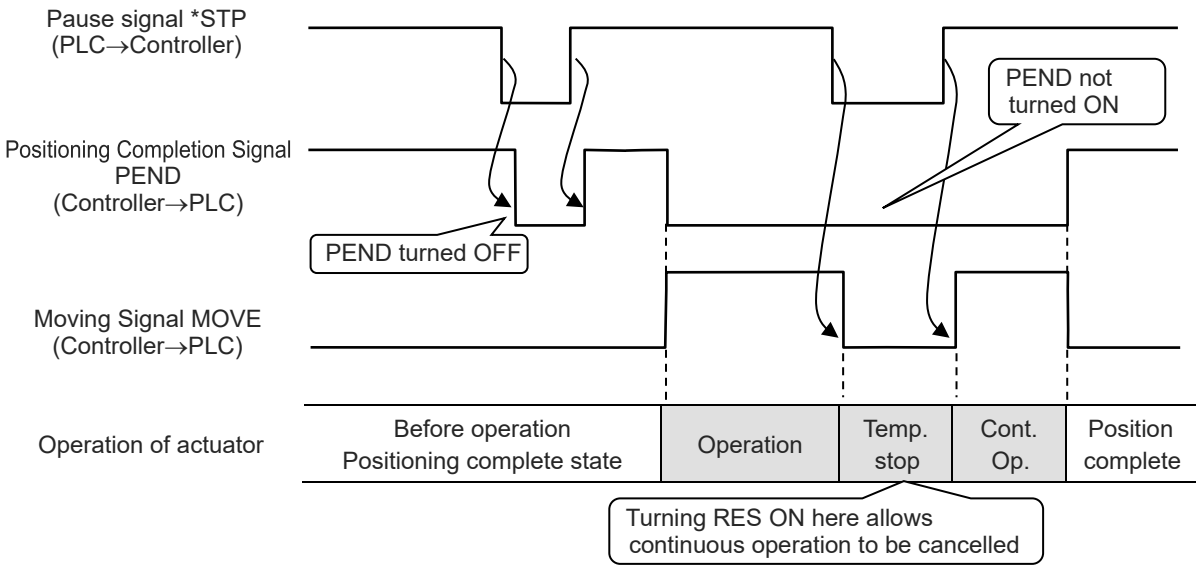
■ Control method

Pause is possible during movement. In addition, the remaining moving distance can be cancelled to interrupt the operation.

The pause signal is an input signal always set to ON. So, it is normally used to remain ON.

Use this function for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If pause signal *STP is turned off during operation of the actuator, the actuator is decelerated to a stop. The deceleration is defined by the value set in the position table.
2) During pause, moving signal MOVE is set to OFF but positioning complete signal PEND is not turned ON.
3) If pause signal *STP is returned to ON, the actuator continues the remaining movement. The acceleration is the value set in the position table.
4) Turning reset signal RES ON during pause (*STP being OFF) allows the remaining movement to be cancelled to interrupt the operation.



Caution

- At occurrence of an alarm in the release level, RES can reset the alarm. Cancel the remaining moving distance after confirmation that alarm signal *ALM (being ON in normal state and OFF at occurrence of an alarm) is set to ON.
  * Refer to [8.3.2 Alarm Details] for details of alarms.
- Turning *STP OFF with the actuator being in the positioning complete state causes PEND to be turned OFF. Note that this situation may not occur when a sequence program is created. It is not an emergency stop output due to an alarm generation of the controller.

4.2.5 Position Direct Command (PIO Patterns 4 and 7) Operation

The start signal is provided for every position number. Only turning ON the relevant input signal according to the table shown below allows the operation based on the data in the target position number to be performed. The operation mode is called the solenoid valve mode because solenoid valves can directly drive air cylinders.
At the completion of positioning, every completed position number is output as well as the positioning complete signal.
PIO pattern 7 is exclusively used for pressing operation using force sensor. It is intended for the actuator equipped with loadcell to enable highly precise pressing control. Before the actuator can be operated, proper calibration and initialization of parameters are required. Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)]

Positioning, pressing, and pitch feed are possible. Their control methods are the same as those of other patterns.

[1] Positioning [Basic] (ST0 to ST6, PE0 to PE6, PEND)

PIO Pattern 4 (ST0 to ST6, PE0 to PE6, PEND)

Position No.	Input	Output	
0	ST0	PE0	PEND
1	ST1	PE1	PEND
2	ST2	PE2	PEND
3	ST3	PE3	PEND
4	ST4	PE4	PEND
5	ST5	PE5	PEND
6	ST6	PE6	PEND

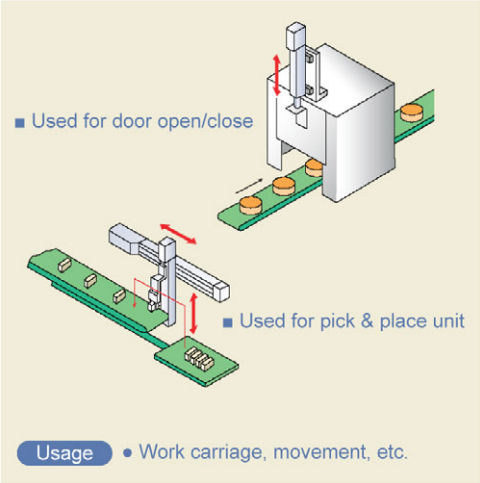
PIO Pattern 7 (ST0 to ST4, PE0 to PE4, PEND)

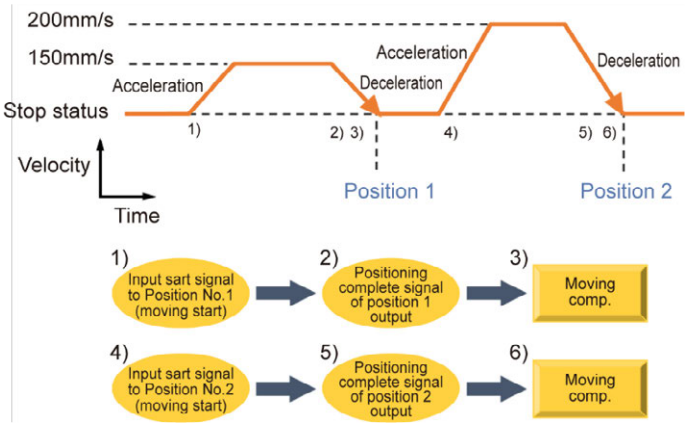
Position No.	Input	Output	
0	ST0	PE0	PEND
1	ST1	PE1	PEND
2	ST2	PE2	PEND
3	ST3	PE3	PEND
4	ST4	PE4	PEND

Note Speed change is not allowed during movement.

- If start signal ST* is issued without home return, the home return operation is automatically done before the operation based on the data of the specified position number. When this specification is not desired, interlock by home return complete signal HEND is required.

■ Sample use

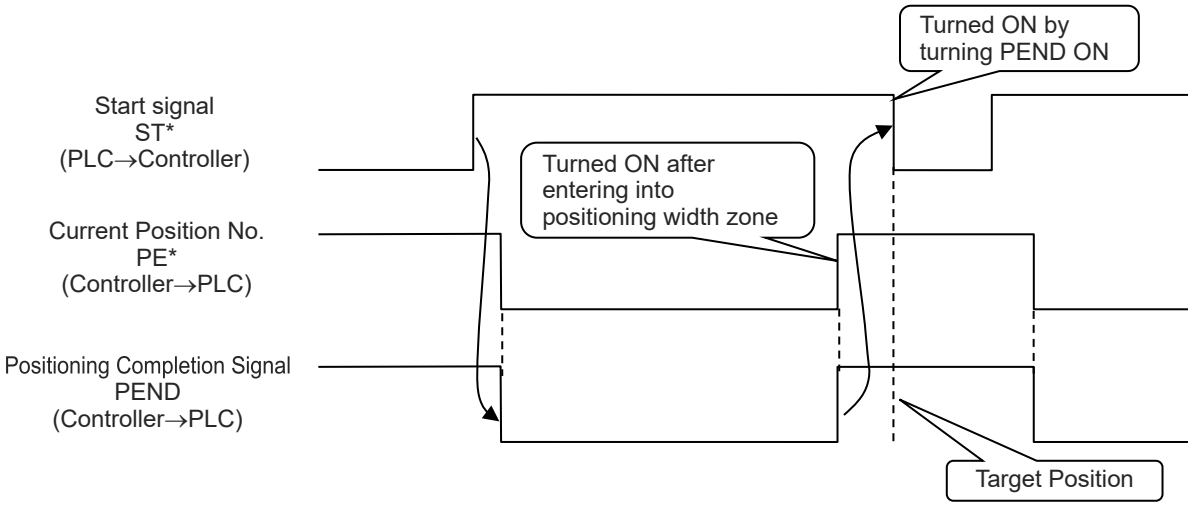




No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0	0.00	150.00	0.30	0.30	Positioning	0.10	0:Absolute position
1	70.00	150.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	150.00	200.00	0.30	0.30	Positioning	0.10	0:Absolute position

■ Control method

1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position.
2) At the completion of positioning, positioning complete signal PEND is turned ON as well as current position No. PE* of the specified position.
3) After PEND is turned ON, turn the ST* signal OFF.
4) Current position No. PE* and positioning completion signal PEND are turned ON if the remaining moving distance is entered into the positioning width zone. The current position number PE* and PEND Signal will be kept ON once it is turned ON unless the start signal ST* is turned back ON, servo is turned OFF or the actuator is out of the positioning band width range. When the pause signal *STP is turned OFF in this condition, the current position number PE* and PEND Signal will also be turned OFF.

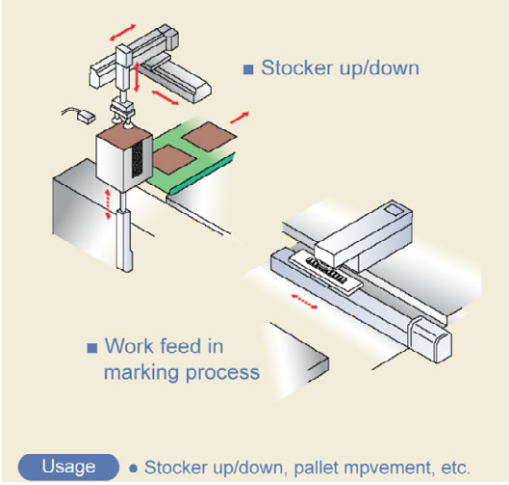


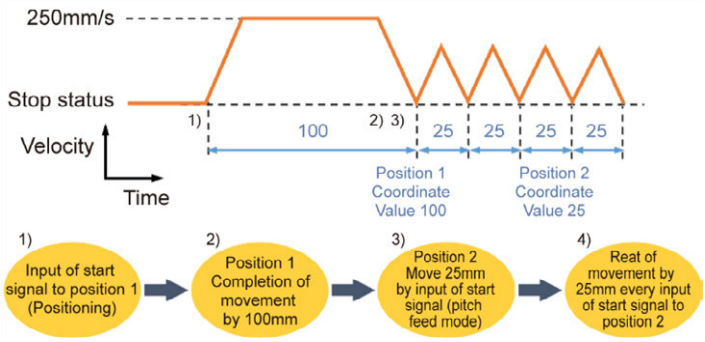
Caution

- If the ST* signal is turned ON for the position after completion of positioning, both the PE* and PEND signals remain ON (except the pitch feed operation).
- Both the PE* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
- Interlock should be taken so that two or more ST* signals are set to ON simultaneously.
  1. Entering the ST* signal of another position during positioning is invalid. If the ST* signal of another position is turned ON during positioning, the operation is terminated after the completion of the positioning being operated.
  2. Entering the ST* signal of another position with the ST* signal of the current position remaining ON after the completion of positioning allows the positioning to the other position to be executed.
- If Parameter No.27 “Movement command type” is set to “0 (factory setting)”, turning ST* OFF during positioning caused the operation to be interrupted.

[2] Pitch Feeding (Relative Movement = Incremental Feed)

■ Sample use





No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	100.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	25.00	250.00	0.30	0.30	Positioning	0.10	1:Relative position
3							

(Position No.2 sets pitch feed.)

■ Control method

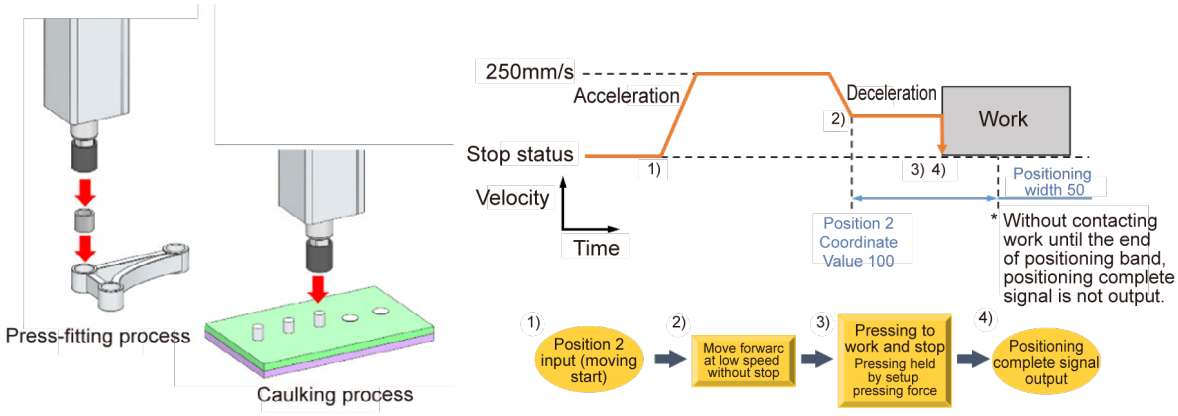
1) The method of controlling pitch feed is the same as that described in [1] Positioning except the setting of the position table. Repeat the positioning of a specific position No.
2) For pitch feed, the “Position” set in the position table indicates the pitch. Set the pitch (relative moving distance = incremental moving distance) in column “Position”.
3) If the operation command is issued, the actuator moves from the current stop position by “Position” in the position table. To perform continuous movement, repeat the operation. Any accumulation error does not occur because the home position (coordinate value 0) is specified as the base point.

Caution

- Because pitch feed is repeated, turning ON the ST* signal of the same position after completion of positioning causes both the PE* and PEND signals to be turned OFF at operation start and turned ON again at completion of positioning in the same way as [1] Positioning.
- If the actuator reaches the software limit (stroke end) in pitch feed, the actuator is decelerated to be stopped and current position No. PE* and positioning complete signal PEND are turned ON at the stop position.
- Both the PE* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
- Interlock should be taken so that two or more ST* signals are set to ON simultaneously.
  1. Entering the ST* signal of another position during positioning is invalid. If the ST* signal of another position is turned ON during positioning, the operation is terminated after the completion of the positioning being operated.
  2. Entering the ST* signal of another position with the ST* signal of the current position remaining ON after the completion of positioning allows the positioning to the other position to be executed.
- If Parameter No.27 “Movement command type” is set to “0” (factory setting), turning ST* OFF during positioning caused the operation to be interrupted.
- Note that, when Parameter No.27 “Movement command type” is set to “1”, starting (ST* ON) pitch feed repeatedly during pause causes the actuator to be moved successively by the number of starts. If this situation is supposed, cancel the remaining moving distance by turning reset signal RES ON in the pause state or take interlock so that start signals are not turned on during pause.
- The pressing operation is enabled by using the pitch feed function.
- In the pitch feed, do not perform a command with a pitch smaller than the minimum encoder resolution (lead/encoder pulse number) or that less than positioning accuracy repeatability.
  There would be no deviation to occur even with the command because it is an operation command to the same position as the positioning complete condition, but the positioning control cannot be performed properly. The direction of operation should be reversed for the home-reversed type.

[3] Pressing Operation

■ Sample use



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	0.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	100.00	250.00	0.30	0.30	Pressing (50%)	50.00	0:Absolute position
3							

(Position No.2 sets pressing operation.)

■ Control method

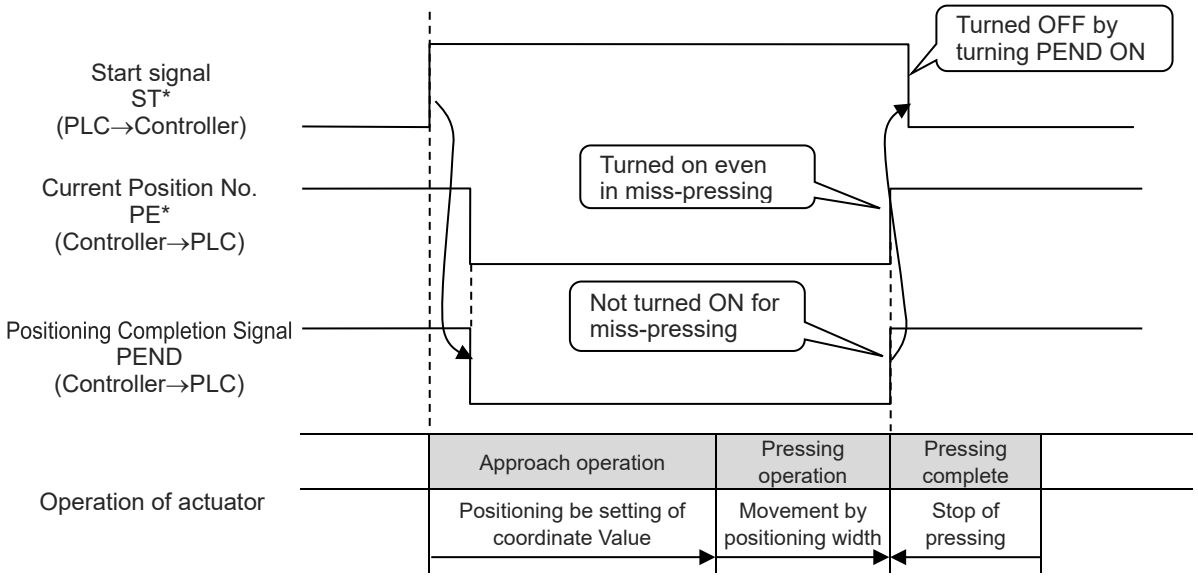
1) The method of controlling the pressing operation is the same as that described in [1] Positioning except the setting of the position table. Any setting of “Operation Type (Pressing)” in the position table allows the pressing operation to be done. “Positioning width” is assumed as pressing operation distance.
2) The actuator moves at the setting speed and rating torque to the position of the coordinate set in “Position” in the similar way as normal positioning. Then the operation changes to pressing. The moving distance in pressing is the value set in “Positioning width”. The pressing is performed with the torque (current limit value) set in percent [%] in “Pressing” being the upper limit.

Pressing operation using force sensor of PIO pattern 7 performs pressing by the pressing force set in percent of the base thrust in pressing operation using force sensor (Note 1).

Note 1 Base thrust in pressing operation using force sensor: Converted thrust at rating motor output in pressing operation using force sensor (Pressing force at limit current value 100%)

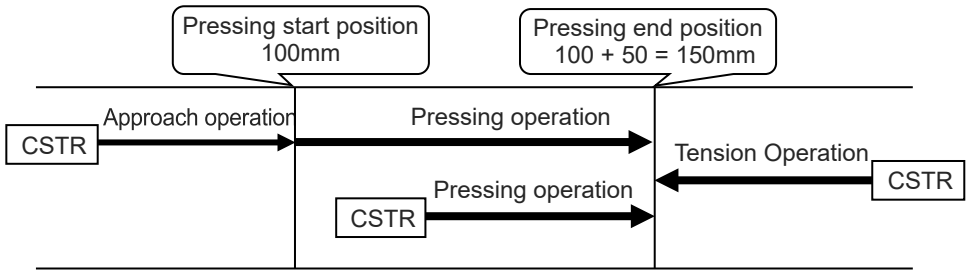
Actuator		Base thrust in pressing operation using force sensor [N]
RCS3-RA6R		600
RCS3-RA7R		857
RCS3-RA8R		1,429
RCS3-RA10R		3,000
RCS2-RA13R	1t type	4,900
	2t type	9,800

3) The control method is the same as that in [1] Positioning. However, the processing of positioning complete signal PEND is different from that in [1] Positioning.
PEND is output when the shaft is stopped by pressing (pressing complete). If the work is not subject to pressing (miss-pressing), the actuator moves by the value set in “Positioning width” to stop but PEND is not turned ON. The current position No. PE* is turned ON at the completion of pressing and even in miss-pressing.



Caution

- The speed during pressing operation is set in Parameter No.34. Refer to [10.3 List of Specifications of Connectable Actuators] for the pressing operation speed.
  Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the pressing speed, the pressing is performed at the setup speed.
- The approach start position of pressing should be located at or before the pressing start position (coordinate 100mm or less in the above example) If not, the moving direction varies depending on the start position to be dangerous.
  For example, pressing at coordinate larger than the pressing end position (larger than 150mm) changes to the tension operation from the current position to the pressing end position. Note that the pressing operation after positioning to the position of 100mm does not take place.



CSTR: Start position

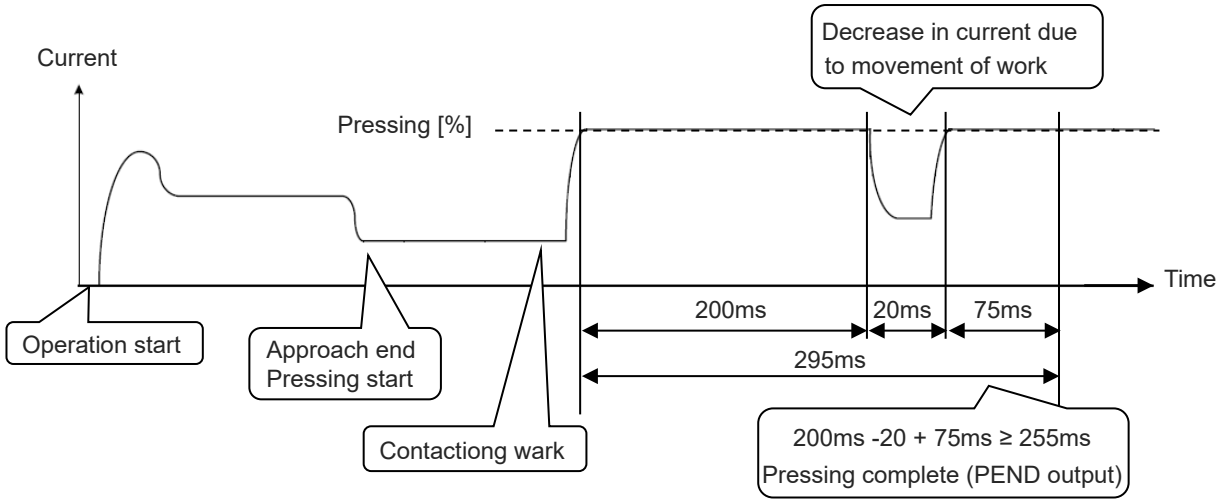
- The work is pressed after the pressing is completed. The work may moves backward or forward. If the actuator is moved backward before the approach position, alarm 0DC “Pressing motion range over error” occurs to stop the actuator. In movement of the work in the pressing direction, PEND is turned OFF if the load current becomes lower than the current limit (pressing [%]). Miss-pressing occurs when the actuator moves by the pressing moving distance set in “Positioning width”. Current Position No. PE* keeps turned on until the next movement command is made even if the work piece gets moved and pushed backward or goes further forward once it is turned on at the pressing operation complete.
- If the index mode is selected for the rotary actuator of multi-rotation specification, pressing operation cannot be set. The positioning complete signal PEND is turned ON when the actuator reaches the positioning width.
- If the actuator is RCS2-RA13R (Ultra-High Thrust Type), there is a limit in the duration and duty ratio of continuous pressing. Use of the product above this limit may cause a failure occurred due to the motor heat generation.
  Refer to [10.3.2 Push Force and Current Limit Value].

Judging completion of pressing operation

(1) For Standard (PIO Pattern 4)

The operation monitors the torque (current limit value) in percent [%] in “Pressing” of the position table and turns pressing complete signal PEND ON when the load current satisfies the condition shown below during pressing. PEND is turned ON at satisfaction of the condition if the work is not stopped.

Accumulated time in which current reaches pressing value [%] ≥ 255 ms (Parameter No.6)

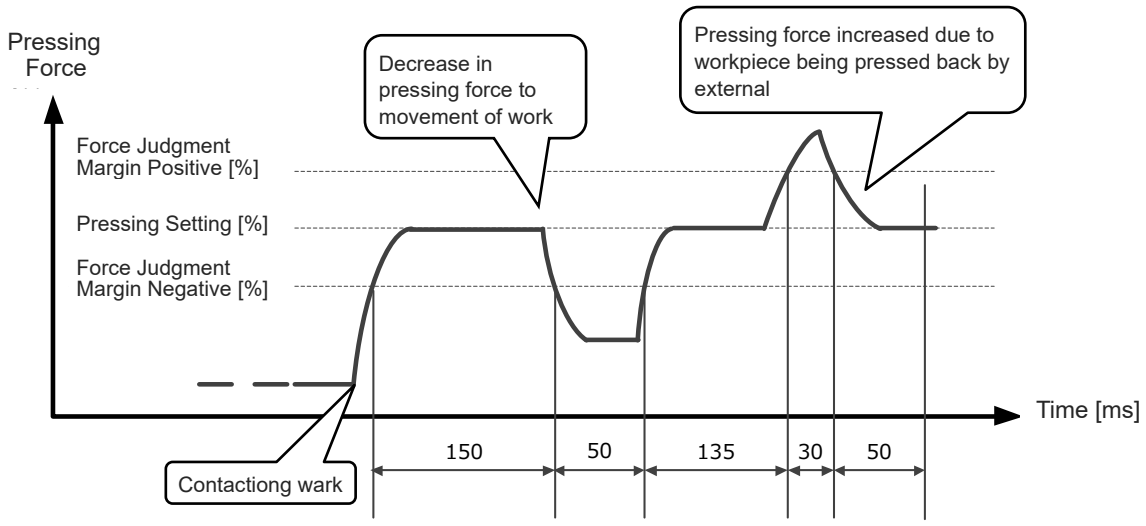


(2) For Force Sensor Used Pressing (PIO Pattern 7)

The pressing complete signal PEND should turn on when the pressing force during a pressing operation satisfies the following condition against the percent [%] of the pressing force set in "Pressing" in the position table. PEND should turn on once the condition is satisfied even if the actuator is not stopped.

● Condition

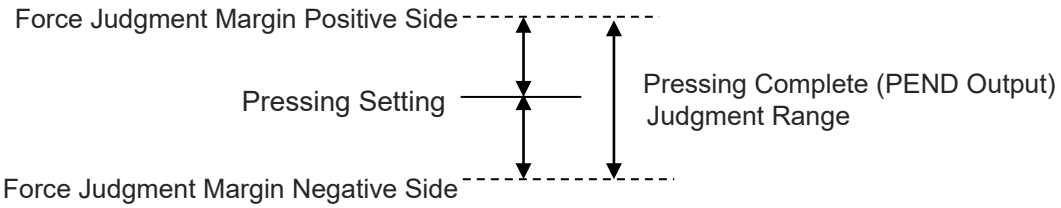
Accumulated Time of Pressing Force being in Range of Force Judgment Margin Positive and Negative ≥ 255ms (Parameter No.6)



The force judgment margin is be expressed with the base that the pressing current limit when the force sensor is used is considered as 100% (Note 1). It should be set in Parameters No. 95 and No. 96. The judgment range of the pressing complete should be determined as follows.

Pressing Setting [%] + Force Judgment Margin Positive [%] to

Pressing Setting [%] - Force Judgment Margin Negative [%]



Note 1 A value that the pressing current limit when the force sensor is used is considered as 100% (force judgment margin)

Actuator	Base thrust in pressing operation using force sensor [N]
RCS3-RA6R	600
RCS3-RA7R	857
RCS3-RA8R	1,429
RCS3-RA10R	3,000

Actuator	Base thrust in pressing operation using force sensor [N]
RCS2-RA13R	
1t type	4,900
2t type	9,800

[Example of Setting]

When setting is established to 150% for the pressing setting, 4% for the force judgment margin positive side and 4% for the force judgment margin negative side in 1t type:

Setup pressing value: 4,900 [N] × 150% = 7,350 [N]

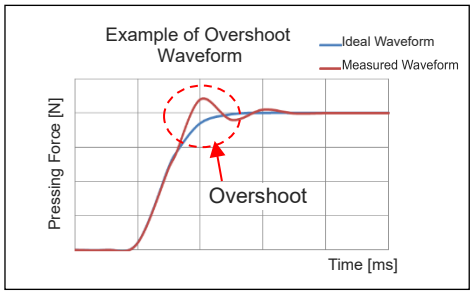
Force judgment margin + and - : 4,900 [N] × 4% = 196 [N].

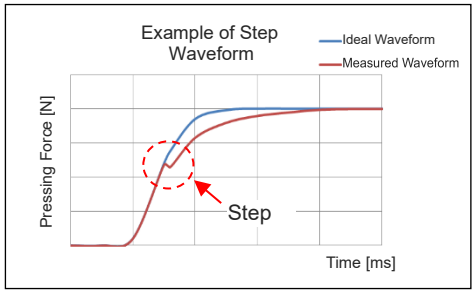
Hence, the pressing complete judging range is between 7,154 to 7,546 [N].

[How to Adjust]

It is recommended to check the status of the pressing force in pressing operation. Connect to the IA-OS and read the current load with the servo monitor features (Note 2) to check.

If there is an overshoot or a step to the pressing force (current load) as shown in the figures below, the phenomenon can be eased by adjusting in the following process.





Step (1)

Try to reduce the pressing velocity when overshooting is being occurred.

The pressing velocity is determined for each actuator to be used, which should be set in Parameter No. 34.

Set the speed lower than the pressing velocity being set temporarily to the position data (Note3), and perform the pressing operation. In case the condition improves with this, revise the value in the position data to the one in Parameter No. 34 and set the velocity in the position data back to the value before.

Note 2 Refer to help window in the IA-OS.

Note 3 If the velocity set in the position data is lower than setting in the pressing velocity in Parameter No. 34, the pressing velocity should follow the setting in the position data.

Step (2)

In case there is no improvement with Step (1), change the force sensor used pressing gain (Parameter No. 94). When it is necessary to change, refer to the table below and increase or decrease gradually (Note 4).

Note 4 Try the following values (for each model) for the setting in Parameter No. 94, 174, 175 and 176.

⊙ RA13R, RA10R (Default factory setting = 1,500)

Responsiveness of Control System (High ← Responsiveness → Low)	Stiffness Subject to Pressing Hard ← Stiffness → Soft					
	1,050	2,100	4,200	8,400	16,800	33,600
	1,200	2,400	4,800	9,600	19,200	38,400
	1,350	2,700	5,400	10,800	21,600	43,200
	1,500	3,000	6,000	12,000	24,000	48,000
	1,650	3,300	6,600	13,200	26,400	52,800
	1,800	3,600	7,200	14,400	28,800	57,600
	1,950	3,900	7,800	15,600	31,200	62,400

⊙ RA8R (Default factory setting = 3,000)

Responsiveness of Control System (High ← Responsiveness → Low)	Stiffness Subject to Pressing Hard ← Stiffness → Soft					
	2,100	4,200	8,400	16,800	33,600	67,200
	2,400	4,800	9,600	19,200	38,400	76,800
	2,700	5,400	10,800	21,600	43,200	86,400
	3,000	6,000	12,000	24,000	48,000	96,000
	3,300	6,600	13,200	26,400	52,800	105,600
	3,600	7,200	14,400	28,800	57,600	115,200
	3,900	7,800	15,600	31,200	62,400	124,800

⊙ RA7R (Default factory setting = 5,000)

Responsiveness of Control System (High ← Responsiveness → Low)	Stiffness Subject to Pressing: Hard ← Stiffness → Soft					
	3,500	7,000	14,000	28,000	56,000	112,000
	4,000	8,000	16,000	32,000	64,000	128,000
	4,500	9,000	18,000	36,000	72,000	144,000
	5,000	10,000	20,000	40,000	80,000	160,000
	5,500	11,000	22,000	44,000	88,000	176,000
	6,000	12,000	24,000	48,000	96,000	192,000
	6,500	13,000	26,000	52,000	104,000	208,000

⊙ RA6R (Default factory setting = 10,000)

Responsiveness of Control System (High ← Responsiveness → Low)	Stiffness Subject to Pressing: Hard ← Stiffness → Soft					
	7,000	14,000	28,000	56,000	112,000	224,000
	8,000	16,000	32,000	64,000	128,000	256,000
	9,000	18,000	36,000	72,000	144,000	288,000
	10,000	20,000	40,000	80,000	160,000	320,000
	11,000	22,000	44,000	88,000	176,000	352,000
	12,000	24,000	48,000	96,000	192,000	384,000
	13,000	26,000	52,000	104,000	208,000	416,000

Step (3)

In case there is no improvement with Step (2), change the force control transition threshold (Parameter No. 173).

When making a change, increase/decrease gradually (Note 5) referring to the conditions below.

Condition 1: When overshooting is being occurred to the pressing force, set down the force control transit threshold.

Condition 2: When with a workpiece with a low rigidity, set up the force control transit threshold.

Note 5 Increase / decrease the setting in Parameter No. 173 with pitch from 5 to 10 (in range from 10 to 90).

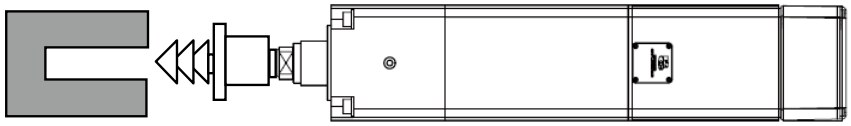
Torque Level Detection in Pressing Operation

It is a signal dedicated for the actuator with loadcell.
Use this as a reference output for other actuators.

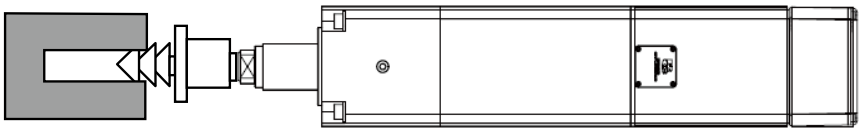
This is a function to detect whether the specified load is applied to the actuator when having a press-fitting process with the pressing operation. The load current is to be checked I the current limitation and the feedback value is to be checked in the pressing using the force sensor, and TRQS Signal should be output after the load output judgment time has passed. If there is no resistance in press-fitting, the specified load would not be applied, thus it is defined as the normal pressing is not conducted and an alarm can be issued from PLC.

■ Image diagram

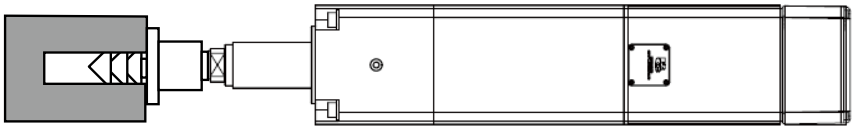
Start Operation



Torque Level Detected while Pressing in



Pressing Complete



■ Control method

It monitors the pressing force set in [%] in “Threshold” in the position data, and turns the torque level status signal TRQS ON when the pressing force reaches the following condition. At the same time, load output judge signal LOAD also turns ON if it is in the position zone.

● Condition

(Accumulated Time of Pressing Force Reaching Threshold Setting)
– (Accumulated Time of Pressing Force Staying at Threshold Setting or Below)
≥ 255ms (Parameter No.50)

(1) Torque Level Detection During Pressing Operation (Enabled with PIO Pattern 7)

■ Control method

The pressing force set in percent [%] in "Threshold" of the position data should be monitored, and when the pressing force satisfies the following condition, the torque level status signal TRQS gets turned on. At that time, if the actuator is in the position zone, the load output judgment signal LOAD also turns on.

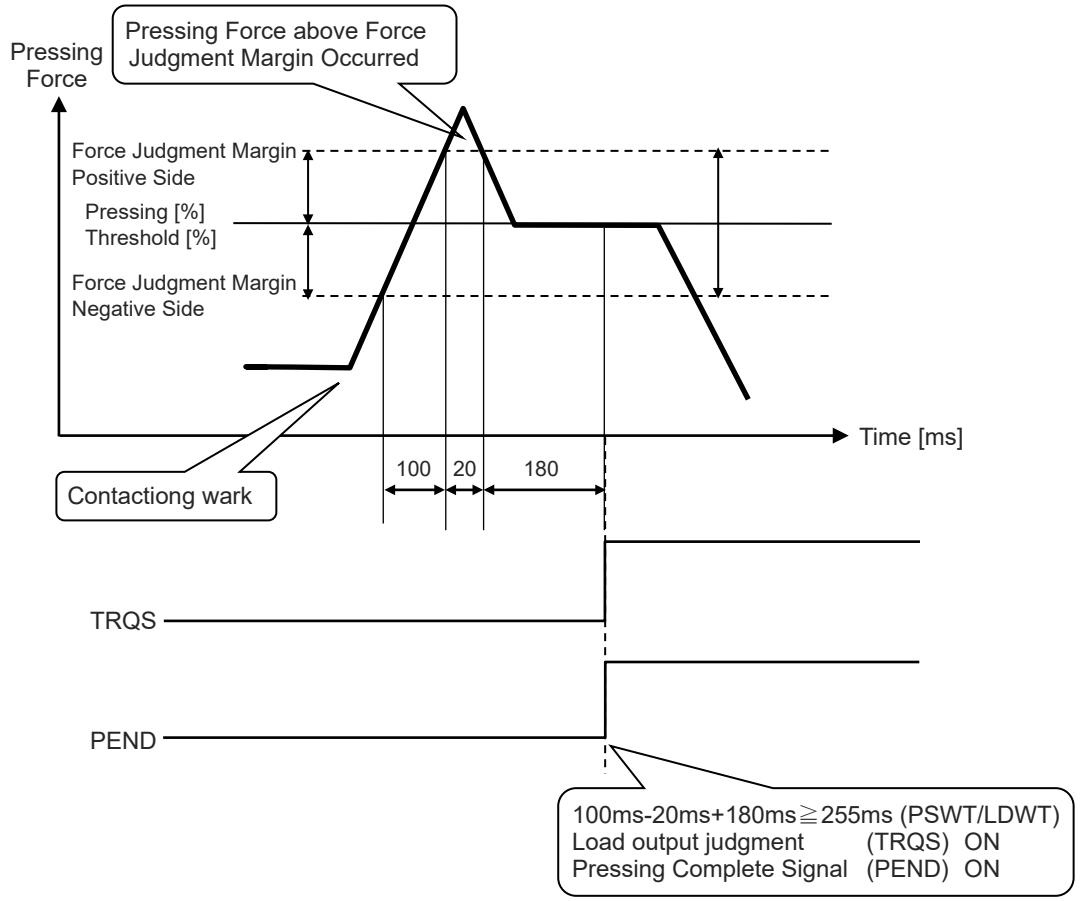
This signal turns off when a movement command to another position gets issued or the servo gets turned off. This signal keeps on until the next movement command is issued once it gets turned on.

● Condition

(Accumulated Time of Pressing Force being in Range of Force Judgment Margin)

– (Accumulated Time of Pressing Force outside the Force Judgment Margin)

≥ 255ms (Parameter No.50)



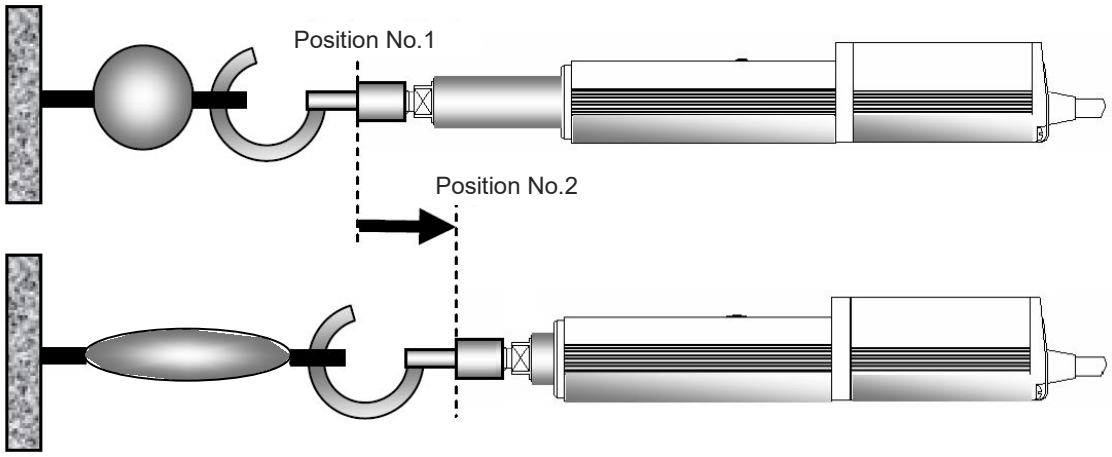
[4] Tension Operation

Do not perform tension operation by pressing operation using force sensor.

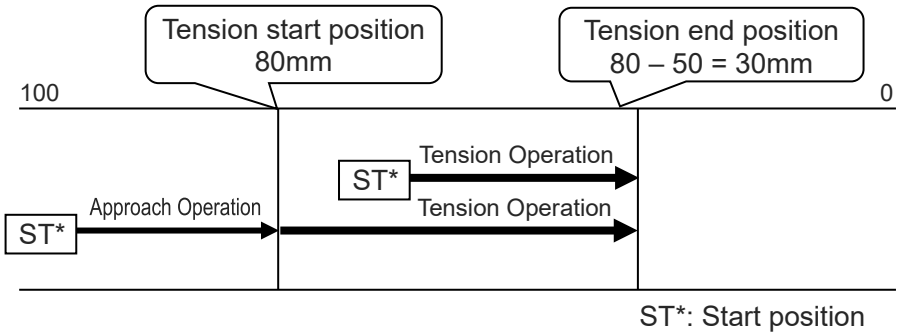
The pressing operation using force sensor requires an actuator applicable for dedicated loadcell and pressing operation using force sensor.

The tension operation by using an actuation equipped with loadcell causes the loadcell to be damaged.

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0							
1	100.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	100.00	250.00	0.20	0.20	Pressing (50%)	-50.00	0:Absolute position
3							



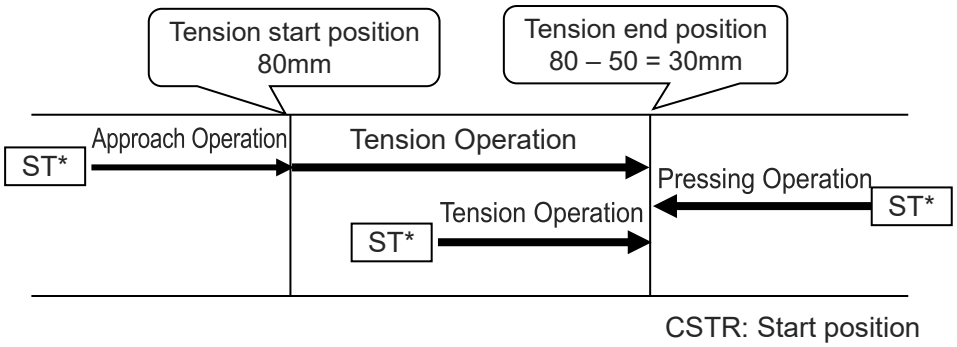
■ Control method

The method of controlling the tension operation is the same as that described in [3] Pressing operation. The control method is explained below by using the sample position table shown above.

1) Position No.2 indicates the settings of tension operation. The settings of “Position” and “Positioning width” show the tension start position and the tension quantity, respectively. Attach – (negative sign) to the tension quantity. Specify the upper limit of the torque required for tension in percent [%] (limited current value) in “Pressing”. The speed, acceleration, and deceleration are the conditions of positioning to the coordinate value (80mm) set in “Position”.
2) Position No.1 indicates the tension start preparation position. Specify a value larger than the coordinate value at which the tension provided by position No.2 ends (80 – 50 = 30mm) in “Position”.
3) First define the positioning in position No.1. Next, the operation in position No.2 moves the actuator to the position of 80mm at the setting speed and rating torque and change to the tension operation. The actuator moves by 50mm in the negative direction in the tension operation. The upper limit of the tensile force is the torque set in [%].
4) In the similar way as pressing, the positioning complete signal is output when the shaft is stopped by tension (pressing complete). If the actuator cannot be stopped during movement within the setting positioning width (miss-pressing), it moves by the setting distance to stop but PEND is not turned ON. The current position No. PE* is turned ON at the completion of pressing and even in miss-pressing.

Caution

- The speed during tension operation is set in Parameter No.34. Refer to [10.3 List of Specifications of Connectable Actuators] for the pressing speed. The speed for pulling operation is same as that for pressing operation.
  Do not set any value larger than the value in the list. If the speed set in the position table is equal to or less than the tension speed, the tension operation is performed at the setup speed.
- The tension ready position should be the tension start position or forward. If not, the moving direction varies depending on the start position to be dangerous.
  The tension operation from a coordinate (less than 30mm = 80 – 50 in the above example) located before the end position (30mm or less) changes to the pressing operation from the current position to the tension end position. Note that the tension operation after positioning to the position of 80mm does not take place.

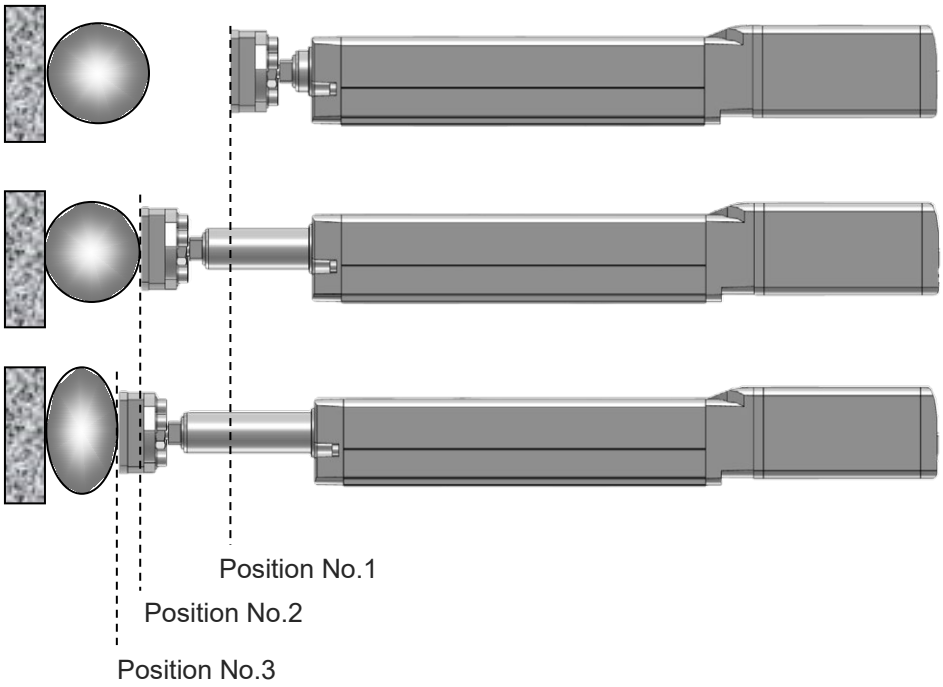


- The work is pulled also after completion of the tension. The work is drawn back or pulled further if the work is moved. When the work is drawn back before the approach position, alarm 0DC “pressing operation range error” occurs to stop the work. When the work is moved in the tension direction and the load current becomes less than the current limit value (pressing in [%]), PEND is turned OFF. Naturally, the work reaches the tension moving distance set in “Positioning width” to cause miss-pressing.
- Do not make control of changing to tension operation on the way of normal positioning (before PEND turning ON). Depending on the position at which start signal is turned ON, the tension operation is performed improperly. Then the PLC cannot manage the position of the actuator.
- Pulling operation cannot be performed with the rotary actuator.

(1) If the actuator is RCS2-RA13R (Ultra-High Thrust Type), there is a limit in the continuous tension time (= continuous pressing time) and the duty of continuous pressing. Use of the product above this limit may cause a failure occurred due to the motor heat generation. Refer to [10.3.2 Push Force and Current Limit Value].

[5] Multi-step Pressing

■ Image diagram



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method	
0								
1	0.00	250.00	0.30	0.30	Positioning	0.10	0:Absolute position	
2	50.00	250.00	0.30	0.30	Pressing (30%)	20.00	0:Absolute position	
3	50.00	250.00	0.30	0.30	Pressing (50%)	20.00	0:Absolute position	
4								

■ Control method

After pressing, the pressing pressure can only be changed in the pressing state.

The method of controlling multi-step pressing is the same as that described in [3] Pressing operation.

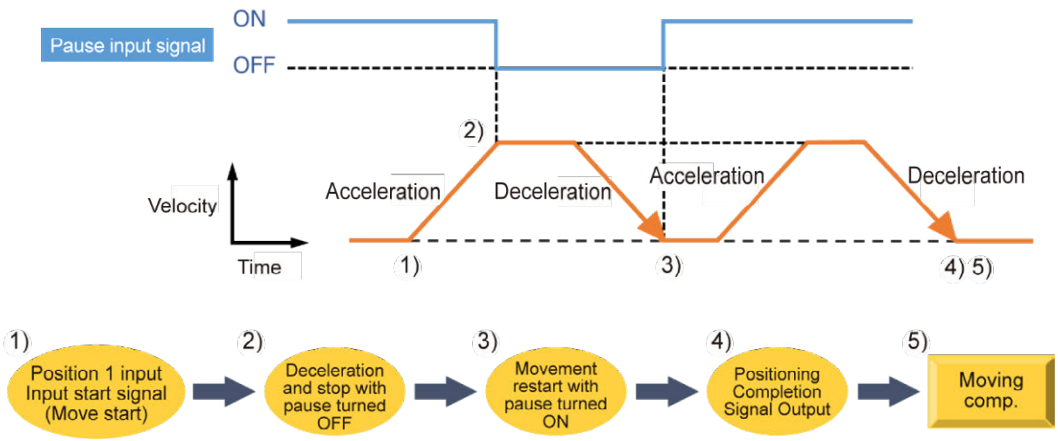
1) Set the weak pressing (30%) in position No.2 and perform the pressing operation.
2) If pressing complete signal PEND is turned ON, start the pressing operation with pressing pressure (50%) greater than the first pressure set in position No.3.
   In this particular operation, turn ON ST3 after completion of ST2, and turn OFF ST2 when PEND is turned OFF. In usual case, do not turn ON two or more ST* signals simultaneously.
   The position data in position No.3 should be the same as that in position No.2 except the setting in “Pressing”.
3) To add a pressing step with another pressing pressure, add a sequence consisting of a position number and a pressing operation.

[6] Pause and Operation Interruption (ST*, *STP, RES, PE*, PEND)

In this mode, the following two methods are possible for pause.

1. Use of pause signal *STP
   Turning reset signal RES ON during the pause allows the remaining moving distance to be cancelled to interrupt the operation.
2. Use of start signal ST*
   This method is valid when Parameter No.27 “Movement command type” is set to “0” (factory setting). The actuator can only be moved while the ST* signal is set to ON and stopped if ST* is turned OFF. Since setting the ST* signal to OFF is assumed as interrupt of operation, the remaining moving distance may not be cancelled.

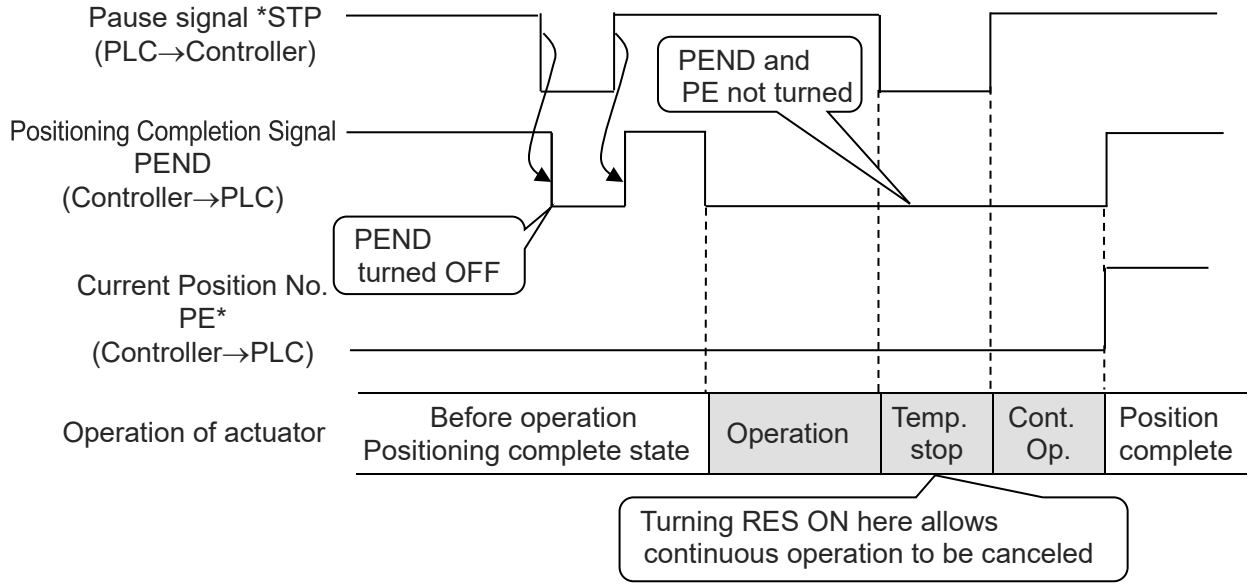
(1) Use of pause signal *STP



■ Control method

The pause signal is an input signal always set to ON. So, it is normally used to remain ON. Use this function for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If pause signal *STP is turned OFF during operation of the actuator, the actuator is decelerated to a stop. The deceleration is defined by the value set in the position table.
2) During pause, current position No. PE* and positioning complete signal PEND are not turned ON.
3) If pause signal *STP is returned to ON, the actuator continues the remaining movement. The acceleration is the value set in the position table.
4) Turning reset signal RES ON during pause (*STP during OFF) allows the remaining movement to be cancelled to interrupt the operation.



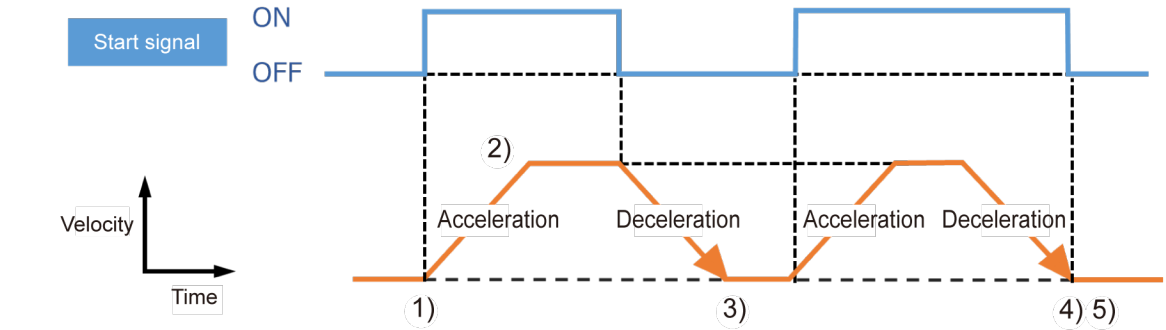
Caution

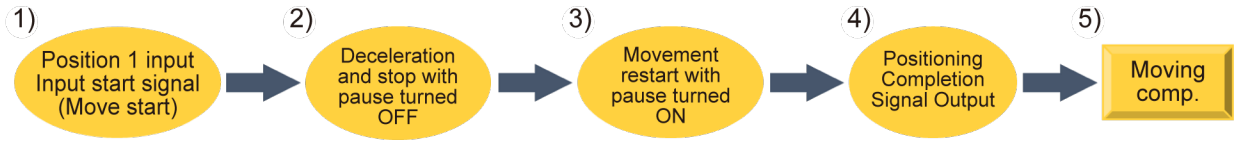
- At occurrence of an alarm in the release level (Note 1), RES can reset the alarm. Cancel the remaining moving distance after confirmation that alarm signal *ALM (being ON in normal state and OFF at occurrence of an alarm) is set to ON.

  Note 1 Refer to [8.3.2 Alarm Details] for details of alarms.

- Turning *STP OFF with the actuator being in the positioning complete state causes PEND to be turned OFF. Note that this situation may not occur when a sequence program is created.

(2) Use of start signal ST*

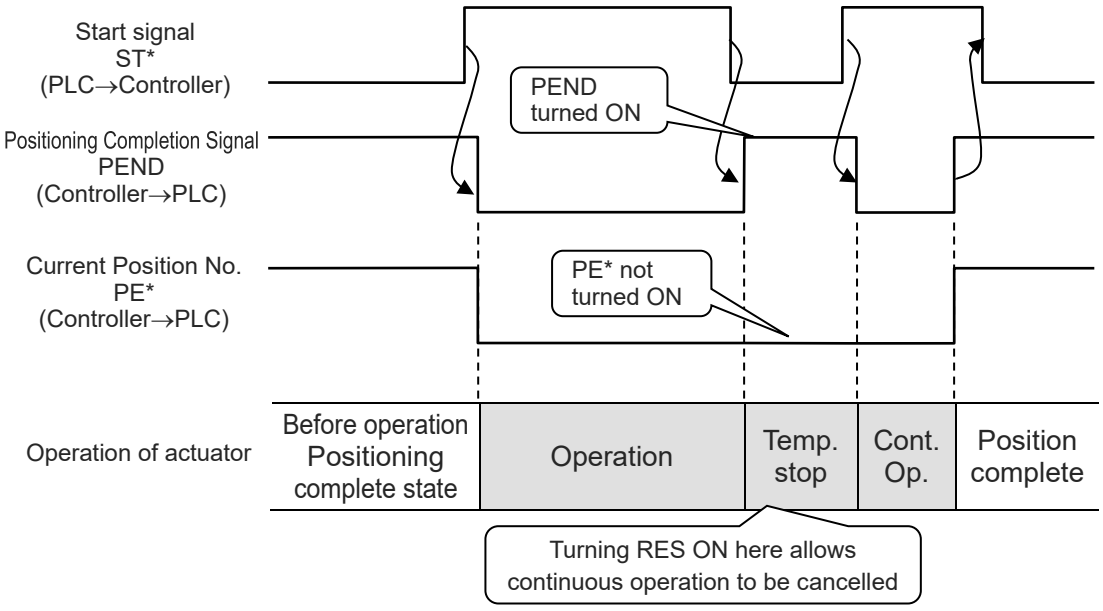




■ Control method

If start signal ST* is turned OFF during movement, the actuator can be paused.
Use the control method for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If the ST* signal is turned OFF during movement, the actuator is paused. The deceleration is the value set in the position table.
2) Turning the ST* signal OFF causes the positioning to be interrupted and deemed complete signal PEND to be turned ON.
3) If the ST* signal is turned ON again, the remaining movement is continued.
The acceleration is the value set in the position table.



4.2.6 Position Direct Command (PIO Pattern 5) Operation

The start signal is provided for every position number. Only turning ON the relevant input signal according to the table shown below allows the operation based on the data in the target position number to be performed. The operation mode is called the solenoid valve mode because solenoid valves can directly drive air cylinders.
Also, in the positioning width set in each position, LS* Signal should turn ON once the actuator gets in the range of the setting values just like it does in detection with a sensor in operation to any position number or even when the servo gets turned OFF and the actuator is moved manually by hand.

Positioning and speed change during operation are possible. Their control methods are the same as those of other patterns.

Caution

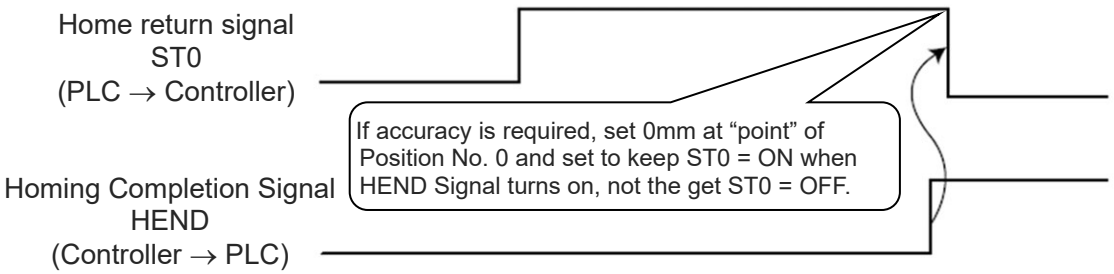
- This pattern does not allow pressing and pitch feed.

[1] Home Return (ST0, HEND)

The I/O of PIO varies as shown in the table below depending on the position number before home return.

Position No.	Input	Output
0	ST0	LS0
1	ST1 ⇒ JOG+	LS1 ⇒ TRQS
2	ST2 ⇒ Invalid	LS2 ⇒ Invalid

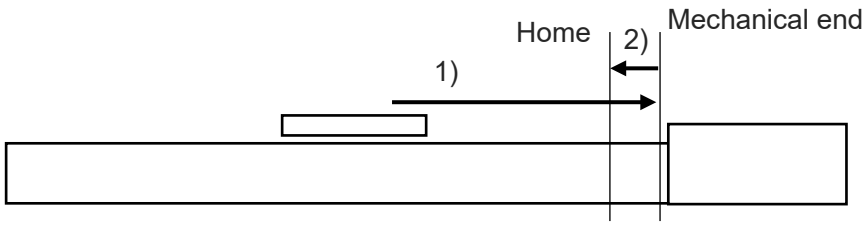
Before home return, the start signal ST1 works as JOG+. By using this function, move the actuator to a position at which home return can be done safely. The speed of ST1 is the home return speed.
After the home return is fully prepared, turn the ST0 signal ON to start the home return. At the completion of the home return, home return complete signal HEND is turned ON. Turn the ST0 signal OFF if HEND is turned ON. HEND remains ON unless the home is lose due to occurrence.
If a certain home positioning precision is required, Set “Position” of position No.0 to 0 mm and the ST0 signal is not changed by the HEND signal to remain ON. After the home return is completed, positioning is provided for position No.0. Refer to [4.2.6 [3] Positioning].



Warning

- Use this pattern with Parameter No.27 “Movement command type” set to “0” (factory setting). When Parameter No.27 is set to “1”, the home return is started as soon as the ST0 signal is turned ON and the operation cannot be stopped even if ST0 is turned OFF.
- If “Position” in position No.0 is set to other than 0mm, the operation is continued without change to provide positioning after home return.

[Home Return Operation of Slider Type/Rod Type Actuator]

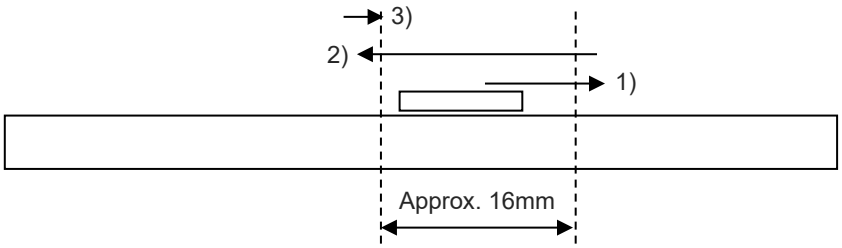


1) With the ST0 signal being ON, the actuator moves toward the mechanical end at the home return speed.
   The moving speed is 20mm/s for most actuators but less than 20mm/s for some actuators.
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 “Home return offset level”. (Note 1)
   Note 1 It moves for the offset amount after the encoder Z-phase is detected.

Caution

- In the home reverse specification, the actuator moves in the reverse direction.
- Make sure to refer to [6.1.2 [18]] when a change to Parameter No.22 “Home return offset level” is required.

[Actuator Movement for Spurious Absolute Type]

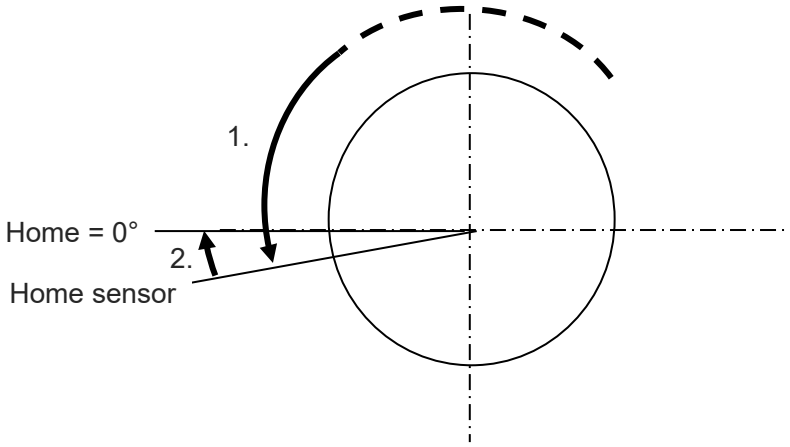


1) If ST0 Signal gets turned ON when the home-return operation is incomplete, the actuator moves towards the home-return direction set in Parameter No.5 at 5mm/s (fixed).
2) Move back and forth in approximately 16mm (to confirm the current position).
3) Home return operation is completed after the actuator confirms the current position.

Caution

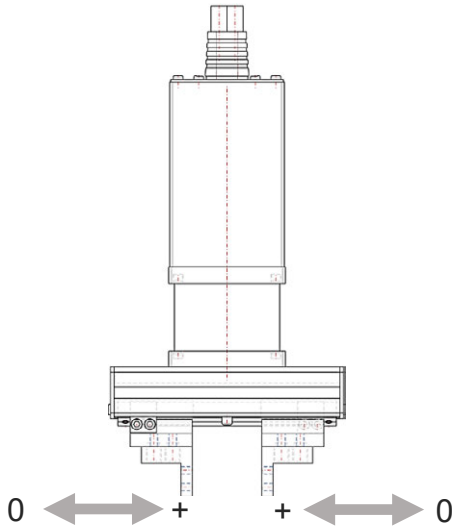
- For Spurious Absolute Type, make sure to have a home return operation after the power is turned ON.
- Alarm 0B3 “Spurious Absolute Error” would be generated if there was an interrupting object in the procedure of 2) and the current position could not be detected properly.

[Home Return Operation of Rotary Actuator]



1. When the HOME signal is turned on, the actuator rotates in CCW (counterclockwise) direction from the view point of the load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)
2. At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The rotation angle is the value set by Parameter No.22 “Home return offset level” after the detection of phase Z.

[Home Return Operation of Actuator of Gripper Type]



(Note) Finger attachment is not included in the actuator package. Please prepare separately.

1) If the ST0 signal is turned ON, the actuator moves toward the mechanical end (to end side) at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 “Home return offset level”.

Caution

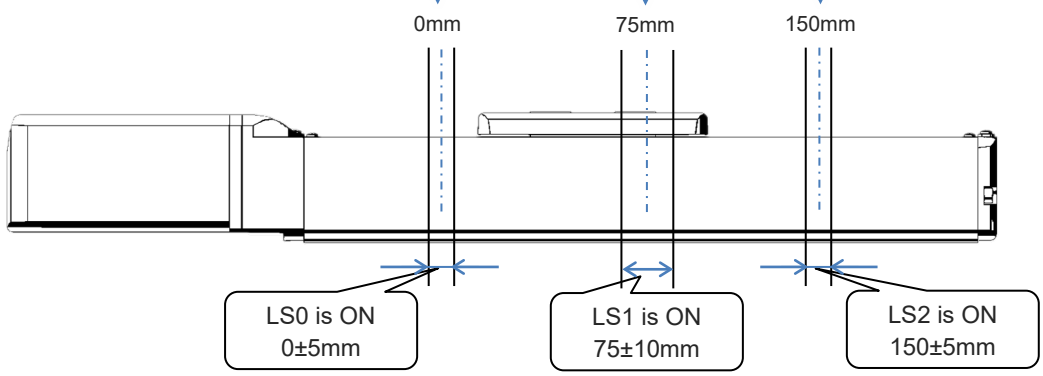
- Make sure to refer to [6.1.2 [18]] when a change to Parameter No.22 “Home return offset level” is required.

[2] Features of LS Signals (LS0 to 2)

The LS* signals are not complete signals for positioning commands such as those for other PIO patterns. Just as it does in detection with a sensor, the applicable LS* Signal should turn ON once the actuator gets in the range of the setting values regardless of the indicated position number.

(Example) The figure below shows the position table and the position at which each of the LS signals is turned ON. It turns ON if the actuator is in the set range even when in operation to another position number or with the actuator in a manual operation by hand while the servo is OFF.

No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Load current threshold[%]	Positioning band[mm] / pressing band[mm]	Zone + side [mm]	Zone - side [mm]	Acceleration/deceleration mode
0	0.00	100.00	0.30	0.30	Positioning	-	5.00	0.00	0.00	0:Trapezoid
1	75.00	100.00	0.30	0.30	Positioning	0	10.00	0.00	0.00	0:Trapezoid
2	150.00	100.00	0.30	0.30	Positioning	0	5.00	0.00	0.00	0:Trapezoid



Caution

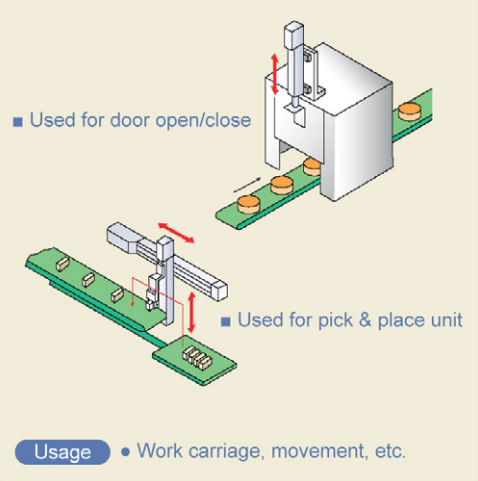
- LS* signal would not be output if the positioning width is set less than the minimum resolution.

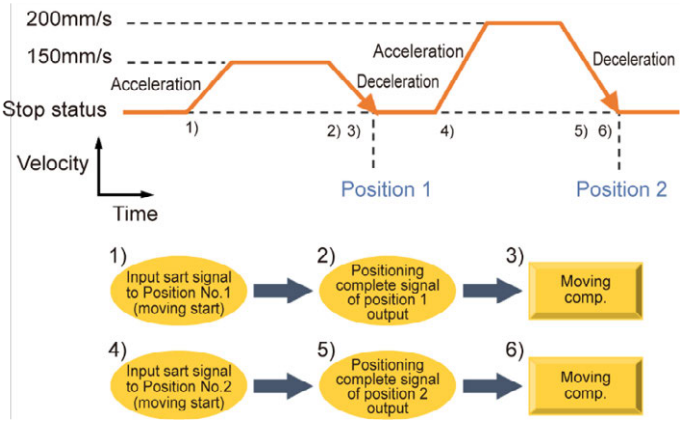
[3] Positioning [Basic] (ST0 to ST2, LS0 to LS2)

Position No.	Input	Output
0	ST0	LS0
1	ST1	LS1
2	ST2	LS2

(Note) Pressing and pitch feed are unavailable.

■ Sample use





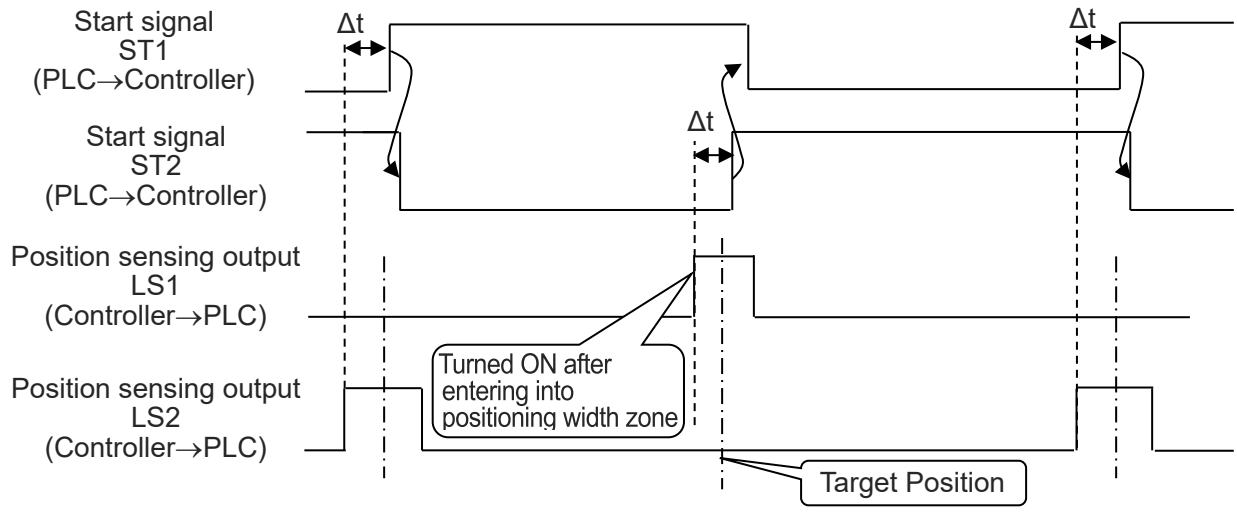
No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[N])	Positioning band[mm] / pressing band[mm]	Positioning method
0	0.000	150.00	0.30	0.30	Positioning	0.100	0:Absolute position
1	70.000	150.00	0.30	0.30	Positioning	0.100	0:Absolute position
2	150.000	200.00	0.30	0.30	Positioning	0.100	0:Absolute position

■ Control method

1) When start signal ST* is turned ON, the actuator starts acceleration based on the data in the specified position table for positioning to the target position. Turning the ST* signal OFF on the way causes the actuator to be decelerated and stopped. So, make the ST* signal remain ON until the actuator reaches the target position.
2) At the completion of positioning, position detection output LS* of the specified position is turned ON.
3) Position detection output LS* is turned ON if the remaining moving distance enters into the positioning width. LS* is set to ON if the current position is located within the positioning width zone or OFF if the current position is located out of the positioning width zone (the same situation occurs in the servo OFF status).
4) Leave the ST* signal to be ON until the actuator is moved to another position and turn off it at the next ST* signal. If the ST* signal is turned OFF at the LS* signal, the actuator is decelerated to a stop in the positioning width and thus the actuator may not reach the target position. In continuous operation, turn on the next ST* signal by setting the positioning width within the required precision range or setting the period taken from detection of the LS* signal to reaching the target position.

(Example) Repetition of ST1 → ST2 → ST1 →• • •

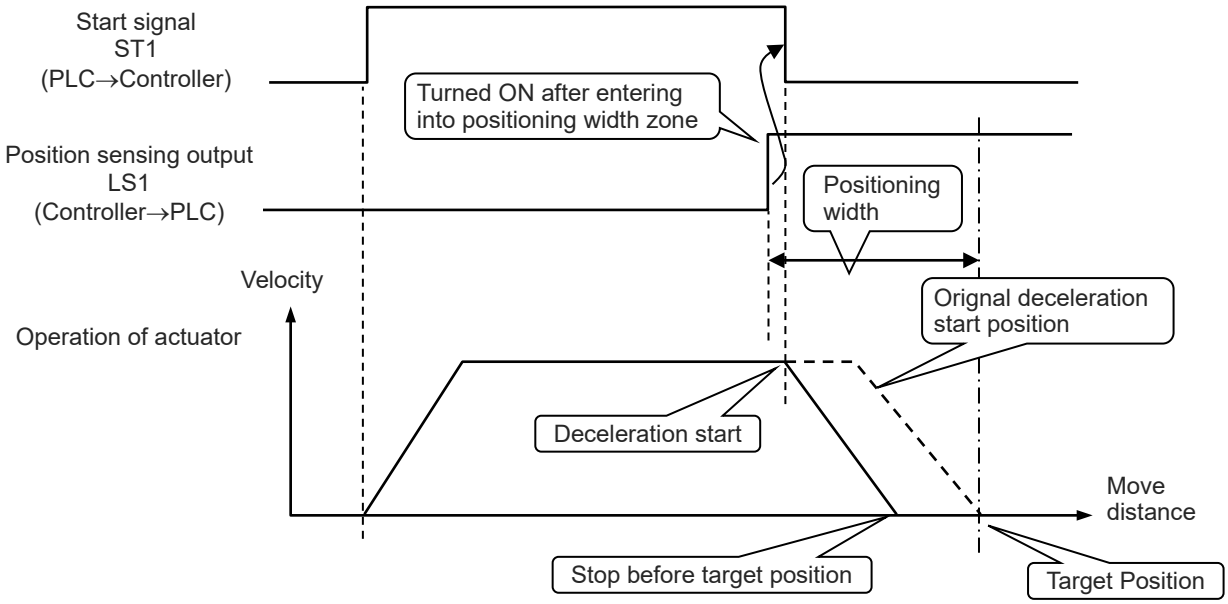
Insert timer Δt if necessary.



Δt : Time required to certainly reach the target position after the position sensing output LS1 or 2 is turned on.

[Example of stop position when the ST* signal is turned OFF by the LS* signal]

If the positioning width is set at a position before the original deceleration start position, the actuator cannot reach the target position.



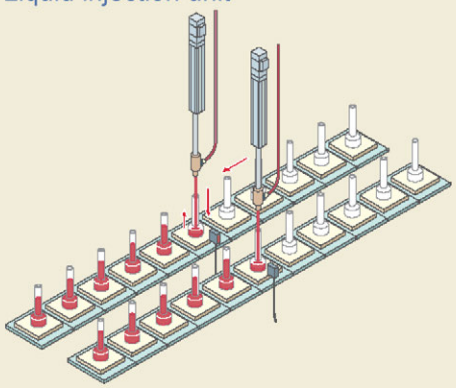
Caution

- If the ST* signal for the position is turned ON after the completion of positioning, the LS* signal remains ON.
- Both the LS* and PEND signals are set to ON in the positioning width zone. Accordingly, they may be turned ON under operation of the actuator if a large positioning width is set.
- Interlock should be taken so that two or more ST* signals are set to ON simultaneously. If two or more ST* signals are input simultaneously, they will be executed according to the following priorities: ST0 → ST1 → ST2.
- LS* signal would not be output if the positioning width is set less than the minimum resolution.

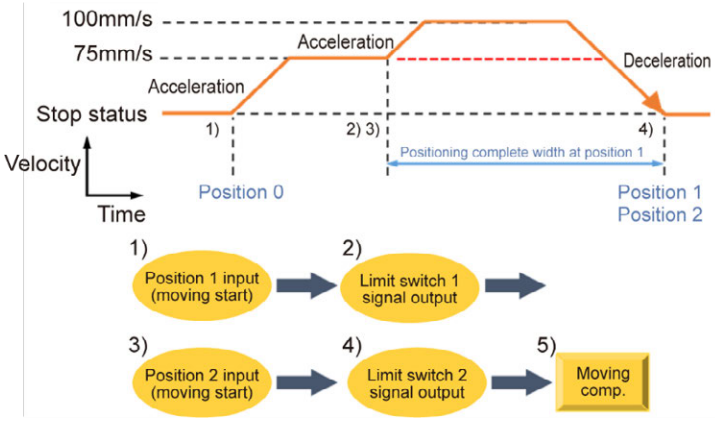
[4] Speed Change During the Movement

■ Sample use

■ Liquid injection unit



The unit inserts nozzles into containers, injects liquid, and moves the nozzles upward so that they may not be contact with the liquid surfaces.



No.	Position [mm]	Velocity [mm/s]	Acceleration [G]	Deceleration [G]	Operation type (Pressing force[%])	Positioning band[mm] / pressing band[mm]	Positioning method
0	0.00	150.00	0.30	0.30	Positioning	0.10	0:Absolute position
1	70.00	150.00	0.30	0.30	Positioning	0.10	0:Absolute position
2	150.00	200.00	0.30	0.30	Positioning	0.10	0:Absolute position

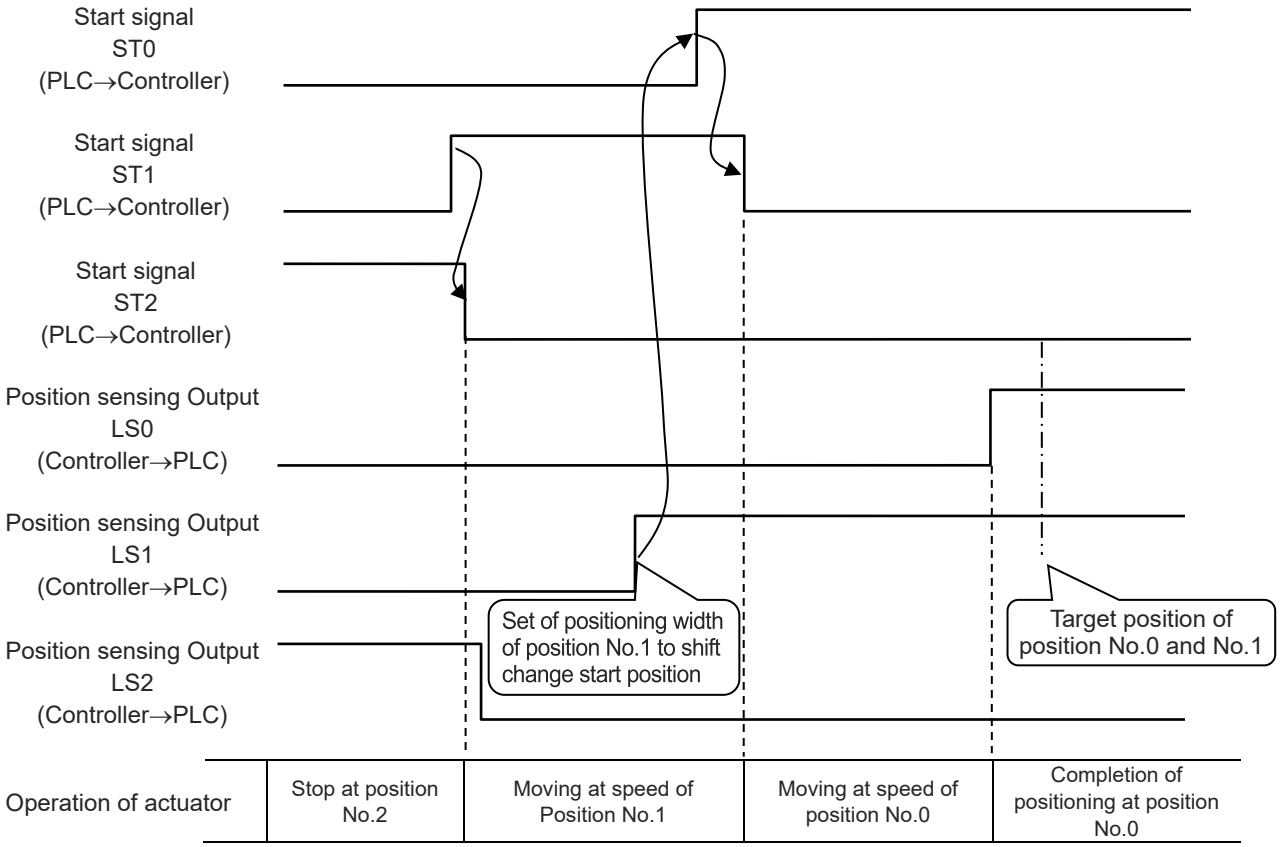
■ Control method

The speed of the actuator can be changed while it moves. The operation control method is the same as that in [3] Positioning. This pattern prioritizes the startup signal commanded first. Therefore, when another position number is started during an operation and the first startup signal is turned OFF, and then the new position number condition starts to operation at this moment (velocity change).

1) In this example, the speed is changed while the actuator moves from the position of 150mm to the position of 0mm. At first, set the positioning to the target position at the first speed in position No.1. In the positioning width, set the distance from the speed change position to the target position. The value is set to 100mm in the example. Thus, for position No.1, position sensing signal LS1 is turned ON at the position before the target position by 100mm.
2) Set the positioning to the target position at the second speed in position No.0.
3) And then, after starting up Position No. 0 (ST0 Signal) with the position detection output signal LS1 in Position No. 1 by starting up Position No. 1 (ST1 Signal), turn OFF ST1 Signal. The operation switches over to Position No. 0 as soon as ST1 Signal is turned OFF.

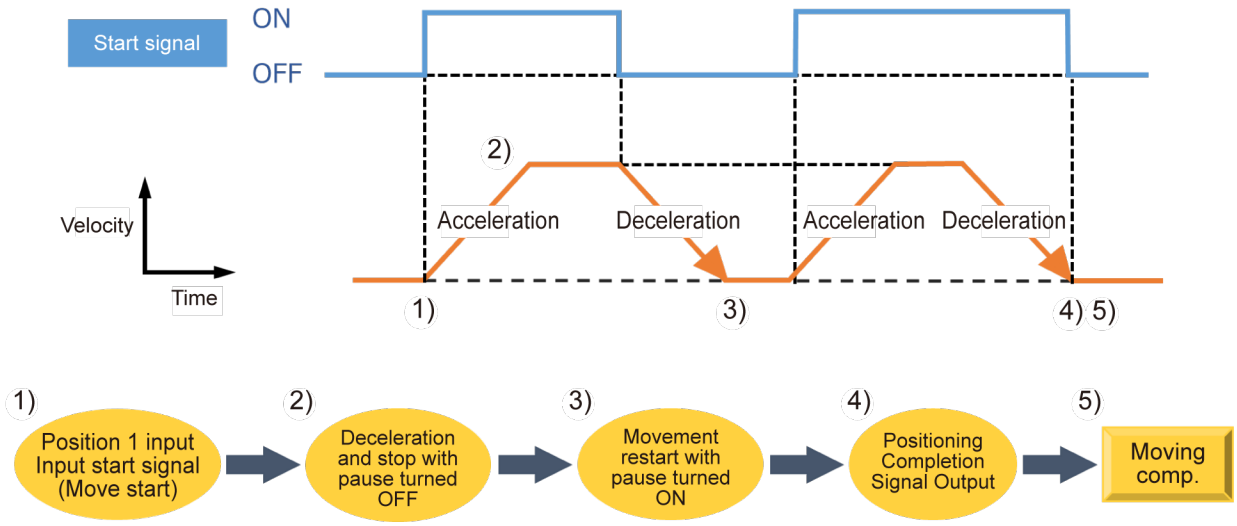
In this example, the target positions No.0 and 1 are equal with each other. They may not be the same. However, setting the target positions to be equal with each other allows the distance from the speed change position to the target position to be known easily. Depending on the timing when the actuator accepts the input signal, the speed change may be delayed a little. Changing the positioning width can adjust the timing.

The timing chart shown below indicates that the actuator changes its speed while it moves to position No.1 after the completion of positioning at position No.2 and moves to position No.0.



[5] Pause and Operation Interruption (ST*, RES, LS*)

Turning start signal ST* OFF allows the actuator to be paused while it is moved. To restart it, turn the same ST* signal ON.

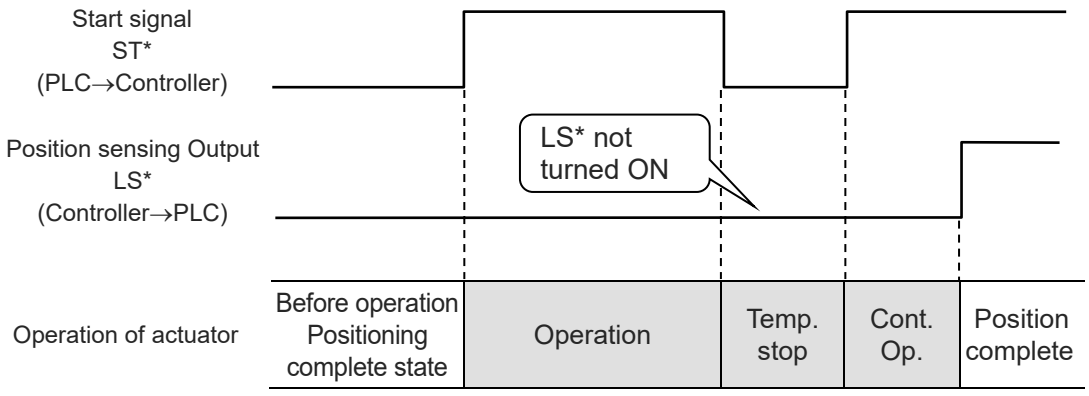


■ Control method

If start signal ST* is turned OFF during movement, the actuator can be paused.

Use the control method for interlock in case where an object is invaded into the moving direction of the actuator being moved.

1) If the ST* signal is turned OFF during movement, the actuator is decelerated to a stop. The deceleration is the value set in the position table.
2) If the ST* signal is turned ON again, the remaining movement is continued. The acceleration is the value set in the position table.



4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)

With the performance of a loadcell for the feedback control of the pressing force during the pressing operation in operation of the force sensor used pressing (PIO Patterns 6 and 7), pressing operation with high precision should be available.
Before having the pressing operation of the force sensor used pressing, have the settings and process described below established.

Caution

- For the force sensor used pressing, there is a need of an actuator applicable for the dedicated loadcell and the force sensor used pressing.
- In the calibration, the value at the moment of the calibration should set as the datum point (0 [N]). Therefore, it is necessary for the loadcell to avoid any load other than a fixture attached on the loadcell during calibration.

[1] Initial Setting

The pressing operation with the force sensor used pressing requires a use of a loadcell. It is necessary to have the initial setting established before starting operation. Establish the settings as shown in the thick-bordered boxes to the four parameters shown in the table below.

No.	Name	Setting for Actuator Equipped with Loadcell	Setting When Using Force Sensor Used Pressing	Remark
92	Loadcell Use Select [0: Not to Use / 1: To Use]	1	1	0: Loadcell Not to be Used 1: Loadcell to be Used
93	Pressing Control Select [0: Current Limit / 1: Force Sensor]	1	1	0: Control with Current Limit (Standard) 1: Control with Force Sensor
117	Automatic Loadcell Calibration at Startup [0: Not to Perform / 1: To Perform]	1	1 (Recommended) or 0	0: Loadcell Calibration Not to be Performed Automatically 1: Loadcell Calibration to be Performed Automatically
118	Pressing Operation When Loadcell Calibration Incomplete [0: Prohibit / 1: Permit]	0	0	0: Pressing Operation When Calibration Incomplete to be Prohibited 1: Pressing Operation When Calibration Incomplete to be Permitted

(1) Setting for Pressing Control with Loadcell

1) Set “1: Loadcell to be Used” in Parameter No. 92 “Use of loadcell”. Set “0” and the loadcell would not activate.
2) Set “1: Control with Force Sensor” in Parameter No. 93 “Selection of pressing control”. Set “0” and the pressing operation with the current limit should activate.

[Settings in Parameter No. 92 and 93 and Pressing Control]

Parameter No.92 Use of loadcell	Parameter No.93 Selection of pressing control	Pressing Control
1: Loadcell to be Used	1: Control with Force Sensor	Pressing Operation with Force Sensor Used Pressing
	0: Control with Current Limit	Pressing Operation with Current Limit
0: Loadcell Not to be Used	1: Control with Force Sensor	Alarm 0A1 Parameter Error
	0: Control with Current Limit	Pressing Operation with Current Limit

(2) Setup for Execution of Loadcell Calibration

The setting whether to perform calibration and also for a protection from pressing operation started without calibration being performed.

1) In order to have accurate measurement, it is necessary to have calibration of the loadcell in an appropriate period of frequency. Set “1” in Parameter No. 117 “Automatic loadcell calibration at start” in order to have calibration automatically and “0” to have it by manual. During the automatic operation, calibration should be performed once at startup when the power to the controller is turned on or when the software reset is conducted from a teaching tool such as an IA-OS. At this moment, the duration for calibration should take 10ms. There is no need of an actuator operation.
2) In Parameter No. 118 “Pressing operation without completion of loadcell calibration”, a protection setting not to have a pressing operation without having calibration performed should be established. Set “0” in it. Executing a pressing operation without having a calibration after the power gets turned on should cause Alarm 0E1 “Loadcell calibration error”. Set “1” in it and a pressing operation without a calibration performed should be available.

[2] Loadcell Calibration (CLBR, CEND)

A loadcell should be set at the condition with no load as 0 (zero) [N] on delivery.
It is necessary to calibrate in such a case as when a pressing fixture such as a pusher is attached is to be set as the datum (0 (zero) [N]).
Have calibration performed in response to necessary situations such as just before starting operation when high precision is required in pressing operation or in cases of readjustment or inspection.
Calibration is available to be performed also on a teaching tool such as the IA-OS. Refer to [the help window in IA-OS] or [an instruction manual of each teaching tool] for details.

PIO signal	Input	Output
	CLBR	CEND

Caution

- A fixture to attach on the tip of a loadcell, consider it at the maximum payload weight or less of an actuator to use.

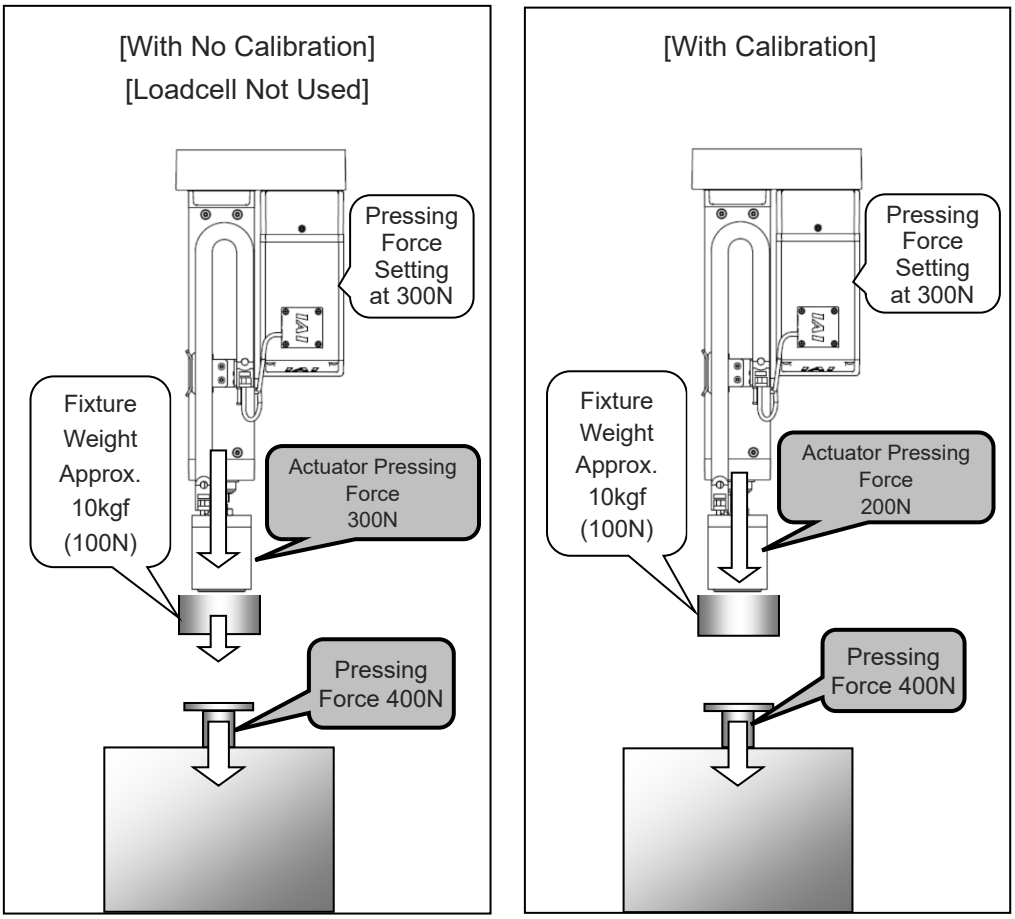
As the figure shows, when pressing at 300N with a pressing fixture with 100N (approx. 10kgf) is to be conducted, setting the current limit that makes the pressing force 300N to the position table should apply 400N of pressing force on a workpiece.

When calibration is not performed or a loadcell is not to be used, the pressing force set in the position table should be

300 [N] - 100 [N] = 200 [N]

from the graph shown in [10.3.2 Push Force and Current Limit Value].

By having calibration, a pressing force (current limit [%]) equivalent to the pressing force of 300N required to be set should be available for setting, which enables pressing operation with high precision. Even with a change in the weight of a pressing fixture, it is not necessary to tune the setting in the position table.

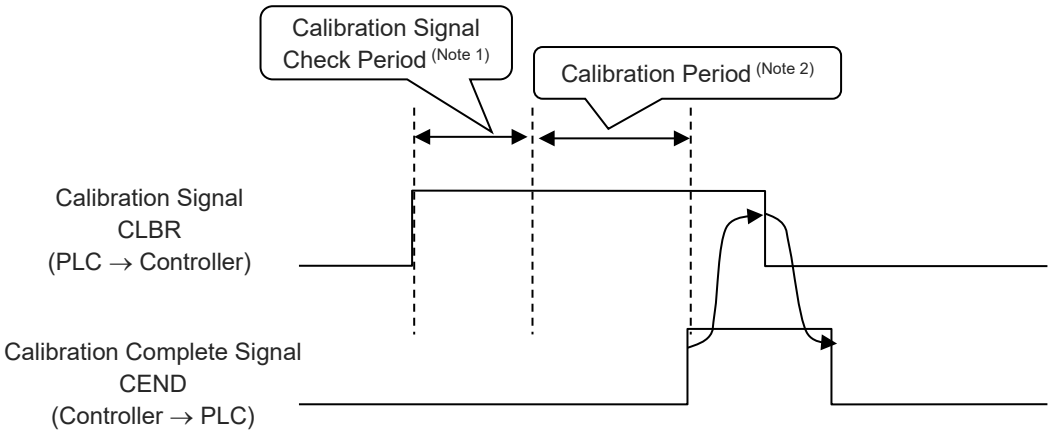


■ Procedures for Loadcell Calibration

1) Stop operation (calibration is not available during axis operation, pressing operation or in pause. If the calibration signal CLBR turns on, Alarm 0E1 “Loadcell calibration error” should occur).
2) Turn on the loadcell calibration signal CLBR.
3) Once the calibration complete signal CEND is turned on, turn CLBR Signal off.
   In case the calibration did not complete in normal condition, Alarm 0E1 “Loadcell calibration error” should occur. Please calibration again.

Caution

- While CLBR Signal is on, any normal operation command can be received.



Note 1 It is a period of time (20ms) for a check of the calibration signal. If CLBR turns off within this period of time, the signal should be ignored and calibration should not be performed.

Note 2 It depends on the setting in Parameter No. 119 “Loadcell calibration error” (setting on delivery at 10ms). If it is set to the automatic calibration at startup, the duration should be fixed at 10ms no matter of this parameter.
CLBR being turned off within this period of time before CEND turning on should generate Alarm 0E1 “Loadcell calibration error”.

Reference

- Loadcell is a measurement device with precision. It is necessary to have regular calibration (adjustment by supplier) in order to maintain precision.

4.3 Pulse Train Control Mode

This controller can switch over the mode between positioner mode and pulse train control mode with the teaching tool. In Pulse Train Control Mode, there are 2 types, incremental type for actuator (PIO Pattern 0) and (Battery-less) absolute type for actuator (PIO Pattern 1), the actuator can be operated by the pulse train output of the host controller (PLC) positioning control function. This operation mode is not to be changed after the system is complete to be established or during an operation.

Caution

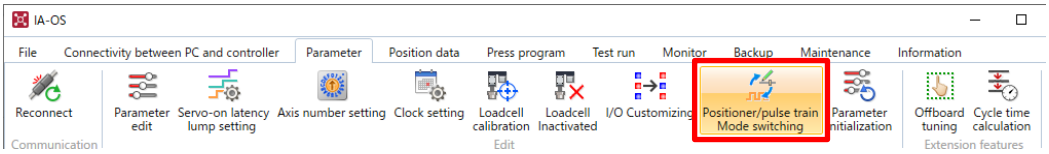
- In Pulse Train Control Mode, the operation is performed corresponding to the input pulse.

  Input Pulse Value → Moving distance
  Input pulse frequency → Velocity
  Change in Input Pulse Frequency → Velocity change and acceleration/deceleration

  Do not use the actuator above the specifications for the commands of the movement amount, acceleration and deceleration from the host controller (PLC). Doing so may cause an abnormal noise or malfunction.
- The pressing operation velocity should be set to the rated pressing velocity described in [10.3 List of Specifications of Connectable Actuators] when it is to conduct the pressing operation. Pressing with velocity not at the rated pressing velocity could end up with pressing force different from that shown in [10.3.2 Push Force and Current Limit Value]. Also, operation in velocity exceeding the rated pressing velocity could cause an error or malfunction.

■ Process to Switch Over to Pulse Train Control Mode

1) Connect controller and IA-OS.
2) Select “Positioner/pulse train Mode switching” in [Parameter] tab.



3) As a confirmation window shows up, select [OK].
4) Once switchover to the pulse train mode is complete, reboot the power supply.

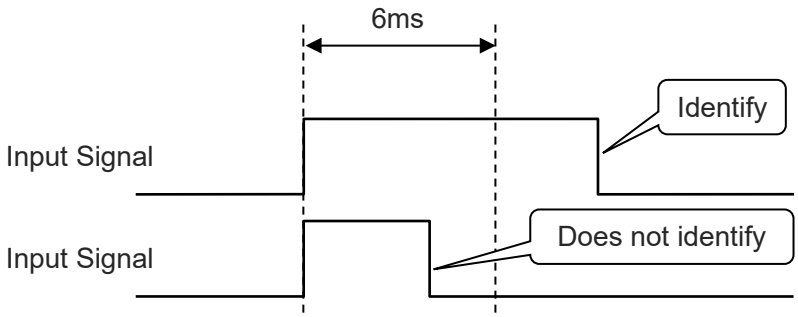
■ Main Functions

	Function Name	Detail
1	Dedicated home return signal	When this function (signal) is used, home return can be performed without using a complex sequence or an external sensor, etc.
2	Brake control function	Since the controller controls the brake, there is no need to program a separate sequence. The electromagnetic brake power is supplied to the controller from a power supply different from the main power. Accordingly, the electromagnetic brake can be released freely after the main power has been cut off.
3	Torque limiting function	The torque can be limited (a desired limit can be set by a parameter) using an external signal. When the torque reaches the specified level, a signal will be output. This function (signal) permits pressing and press fitting operations.
4	Position-command primary filter function	Soft start and stop can be achieved even when the actuator is operated in the command-pulse input mode where acceleration and deceleration are not considered.
5	Resistration of datum position PIO Pattern 1 : Dedicated for absolute type	Operation is available with the datum position set up at any position in the movable range of the actuator.

4.3.1 Input Signal Controls

The input signals in this controller are equipped with the input time constant for 6ms in order to prevent error operation caused by chattering or noise.
Therefore, it is necessary to input each input signal for 6ms or more (Note 1). A signal with 6ms or less will not be identified.

Note Command pulse train inputs (PP, /PP, NP, /NP) do not have input time constants. Also, it is necessary to input 16ms or more for CSTP Signal.



Caution

- To use I/O signals, be sure to tilt the operation mode setting switch on the front panel of the controller to the “AUTO” position.

4.3.2 Operation Ready and Auxiliary Signals

[1] System Ready (PWR)

PIO signal	Output
	*PWR

The signal is turned ON if the controller can be controlled after main power-on.
It is turned ON once the initialization terminates normally after main power-on and SCON2 can be controlled regardless of alarm and servo status.
Even in the alarm condition, when the SCON2 can control the system, it is turned “ON”.

[2] Emergency Stop Status (EMGS)

PIO signal	Output
	*EMGS

1) The emergency stop status EMGS is turned on when in a non-emergency-stop state and turned off when EMG terminal on [3.1.3 [2] Actuator Emergency Stop Circuit] is 0V (emergency stop condition or disconnected).
2) It turns back ON once the emergency stop condition is released and EMG terminal goes up to 24V DC. Have an appropriate safety treatment such as interlock with this signal for the host controller (PLC, etc.).

Caution

- It is not an emergency stop output due to an alarm generation of the controller.

[3] Operation Mode (RMOD, RMDS)

PIO signal	Input	Output
	RMOD	RMDS

Two operation modes are provided so that the operation by pulse train does not overlap with the operation by a teaching tool such as IA-OS through SIO communication.
The mode change is done by the operation mode setting switch on the front panel of the controller.

AUTO····· Operation by pulse train is valid.
MANU ····· Operation through SIO communication is valid.

However, the controller is subject to link connection (Note 1) to connect with a teaching tool such as the IA-OS by using a SIO converter, the controller may be far apart from the teaching tool. In such a case, the controller can be entered into the “MANU” mode by setting PIO signal RMOD to ON.

Because the RMDS signal is set to ON with the “MANU” mode selected by using the signal, make the operation sequence interlocked.
The table below lists the switches on the front panel, the modes selected by the RMOD signal and the corresponding output states of the RMDS signal.

Note 1 For the details of the link connection, refer to [10.1 Way to Set Multiple Controllers with 1 Teaching Tool].

○: Selected or set to ON ×: Unselected or set to OFF

Condition		Status							
Teaching tool such as IA-OS	PIO Start Disable (Note 2)	○	○	○	○	×	×	×	×
	PIO Start Enable (Note 2)	×	×	×	×	○	○	○	○
Switches on front panel	AUTO	○	○	×	×	○	○	×	×
	MANU	×	×	○	○	×	×	○	○
PIO Input	RMOD	×	○	×	○	×	○	×	○
PIO Output	RMDS	×	○	○	○	×	○	○	○
PIO valid: ◎, PIO invalid:●		◎	●	●	●	◎	◎	◎	◎

Operation by normal PIO

Note 2 “PIO start enable” or “PIO start disable” is the function to select a restriction while the teaching tool such as IA-OS is connected.

Caution

- Note that selecting “PIO start enable” by using the teaching tool such as IA-OS makes all PIO signals valid to enable operation however the states of the switches and RMOD signal input may be.
  In this status, the actuator may be started depending on the signals from PLC.
- If the teaching tool such as PC software is disconnected from the controller, “PIO start enable” or “PIO start disable” holds the state selected before. After teaching operation or debugging is terminated, select “PIO start enable” and disconnect the teaching tool such as PC software from the controller.

[4] Compulsory Stop (CSTP)

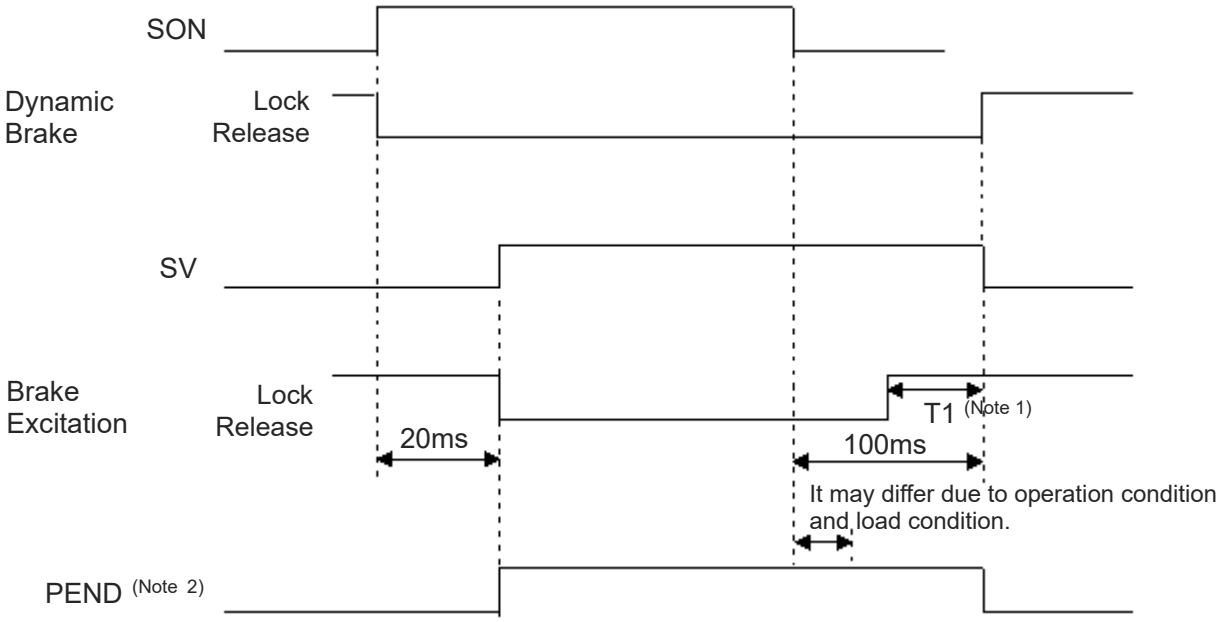
PIO signal	Input
	CSTP

This signal is used to forcibly stop the actuator.
Input the CSTP signal continuously for 16ms or longer. Once the CSTP signal is received, the actuator decelerates and stops with the maximum torque, and then turns the servo OFF. At this time, the deviation counter is cleared.

[5] Servo ON (SON, SV, PEND)

PIO signal	Input	Output	
	SON	SV	PEND

1. Servo ON signal SON is the input signal making the servo motor of the actuator operable.
2. If the servo-on is performed to enable operation, the SV output signal is turned ON. Concurrently positioning completion signal PEND is turned ON.
3. With the power being supplied, then controller cannot be operated while the SV signal remains OFF. If the SON signal is turned OFF under operation of the actuator, the actuator is decelerated and stopped with the maximam torque. After the stop, the servo OFF occurs to enter the motor into the free running state.
   The brake (option) is of release-in-excitation type. Therefore, making the excitation on will release the brake while making it off will lock the brake.



Note 1 T1 is 30ms before SV becames OFF.

Note 2 PEND would not turn ON in the pause condition.

● Servo OFF status

1. Once the actuator stops, no retaining torque will be supplied.
2. The pulse train input, HOME (home return signal), TL (torque-limiting selection signal) and CSTP (external forced stop signal) are all ignored.
3. Output signals SV (ready signal), HEND (home return complete signal) and TLR (torque limiting signal) are all cleared (turned OFF).
4. INP (Positioning Completion Signal)
   The INP (Positioning Completion Signal) is OFF when the servo is OFF.

[6] Home Return (HOME, HEND)

PIO signal	Input	Output
	HOME	HEND

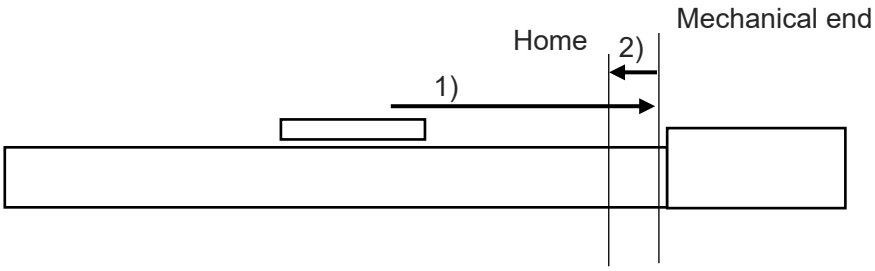
The HOME signal is intended for home return.
When the HOME signal is turned ON, the command will be processed at the leading edge (ON edge) of the signal and the actuator will perform home return operation.
Once the home return is completed, the home return completion signal HEND will turn ON.

Set the home (enter “0”) in the current value register of the host controller (PLC) using the current value preset function, etc., when the HOME signal turns ON.

Caution

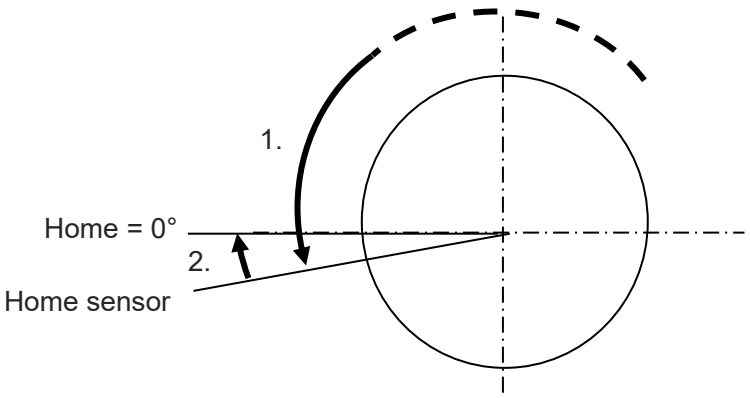
- The HOME signal is given priority over any pulse train command. Even when the actuator is moving with a pulse train command, it will start home return once the HOME signal is turned ON.
- The HOME signal is processed only at the leading edge (ON edge) of the signal.
- If the SON signal is turned OFF or an alarm is detected during home return, the home return operation will stop. If the servo is turned OFF, the home return command will be cancelled even when the HOME signal remains ON. To perform home return again, therefore, turn the HOME signal OFF and then turn it ON again.
- The actuator can be operated without using this function. If this function is not used, however, management of position data will solely be dependent on the host controller (monitoring soft stroke limit is effective in the home return complete status).
  Therefore, take the necessary measures to prevent an over-stroke, such as not sending pulse commands with travel distances exceeding the effective stroke or providing external limit switches for stroke end detection, etc., to forcibly stop the actuator.
- For PIO pattern 0, servo-off, switching operation mode setting switch from MANU to AUTO or deviation counter clearing causes HEND to be turned OFF. Perform home return again.

[Home Return Operation of Slider Type/Rod Type Actuator]



1) With the HOME signal being ON, the actuator moves toward the mechanical end at the home return speed. The moving speed is 20mm/s for most actuators but less than 20mm/s for some actuators.
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 “Home return offset level”.

[Operation of Rotary Actuator]

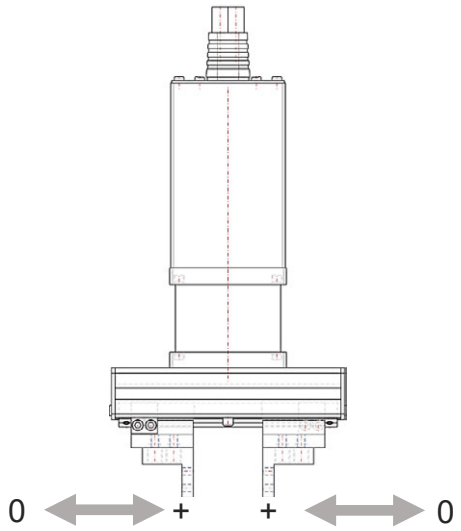


1. The actuator rotates in CCW (counterclockwise) direction from the view point of the load side. The velocity is either 20deg/s or 5deg/s. (It depends on the setting of each actuator.)
2. At the home sensor input, the actuator is turned in the reverse direction and stopped at the home position. The rotation angle is the value set by Parameter No.22 “Home return offset level” after the detection of phase Z.

Caution

- In the home reverse specification, the actuator moves in the reverse direction.
- Make sure to refer to [6.1.2 [18]] when a change to Parameter No.22 “Home return offset level” is required.

[Home Return Operation of Actuator of Gripper Type]



(Note) Finger attachment is not included in the actuator package.
Please prepare separately.

1) If the HOME signal is turned ON, the actuator moves toward the mechanical end (to end side) at the home return speed (20mm/s).
2) The actuator is turned at the mechanical end and stopped at the home position. The moving distance is the value set by Parameter No.22 “Home return offset level”.

Caution

- In the home reverse specification, the actuator moves in the reverse direction.
- Make sure to refer to [6.1.2 [18]] when a change to Parameter No.22 “Home return offset level” is required.

[7] Datum Position Move (RSTR, REND)

PIO signal	Input	Output
	RSTR	REND

RSTR Signal is a command signal to move (Note 1) to the datum position * set at any point.
This command is processed at the startup (ON-edge) and operation to the datum position is conducted.
Once the movement to the datum position is complete, output datum position movement complete REND signal turns ON (Note2).
For the absolute type actuators with no home-return operation conducted, have the position management of the host controller conducted at this point.

* Set it in Parameter No. 167 only for the absolute type actuators.

Note 1 Movement to the datum position is made under the following conditions.

Position	Pulse train datum position (Parameter No.167 setting position)
Velocity	PIO jog velocity (Parameter No.26 setting velocity)

Note 2 REND Signal turns off under the following conditions.

1. RSTR signal is ON
2. When servo is OFF
3. ON-edge is detected due to one of the signals of compulsory stop (CSTP), home return (HOME) or deviation counter clearing (DCLR).
4. Mode changed from AUTO to MANU

Caution

- Servo alarm will be generated when RSTR signal is turned ON while HEND is OFF.
- An alarm for DCLR Signal detection in the datum position movement command will be generated if turning RSTR Signal gets turned on while DCLR Signal is on.

[8] Zone Signal (ZONE1, ZONE2)

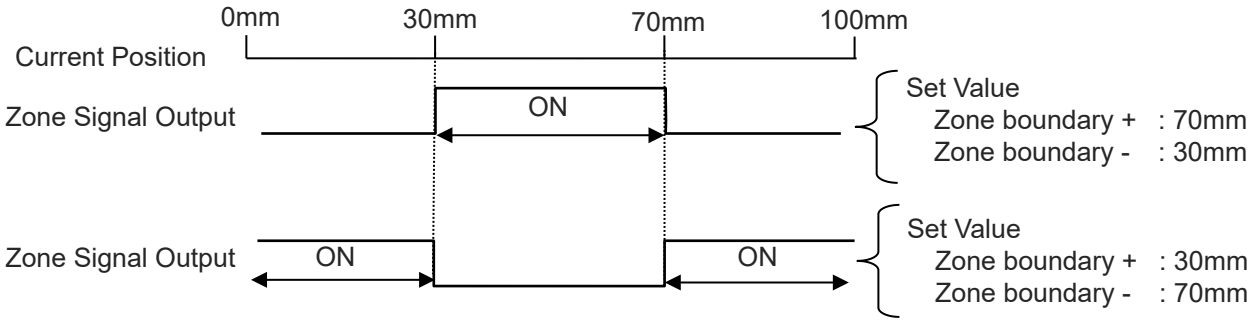
PIO signal	Output	
	ZONE1	ZONE2

Each of the signals turns ON when the current actuator position is inside the range specified by the relevant parameter.
Two zones, ZONE1 and ZONE2, can be set.
When the current position of the actuator is in ZONE1, it is turned ON if it is in the range of Parameter No.1 “Zone Boundary 1+” and Parameter No.2 “Zone Boundary 1-”, while is OFF when out of the range. These signals are always enabled in the home return complete state and not affected by the servo status or alarm status. (The ZONE2 signal turns ON/OFF according to Parameter No.23 “Zone Boundary 2+” and Parameter No.24 “Zone Boundary 2-”.

● Setting values and signal output range
The zone output range varies depending on the difference between the value set for the plus side of the zone boundary and that for the minus side.

1. Value set for plus side > value set for minus side: The output signal is set to ON in the range and OFF out of the range.
2. Value set for plus side < value set for minus side: The output signal is set to OFF in the range and ON out of the range.

[For Straight Slide Actuators]



Caution

- These signals become effective after the coordinate system is established following home return. Turning on the power is not enough to output these signals.
- These signals are not available if the home return function of the controller is not used.

[9] Alarm, Alarm Reset (*ALM, RES)

PIO signal	Input	Output
	RES	*ALM

1. Alarm signal *ALM is set to ON in the normal status but turned OFF at the occurrence of an alarm at a level equal to or higher than the operation release level.
2. Turning reset signal RES ON under occurrence of an alarm at the operation release level allows the alarm (Note 1) to be released. The action is taken at the rising edge (ON edge).
3. The alarm reset should be done after the cause of the alarm is confirmed and removed. If alarm reset and restart are repeated many times without removal of the cause, a severe failure such as motor burnout may occur.

Note 1 Check [8.3.2 Alarm Details] for details of alarms.

Caution

- An alarm of the cold start level cannot be cancelled by RES. Confirm the cause, remove it, and then reboot the unit.

[10] Binary Output of Alarm Data Output (*ALM, ALM1 to 8)

PIO signal	Output	
	*ALM	ALM1 to ALM8

1. If an alarm at a level equal to or higher than the operation release level occurs, completed position number output signals PM1 to PM8 output the alarm information in the binary code format.
2. The PLC can read the binary code of alarm signal *ALM as the strobe signal to check the alarm information.

Refer to [4.2.3 [7] Binary Output of Alarm Data Output] for details of the binary codes.

[11] Brake Release (BKRL)

PIO signal	Input
	BKRL

The brake can be released while BKRL signal is turned ON. For the actuator equipped with a brake, the brake can be controlled by turning the servo ON/OFF, however, a release of the brake may be necessary in the case of installing the unit to a system so the slider or rod can be moved by hand.
This operation can be performed not only by the brake release switch on the front panel of the controller, but also by the brake release signal BKRL.

Caution

- Take sufficient care to release the brake. Inappropriate brake release may cause people to be injured and/or the actuator, the work and/or the machine to be damaged.
- After the brake is released, always make the brake applied again. Any operation with the brake remaining released is extremely dangerous. The slider or rod may drop to cause people to be injured and/or the actuator, the work and/or the machine to be damaged.
- Make certain that this signal is turned OFF (brake is activated) when the power is supplied to the controller.
- It is prohibited to switch over between AUTO and MANU while this signal is ON (brake is released).

4.3.3 Pulse Train Input Operation

[1] Command Pulse Input (PP•/PP, NP•/NP)

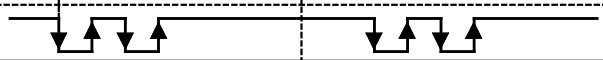
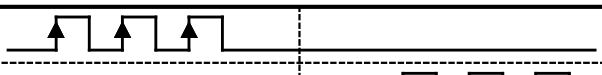
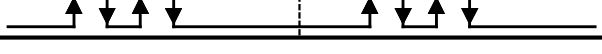
In the differential type, it is able to have 2.5Mpps of pulse train input at maximum. When the host controller possesses only the pulse output function of the open collector, it is able to input 200kpps pulse at maximum by connecting AK-04 (option).

6 types of command pulse train can be selected. Set the pulse train format in Parameter No.63 and active high/low in Parameter No.64. Refer to [4.3.4 Settings of Basic Parameters Required for Operation]

Caution

- The directions in which the actuator moves upon receiving forward / reverse pulses conform to the pulse count direction set in Parameter No.62.
- As for the forward/reverse directions, pay attention to the host controller setting or PP•/PP and NP•/NP connections.
- Set the actuator acceleration/deceleration on the host controller side.
- The actuator acceleration/deceleration should not exceed the rated acceleration/deceleration of the applicable actuator. Refer to [Instruction manual of each actuator] for the rated acceleration/deceleration of each actuator.

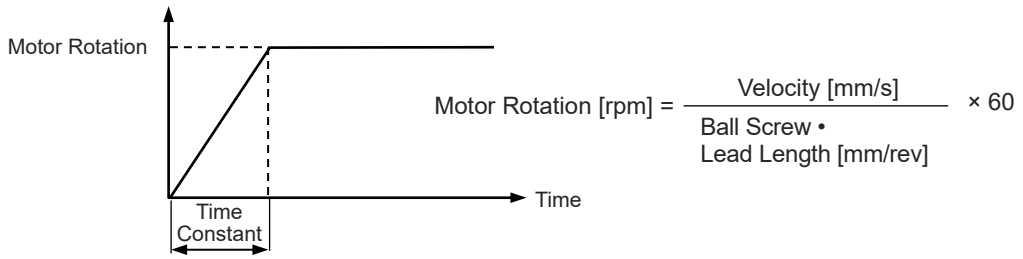
  * The rotating direction of the motor is defined so that the counterclockwise direction as viewed from the end of the load shaft represents the forward direction.

Command Pulse Train Mode		Input Terminal	In Normal Rotation	In Reverse Rotation
Negative Logic	Normal Rotation Pulse Train	PP•/PP		
	Reverse Rotation Pulse Train	NP•/NP		
	The normal rotation pulse train shows the motor rotation amount in normal direction, and reverse rotation pulse train shows the motor rotation amount in reverse direction.			
	Pulse Train	PP•/PP		
	Symbol	NP•/NP	Low	High
	The command pulse shows the motor rotation amount and the command symbol shows the rotation direction.			
	A/B Phase Pulse Train	PP•/PP		
		NP•/NP		
	The A/B Phase 4-fold Pulse with the phase difference of 90° shows the commands for the rotation amount and direction.			
Positive Logic	Normal Rotation Pulse Train	PP•/PP		
	Reverse Rotation Pulse Train	NP•/NP		
	Pulse Train	PP•/PP		
	Symbol	NP•/NP	High	Low
	A/B Phase Pulse Train	PP•/PP		
		NP•/NP		

Caution

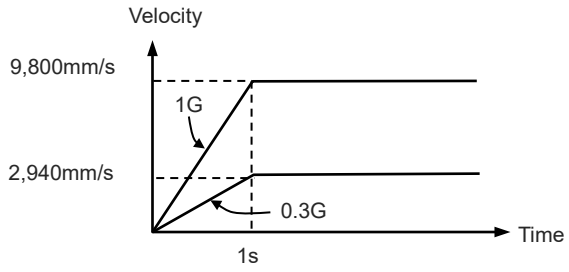
- Consider the electric gear ratio of the host side and that of the controller side via the following calculation.

[Reference] Acceleration/deceleration settings of general positioning device



1G = 9,800mm/s^2 : Acceleration capable to accelerate up to 9,800mm/s per second

0.3G : Acceleration capable to accelerate up to 9,800mm/s × 0.3 = 2,940mm/s per second



Caution

- Set the acceleration/deceleration speed not to exceed the maximum acceleration/deceleration speed of the actuator. Operation with speed exceeding the maximum acceleration/deceleration may cause malfunction.

[2] Position Complete (INP)

PIO signal	Output
	INP

This signal will turn ON when the remaining travel pulses (accumulated pulses) on the deviation counter enters the positioning width.
When the servo is ON, this signal turns ON when the accumulated pulses on the deviation counter are within the number of pulses set in Parameter No.10 “Default positioning width”.
This signal is OFF while the servo is OFF.

Caution

- This signal will turn ON when the servo turns ON (because positioning is executed at the current position where the servo is ON).
- This signal turns on in response to the deviation (servo lag pulses) and the variance to the command pulse in 1ms.
  Even if the deviation is within the positioning width, the signal would not turn on if there is a variance to the command pulse in 1ms.

[3] Torque Limit Select (TL, TLR)

PIO signal	Input	Output
	TL	TLR

This signal is used to limit the torque of the motor.
While the TL signal is ON, the actuator thrust (motor torque) can be limited to the torque set in Parameter No.57 “Torque limit”.
With the TL signal being ON, the torque limiting signal TLR will turn ON when the actuator thrust reaches the torque limit.
The TL signal is disabled during home return or forced stop.

Caution

- Do not turn the TL signal OFF while the TLR signal is ON.
- An excessive deviation (accumulated pulses) may generate while torque is being limited (TL signal is ON) (for example, the actuator may receive a load just like it receive a pressing force in pressing operation and therefore become no longer operable). If the TL signal is turned OFF in this condition, actuator control will start at the maximum torque the moment the signal changes, thus causing the actuator to move suddenly or run uncontrollably.
  After turning TLR signal ON (pressing comprete etc.), perform an operation in the reversed way to confirm TLR signal turns OFF. If the condition is difficult for the reversed movement, turn the servo OFF or clear the deviation counter (by turning DCLR ON).

[4] Deviation Counter Clear (DCLR)

PIO signal	Input
	DCLR

This is the signal to clear the deviation counter that stores the specified pulse until its process is completely finished (positioning is completed) once a command pulse is input.
It is used when the deviation is desired to be cleared after the pressing by TL signal is complete (TLR signal ON). Once the deviation is cleared, TLR signal turns OFF and the condition can be made as it is positioned at the point where the pressing is complete.

Caution

- DCLR signal is a signal that is processed at the startup (ON edge). Therefore, input the pulse train while DCLR signal is on and the actuator will operate. Turn this signal ON only when the deviation counter is to be cleared.

4.3.4 Settings of Basic Parameters Required for Operation

It is a mandatory parameter to perform an operation.
(The parameters listed in the table below may only be set if the actuator performs only positioning operation.)

Parameter No.	Name	Details
65	Electronic Gear Numerator	This parameter determines the unit travel distance of the actuator per command pulse train input 1 pulse.
66	Electronic Gear Denominator	
63	Command Pulse Mode	Specifies the command pulse train input mode.
64	Command Pulse Mode Input Polarity	Sets the type of active high/low of the specified pulse train

[1] Electronic Gear Setting

This parameter determines the unit travel distance of the actuator per command pulse train input 1 pulse.

User Parameter No.65/No.66 Electronic Gear Numerator/Denominator

No.	Name	Unit	Input Range	Default factory setting
65	Electronic Gear Numerator	–	1 to 99,999,999	1
66	Electronic Gear Denominator	–	1 to 99,999,999	1

Determine the movement amount and calculate value for the electronic gear setting by following the formula below:
Linear Axis Unit Travel Distance: Min. Travel Distance Unit (1, 0.1, 0.01mm etc.) /pulse
Rotary Axis Unit Travel Distance: Min. Travel Distance Unit (1, 0.1, 0.01deg. etc.) /pulse

■ Electronic Gear Formula:

In the case of Linear Axis

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{\text{No. of Encoder Pulses}^{(\text{Note 1})}\ [\text{pulse/rev}]}{\text{Actuator Lead Length [mm/rev]}} \times \text{Unit Travel Distance [mm/pulse]}$$

In the case of Rotary Axis

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{\text{No. of Encoder Pules [pulse/rev]}}{360\ [\text{deg/rev}] \times \text{Rotary Axis Reduction Ratio}} \times \text{Unit Travel Distance [deg/pulse]}$$

Note 1 Refer to [10.3 List of Specifications of Connectable Actuators] for the encoder pulse of each actuator.

■ Formula for velocity:

The velocity of the actuator can be figured out with the following formula.

Velocity = Unit Travel Distance × Input Pulse Frequency [Hz]

■ Examples of electronic gear calculations:

To set the unit travel distance to 0.01 (1/100) mm for an actuator a ball screw lead of 10mm, equipped with an encoder of 16384pulses/rev.

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{\text{No. of Encoder Pluses [pulse/rev]}}{\text{Ball Screw Lead Length [mm/rev]}} \times \text{Unit Travel Distance [mm/pulse]}$$

$$= \frac{16384}{10} \times \frac{1}{100} = \frac{2048}{125}$$

The electronic gear numerator is calculated as 2048, while the electronic gear denominator is calculated as 125. Based on these settings, the travel distance per command pulse train input pulse becomes 0.01mm.

Caution

- The fraction has to be completely reduced so both the electric gear numerator (CNUM) and electric gear denominator (CDEN) can be 99,999,999 or less and make them to be integral numbers. (Do not stop reducing the fraction on the way.)
- CNUM and CDEN on the line axis have to satisfy the following relative formulas.

- Use rotary actuators of multi-rotation specification within the range where the following formula is satisfied. Moreover, the maximum rotation angle is ±9999 [deg] (maximum software stroke limit).

$$\pm 2^{27} \geq \frac{\text{Maximum rotation angle [deg]}}{\text{Unit Travel Distance [deg/pulse]}}$$

Maximum rotation angle : Set the usage conditions (MAX.-9,999 to 9,999 [deg])
Unit Travel Distance : Travel distance per command pulse

- Do not set the minimum movement unit out of the encoder resolution ability. If this setting is conducted, the actuator would not start moving until enough command pulse is stored in the encoder resolution error.

$$\text{Encoder resolution for linear axis [mm/pulse]} = \frac{\text{Ball Screw Lead Length [mm/rev]}}{\text{No. of Encoder Pluses [pulse/rev]}}$$

$$\text{Encoder resolution for rotational axis [deg/pulse]} = \frac{360\ \text{[deg/rev]} \times \text{Rotary Axis Reduction Ratio}}{\text{No. of Encoder Pluses [pulse/rev]}}$$

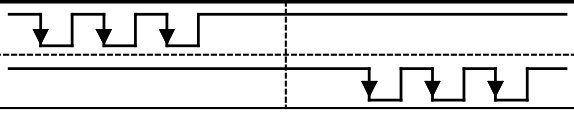
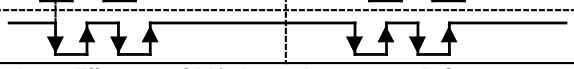
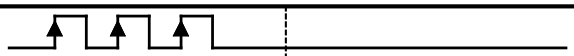
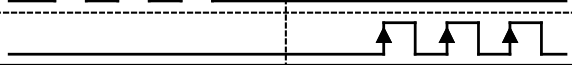
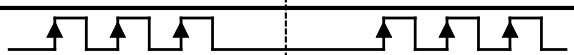
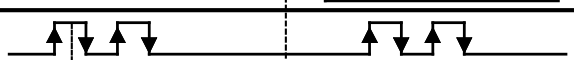
- Pay attention not to exceed the specification limit when setting the velocity, acceleration and deceleration.
- The pressing operation velocity should be set to the rated pressing velocity described in [10.3 List of Specifications of Connectable Actuators] when it is to conduct the pressing operation.

[2] Format Settings of Command Pulse Train

Set the format of command pulse train in Parameter No.63 and active high/low in No.64.

(1) Command Pulse Mode

No.	Name	Unit	Input Range	Default factory setting
63	Command Pulse Input Mode	–	0 to 2	1

Command Pulse Train Mode		Input Terminal	In Normal Rotation	In Reverse Rotation	Setting Value of Parameter No. 63
Negative Logic	Normal Rotation Pulse Train	PP•/PP			2
	Reverse Rotation Pulse Train	NP•/NP			
	The normal rotation pulse train shows the motor rotation amount in normal direction, and reverse rotation pulse train shows the motor rotation amount in reverse direction.				
	Pulse Train	PP•/PP			1
	Symbol	NP•/NP	Low	High	
	The command pulse shows the motor rotation amount and the command symbol shows the rotation direction.				
	A/B Phase Pulse Train	PP•/PP			0
		NP•/NP			
	The A/B Phase 4-fold Pulse with the phase difference of 90° shows the commands for the rotation amount and direction.				
Positive Logic	Normal Rotation Pulse Train	PP•/PP			2
	Reverse Rotation Pulse Train	NP•/NP			
	Pulse Train	PP•/PP			1
	Symbol	NP•/NP	High	Low	
	A/B Phase Pulse Train	PP•/PP			0
		NP•/NP			

(2) Command Pulse Mode Input Polarity

No.	Name	Unit	Input Range	Default factory setting
64	Command Pulse Input Mode Polarity	–	0: Positive logic 1: Negative logic	0

[3] Pulse Train Datum Position (Parameter No. 167)

No.	Name	Unit	Input Range	Default factory setting
167	Pulse Train Datum Position	mm	-9,999.99 to 9,999.99	0

In the condition of the Pulse Train Contorol Mode (PIO pattern 7) selected, an operation is made with the position at the this parameter set as the datum position. It is used to Pulse Train Control for the absolute type actuator.

4.3.5 Output Setting of Feeldback Pulse

This is a parameter to set when outputting the feedback pulse to the host controller (PLC, etc.).
This function is also available in Positioner Mode.

[1] Setting Feedback Pulse Output Effective

Set it if the feedback pulse is to be used.

No.	Name	Unit	Input Range	Default factory setting
68	Feedback Pulse Output	–	0: Disable, 1: Enable	1

You can select whether to enable or disable the feedback pulse output.

Caution

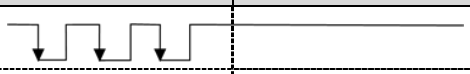
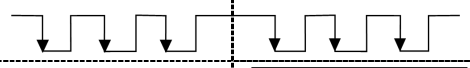
- Make this setting invalid if the feedback pulse is not output.

[2] Format Settings for Feedback Pulse

Set the format of output pulse in Parameter No.69 and active high/low in No.70.

(1) Feedback Pulse Train

No.	Name	Unit	Input Range	Default factory setting
69	Feedback Pulse Train	–	0 to 2	0

Command Pulse String Mode		Input Terminal	In Normal Rotation	In Reverse Rotation	Setting Value
Negative Logic	Normal Rotation Pulse String	AFB • /AFB			2
	Reverse Rotation Pulse String	BFB • /BFB			
	The normal rotation pulse string shows the motor rotation amount in normal direction, and reverse rotation pulse string shows the motor rotaion amount in reverse direction.				
	Pulse Train	AFB • /AFB			1
	Symbol	BFB • /BFB	Low	High	
	The command pulse shows the motor rotation amount and the command symbol shows the rotation direction.				
	A/B Phase Pulse String	AFB • /AFB			0
		BFB • /BFB			
	The A/B Phase 4-fold Pulse with the phase difference of 90deg shows the command for the rotation amount and direction.				
Positive Logic	Normal Rotation Pulse String	AFB • /AFB			2
	Reverse Rotation Pulse String	BFB • /BFB			
	Pulse Train	AFB • /AFB			1
	Symbol	BFB • /BFB	High	Low	
	A/B Phase Pulse String	AFB • /AFB			0
		BFB • /BFB			
ZFB • /ZFB			When the actuator encoder is other than the serial encoder, the Z-phase signal is output as it is. In the case of serial encoder, the range of ±0.5° of mechanical angle from the point 0 position (origin), is output as the Z-phase signal. Only when the motor rpm is 100rpm or less, this accuracy can be guaranteed for the communication frequency with the encoder. * When the encoder pulse count is 16384 (Pulse/rev), it shows the serial encoder.		

(2) Feedback Pulse Form Polarity

No.	Name	Unit	Input Range	Default factory setting
70	Feedback Pulse Form Polarity	–	0: Positive logic 1: Negative logic	0

[3] Electric Gear Settings for Feedback Pulse

This is the parameter to determine the output pulse corresponding to the actuator movement amount. Determine the movement amount per pulse to define how many millimeters (or deg) you would like the actuator to move with the output of 1 pulse.

Movement in line axis per pulse = Minimum output unit (1, 0.1, 0.01mm etc.)/pulse
Movement in rotary axis per pulse = Minimum output unit (1, 0.1, 0.01deg etc.)/pulse

(1) Feedback Pulse Gear Ratio Specification Selection (Parameter No.114)

No.	Name	Unit	Input Range	Default factory setting
114	Feedback Pulse Form Polarity	–	0, 1	0

0: It outputs the pulse equivalent to the input pulse.
If the movement amount of input pulse is 0.01mm, 1 pulse is output when moved for 0.01mm. Thus, 1 pulse is output in response to 1 pulse of input.
Output pulse is determined by the electric gear for input (Parameters No.65 and 66).

1: The relation of the output pulse and the actuator movement can be set freely. Set the electric gear in Parameters No.115 and 116.

(2) Electrical Gear (Feedback Pulse) (Parameter No.115, No.116)

The relationship between output pulse and travel can be set arbitrarily.
These parameters are enabled when Parameter No.114 is set to 1.

No.	Name	Unit	Input Range	Default factory setting
115	Electronic Gear Numerator (Feedback Pulse)	–	1 to 99,999,999	1
116	Electronic Gear Denominator (Feedback Pulse)	–	1 to 99,999,999	1

■ Electronic Gear Formula:

In the case of Line Axis

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{\text{Ball Screw Lead Length [mm/rev]}}{\text{No. of Encoder Pulse (Note 1) [pulse/rev]}} \times \frac{1}{\text{Movement amount per pulse [mm]}}$$

In the case of Rotary Axis

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{360\ [\text{deg/rev}] \times \text{Rotary Axis Reduction Ratio}}{\text{No. of Encoder Pules (Note 1) [pulse/rev]}} \times \frac{1}{\text{Movement amount per pulse [deg]}}$$

Note 1 Number of encoder pulse of each actuator, refer to catalog of each actuator or instruction manual.

■ Formula for velocity:

The velocity of the actuator is in proportion to the frequency of the output pulse.

Velocity = Movement amount per pulse × Output Pulse Frequency [Hz]

■ Examples of electronic gear ratio calculations:

When outputting the feedback pulse of the actuator equipped with an encoder with 10mm ball screw lead and 16384pulse/rev in 0.02mm movement per pulse:

$$\frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}} = \frac{\text{Ball Screw Lead Length [mm/rev]}}{\text{No. of Encoder Pluses [pulse/rev]}} \times \frac{1}{\text{Movement amount per pulse [mm]}}$$

$$= \frac{10}{16384} \times \frac{100}{2} = \frac{125}{4096}$$

The electric gear numerator = 125, electric gear denominator = 4096 will give the output of 1 pulse in 0.02mm of the actuator move.

Caution

- The fraction has to be completely reduced so both the electric gear numerator and electric gear denominator can be 99,999,999 or les and make them to be integral numbers. (Do not stop reducing the fraction on the way.)
- Electronic gear numerator and electronic gear denominator on the line axis have to satisfy the following relative formulas.

$$2^{27} \geq \frac{\text{Stroke Length [mm]}}{\text{Ball Screw Lead Length [mm/rev]}} \times \text{No. of Encoder Pluses [pulse]} \times \frac{\text{Electronic Gear Numerator}}{\text{Electronic Gear Denominator}}$$

- Do not attempt to establish a setting that gives a condition that electronic gear numerator > electronic gear denominator.
  The formula is as shown above and the pulse output is based on the encoder pulse, therefore evenly allocated feedback pulse responding to the velocity cannot be output.

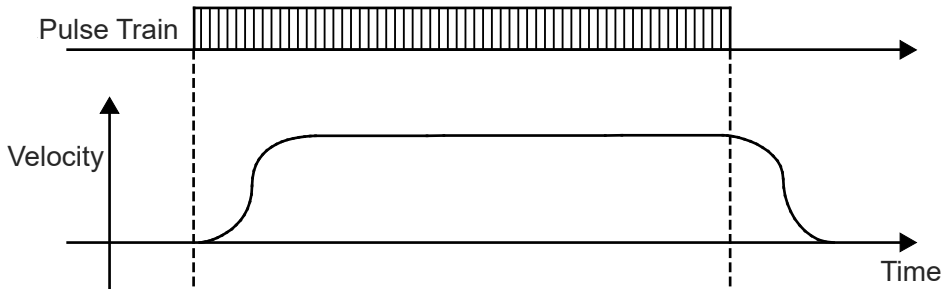
4.3.6 Parameter Settings Required for Advanced Operations

Depending on systems and/or loads, set the following parameters if necessary.

[1] Position Command Primary Filter Time Constant

No.	Name	Unit	Input Range	Default factory setting
55	Position Command Primary Filter Time Constant	ms	0.0 to 100.0	0.0

The acceleration/deceleration of the actuator can be set in S-shaped curve with this parameter setting. (It is not the S-shaped acceleration/deceleration function.)
If command pulse train is input at a certain frequency, the actuator is accelerated/decelerated slowly depending on the time constant.
The actuator moves by the number of command pulses.
Even if the host controller (PLC etc.) has no acceleration/deceleration function or the frequency of command pulses varies rapidly, the actuator can be accelerated/decelerated smoothly.
The delay in positioning stabilizing time requires approximately 3 times longer than the set value after the command pulse input stop. If the set value is 100ms, the stabilizing time would be approximately 300ms.



[2] Torque Limit

No.	Name	Unit	Input Range	Default factory setting
57	Torque Limit	%	0 to 70	70

Set a desired torque limit used in the torque limit input signal TL, which is an external input signal.
Set a desired torque as a percentage [%] of the rated thrust representing 100% (the rated thrust is specified in the catalog).
When the external torque-limit input signal turns ON, the torque will be limited according to the setting.
Once the torque current reaches a level corresponding to the specified torque limit, the torque limiting signal TLR will be output as an external output signal.

[3] Deviation Error Monitor During Torque Limiting

No.	Name	Unit	Input Range	Default factory setting
59	Deviation Error Monitor During Torque Limiting	–	0: Disable, 1: Enable	0

You can select whether to enable or disable the function to monitor deviation while torque is being limited (the TL signal is ON).
By enabling this function, you can have the controller output an error while torque is being limited, if a deviation equal to or exceeding the specified value.

[4] Select Enable/Disable Deviation Counter Clear Input

No.	Name	Unit	Input Range	Default factory setting
60	Select Enable/Disable Deviation Counter Clear Input	–	0: Enable, 1: Disable	0

You can select whether to enable or disable the function to clear the deviation.
Disable this function in conditions where torque must be limited (pressing is not performed).

[5] Select Enable/Disable Torque Limit Command Input

No.	Name	Unit	Input Range	Default factory setting
61	Select Enable/Disable Torque Limit Command Input	–	0: Enable, 1: Disable	0

Torque control of the motor with the value set in Parameter No. 57 Torque limit can be performed with PIO (TL Signal ON) from the host system. In this parameter, a choice can be made from using (make activated) TL Signal (Torque Limiting Signal) and not using (make inactivated) the signal.

[6] Pulse Count Direction

No.	Name	Unit	Input Range	Default factory setting
62	Pulse Count Direction	–	0: Motor forward rotation 1: Motor reverse rotation	In accordance with actuator

You can set the direction in which the motor turns according to command pulses.

[7] Select Enable/Disable Compulsory Stop Input

No.	Name	Unit	Input Range	Default factory setting
67	Select Enable/Disable Compulsory Stop Input	–	0: Enable, 1: Disable	0

Compulsory stop of the actuator can be performed with PIO (CSTP Signal ON) from the host system. In this parameter, a choice can be made from using (make activated) CSTP Signal (Compulsory Stop Input Signal) and not using (make inactivated) the signal.

4.4 Operation of Field Network Type

In the field networks, the following operation modes are available to choose from for operation. (Except for the motion network)
Operation should be made with the data necessary for operation (such as target position, velocity, acceleration, pressing current, etc.) written in the determined addresses from such as PLC connected to the host.
For details regarding operation of each field network, refer to the instruction manuals listed below.

Field Network Name	Description	Reference
CC-Link	Control of the actuator is available with I/O communication using the control signals same as those for PIO or the numerical data communication.	Refer to the other ME0469
CC-Link IE Field		
DeviceNet		
EtherCAT		
EtherNet/IP		
MECHATROLINK-III (Standard I/O Profile)		
PROFINET IO		
EtherCAT (CiA401 Drive Profile)	Synchronized control of several actuators in constant periodicity is available.	Refer to the other ME0472
MECHATROLINK-III (Standard Servo Profile)		Refer to the other ME0471
RS-485	Actuator is controlled with using a general protocol “Modbus” communication.	Refer to the other ME0162
Modbus/TCP	It is a Modbus communication using TCP/IP. It can be used when the EtherNet/IP specification is selected.	Refer to the other ME0469 or ME0162

Note This controller are the slave units (slave stations).
Check the instruction manual of the master unit of each supplier and PLC to be mounted for the details of each network.
For the instruction of the field network, the instruction manual is provided separately. Use the manual together with this manual.

4.5 Absolute Reset

The Battery-less absolute type or absolute type, controllers retain the encoder position data even with power is OFF. For those types, it is unnecessary to perform home-return operation every time the power is turned ON.

Absolute Type registers the home position in the cases of (1) to (3) (absolute reset) to retain.
(1) At initial startup
(2) When the power to the controller is turned off and absolute battery is replaced
(3) When the encoder cable is taken off the controller

Battery-less Absolute Type registers the home position in the cases of (1) and (2) stated below to retain.
(1) At motor replacement
(2) (At initial startup etc.) When absolute error generated

Refer to [2.6.6 Absolute Battery] for the specifications of the absolute battery and absolute unit.

For how to replace an absolute battery or absolute unit, check in [7.4.1 Replacement of Absolute Battery].

4.5.1 How to Perform Absolute Reset

The absolute reset is performed by using a teaching tool such as IA-OS or PIO.
Each of the absolute reset procedures is described below.

[1] Absolute Reset Procedure from Teaching Tool

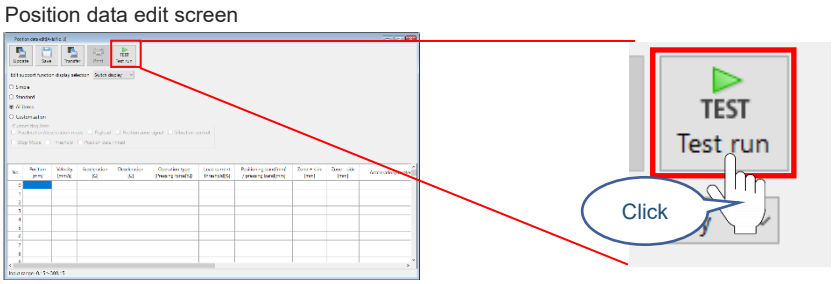
1) Connect the controller with the actuator. Refer to [3.3.3].
2) Connect the absolute battery (Enclosed battery if starting up for the first time, new battery if replacing) to the absolute battery connecting connector on the front panel of the controller. Refer to [7.4.1 Replacement of Absolute Battery]
3) Connect the teaching tool and turn ON the power of the controller.
4) The absolute encoder error appears on the teaching tool. Perform alarm reset. If the condition is in an emergency stop state, release the stop.
5) Perform home-return operation. Once the home return is complete, the point of origin is memorized at the same time the origin point is established.

In below explains the procedure using each teaching tool:

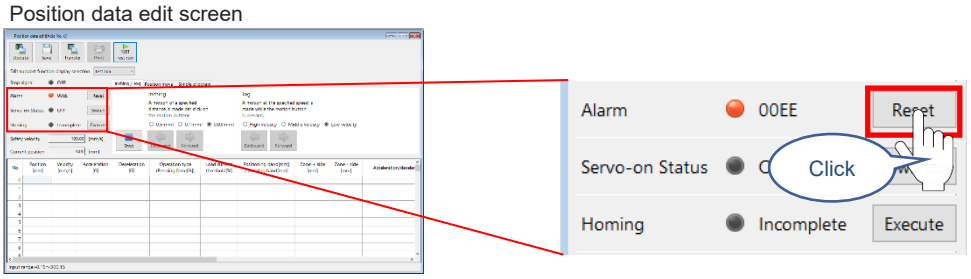
[For IA-OS]

Refer to [First Step Guide (ME0391)] for how to install the IA-OS.

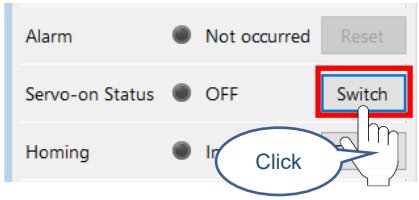
1. Open Position data edit screen and click TEST Test run .



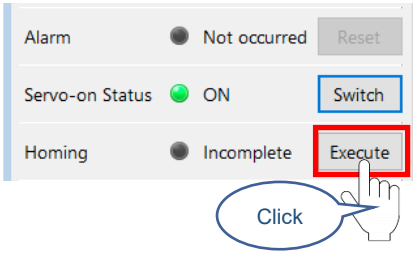
2. Click Reset located on the right of “Alarm” in Position data edit screen.



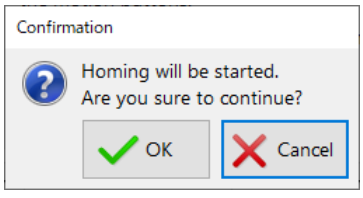
3. The alarm should be reset.
Click Switch located on the right of “Servo-on Status”.



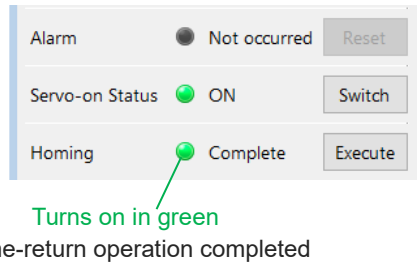
4. The servo on the actuator should turn on.
(The lamp at Servo-on Status should turn on in “green”.)
Click Execute located on the right of “Homing”.



5. The confirmation screen for the home-return operation should be displayed.
Click OK .
The actuator should start the home-return operation.

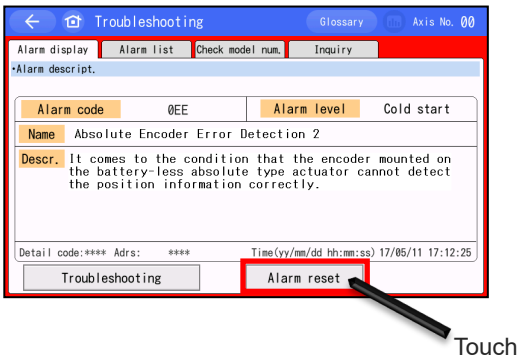


6. The lamp at Homing Complete should turn on in “green” once the actuator completes the home-return operation in the normal condition.



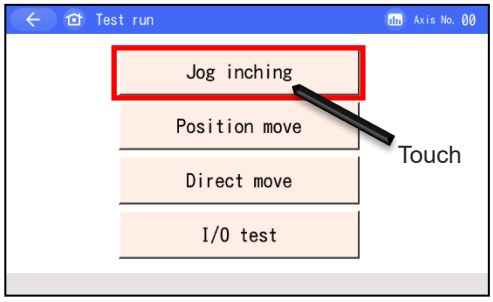
[For teaching pendant (TB-02/TB-03)]

1. Touch Alarm reset .

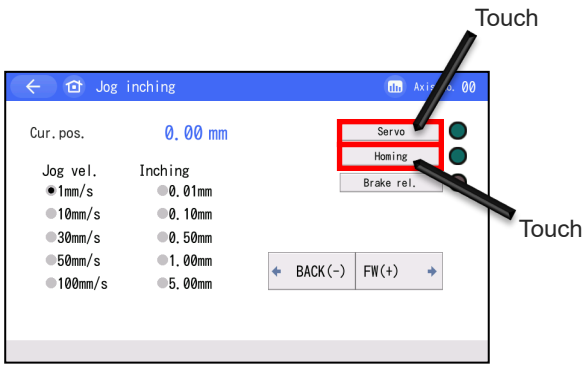


2. Touch Trial operation on the Menu 1 screen.

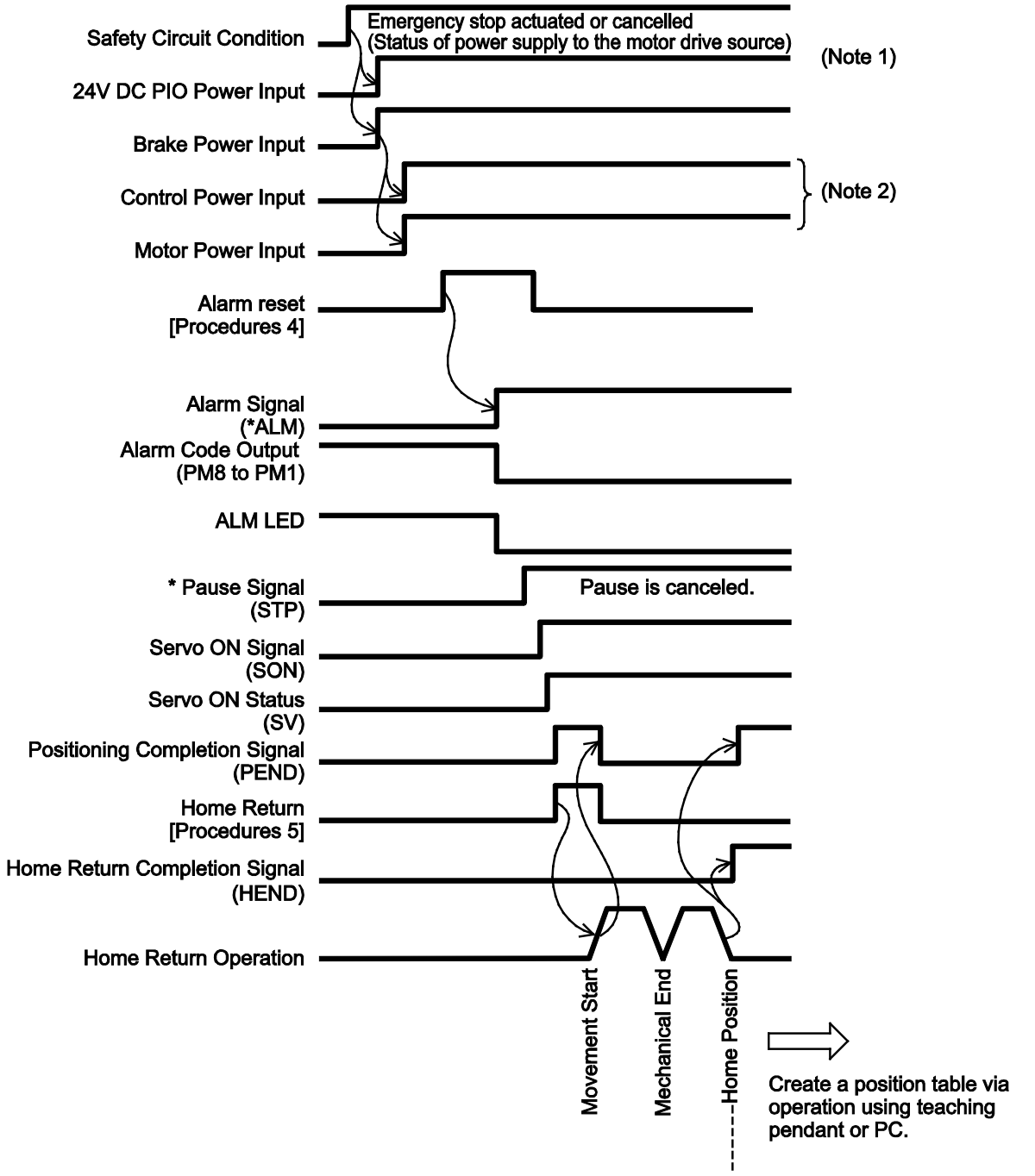
3. On the test run screen, touch Jog inching .



4. On the jog/inching screen, turn the servo on by touching Servo , then touch Homing .



[Absolute Reset Process]



Note 1 Turn ON 24V power supply for PIO (and 24V power supply for brake if the actuator is equipped with a brake) prior to turn ON the control power supply or motor power supply.

Note 2 Have the control power supply and motor power supply in common, and have them turned ON that the same time.

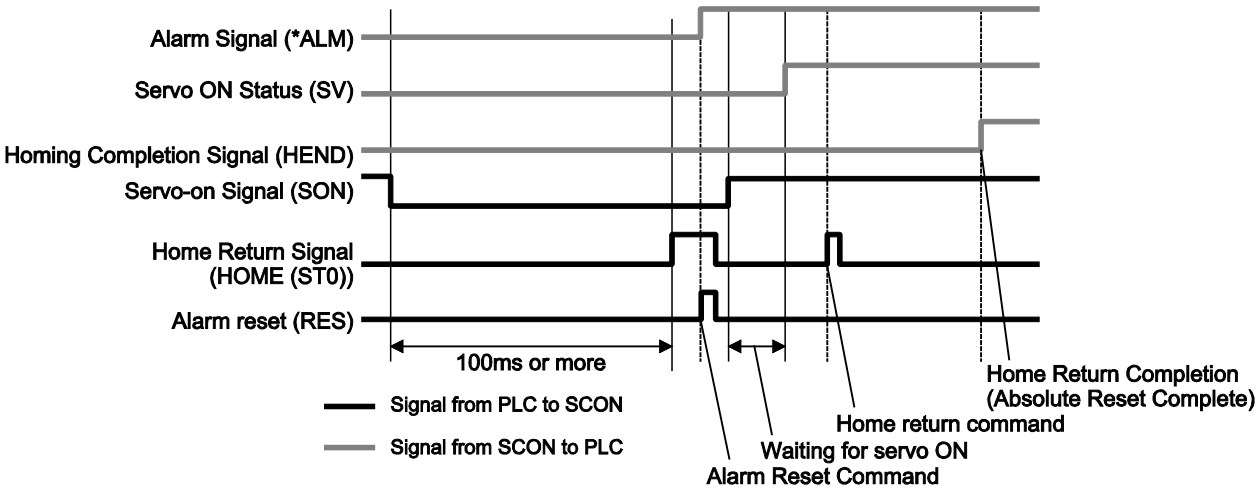
[2] Absolute Reset Using PIO

As ABS-related alarms are the cold start level alarms, an alarm reset cannot be conducted only with RES Signal. In order to reset an ABS-related alarm from PIO, perform the process from Step 1 to 8 below.

For the absolute reset after other alarms, follow Step 6 and after.

1) Turn off the servo-on input SON and confirm that the servo-on status SV is off. (Turn the SV and SON signals OFF and continue this status for 100ms or longer.)
2) Turn the home return signal HOME (ST0 signal in case of PIO pattern 5) from OFF to ON. (Processed with ON edge.)
3) Turn the reset signal RES from OFF to ON. (Processed with ON edge.)
4) Check that the alarm signal *ALM is ON (controller's alarm (Note 1) is cancelled).
   Note 1 If the cause of the alarm is not removed, an alarm will be present again (*ALM signal OFF). Check the condition including other alarm causes.
5) Turn the home return signal HOME (ST0 signal in case of PIO pattern 5) and reset signals RES OFF.
6) Turn the servo-on signal SON ON.
7) Once the servo-on status SV is confirmed, the home-return signal HOME (ST0 Signal when PIO Pattern 5) should turn on. (with ON edge) The home return operation is started.
8) When the homing completion signal HEND is turned ON (completion of home return), absolute reset is completed.

[Timing]



SCON2-CG

Chapter 5

Various Functions

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5.1 Vibration Suppress Control Function

5.1.1 Overview

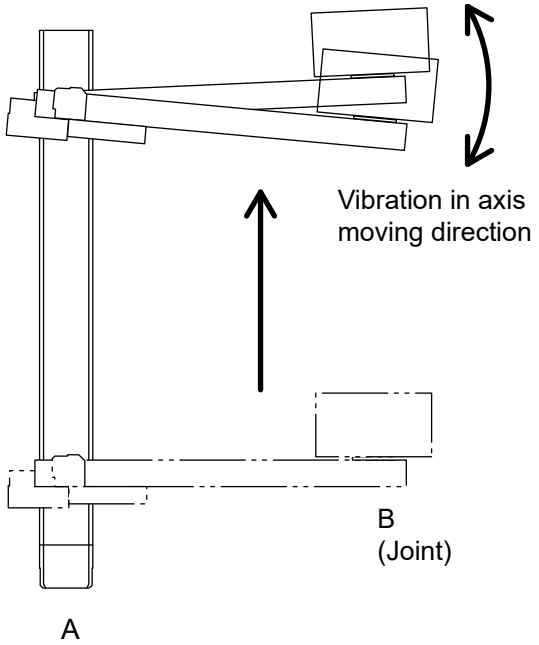
The vibration suppress control function suppresses vibrations of loads induced by our actuators. The function can suppress vibrations in the same direction as the movement of the actuator in the frequency range from 0.5 to 30Hz.
Measure the frequency of the generated vibration and set it to the parameter. Three frequencies can be defined as parameters. Specify the parameters in the position table to reflect them on suppression of vibrations generated by the operation. For a single moving command (position data), only a single parameter can be set.

(Note) Before this function can be used, you must read the cautions described on the next page.

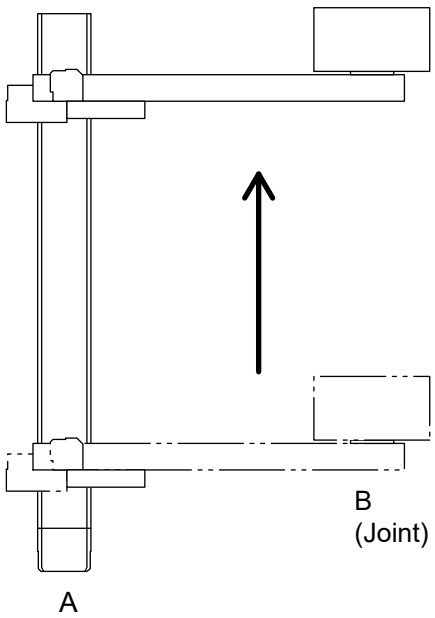
Functional Operation

The figure below shows an example in which two actuators are subject to 2-axis combination. Actuator A is moved to cause actuator B corresponding to a joint to be vibrated. Measure the vibrations of B in the direction in which A is moved and make proper vibration suppress control in the direction to suppress the vibrations of B. Vibrations of actuator B caused by the movement of B cannot be suppressed.

★No setting of vibration suppress control



☆Setting of vibration suppress control



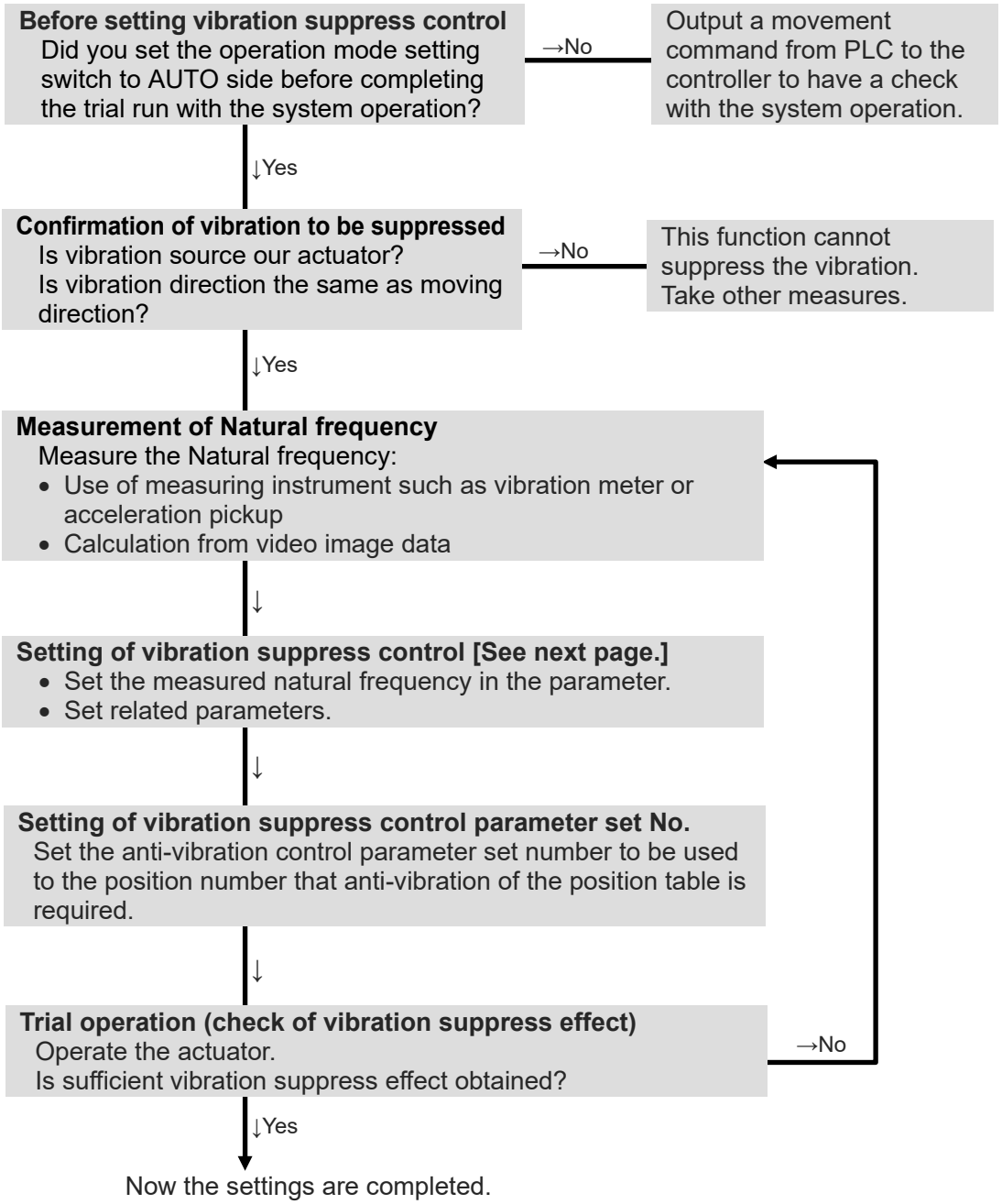
Caution

- Vibrations subject to vibration suppress control
  Vibrations subject to vibration suppress controlI is the vibration of the load generated by IAI actuator, and is in the same directions as the actuator movement.
- Vibrations not subject to vibration suppress control
  1. Vibration whose source is not the operation of the actuator
  2. Vibration in a direction different from the direction in which the actuator, or the vibration source, is moved.
  3. Vibration of vibrating object itself (This function moves objects easily vibrated without vibrations and cannot suppress vibrations already generated.)
- Conditions in which vibration suppress effect can hardly be obtained
  1. When the frequency to control is the same value as the mechanical angle of the motor (motor rotation) or the electrical angle of the motor
     Frequency of motor's mechanical angle (motor revolution):
     operation speed [mm/s]/lead length [mm]
     Frequency of motor's electric angle:
     4 times of frequency of mechanical angle for servo motor installation axis
     Same as frequency of linear actuator's mechanical angle
     Example 1: Servo motor installation axis
     For lead length 20mm and operation speed 100mm/s:
     Frequency of mechanical angle (motor revolution) : 5Hz
     Frequency of electric angle (four times of frequency of mechanical angle) : 20Hz
     Example 2: Linear Actuator
     For lead length 50mm and operation speed 1,000mm/s:
     Frequency of mechanical angle : 20Hz
     Frequency of electric angle (same as frequency of mechanical angle) : 20Hz
  2. When a higher speed response is required for the vibration control than the set speed control response, the speed response is not able to catch up with the vibration control.
- Vibration suppress control unavailable in home return and pressing operations
  Home return and pressing operations cannot suppress vibrations. Operating the vibration suppress control function in pressing causes 0A2 "position data error" to occur.

- Prohibition of simultaneous use of vibration suppress control with feed forward gain
  The vibration suppress control function cannot be used with feed forward gain simultaneously.
- Prohibition of switch to use vibration suppress control during moving operation
  Switching between vibration suppress control and normal positioning is disabled during movement of the actuator. Any switching command causes 0C5 “Illegal transition command in control system” to occur.
- Response of vibration suppress control
  Vibration suppress control has time lag from speed command in the operation plan. This makes tact time longer. Lower the setting frequency is, longer the time lag is.
- Prohibition of use of vibration suppress control in pulse-train control mode
  The vibration suppress control function cannot be used in the pulse-train control mode.
- Consideration of servo gain
  If the servo gain setting is not conducted properly, the effect of the anti-vibration control may get dropped. First adjust the servo gain prior to setting of vibration suppress control.

5.1.2 Setting Procedure

To use the vibration suppress control function, make proper measurements and adjustments depending on the procedure described below.



5.1.3 Settings of Parameters for Vibration Suppress Control

Set the parameters associated with vibration suppress control, which are listed in the table below.

Parameter No.	Parameter Set No.	Parameter Name	Unit	Factory Setting	Input Range
97	1	Damping characteristic coefficient 1	Rate	10	0 to 1,000
98		Damping characteristic coefficient 2	Rate	1,000	0 to 1,000
99		Natural frequency	1/1,000Hz	10,000	500 to 30,000
100		Notch filter gain	Rate	9,990	1 to 20,000
101	2	Damping characteristic coefficient 1	Rate	10	0 to 1,000
102		Damping characteristic coefficient 2	Rate	1,000	0 to 1,000
103		Natural frequency	1/1,000Hz	10,000	500 to 30,000
104		Notch filter gain	Rate	9,990	1 to 20,000
105	3	Damping characteristic coefficient 1	Rate	10	0 to 1,000
106		Damping characteristic coefficient 2	Rate	1,000	0 to 1,000
107		Natural frequency	1/1,000Hz	10,000	500 to 30,000
108		Notch filter gain	Rate	9,990	1 to 20,000
109		Default vibration suppress No.		0	0 to 3
110		Stop method at servo OFF		0	0, 1

[1] Damping Characteristic Coefficient 1, 2 (Parameter No.97/98, 101/102 and 105/106)

Do not change.

[2] Natural Frequency [1/1,000Hz] (Parameter No.99, 103 and 107)

Set the natural frequency of the load measured.

Set the specific frequency of the loaded object close to the setting so a higher anti-vibration performance can be obtained.

Reference : Other vibration measuring methods

- Use of measuring instrument such as vibration meter and acceleration pickup
- Calculation from video image data

[3] Notch Filter Gain (Parameter No.100, 104 and 108)

Set the notch filter gain following the table below in response to the measured specific frequency of the loaded object. See the table below for reference. Provide fine adjustment if overshooting occurs.

If the notch filter gain setting is too high, overshooting would occur during the settling time.

If the notch filter gain setting is too low, undershooting would occur during the settling time.

Natural Frequency [Hz]	Setting Value of Notch Filter Gain	
	Other than linear actuator	Linear actuator
0.5	9,900	9,880
1	9,980	9,970
2 to 30	9,990	9,990

[4] Default Vibration Suppress No. (Parameter No.109)

When a position is written into a position table not registered yet, the value set to this parameter is automatically entered in the “Vibration suppress No.” field. To change the setting, edit the position table later.

0: Normal position control (factory setting)

1: Vibration suppress control parameter set 1

2: Vibration suppress control parameter set 2

3: Vibration suppress control parameter set 3

[5] Stop method at Servo OFF (Parameter No.110)

The table below shows the relationship between the values of Parameter No.110 and stop commands.

<table>
<tr><th rowspan="3">Stop Command</th><th colspan="4">Stop Process</th></tr>
<tr><th colspan="2">0</th><th colspan="2">1</th></tr>
<tr><th>Vibration suppress control</th><th>Normal positioning control</th><th>Vibration suppress control</th><th>Normal positioning control</th></tr>
<tr><td>Pause</td><td>Deceleration by vibration suppress and stop</td><td>Normal deceleration and stop</td><td rowspan="4">Deceleration by vibration suppress and stop</td><td rowspan="4">Normal deceleration and stop</td></tr>
<tr><td>Servo OFF</td><td colspan="2" rowspan="3">Sudden stop by emergency stop torque</td></tr>
<tr><td>Emergency Stop</td></tr>
<tr><td>Error (Operation-cancellation level alarms)</td></tr>
<tr><td>Error (Cold start)</td><td colspan="4">Sudden stop due to emergency stop torque</td></tr>
</table>

5.1.4 Setting of Position Data

To make the anti-vibration control effective, set the parameter set number to be used in Anti-Vibration Number Column in Position Data.

(Note) The vibration suppress control function cannot be used in pressing operation.

No.	Position [mm]	Velocity [mm/s]	Accele-ration [G]	Decele-ration [G]	Pressing [%]	Thresh-old [%]	Positioning width [mm]	Zone+ [mm]	Zone- [mm]	Acceleration/ Deceleration mode	Incre-mental	Gain set	Stop mode	Vibration suppress No.
0														
1	0.00	720.00	0.30	0.30	0	0	0.10	0.00	0.00	0	0	0	1	0
2	50.00	720.00	0.30	0.30	0	0	0.10	0.00	0.00	0	0	0	0	1
3	50.00	720.00	0.30	0.30	50	0	50.00	0.00	0.00	0	0	0	0	3
4														

Set natural frequency 1 (valid)
Set natural frequency 3 (It cannot be in common with Error: 0A2 Position Data Error Pressing Operation.)

5.2 Power-saving Function (Auto Servo-motor OFF Function)

Equipped with AUTO servo OFF to reduce power consumption while the actuator is stopped. Fully understand the descriptions in this section and use without any safety or operational issues.

With automatic servo OFF function, the servo turns OFF automatically after a certain period of time once positioning is completed. Once the next positioning start signal “CSTR” is commanded, the servo automatically turns ON and executes positioning operation. Since holding current does not flow during the stop, power consumption can be reduced.
Three types of setting are available for the period of time from positioning complete to servo OFF.

With the power-saving function, the status of the actuator determines which is to be enabled: the setting of Parameter No. 53 “Default stop mode”, or “stop mode” in the position table. The details are as described below.

Status	Setting
Home return complete and on stand-by (Positioning to the target position not performed)	Execution of power-saving function at the value set for Parameter No. 53 (Stop mode setting of position No. disabled)
After turning the power ON, stand-by state with servo ON (Positioning to the target position not performed)	Execution of power-saving function at the value set for Parameter No. 53 (Stop mode setting of position No. disabled)
Positioning complete in the target position set in the position table	Execution of power-saving function at the value set for “stop mode” of each position No. (Set value of Parameter No. 53 disabled)

Warning

- Do not use this function if the automatic servo OFF is followed by pitch feed (relative movement). Servo ON/OFF may cause slight position shift to occur. If position shift occurs due to external force during servo OFF, positioning to the correct position is disabled. It is because pitch feed is operated based on the position at start used as the base point.

Caution

- Automatic servo OFF function is disabled for push-motion operation. Do not use it. This function will be enabled upon completion of positioning operation. For push-motion operation, it will be enabled only when contactless (completion of operation without contact = same status as positioning complete).
- There is no holding torque during AUTO servo OFF. The actuator will move if external force is applied. Take extra care regarding interference and safety when setting.

[1] Setting Time until Automatic Servo OFF

Three types of setting are available for delay time from positioning complete until servo OFF. Set in the following parameters in units of second [s].

Parameter No.	Name	Unit	Input range	Initial value
36	Automatic servo OFF delay time 1	s	0 to 9,999	0
37	Automatic servo OFF delay time 2	s	0 to 9,999	0
38	Automatic servo OFF delay time 3	s	0 to 9,999	0

[2] Setting of Power-saving Method

Select from the following conditions, and set in “stop mode” of the position table, or with Parameter No. 53 “Default stop mode” using a numerical value.

Set Value	Operation after completion of positioning	Parameter No.
0	Servo ON not changed	—
1	After a fixed time (parameter No. 36 set value) automatic servo OFF	36
2	After a fixed time (parameter No. 37 set value) automatic servo OFF	37
3	After a fixed time (parameter No. 38 set value) automatic servo OFF	38

[3] Status of positioning complete signal in selection of automatic servo OFF

Automatic servo OFF causes the actuator to be in other than the positioning complete state due to the servo OFF. Positioning complete signal PEND is turned OFF. Changing the PEND signal to the in-position signal judging whether the actuator is stopped within the positioning width zone instead of the positioning complete signal allows PEND not to be turned OFF during servo OFF. This setting is reflected on complete position numbers PM1 to PM** in PIO patterns 0 to 3 and 6 confirming the positioning complete position No. or current position numbers PE* in PIO patterns 4 and 7.

Define the setting in Parameter No.39.

Value set in Parameter No.39	Content of PEND signal	Signal outputs during automatic servo OFF		
		PEND	PM1 to PM**	PE**
0	Positioning Completion Signal	OFF	OFF	OFF
1	In-position Signal	ON	ON	ON

(Note) While the automatic servo OFF, SV of the controller status indicator LED on the front panel flashes green.

(1) For Parameter No.39 = 0

Operation of actuator	Positioning operation	Automatic servo OFF standby	Servo OFF	Positioning operation
Servo Condition	ON	ON	OFF	ON
Completed Position No. Input (Current position number output)	PM1 to ** = 0	PM1 to ** = Output	PM1 to ** = 0	PM1 to ** = 0
Positioning Completion Signal PEND	OFF	ON	OFF	OFF

Servo OFF delay time (Parameter No.36 to 38)

(2) For Parameter No.39 = 1

Operation of actuator	Positioning operation	Automatic servo OFF standby	Servo OFF	Positioning operation
Servo Condition	ON	ON	OFF	ON
Completed Position No. Input (Current position number output)	PM1 to ** = 0	PM1 to ** = Output	PM1 to ** = Output	PM1 to ** = 0
Positioning Completion Signal PEND	OFF	ON	ON	OFF

Servo OFF delay time (Parameter No.36 to 38)

5.3 Collision Detection Feature

It is a feature to rapidly stop or evacuation the actuator when it has a contact to an object during operation.
Understand the explanation in this section well for use without any problem in operation and for safety.

Caution

- Collision detection is a support feature to reduce damage to a workpiece in unexpected occasions. It is a feature to detect collision, and not a feature to prevent collision in advance. Also, as the appropriate values of the setup items should differ depending on the system, it is necessary to adjust them in the parameters.
- Reduction of impact at collision with the collision detection is not what guarantees for injuries or damage to an operator.
- This feature does not function in the following status.
  - ●Pulse Train Control Mode
  - ●Half Direct Numerical Mode 1, 2, 3 in Field Network Specification
  - ●Full Direct Mode, Full Direct 2 Mode Mode in Field Network Specification
  - ●Motion Network Applicable Specification (Function option model “M” and I/O type: EC/ML3)
  - ●Operation mode is Direct Numerical Indication, Full Direct Mode, Full Direct 2 Mode in RCON connection specification
  - ●With RCON connection specifications, RCON-GW network type is ECM/ML3/SSN
  - ●Connected to RSEL in RCON connection specification
  - ●During Pressing Operation
- Compensation should not be made even if there is any unexpected damage.

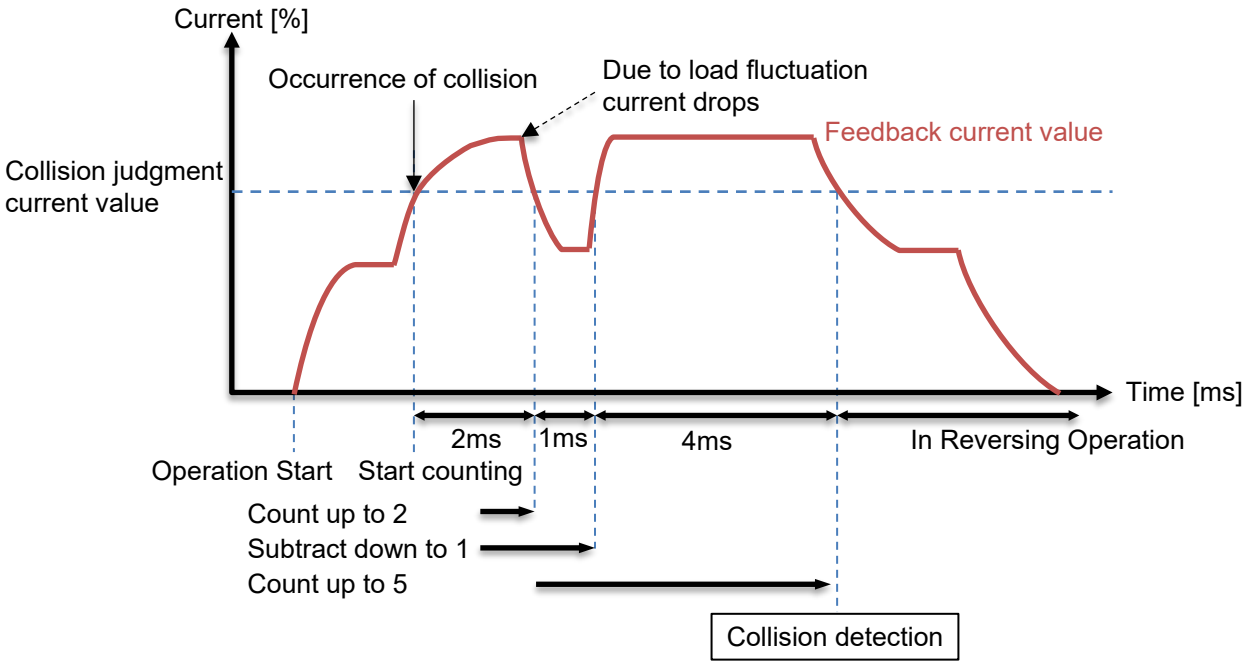
5.3.1 Collision Judgment

If the collision detection is set to the positioning operation, it should be defined as “Collision Detected” when the collision judgment time as passed after the collision judgment current or collision judgment distance has exceeded.
Also, each judgment criteria can be set in parallel. If both are set in parallel, “Collision Detected” should be output when the judgment criteria for both has been exceeded.
Once it is judged as “Collision Detection”, an alarm or warning should be output. Also, when an effective value is set in the collision detection reversing position number, an alarm or warning should be output after the evacuation operation.
Also, when a new movement command is received during collision detection, the process of current collision detection should get reset.

[Collision judgment current value]

Comparing to the feedback current, the collision judgment current should judge collision for current when Feedback Current > Collision Judgment Current. The judgment should be disabled when “0” is set in the judgment current and should be enabled when a value higher than “0” is set.

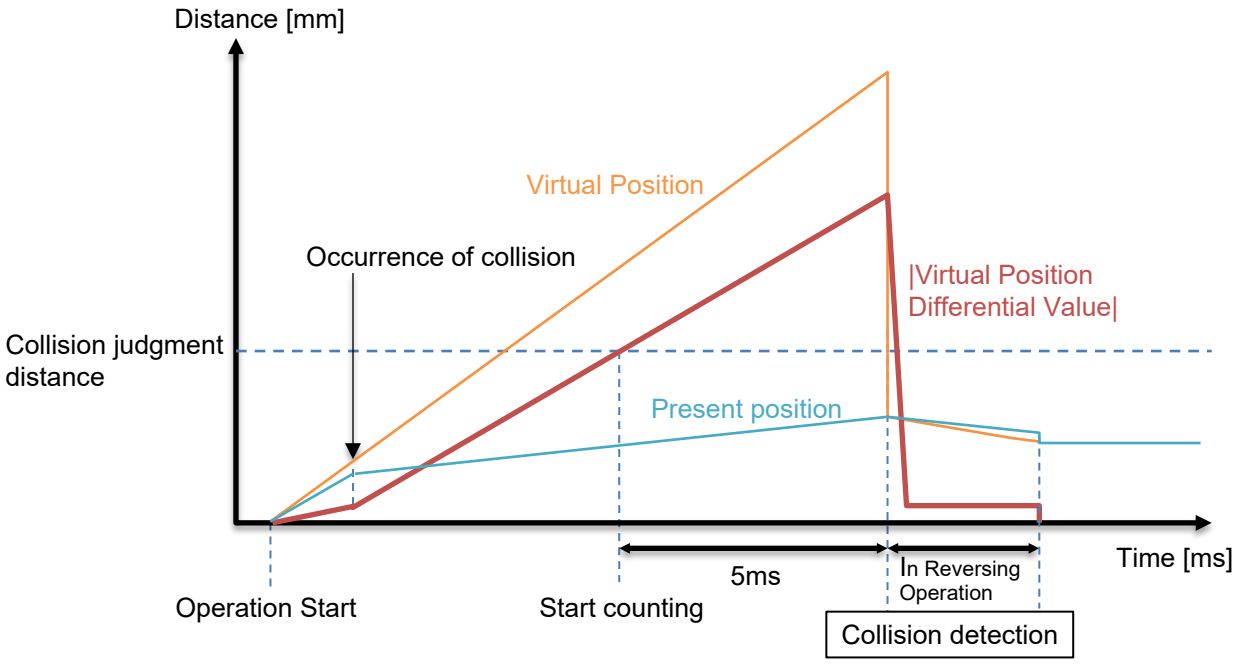
As an actuator raise current in the acceleration/deceleration range, there is a risk that collision detection only with the current judgment may cause error detection, however, error detection in the acceleration/deceleration range should be able to be avoided if the judgment distance is set up at the same time. Also, if “0” (disable) is set in each judgment value at the same time, Error No. 0A1 “Parameter Data Error” should occur.



[Collision judgment distance]

Then collision judgment distance should judge it as a collision detection for distance when the gap between the current position and the virtual position (virtual position differential value) is |Virtual Position Differential Value| > Collision Judgment Distance compared to the absolute value. The judgment should be disabled when “0” is set in the judgment distance and should be enabled when a value higher than “0” is set.

Even if the collision detection is not set, as there is a virtual position differential existed, there is a risk that collision detection only with the distance judgment may cause error detection. An error detection when the collision detection is not set can be avoided when the judgment current values are set at the same time. Also, if “0” (disable) is set in each judgment value at the same time, Error No. 0A1 “Parameter Data Error” should occur.



[Collision Judgment Time]

The collision judgment time is a time setting to judge as collision after the collision judgment currency and collision judgment distance are exceeded. The count should go up when it is above the judgment value and should go down when below it, and it should be judged collision detection when the counter exceeds the collision judgment time. The count should go up after the judgment values for both are exceeded when both of them are set.

Also, Error No. 0A1 “Parameter Data Error” should occur when a value out of the range of the judgment time (from 1 to 65535 [ms]) is set.

5.3.2 Judgment Operation

By indicating a position number to the reversing operation at collision detection position number, a reversing operation should be performed after a collision gets detected.
The position data to be used in the reversing operation should be “Position”, “Velocity”, “Acceleration”, “Deceleration” and “Positioning Band” only. Using “Position” set in the position data, relative operation in the reversed direction of the operational direction from the current position where a collision was judged. If the position for the operation to move to is out of the software stroke limit range, the relative movement distance should be limited to a position in the software stroke limit range. When the indicated position data is not enough (any in velocity, acceleration, deceleration or positioning band is out of range), Error No. 0A2 “Position Data Error” should be output.
Also, the collision detection should be deactivated during the reversing operation and any other operation command cannot be sent. The jog switch feature should also be deactivated. Also, as evacuation from collision is a purpose during the reversing operation, the pause command should be disabled.
Error No. 0Df “Collision Detection” (Alarm) or Error No. 049 “Collision Warning” (Warning) should be output after a reversing operation is complete depending on the setting in Parameter No. 225 “Select Collision Detection Feature Output”. Also, when the servo-off command or deceleration stop command is conducted during the reversing operation, the reversing operation should be cancelled and Error No. 0DF “Collision Detection” (Alarm) or Error No. 049 “Collision Warning” (Warning) should be output.

The behaviors after the collision detection by settings and combinations of the reversing operation and output selection should be as shown below.

Reversing operation	Output selection	Behaviors after the collision detection
Enabled	Alarm	Alarm to be output and servo to be turned off and stopped after reversing operation complete
	Warning	Warning to be output and servo-on status to be retained and stop after reversing operation complete
Disabled	Alarm	Alarm to be output and servo to be turned off and stopped after collision detected
	Warning	Warning to be output (not stopped) after collision detected

* Set “0” to “Position” in the position data for reversing operation when the reversing operation is enabled, and a reversing operation should not be conducted after a collision detection and stops.

5.3.3 Collision Detection Setup

For the setup of collision detection, the following tools are available for use.

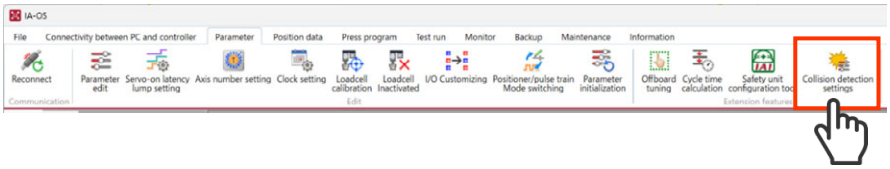
Product name	Applicable versions
PC Software IA-OS	Ver.13.01.00.00 or later
Touch Panel Teaching Pendant TB-03/02	Ver.4.42 or later

[How to Set up in IA-OS]

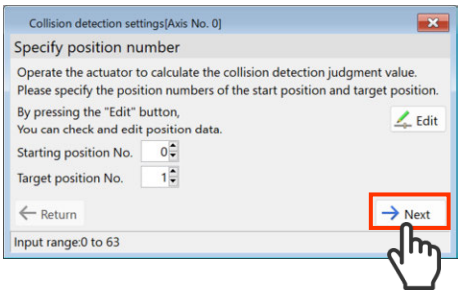
Follow the process below to set up the collision detection.

- Parameter → Collision Detection Setup in IA-OS Menu

1. Select in the menu of IA-OS.

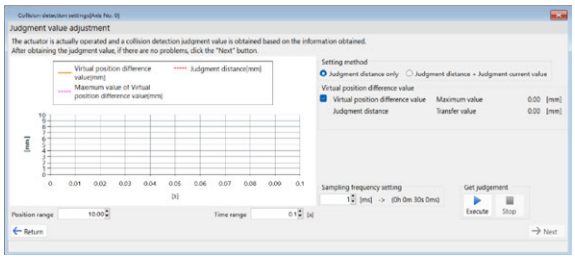


Indicate Position Number window should open.



2. Select the measurement start position number and target position number and click → Next.

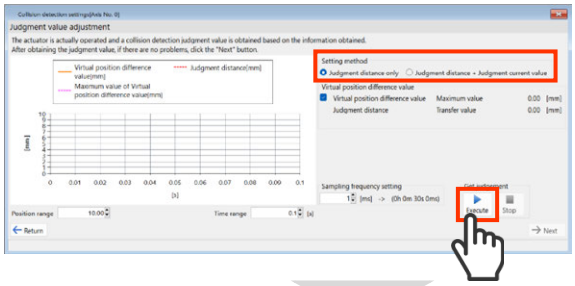
Judgment Value Setup window should open.
* Click Edit and the Edit Position Data window should open.



3. Select a method for collision detection judgment and click Execute.

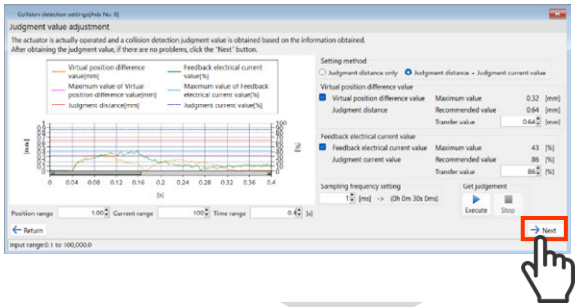
Collision Judgment Methods
- With Judgment Distance Only
- Judgment Distance + Judgment Current Value

Note: Actuator starts moving.



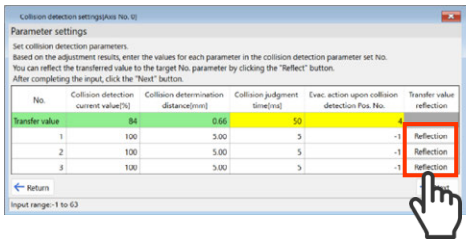
4. The feedback values should be shown in the graph. Click → Next.

The parameter setup window should open.



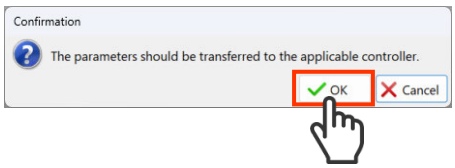
5. Set up each collision detection parameter in the "Transferred Value" line based on the result of adjustment, and click Reflection.

* Adjust the transferred values with trial runs.



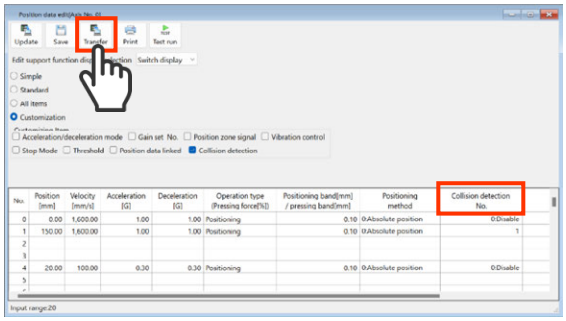
6. Click → Next and the confirmation window should appear. Click OK.

The parameters should be transferred to the controller.
Follow the coming instructions to perform the software reset.



7. Register the parameter set number that was set in "Collision Detection Number" in the Edit Position Data window.

* "Collision Detection Number" can be shown if "All Items" or "Customize" is selected by switching display.



SCON2-CG

Chapter 6

Parameter

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6.1 Parameter

Parameters are the data to set up considering the system and application.
When a change is required to the parameters, make sure to back up the data before the change so the settings can be returned anytime.
With using PC software, it is able to store the backup to the PC. Teaching pendant is able to store the back up to the memory card.
Also, for the purpose of rapid recovery after the investigation of failure unit or replacing the controller, keep data backup or memo also after the parameter change.
The change to the parameters will be activated after they are edited, written to the flash FeRAM, then either software reset or reboot of the power. It will not be active only with writing on the teaching tool.

Warning

- Parameter setting has great influences on operations of the controller. Incorrect parameter setting may not only cause malfunction or failure of the controller to occur but also people and assets to be exposed to risk.
- The controller is configured to be applicable to normal operation at shipment. Before providing certain change or setting for the controller to be fit to your system, understand the control methods of the controller sufficiently. Please contact us if you have anything unclear.
- Do not turn OFF the power to the controller during the parameter writing.

6.1.1 Parameter List

The categories in the table below indicate whether parameters should be set or not. There are five categories as follows:

A: Check the settings before use.
B: Use parameters of this category depending on their uses.
C: Use parameters of this category with the settings at shipments leaving unchanged as a rule. Normally they may not be set.
D: Parameters of the category are set at shipment in accordance with the specification of the actuator. Normally they may not be set.
E: Parameters of the category are exclusively used by us for convenience of production. Changing their settings may not only cause the actuator to operate improperly but also to be damaged. So, never change the setting of the parameters.

Category do not appear on the teaching tool.
Also, the unused parameter numbers are not mentioned in the list.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	For Positioner Mode	For Pulse Train Mode	Relevant sections
1	B	Zone Boundary 1+	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side (Note2)	○	○	6.1.2 [1]
2	B	Zone Boundary 1-	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on - side (Note2)	○	○	6.1.2 [1]
3	A	Soft limit+	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side (Note2)	○	○	6.1.2 [2]
4	A	Soft limit-	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on - side (Note2)	○	○	6.1.2 [2]
5	D	Home return direction	–	0: Reverse, 1: Normal	In accordance with actuator (Note2)	○	○	6.1.2 [3]
6	C	Press & hold stop judgment period	ms	0 to 9,999	255	○	–	6.1.2 [4]
7	C	Servo gain number	–	0 to 31	In accordance with actuator (Note2)	○	○	6.1.2 [5] 6.2
8	B	Default speed	mm/s (deg/s)	1 to Actuator's max. speed	Rated actuator's speed (Note2)	○	–	6.1.2 [6]
9	B	Default acceleration/deceleration	G	0.01 to actuator's max. acceleration/ deceleration	Rated actuator's acceleration/ deceleration (Note2)	○	–	6.1.2 [7]
10	B	Default positioning width	mm (deg)	0.01 to 9,999.99	In accordance with actuator (Note2)	○	○	6.1.2 [8]
13	C	Current-limiting value during home return	%	0 to 300	In accordance with actuator (Note2)	○	○	6.1.2 [9]
14	E	Dynamic brake	–	0: Disabled, 1: Enabled	1	○	○	6.1.2 [10]
15	B	Select enable/disable pause input	–	0: Enabled, 1: Disabled	0	○	–	6.1.2 [11]

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
16	B	SIO communication speed	bps	9,600 to 230,400	38,400	○	○	6.1.2 [12]
17	B	Minimum delay time for slave transmitter activation	ms	0 to 255	5	○	○	6.1.2 [13]
18	E	Home position check sensor input polarity	–	0 to 2	In accordance with actuator (Note2)	○	○	6.1.2 [14]
19	E	Overrun sensor input polarity	–	0 to 2	In accordance with actuator (Note2)	○	○	6.1.2 [15]
20	E	Creep sensor input polarity	–	0 to 2	In accordance with actuator (Note2)	○	○	6.1.2 [16]
21	B	Select enable/disable servo ON input	–	0: Enabled, 1: Disabled	0	○	○	6.1.2 [17]
22	C	Home return offset level	mm (deg)	0.00 to 9,999.99	In accordance with actuator (Note2)	○	○	6.1.2 [18]
23	B	Zone Boundary 2+	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side (Note2)	○	○	6.1.2 [1]
24	B	Zone Boundary 2-	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on – side (Note2)	○	○	6.1.2 [1]
25	A	PIO pattern selection	–	0 to 7	0 (Standard Type)	○	○	6.1.2 [19]
26	B	PIO jog velocity	mm/s (deg/s)	1 to Actuator's max. speed	In accordance with actuator (Note2)	○	–	6.1.2 [20]
27	B	Movement command type	–	0: Level 1: Edge	0	○	–	6.1.2 [21]
31	C	Velocity loop proportional gain	–	1 to 99,999,999	In accordance with actuator (Note2)	○	○	6.1.2 [22]
32	C	Velocity loop integral gain	–	1 to 99,999,999	In accordance with actuator (Note2)	○	○	6.1.2 [23] 8.3
33	C	Torque filter time constant	–	0 to 2,500	In accordance with actuator (Note2)	○	○	6.1.2 [24] 8.3
34	C	Press velocity	mm/s (deg/s)	1 to actuator's max. pressing speed	In accordance with actuator (Note2)	○	–	6.1.2 [25]
35	C	Safety velocity	mm/s (deg/s)	1 to 250 (max. for actuator of 250 or less)	100	○	○	6.1.2 [26]
36	B	Auto Servo-motor OFF delay time 1	s	0 to 9,999	0	○	–	6.1.2 [27]
37	B	Auto Servo-motor OFF delay time 2	s	0 to 9,999	0	○	–	6.1.2 [27]
38	B	Auto Servo-motor OFF delay time 3	s	0 to 9,999	0	○	–	6.1.2 [27]
39	B	Position complete signal output method (Note3)	–	0: PEND 1: INP	0	○	–	6.1.2 [28]

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
40	C	Select enable/disable homereturn input	–	0: Enabled, 1: Disabled	0	○	○	6.1.2 [29]
41	C	Select enable/disable operatingmode input	–	0: Enabled, 1: Disabled	0	○	○	6.1.2 [30]
42	C	Enable function	–	0: Enabled, 1: Disabled	1	○	○	6.1.2 [31]
45	B	Silent interval magnification	time	0 to 10	0	○	○	6.1.2 [32]
46	B	Velocity override	%	1 to 100	100	○	–	6.1.2 [33]
47	B	PIO jog velocity 2	mm/s (deg/s)	1 to Actuator's max. speed	In accordance with actuator (Note2)	○	–	6.1.2 [20]
48	B	PIO inch distance	mm/s (deg/s)	0.01 to 1.00	0.10	○	–	6.1.2 [34]
49	B	PIO inch distance 2	mm/s (deg/s)	0.01 to 1.00	0.10	○	–	6.1.2 [34]
50	C	Load output judgment time period	ms	0 to 9,999	255	○	–	6.1.2 [35]
52	B	Default acceleration/deceleration mode	–	0 to 2	0 (Trapezoid)	○	○	6.1.2 [36]
53	B	Default stop mode	–	0 to 3	0 (Does not use)	○	–	6.1.2 [37]
54	C	Current-control width number	–	0 to 15	In accordance with actuator (Note2)	○	○	6.1.2 [38]
55	B	Position-command primary filter time constant	ms	0.0 to 100.0	0.0	○	○	6.1.2 [39]
56	B	S-motion ratio setting	%	0 to 100	0	○	–	6.1.2 [40]
57	B	Torque limit	%	0 to 70	70	–	○	4.3.6
59	C	Deviation error monitor during torque limiting	–	0: Disabled, 1: Enabled	0	–	○	4.3.6
60	B	Select enable/disable deviation counter clear input	–	0: Enabled, 1: Disabled	0	–	○	4.3.6
61	B	Select enable/disable torque limit command input	–	0: Enabled, 1: Disabled	0	–	○	4.3.6
62	B	Pulse count direction	–	0: Forward motor rotation 1: Reverse motor rotation	In accordance with actuator (Note2)	○	○	4.3.6
63	B	Command pulse input mode (Pulse string mode)	–	0 to 2	1 (pulse-train and moving direction angle)	–	○	4.3.4
64	B	Command pulse input mode polarity	–	0: Positive Logic 1: Negative Logic	0	–	○	4.3.4
65	B	Electronic gear numerator	–	1 to 99,999,999	1	○	○	4.3.4
66	B	Electronic gear denominator	–	1 to 99,999,999	1	○	○	4.3.4

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Note 3 In the pulse train control mode, INP is automatically selected. (Cannot be selected)

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
67	B	Compulsory stop input	–	0: Enabled, 1: Disabled	0	–	○	4.3.6
68	B	Feedback pulse output	–	0: Enabled, 1: Disabled	1	○	○	6.1.2 [51]
69	B	Feedback pulse train	–	0 to 2	0	○	○	6.1.2 [52]
70	B	Feedback pulse form polarity	–	0: Positive Logic 1: Negative Logic	0	○	○	6.1.2 [53]
71	B	Feedforward gain	–	0 to 100	0	○	○	6.1.2 [54] 6.2
72	E	The timer value for monitoring the drive source cutoff relay welding	ms	0 to 60,000	3,000	○	○	6.1.2 [55]
73	D	Encoder voltage level	–	0 to 3	Depending on encoder cable length (Note2)	○	○	6.1.2 [56]
74	C	PIO power supply supervision	–	0: Enabled, 1: Disabled	0	○	○	6.1.2 [57]
76	D	Belt breaking sensor input polarity	–	0 to 2	In accordance with actuator (Note2)	○	○	6.1.2 [58]
77	D	Ball screw lead length	mm (deg)	0.01 to 999.99	In accordance with actuator (Note2)	○	○	6.1.2 [59]
78	D	Axis operation type	–	0: Line Axis 1: Rotary Axis	In accordance with actuator (Note2)	○	–	6.1.2 [60]
79	B	Rotary axis mode selection	–	0: Normal Mode 1: Index Mode	In accordance with actuator (Note2)	○	–	6.1.2 [61]
80	B	Rotary axis shortcut selection	–	0: Disabled, 1: Enabled	In accordance with actuator (Note2)	○	–	6.1.2 [62]
84	A	Field bus operation mode (Note4)	–	0 to 9	Separate volume	○	–	Separate volume
85	A	Field bus node address (Note4)	–	0 to 65,535	Separate volume	○	–	Separate volume
86	A	Field bus baud rate (Note4)	–	0 to 4	Separate volume	○	–	Separate volume
87	E	Network type (Note4)	–	0 to 11	Separate volume	○	–	Separate volume
88	D	Software limit margin	mm (deg)	0.00 to 9,999.99	In accordance with actuator (Note2)	○	○	6.1.2 [67]
89	D	Allowable time of exceeding torque allowing continuous pressing	s	0 to 300	In accordance with actuator (Note2)	○	–	6.1.2 [68]
90	C	Fieldbus I/O format (Note4)	–	0 to 3	Separate volume	○	–	Separate volume
91	C	Current limit value at stopping due to miss-pressing	–	0: Current limit value during movement 1: Current limit value during pressing	0	○	–	6.1.2 [70]

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

Note 4 These parameters are exclusively used for the field network. Set the parameters according to the Instruction Manual of each field network, a separate volume.

No.	Category	Name		Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
92	C	Use of loadcell		–	0: Not Applicable 1: Use	In accordance with actuator (Note2)	○	–	6.1.2 [71]
93	C	Selection of pressing control		–	0: Current limit 1: Force sensor	In accordance with actuator (Note2)	○	–	6.1.2 [72]
94	C	Pressing operation using force sensor gain		–	100 to 999,999	In accordance with actuator (Note2)	○	–	6.1.2 [73]
95	C	Force judgment margin +		%	0 to Maximum Pressing Force	In accordance with actuator (Note2)	○	–	6.1.2 [74]
96	C	Force judgment margin -		%	0 to Maximum Pressing Force	In accordance with actuator (Note2)	○	–	6.1.2 [74]
97	C	Vibration suppress parameter set 1	Damping characteristic coefficient 1	–	0 to 1,000	10	–	–	6.1.2 [75] 5.1.3
98	C		Damping characteristic coefficient 2	–	0 to 1,000	1,000	–	–	6.1.2 [75] 5.1.3
99	B		Natural frequency	1/1,000Hz	500 to 30,000	10,000	–	–	6.1.2 [75] 5.1.3
100	C		Notch filter gain	–	1 to 20,000	9,990	–	–	6.1.2 [75] 5.1.3
101	C	Vibration suppress parameter set 2	Damping characteristic coefficient 1	–	0 to 1,000	10	–	–	6.1.2 [75] 5.1.3
102	C		Damping characteristic coefficient 2	–	0 to 1,000	1,000	–	–	6.1.2 [75] 5.1.3
103	B		Natural frequency	1/1,000Hz	500 to 30,000	10,000	–	–	6.1.2 [75] 5.1.3
104	C		Notch filter gain	–	1 to 20,000	9,990	–	–	6.1.2 [75] 5.1.3
105	C	Vibration suppress parameter set 3	Damping characteristic coefficient 1	–	0 to 1,000	10	–	–	6.1.2 [75] 5.1.3
106	C		Damping characteristic coefficient 2	–	0 to 1,000	1,000	–	–	6.1.2 [75] 5.1.3
107	B		Natural frequency	1/1,000Hz	500 to 30,000	10,000	–	–	6.1.2 [75] 5.1.3
108	C		Notch filter gain	–	1 to 20,000	9,990	–	–	6.1.2 [75] 5.1.3
109	B	Default vibration suppress No.		–	0 to 3	0	○	–	6.1.2 [76] 5.1.3
110	B	Stop method at servo OFF		–	0: Rapid stop 1: Deceleration to stop	0	○	–	6.1.2 [77] 5.1.3
111	B	Calendar function		–	0: Not Applicable 1: Use	1	○	○	6.1.2 [78]
112	B	Monitoring mode		–	0: Disabled, 1: 4CH, 2: 8CH, 3: 2CH	1	○	○	6.1.2 [79]
113	B	Monitoring cycle		ms	1 to 60,000	1	○	○	6.1.2 [80]
114	B	Selecting used feedback pulse gear ratio		–	0: Not Applicable 1: Use	0	○	○	6.1.2 [81]
115	B	Electronic gear numerator (Feedback Pulse)		–	1 to 99,999,999	1	○	○	6.1.2 [82]

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
116	B	Electronic gear denominator (Feedback Pulse)	–	1 to 99,999,999	1	○	○	6.1.2 [82]
117	B	Automatic loadcell calibration at start	–	0: Does not perform 1: Perform	1	○	–	6.1.2 [83]
118	B	Pressing operation without completion of loadcell calibration	–	0: Forbidden, 1: Allow	0	○	–	6.1.2 [84]
119	B	Loadcell calibration time	ms	1 to 9,999	10	○	–	6.1.2 [85]
120	C	Servo gain number 1	–	0 to 31	In accordance with actuator (Note2)	○	–	6.1.2 [5] 8.3
121	C	Feed forward gain 1	–	0 to 100	In accordance with actuator (Note2)	○	–	6.1.2 [54]
122	C	Velocity loop proportional gain 1	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [22] 8.3
123	C	Velocity loop integral gain 1	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [23] 8.3
124	C	Torque filter time constant 1	–	0 to 2,500	In accordance with actuator (Note2)	○	–	6.1.2 [24] 8.3
125	C	Current control width number 1	–	0 to 15	In accordance with actuator (Note2)	○	–	6.1.2 [38] 8.3
126	C	Servo gain number 2	–	0 to 31	In accordance with actuator (Note2)	○	–	6.1.2 [5] 8.3
127	C	Feed forward gain 2	–	0 to 100	In accordance with actuator (Note2)	○	–	6.1.2 [54]
128	C	Velocity loop proportional gain 2	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [22] 8.3
129	C	Velocity loop integral gain 2	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [23] 8.3
130	C	Torque filter time constant 2	–	0 to 2,500	In accordance with actuator (Note2)	○	–	6.1.2 [24] 8.3
131	C	Current control width number 2	–	0 to 15	In accordance with actuator (Note2)	○	–	6.1.2 [38] 8.3
132	C	Servo gain number 3	–	0 to 31	In accordance with actuator (Note2)	○	–	6.1.2 [5] 8.3
133	C	Feed forward gain 3	–	0 to 100	In accordance with actuator (Note2)	○	–	6.1.2 [54]
134	C	Velocity loop proportional Gain 3	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [22] 8.3
135	C	Velocity loop integral Gain 3	–	1 to 99,999,999	In accordance with actuator (Note2)	○	–	6.1.2 [23] 8.3
136	C	Torque filter time constant 3	–	0 to 2,500	In accordance with actuator (Note2)	○	–	6.1.2 [24] 8.3
137	C	Current control width number 3	–	0 to 15	In accordance with actuator (Note2)	○	–	6.1.2 [38] 8.3
138	C	Servo gain switchover time constant	ms	10 to 2,000	10	○	–	6.1.2 [86]

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
139	A	Home preset value	mm (deg)	-9,999.99 to 9,999.99	In accordance with actuator (Note2)	○	○	6.1.2 [87]
140	B	IP Address	–	0.0.0.0 to 255.255.255.255	192.168.0.1	○	–	Separate volume
141	B	Subnet mask	–	0.0.0.0 to 255.255.255.255	255.255.255.0	○	–	Separate volume
142	B	Default gateway	–	0.0.0.0 to 255.255.255.255	0.0.0.0	○	–	Separate volume
143	B	Overload load level ratio	%	50 to 100	100	○	○	6.1.2 [91]
147	B	Total travel count threshold	Times	0 to 999,999,999	0 (Disabled)	○	–	6.1.2 [92]
148	B	Total travel distance threshold	mm (deg)	0 to 999,999,999	0 (Disabled)	○	○	6.1.2 [93]
149	B	Zone output changeover	–	0: PZON output select 1: ZONE1/ZONE2 output select	0	○	–	6.1.2 [94]
150	A	Linear absolute home preset value	mm (deg)	-9,999.99 to 9,999.99	In accordance with actuator (Note2)	○	○	6.1.2 [95]
151	B	Light error alarm output select	–	0: Battery Voltage Drop / Fan revolution drop / At overload warning output 1: Output when message level alarm is generated in addition to error in 0	0	○	○	6.1.2 [96]
159	B	FB half direct mode speed unit	–	0: 1mm/s Unit 1: 0.1mm/s Unit	0	○	–	Separate volume
163	C	Nominal rigidity	N/mm	1 to 99,999	In accordance with actuator (Note2)	○	–	6.1.2 [98]
164	C	Force control band	rad/s	1 to 99	10	○	–	6.1.2 [99]
165	B	Delay time after dhutdown release	ms	0 to 10,000	0	○	○	6.1.2 [100]
167	B	Pulse train datum position	mm (deg)	-9,999.99 to 9,999.99	0.00	–	○	6.1.2 [101]
173	B	Force control transition threshold	%	10 to 90	In accordance with actuator (Note2)	○	–	6.1.2 [102]
174	C	Force gains 1	–	100 to 999,999	In accordance with actuator (Note2)	○	–	6.1.2 [103]
175	C	Force gains 2	–	100 to 999,999	In accordance with actuator (Note2)	○	–	6.1.2 [103]
176	C	Force gains 3	–	100 to 999,999	In accordance with actuator (Note2)	○	–	6.1.2 [103]
180	C	Load data analog output	–	0: Enabled, 1: Disabled	1	○	–	Separate volume

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
188	B	Network number	–	1 to 239	1	○	–	Separate volume
191	B	Position data expansion function setting	–	0: Disabled 1: Drive torque limit 2: Push speed	0	○	–	6.1.2 [106]
192	B	Actuator identification system	–	0: Not Applicable 1: Use	In accordance with actuator (Note2)	○	○	6.1.2 [107]
194	B	JOG switch	–	0: Enabled, 1: Disabled	0	○	○	6.1.2 [108]
195	C	Virtual axis	–	0: Disabled, 1: Enabled	0	○	○	6.1.2 [109]
196	C	Virtual axis absolute initial position	mm (deg)	-9,999.99 to 9,999.99	0.00	○	○	6.1.2 [110]
199	A	Select enable/disable safety unit	–	0: Disabled, 1: Enabled	0	○	○	6.1.2 [111]
200	B	Velocity drop when SLS	–	0: Disabled, 1: Enabled	1	○	–	6.1.2 [112]
201	B	Deceleration and stop when SS2	–	0: Disabled, 1: Enabled	1	○	–	6.1.2 [113]
202	B	Micro operation during safety stop	–	0: Disabled, 1: Enabled	1	○	–	6.1.2 [114]
203	B	Velocity drop ratio at SLS	%	1 to 100	90	○	–	6.1.2 [115]
204	B	Micro operation movement amount at safety stop	mm	0.01 to Ball screw lead length	1.00	○	–	6.1.2 [116]
205	B	Pressing unit system selected	–	0: % Unit system 1: N Unit system	1	○	–	6.1.2 [117]
206	B	Min. unit of pressing force	–	2:1N 3:10N	In accordance with actuator (Note2)	○	–	6.1.2 [118]
207	B	Position data unit	–	0: 0.01mm 1: 0.001mm	In accordance with actuator (Note2)	○	○	6.1.2 [119]
208	B	Port number for UDP search frame	–	49152 to 65535	49152	○	–	6.1.2 [120]
209	B	System I/O enable feature	–	0: Always Enabled, 1: Disabled	0	○	○	6.1.2 [121]
210	B	Drive recorder mode select	–	0: Disabled, 1: 4CH, 2: 8CH, 3: 2CH	2	○	○	6.1.2 [122]
211	B	Drive recorder save history select	–	0: 3 History, 1: 6 History, 2: 12 History	0	○	○	6.1.2 [123]
212	B	Drive recorder sampling frequency	ms	1 to 1,000	10	○	○	6.1.2 [124]

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.

Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.

No.	Category	Name	Unit (Note1)	Input Range	Default factory setting	for Positioner Mode	for Pulse Train Mode	Relevant sections
213	B	Collision judgment current value 1	%	0 to In accordance with actuator	100	○	–	6.1.2 [125]
214	B	Collision judgment distance 1	mm	0.00 to In accordance with actuator	5.00	○	–	6.1.2 [126]
215	B	Collision judgment time 1	ms	1 to 65535	5	○	–	6.1.2 [127]
216	B	Collision Detection 1 Evacuation Operation Position Number	–	-1 to Depends on Controller Setting (Max. Number of Position Numbers)	-1: Disabled	○	–	6.1.2 [128]
217	B	Collision judgment current value 2	%	0 to In accordance with actuator	100	○	–	6.1.2 [125]
218	B	Collision judgment distance 2	mm	0.00 to In accordance with actuator	5.00	○	–	6.1.2 [126]
219	B	Collision judgment time 2	ms	1 to 65535	5	○	–	6.1.2 [127]
220	B	Collision Detection 2 Evacuation Operation Position Number	–	-1 to Depends on Controller Setting (Max. Number of Position Numbers)	-1: Disabled	○	–	6.1.2 [128]
221	B	Collision judgment current value 3	%	0 to In accordance with actuator	100	○	–	6.1.2 [125]
222	B	Collision judgment distance 3	mm	0.00 to In accordance with actuator	5.00	○	–	6.1.2 [126]
223	B	Collision judgment time 3	ms	1 to 65535	5	○	–	6.1.2 [127]
224	B	Collision Detection 3 Evacuation Operation Position Number	–	-1 to Depends on Controller Setting (Max. Number of Position Numbers)	-1: Disabled	○	–	6.1.2 [128]
225	B	Select Collision Detection Feature Output	–	0: Alarm 1: Warning	0: Alarm	○	–	6.1.2 [129]

6.1.2 Detail Explanation of Parameters

Caution

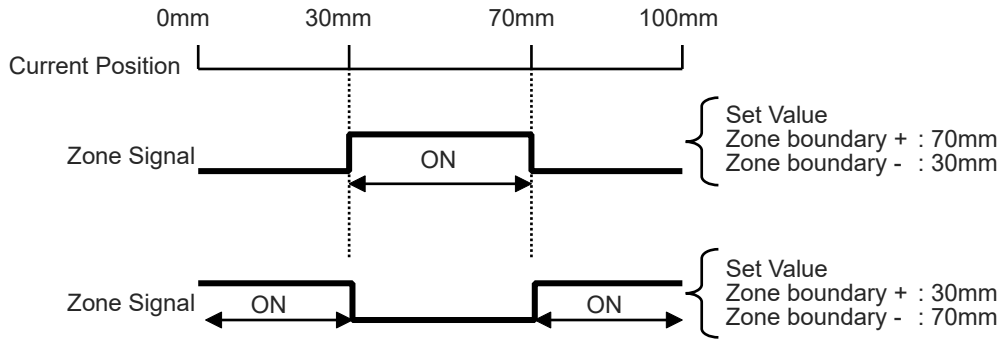
- After changing (writing) parameters, perform a software reset or power reboot so that the set values can be reflected.
- The unit (deg) is for rotary actuator. Note that it will be displayed as millimeter [mm] on the teaching tool.

[1] Zone Boundary 1+, Zone Boundary 1- (Parameter No.1, No.2)
Zone Boundary 2+, Zone Boundary 2- (Parameter No.23, No.24)

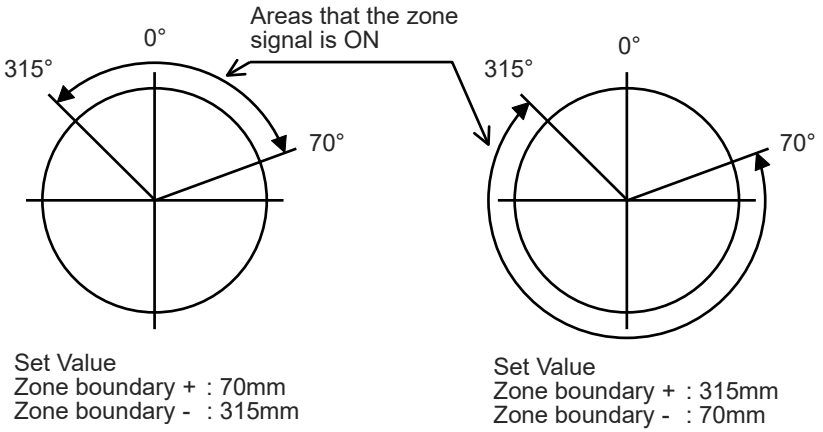
No.	Name	Unit	Input Range	Default factory setting
1	Zone Boundary 1+	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side
2	Zone Boundary 1-	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on - side
23	Zone Boundary 2+	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side
24	Zone Boundary 2-	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on - side

Set the range to turn zone signals (ZONE1, ZONE2) ON.
The minimum setting unit is 0.01mm (deg).
If a specific value is set to both zone boundary + and zone boundary -, the zone signal is not output.
A setting sample is shown next page.

[Example of when line axis]



[Example of Rotary Actuator Index Mode]



Caution

- Unless the zone signal detection range is set at a value above minimum resolution, a signal will not be output. The minimum resolution can be calculated with the equation below.
  Minimum resolution [mm/pulse] = Actuator lead [mm/r] / Encoder resolution [pulse/r]

[2] Soft limit +, Soft limit – (Parameter No.3, No.4)

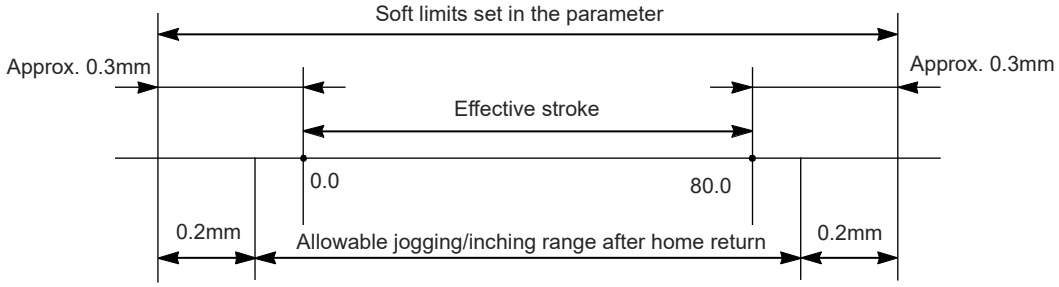
No.	Name	Unit	Input Range	Default factory setting
3	Soft limit +	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on + side
4	Soft limit -	mm (deg)	-9,999.99 to 9,999.99	Actual stroke on - side

0.3 mm (deg) is added to the outside of the effective actuator stroke for the default setting. Change as required to prevent collision when there are obstacles, or when used slightly above effective stroke within the movable range.
The minimum setting unit is 0.01mm.

Caution

- Take extra care not to set incorrect values as this will lead to a collision with the mechanical end.
- If changing, set a value extended by 0.3mm to the outside of the effective stroke.

Example) Set the effective stroke to between 0.0mm to 80.0mm
Parameter No.3 (positive side) 80.3
Parameter No.4 (negative side) -0.3



The operational range for jog and inching after the home return is 0.2mm less than the set value.
Alarm Code 0D9 “Software stroke limit over error” will be generated when the set value exceeded the value (0 when shipped out) set in Parameter No.88 “Software limit margin”.
If the setting is not done in Parameter No.88, the value set in this parameter become the detection value for Alarm Code 0D9 “Software stroke limit over error”.

[3] Home return direction (Parameter No.5)

No.	Name	Unit	Input Range	Default factory setting
5	Home return direction	—	0: Reverse, 1: Normal	In accordance with actuator

Unless there is a request of Home Reversed Type (option), the home-return direction is on the motor side for the line axis, counterclockwise side for the rotary axis and outer (open) side for the gripper.
If it becomes necessary to reverse the home direction after the actuator is installed on the machine, change the setting. Refer to [Actuator Coordinate System].

Caution

- Homing direction cannot be changed with some models.
- If it becomes necessary to reverse the homing direction after assembly to equipment, check the model of the applicable actuator to ensure that the homing direction is changeable.
- For models with which change is not possible, the actuator must be replaced. Contact IAI if anything is unclear.

[4] Press & hold stop judgment period (Parameter No.6)

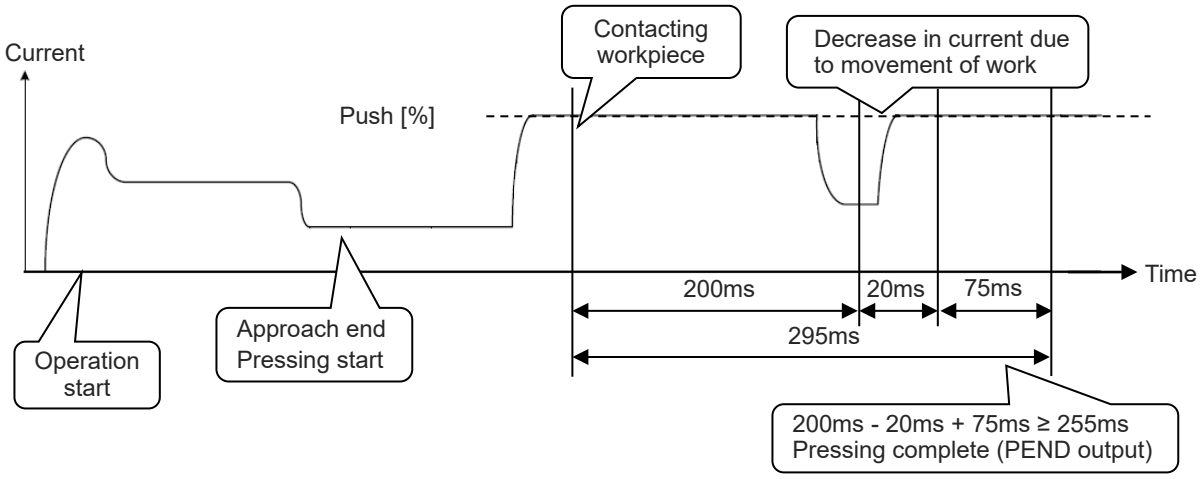
No.	Name	Unit	Input Range	Default factory setting
6	Press & hold stop judgment period	ms	0 to 9,999	255

Judging completion of pressing operation

This is the parameter to set the completion judgment time in pressing operation. (PIO pattern 0 to 3).

The torque (current limit value) set in percent [%] in "Pushing" in the position table is monitored, and the pushing complete signal PEND turns ON when the load current reaches the following conditions during push-motion operation. PEND signal turns ON when the conditions are satisfied even if the workpiece is not stopped.

Accumulated time in which current reaches pressing value [%] ≥ 255 ms (Parameter No.6)



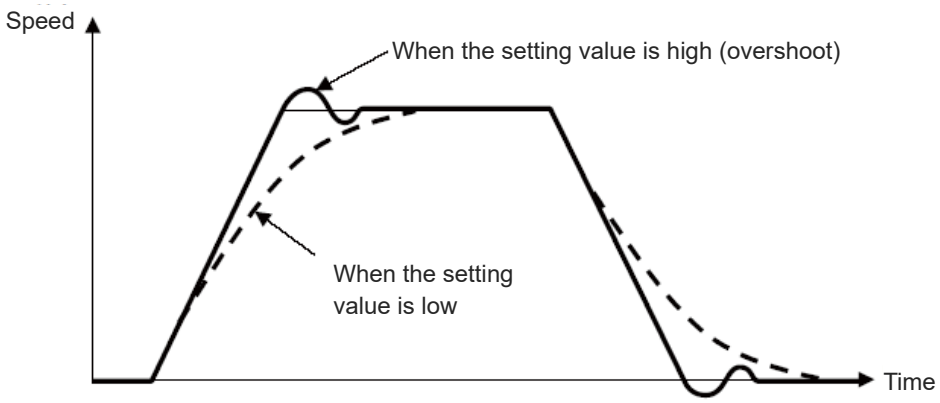
[5] Servo gain number (Parameter 7, 120, 126, 132)

No.	Name	Unit	Input Range	Default factory setting
7	Servo gain number	—	0 to 31	In accordance with actuator
120	Servo gain number 1	—	0 to 31	In accordance with actuator
126	Servo gain number 2	—	0 to 31	In accordance with actuator
132	Servo gain number 3	—	0 to 31	In accordance with actuator

The servo gain is also called position loop gain or position control system proportion gain. The parameter defines the response when a position control loop is used. Increasing the set value improves the tracking performance with respect to the position command. However, increasing the parameter value excessively increases the changes of overshooting.

When the set value is too low, the follow-up ability to the position command is degraded and it takes longer time to complete the positioning.

For a system of low mechanical rigidity or low natural frequency, setting a large servo gain number may generate mechanical resonance, which then cause not only vibrations and/or noises but also overload error to occur.



[6] Default speed (Parameter No.8)

No.	Name	Unit	Input Range	Default factory setting
8	Default speed	mm/s (deg/s)	1 to Actuator's max. speed	Rated actuator's speed

The factory setting is the rated velocity of the actuator.
When a target position is set in an unregistered position table, the setting in this parameter is automatically written in the applicable position number.
It is convenient to set the velocity often used.

[7] Default acceleration/deceleration (Parameter No.9)

No.	Name	Unit	Input Range	Default factory setting
9	Default acceleration/deceleration	G	0.01 to actuator's max. acceleration/deceleration	Rated actuator's acceleration/deceleration

The actuator rated acceleration/deceleration is set at shipment.
This setting value should be automatically written to the acceleration/deceleration in the applicable position numbers when the target position gets written to the unregistered position table. This setting also gets reflected to the jog/inching operations with a teaching tool.
Enter frequently used values for convenience.

[8] Default acceleration/deceleration (Parameter No.9)

No.	Name	Unit	Input Range	Default factory setting
10	Default positioning width	mm (deg)	0.01 to 9,999.99	In accordance with actuator

When a target position is set in an unregistered position table, the setting in this parameter is automatically written in the applicable position number. When the remaining moving distance enters into this width, the positioning complete signal is output.
It is convenient to set the positioning width often used.

Caution

- For the initial positioning band width, set a value of or higher than the minimum positioning band width.

[9] Current-limiting value during home return (Parameter No.13)

No.	Name	Unit	Input Range	Default factory setting
13	Current-limiting value during home return	%	0 to 300	In accordance with actuator

The factory setting conforms to the standard specification of the actuator.
Increasing this setting will increase the home return torque.
Normally this parameter need not be changed. If the home return should be completed before the correct position depending on the affixing method, load condition or other factors when the actuator is used in a vertical application, the setting value must be increased.

[10] Dynamic brake (Parameter No.14)

No.	Name	Unit	Input Range	Default factory setting
14	Dynamic brake	—	0: Disabled, 1: Enabled	1

This parameter defines whether the dynamic brake is enabled or disabled while the actuator is at standstill.
Normally it need not be changed.

[11] Select enable/disable pause input (Parameter No.15)

No.	Name	Unit	Input Range	Default factory setting
15	Select enable/disable pause input	—	0: Enabled, 1: Disabled	0

This parameter defines whether the pause input signal is disabled or enabled.
If pause from PIO is not required, setting the parameter to “1” allows the actuator to be operated without wiring of the pause signal input.

[12] SIO communication speed (Parameter No.16)

No.	Name	Unit	Input Range	Default factory setting
16	SIO communication speed	bps	9,600 to 230,400	38,400

Set the SIO baud rate for the startup.
Set an appropriate value in accordance with the communication speed of the host.
One of 9,600, 14,400, 19,200, 28,800, 38,400, 76,800, 115,200 and 230,400 bps can be selected as the communication speed.

Caution

- After the PC software is connected, the baud rate setting is changed to that of the PC software. To make effective the value set in the parameter, cycle controller power.

[13] Minimum delay time for slave transmitter activation (Parameter No.17)

No.	Name	Unit	Input Range	Default factory setting
17	Minimum delay time for slave transmitter activation	ms	0 to 255	5

In this setting, set the time from receiving the command (received data) during the SIO communication till the response (sent data) is returned to the host side.

[14] Home position check sensor input polarity (Parameter No.18)

No.	Name	Unit	Input Range	Default factory setting
18	Home position check sensor input polarity	—	0 to 2	In accordance with actuator

A parameter to select input polarity of the home sensor.
Home sensor is optional.

Set value	Content
0	Standard specification (Home sensor not in use)
1	Input is a-contact
2	Input is b-contact

[15] Overrun sensor input polarity (Parameter No.19)

No.	Name	Unit	Input Range	Default factory setting
19	Overrun sensor input polarity	—	0 to 2	In accordance with actuator

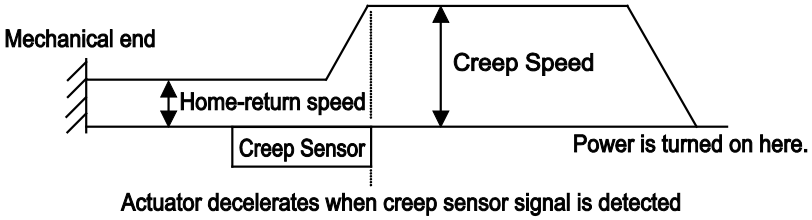
A parameter to select input polarity of the overrun sensor.
This parameter is set properly prior to the shipment according to the specification of the actuator.

Set value	Content
0	Standard specification (Overrun sensor not in use)
1	Input is a-contact
2	Input is b-contact

[16] Creep sensor input polarity (Parameter No.20)

No.	Name	Unit	Input Range	Default factory setting
20	Creep sensor input polarity	—	0 to 2	In accordance with actuator

Even though the actuator with long stroke requires time to home-return if the power is shut at a point far from the home position, the required time can be improved with using the creep sensor. The actuator moves at the creep speed (100mm/s or less) until a creep sensor signal is detected, upon which the actuator will decelerate to the home return speed.



Creep sensor is an option for the line axis type.
This parameter is set properly prior to the shipment according to the specification of the actuator.

Set value	Content
0	Standard specification (Creep sensor not in use)
1	Input is a-contact
2	Input is b-contact

[17] Select enable/disable servo ON input (Parameter No.21)

No.	Name	Unit	Input Range	Default factory setting
21	Select enable/disable servo ON input	—	0: Enabled, 1: Disabled	0

This parameter defines whether the servo ON input signal is disabled or enabled.
When the servo ON input signal is disabled, the servo is turned ON as soon as the controller power is turned ON.
Set this parameter to “1” if servo ON/OFF is not provided by PIO signals.

[18] Home return offset level (Parameter No.22)

No.	Name	Unit	Input Range	Default factory setting
22	Home return offset level	mm (deg)	0.00 to 9,999.99	In accordance with actuator

The distance from the encoder datum point (Z-phase) to the home position is set up.
An adjustment is available for the following cases.

- Want to match the actuator home position and the mechanical origin of the system.
- Want to set a new home after reversing the factory-set home direction.
- Want to eliminate a slight deviation from the previous home position generated after replacing the actuator.

Adjustment Process
1) Homing execution
2) Offset check
3) Parameter setting change

If setting a number close to a multiple of the lead length (including home-return offset value = 0) to the home offset value, there is a possibility to servo lock on Z-phase at absolute reset, thus the coordinates may get shifted for the lead length.
For Absolute Type, do not attempt to set a value near a number that the lead length is multiplied by an integral number.
Have enough margin. After the setting, repeat home return several times to confirm that the actuator always returns to the same home position.

Caution

- If the homing offset has been changed, the software limit parameter also needs to be reviewed.
  If the value must be set above the default setting, contact IAI.

[19] PIO pattern selection (Parameter No.25)

No.	Name	Unit	Input Range	Default factory setting
25	PIO pattern selection	—	0 to 7	0 (Standard Type)

Select the PIO operation pattern.
For the details of PIO patterns, refer to [3.1.2 PIO Pattern Selection and PIO Signal] or [3.2.2 I/O Signals in Pulse Train Control Mode].

[For Positioner Mode]

Pattern type	Value set in Parameter No.25	Mode	Overview
PIO Pattern 0	0 (factory setting)	Positioning mode (Standard type)	• Number of positioning points: 64 points • Position command: Binary code • Zone signal output: 1 point (Note 1) • Position zone signal output: 1 point (Note 1)
PIO Pattern 1	1	Teaching mode (Teaching type)	• Number of positioning points: 64 points • Position command: Binary code • Position zone signal output: 1 point (Note 1) • Jog operation enabled by PIO signal • Writing current position data to position table enabled by PIO signal
PIO Pattern 2	2	256-point mode (Number of positioning points 256-point type)	• Number of positioning points: 256 points • Position command: Binary code • Position zone signal output: 1 point (Note 1)
PIO Pattern 3	3	384-point mode (Number of positioning points 384-point type)	• Number of positioning points: 384 points • Position command: Binary code • Zone signal output: None
PIO Pattern 4	4	Solenoid valve mode 1 (7-point type)	• Number of positioning points: 7 points • Position command: Individual No. signal ON • Zone signal output: 1 point (Note 1) • Position zone signal output: 1 point (Note 1)
PIO Pattern 5	5	Solenoid valve mode 2 (3-point type)	• Number of positioning points: 3 points • Position command: Individual No. signal ON • Zone signal output: 1 point (Note 1) • Position zone signal output: 1 point (Note 1)
PIO Pattern 6	6	Pressing operation using force sensor mode 1	• Number of positioning points: 32 points • Position command: Binary code • Position zone signal output: 1 point (Note 1) • Judgment of pressing force enabled
PIO Pattern 7	7	Pressing operation using force sensor mode 2 (Solenoid valve Type)	• Number of positioning points: 5 points • Position command: Individual No. signal ON • Position zone signal output: 1 point (Note 1) • Judgment of pressing force enabled

Note 1 Position zone signal can be switched over to zone signal. Refer to [6.1.2 [95] Zone output changeover (Parameter No.149)].

[For Pulse Train Control Mode]

Pattern type	Value set in Parameter No.25	Mode	Overview
PIO Pattern 0	0 (factory setting)	Pulse train control mode for incremental	• Differential pulse input (MAX.200kpps) • Home return function • Zone signal output: 2 points • No feedback pulse output
PIO Pattern 1	1	Pulse train control mode for absolute	• Setting the datum point (1 places) • Differential pulse input (MAX.200kpps) • Home return function • Zone signal output: 2 points • No feedback pulse output

* Refer to [3.2 Pulse Train Control Mode] for details.

Caution

- Make sure to set to “Positioner Mode” when performing an operation with using the serial communication.
  If it happens to be in the “Pulse train control mode” by mistake, the controller may operate erratically because it is operated according to the “Pulse train control mode” parameters.

[20] PIO jog velocity (Parameter No.26), PIO jog velocity 2 (Parameter No.47)

No.	Name	Unit	Input Range	Default factory setting
26	PIO jog velocity	mm/s (deg/s)	1 to Actuator’s max. speed	In accordance with actuator
47	PIO jog velocity 2			

This is the jog operation velocity setting with PIO signal (jog input command) when PIO pattern = 1 (Teaching Mode) is selected.
Set an appropriate value in accordance with the purpose of use.

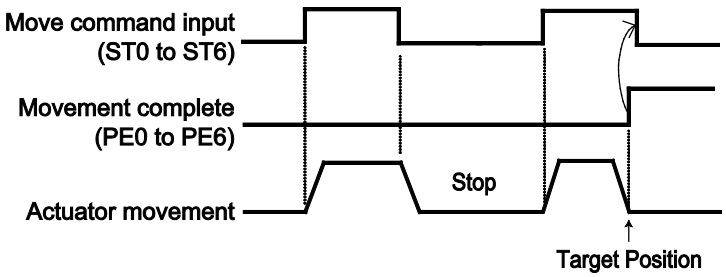
[21] Movement command type (Parameter No.27)

No.	Name	Unit	Input Range	Default factory setting
27	Movement command type	—	0: Level, 1: Edge	0

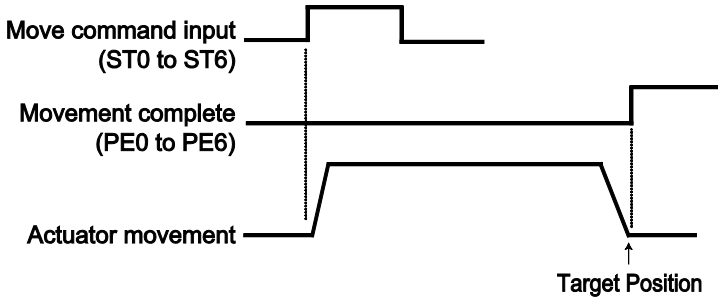
Set the input methods for the start signal (ST0 to ST6, or ST0 to ST2 if PIO Pattern = 5) when PIO Pattern 4 = Solenoid Valve Mode 1 (7-point type), PIO Pattern 5 = Solenoid Valve Mode 2 (3-point type) and PIO Pattern 7 = Force Sensor Used Pressing Mode 2 (Electromagnetic Valve Mode)

Set Value	Input method	Description
0	Level	The actuator starts moving when the input signal turns ON. When the signal turns OFF during movement, the actuator will decelerate to a stop and complete its operation.
1	Edge	The actuator starts moving when the rising edge of the input signal is detected. The actuator will not stop when the signal turns OFF during the movement, until the target position is reached.

[Level System]



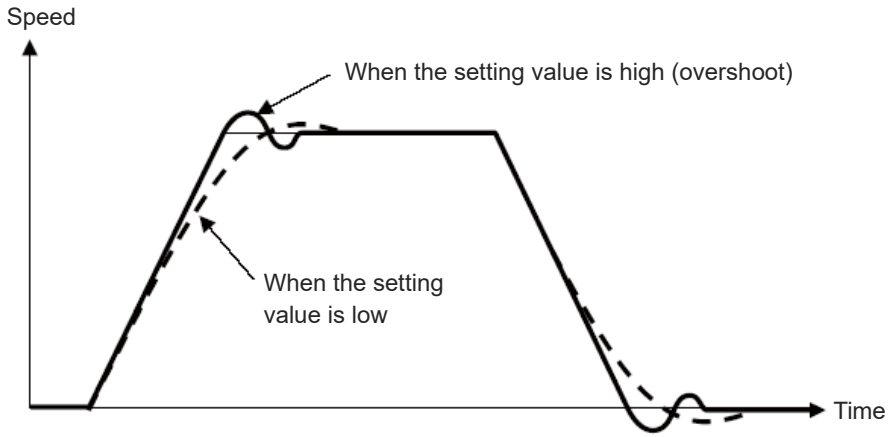
[Edge System]



[22] Velocity loop proportional gain (Parameter No.31, 122, 128, 134)

No.	Name	Unit	Input Range	Default factory setting
31	Velocity loop proportional gain	—	1 to 99,999,999	In accordance with actuator
122	Velocity loop proportional gain 1	—	1 to 99,999,999	In accordance with actuator
128	Velocity loop proportional gain 2	—	1 to 99,999,999	In accordance with actuator
134	Velocity loop proportional gain 3	—	1 to 99,999,999	In accordance with actuator

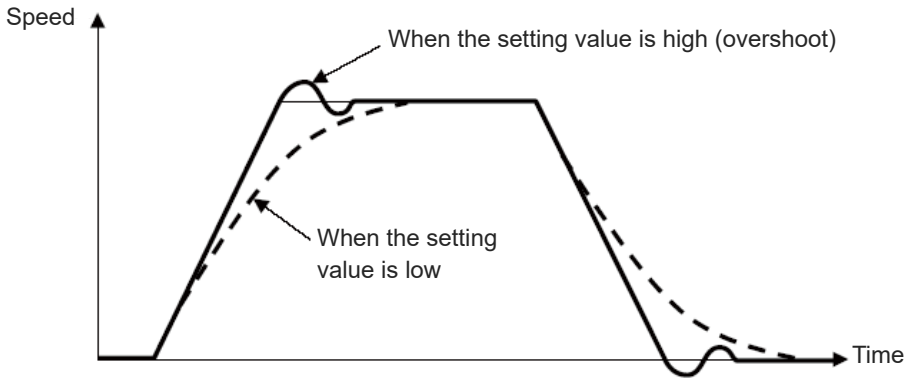
This parameter determines the response of the speed control loop. When the set value is increased, the follow-up ability to the velocity command becomes better (the servo-motor rigidity is enhanced). The higher the load inertia becomes, the larger the value should be set. However, excessively increasing the setting will cause overshooting or oscillation, which facilitates producing the vibrations of the mechanical system.



[23] Velocity loop integral gain (Parameter No.32, 123, 129, 135)

No.	Name	Unit	Input Range	Default factory setting
32	Velocity loop integral gain	—	1 to 99,999,999	In accordance with actuator
123	Velocity loop integral gain 1	—	1 to 99,999,999	In accordance with actuator
129	Velocity loop integral gain 2	—	1 to 99,999,999	In accordance with actuator
135	Velocity loop integral gain 3	—	1 to 99,999,999	In accordance with actuator

The parameter which corresponds to deviation caused by external factors, such as friction.
The increased set value improves the repulsive force against load fluctuation.
If it is too high, overshoot and oscillation, as well as vibration in the mechanical system may occur.
Adjust appropriately while observing the response.



[24] Torque filter time constant (Parameter No.33, 124, 130, 136)

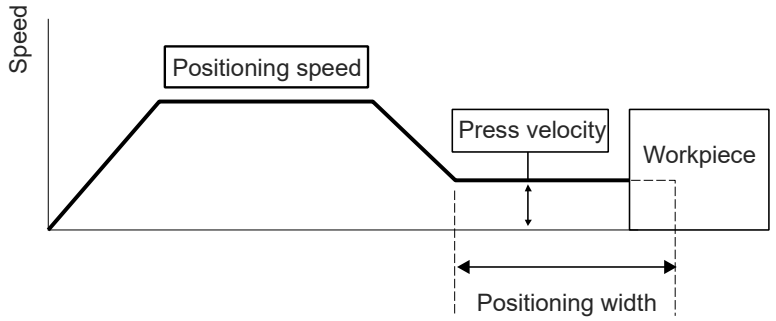
No.	Name	Unit	Input Range	Default factory setting
33	Torque filter time constant	—	0 to 2,500	In accordance with actuator
124	Torque filter time constant 1	—	0 to 2,500	In accordance with actuator
130	Torque filter time constant 2	—	0 to 2,500	In accordance with actuator
136	Torque filter time constant 3	—	0 to 2,500	In accordance with actuator

This parameter decides the filter time constant for the torque command. When vibrations and/or noises occur due to mechanical resonance during operation, this parameter may be able to suppress the mechanical resonance. This function is effective for torsion resonance of ball screws (several hundreds Hz).

[25] Press velocity (Parameter No.34)

No.	Name	Unit	Input Range	Default factory setting
34	Press velocity	mm/s (deg/s)	1 to actuator's max. pressing speed	In accordance with actuator

This is the parameter to set the velocity in pressing operation.
The setting is done considering the actuator type when the product is delivered. For details, refer to [10.3 List of Specifications of Connectable Actuators].
If a change to the setting is required, make sure to have the setting below the maximum pressing velocity of the actuator. Setting it fast may disable to obtain the specified pressing force. Also when setting at a low velocity, take 5mm/s as the minimum.



Caution

- If the velocity of the positioning of the position table is set below this parameter, the pressing speed will become the same as the positioning speed.

[26] Safety velocity (Parameter No.35)

No.	Name	Unit	Input Range	Default factory setting
35	Safety velocity	mm/s (deg/s)	1 to 250 (Maximum speed should be the upper limit for actuators with maximum speed less than 250)	100

This is the parameter to set the maximum speed of manual operation while the safety velocity selected in the teaching tool. Do not have the setting more than necessary.

[27] Auto servo-motor OFF delay time 1, 2, 3 (Parameter No.36, No.37, No.38)

No.	Name	Unit	Input Range	Default factory setting
36	Auto servo-motor OFF delay time 1	s	0 to 9,999	0
37	Auto servo-motor OFF delay time 2	s	0 to 9,999	0
38	Auto servo-motor OFF delay time 3	s	0 to 9,999	0

Set the duration from the time after positioning complete until automatic servo OFF when using the power-saving function.
For details, refer to [5.2 Power-saving Function (Auto Servo-motor OFF Function)].

[28] Position complete signal output method (Parameter No.39)

No.	Name	Unit	Input Range	Default factory setting
39	Position complete signal output method	—	0: PEND, 1: INP	0

This is the parameter to select the type of the positioning complete signals to be used.
It is available except for when PIO Pattern = 5 (Electromagnetic Valve Type 2 (3-point type)) is selected.
There are 2 types of positioning complete signals and the output condition would differ depending on whether the servo is ON after the positioning is complete or the servo is OFF.

<table>
<tr><th>Setting</th><th colspan="2">Signal Type</th><th>During Servo ON (positioning complete)</th><th>During Servo OFF</th></tr>
<tr><td>0</td><td colspan="2">PEND</td><td>It will not turn OFF even if the current position is out of the range of the positioning width.</td><td>Turns OFF in any case</td></tr>
<tr><td>1</td><td colspan="2">INP (Note 1)</td><td colspan="2">Turns ON when the current position is in the positioning width, and OFF when out of it.</td></tr>
<tr><td rowspan="2">Pulse train control mode (Note 1)</td><td rowspan="2">INP</td><td>AUTO</td><td>Turns ON when the current position is in the positioning width (Parameter No.10), and OFF when out of it.</td><td>Turns OFF in any case</td></tr>
<tr><td>MANU</td><td colspan="2">Turns ON when the current position is in the positioning width (Parameter No.10), and OFF when out of it.</td></tr>
</table>

Complete position No. outputs PM1 to PM** and current position No. outputs PE0 to PE6 are issued in the similar way.

Note 1 In Pulse train control mode, the signal becomes INP compulsorily when the setting is AUTO, and turns OFF during the servo-off condition.

[29] Select enable/disable homereturn input (Parameter No.40)

No.	Name	Unit	Input Range	Default factory setting
40	Select enable/disable homereturn input	—	0: Enabled, 1: Disabled	0

This parameter defines whether the home return input signal is disabled or enabled.
Normally this parameter need not be changed.

[30] Select enable/disable operatingmode input (Parameter No.41)

No.	Name	Unit	Input Range	Default factory setting
41	Select enable/disable operatingmode input	—	0: Enabled, 1: Disabled	0

This parameter defines whether the operation mode input signal RMOD is disabled or enabled.
Normally this parameter need not be changed.

[31] Enable function (Parameter No.42)

No.	Name	Unit	Input Range	Default factory setting
42	Enable function	—	0: Enabled, 1: Disabled	1

Set valid/invalid the deadman switch function if the teaching pendant is equipped with a deadman switch.

[32] Silent interval magnification (Parameter No.45)

No.	Name	Unit	Input Range	Default factory setting
45	Silent interval magnification	times	0 to 10	0

Use this parameter to set the silent interval (no communication) time by the time taken for communication of 3.5 characters or longer before command data transmission when the controller is operated via serial communication (RTU).
This parameter need not be changed when a teaching tool such as PC software is used.
If “0” is set, no multiplier is applied.

[33] Velocity override (Parameter No.46)

No.	Name	Unit	Input Range	Default factory setting
46	Velocity override	%	1 to 100	100

When executing travel commands from the PLC side, override can be applied against the travel speed set in the "Velocity " field in the position table. Minimum setting unit is 1%, and input range is 1 to 100%.
Actual travel speed = “speed set in position table” × “set value of Parameter No. 46”

Example) If the value in the "Velocity " column of the position table is 500mm/s and parameter No. 46 is 20%, the actual travel speed will be 100mm/s.

Note This parameter is ignored for move commands from a teaching tool such as PC software.

[34] PIO inch distance, PIO inch distance 2 (Parameter No.48, No.49)

No.	Name	Unit	Input Range	Default factory setting
48	PIO inch distance	mm (deg/s)	0.01 to 1.00	0.10
49 (Note1)	PIO inch distance 2	mm (deg/s)	0.01 to 1.00	0.10

When the selected PIO pattern is “1” (Teaching Mode), Parameter No.48 defines the inching distance to be applied when inching input commands are received from the PLC.

Note 1 Parameter No.49 “PIO inching distance 2” is not used for the controller.

[35] Load output judgment time period (Parameter No.50)

No.	Name	Unit	Input Range	Default factory setting
50	Load output judgment time period	ms	0 to 9,999	255

This parameter defines the time taken to judging whether torque level status signal (TRQS) is ON. If the command torque exceeds the value set in “Threshold” of position data for the time set by this parameter during pressing operation, torque level status signal (TRQS) is turned ON. Refer to [4.2.4 [4]] or [4.2.5 [3]] for the details of the pressing operation.

[36] Default acceleration/deceleration mode (Parameter No.52)

No.	Name	Unit	Input Range	Default factory setting
52	Default acceleration/deceleration mode	—	0: Trapezoid pattern 1: S-motion 2: First-order delay filter	0 (Trapezoid pattern)

When a target position is written to an unregistered position table, this value is automatically set as the “Acceleration/deceleration mode” of the applicable position number.

[37] Default stop mode (Parameter No.53)

No.	Name	Unit	Input Range	Default factory setting
53	Default stop mode	—	0 to 3	0 (Does not use)

This parameter defines the power-saving function.
For details, refer to [5.2 Power-saving Function (Auto Servo-motor OFF Function)].

[38] Current-control width number (Parameter No.54, 125, 131, 137)

No.	Name	Unit	Input Range	Default factory setting
54	Current-control width number	—	0 to 15	In accordance with actuator
125	Current-control width number 1	—	0 to 15	In accordance with actuator
131	Current-control width number 2	—	0 to 15	In accordance with actuator
137	Current-control width number 3	—	0 to 15	In accordance with actuator

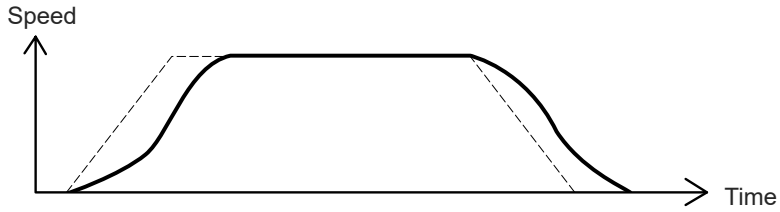
This parameter is for the manufacturer’s use only to determine the response capability of the current loop control. Therefore, do not change the settings in this parameter. If the parameter is changed carelessly, control safety may be adversely affected and a very dangerous situation may result.

[39] Position-command primary filter time constant (Parameter No.55)

No.	Name	Unit	Input Range	Default factory setting
55	Position-command primary filter time constant	ms	0.0 to 100.0	0.0

Use this in the case to set the value in “Acceleration/deceleration mode” box in the position table to “2: 1-step delay filter”, or in the case that there is no acceleration/deceleration function the host controller in Pulse Train Control Mode.
This draws a more gentle acceleration/deceleration curve compared to trapezoidal patterns.

The greater the setting value is, the longer the delay is and the slower the acceleration/deceleration is. The impact at the acceleration and deceleration will be eased, but the cycle time will become longer.
Use for applications where minor vibrations to the workpiece during acceleration/deceleration are to be avoided.
Refer to [4.3.6 [1] Position Command Primary Filter Time Constant] for Pulse Train Control Mode.



However, this is not reflected for jogging/inching operations via a PC software or teaching pendant.

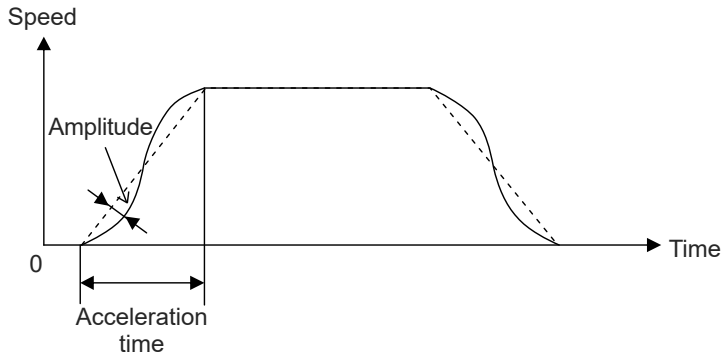
Caution

- In the following cases the first-order delay filter becomes disabled.
  1. When a position command or direct numerical value command with the first-order delay filter is set during actuator operation.
  2. When using a rotary actuator in index mode.
  3. When parameter No. 55 is set to 0.

[40] S-motion ratio setting (Parameter No.56)

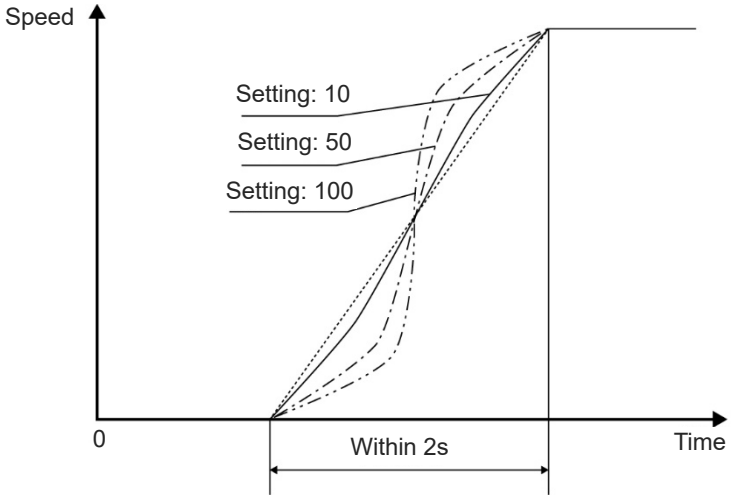
No.	Name	Unit	Input Range	Default factory setting
56	S-motion ratio setting	%	0 to 100	0

Used when the value of “Acc/Dec mode” field in the position table is set to “1 (S-motion ratio setting)”.
This softens the shocks of acceleration/deceleration without extending the cycle time.



The S-motion is a sine curve that has the acceleration time as 1 cycle.
The level of its swing width can be set by this parameter.

Setting [%]	Degree of amplitude
0	No S-motion (dotted line in the image diagram)
10	Amplitude of sinusoidal wave × 0.1 (solid line in the image diagram)
50	Amplitude of sinusoidal wave × 0.5 (single-dot chain line in the image diagram)
100	Amplitude of sinusoidal wave × 1 (double-dot chain line in the image diagram)



Caution

- Be sure to execute the command while the actuator is stopped.
- Because it changes speed, etc. during travel, even if executing position command or direct numerical value command with S-motion setting while the actuator is under operation, the control will be trapezoid instead of S-motion.
- For rotary actuator in the index mode, S-motion control is disabled. Even if S-motion control is specified, the control will be trapezoid.
- Do not use S-motion control if the setting of the acceleration time or the deceleration time exceeds 2s. The control will be trapezoid.
- Avoid pauses during acceleration or deceleration operation.

[41] Torque limit (Parameter No.57) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
57	Torque limit	%	0 to 70	70

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[42] Deviation error monitor during torque limiting (Parameter No.59) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
59	Deviation error monitor during torque limiting	—	0: Disabled, 1: Enabled	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[43] Select enable/disable deviation counter clear input (Parameter No.60) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
60	Select enable/disable deviation counter clear input	—	0: Enabled, 1: Disabled	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[44] Select enable/disable torque limit command input (Parameter No.61) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
61	Select enable/disable torque limit command input	—	0: Enabled, 1: Disabled	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[45] Pulse count direction (Parameter No.62)

No.	Name	Unit	Input Range	Default factory setting
62	Pulse count direction	—	0: Forward motor rotation 1: Reverse motor rotation	In accordance with actuator

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[46] Command pulse input mode (Parameter No.63) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
63	Command pulse input mode	—	0 to 2	1

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.4 Settings of Basic Parameters Required for Operation].

[47] Command pulse input mode polarity (Parameter No.64) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
64	Command pulse input mode polarity	—	0: Positive Logic 1: Negative Logic	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.4 Settings of Basic Parameters Required for Operation].

[48] Electronic gear numerator (Parameter No.65)

No.	Name	Unit	Input Range	Default factory setting
65	Electronic gear numerator	—	1 to 99,999,999	1

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.4 Settings of Basic Parameters Required for Operation].

[49] Electronic gear denominator (Parameter No.66)

No.	Name	Unit	Input Range	Default factory setting
66	Electronic gear denominator	—	1 to 99,999,999	1

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.4 Settings of Basic Parameters Required for Operation].

[50] Compulsory stop input (Parameter No.67) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
67	Compulsory stop input	—	0: Enabled, 1: Disabled	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[51] Select enable/disable feedback pulse output (Parameter No.68)

No.	Name	Unit	Input Range	Default factory setting
68	Select enable/disable feedback pulse output	—	0: Enabled, 1: Disabled	1

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[52] Feedback pulse form (Parameter No.69)

No.	Name	Unit	Input Range	Default factory setting
69	Feedback pulse form	—	0 to 2	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].

[53] Feedback pulse form polarity (Parameter No.70) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
70	Feedback pulse form polarity	—	0: Positive Logic 1: Negative Logic	0

This parameter is exclusively used for the pulse-train control mode.
Refer to [4.3.6 Parameter Settings Required for Advanced Operations].
The setting is the same for the cases other than Pulse Train Control Mode.

[54] Feedforward gain (Parameter No. 71)

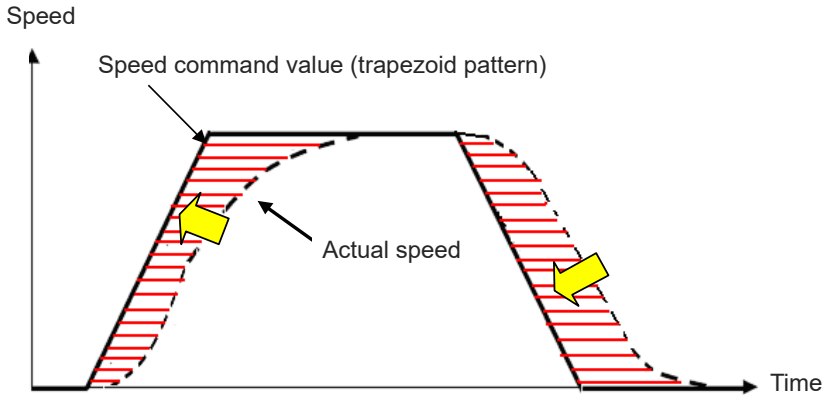
No.	Name	Unit	Input Range	Default factory setting
71	Feedforward gain	—	0 to 100	0

Sets the feed forward gain amount of the position control system.

Performing this setting increases the servo gain and improves responsiveness of the position control loop.
Properly adjust Parameter No. 7 “Servo gain number” and Parameter No. 31 “Velocity loop proportional gain”, etc., to further improve the tact time and following performance. As a result, positioning time can be shortened.

Gain adjustment of position, speed, and current loop in the feedback control directly changes the response of the servo control system, so affecting the stability of the control system due to inappropriate setting may cause vibration and abnormal noise. However, this parameter only changes the speed command value, so it is irrelevant to the servo loop, and it would not generate persistent vibration and noise. However, if the setting is excessive, every time it operates, vibration and noise may be generated until the machine follows the command value. In the trapezoidal pattern, adding the value resulting from multiplying the speed command by the “feed forward gain” to the speed command can reduce the delay of speed follow-up and the position deviation.

The feedback control providing control in accordance with the result causes control delay to occur. This conducts the supportive control independent from the control delay.



Caution

- Anti-vibration control function is unavailable when the feed-forward gain is used (with the settings except for 0).

[55] The timer value for monitoring the drive source cutoff relay welding (Parameter No. 72)

No.	Name	Unit	Input Range	Default factory setting
72	The timer value for monitoring the drive source cutoff relay welding	ms	0 to 60,000	3,000

This parameter defines the timer period in which fusing of the emergency stop relay for cutting off the motor drive power is detected.
If the motor AC power is not cut off after elapse of the timer period set by this parameter following the cutoff of the driver power, the control will recognize that the relay has been fused and generate an alarm.
Normally this parameter need not be changed. When a value between 0 and 9 is set, no fusing is detected.

[56] Encoder voltage level (Parameter No.73)

No.	Name	Unit	Input Range	Default factory setting
73	Encoder voltage level	—	0 to 3	Depending on encoder cable length

To stabilize encoder detection signals, this parameter defines the voltage supplied to the encoder circuit to one of four levels in accordance with the encoder type and the length of the encoder relay cable.
Normally this parameter need not be changed. If you have changed the length of the encoder relay cable after the shipment, the value of the parameter may be changed.

[57] PIO power supply supervision (Parameter No.74)

No.	Name	Unit	Input Range	Default factory setting
74	PIO power supply supervision (Note 1)	—	0: Enabled, 1: Disabled	0

A power monitor function is provided to prevent incorrect operations, burning of the I/O board and/or breakdown of parts caused by an abnormal voltage of the 24V DC for PIO power supply. This parameter can be disabled in certain situations such as when the controller is operated by a teaching tool without connection of PIO during trail operation for adjustments. Do not forget put it back to “0” (Enabled) before starting the system operation after the test run for the adjustment is finished.

Note 1 The power monitoring will not be conducted no matter the settings for the Field network types (CC-Link/DeviceNet, etc.).

[58] Belt breaking sensor input polarity (Parameter No.76)

No.	Name	Unit	Input Range	Default factory setting
76	Belt breaking sensor input polarity	—	0 to 2	In accordance with actuator

Set the input polarity of the sensor for Belt Break Detection in the Ultra-High Thrust Type RCS2-RA13R.

Set Value	Description
0	Not used
1	Input is a contact
2	Input is b contact

Caution

- Changing the setting of this parameter disables the alarm to be detected.

[59] Ball screw lead length (Parameter No.77)

No.	Name	Unit	Input Range	Default factory setting
77	Ball screw lead length	mm (deg)	0.01 to 999.99	In accordance with actuator

This parameter set the ball screw lead length.
The factory setting is the value in accordance with the actuator characteristics.

Caution

- If the setting is changed, not only the normal operation with indicated speed, acceleration or amount to move is disabled, but also it may cause a generation of alarm, or malfunction of the unit.

[60] Axis operation type (Parameter No.78)

No.	Name	Unit	Input Range	Default factory setting
78	Axis operation type	—	0: Line Axis 1: Rotary Axis	In accordance with actuator

This parameter defines the type of the actuator used.

Connected Actuator	Set Value	Remarks
Line Axis	0	Actuator other than rotary type
Rotary Axis	1	Rotary type actuator (RS-30/60, RCS2-RT6/RT6R/RT7/RT7R/ RTC8L/RTC8HL/RTC10L/RTC12L/DD Motor)

Caution

- Do not change the setting of this parameter. Failure to follow this may cause an alarm or fault to occur.

[61] Rotary axis mode selection (Parameter No.79)

No.	Name	Unit	Input Range	Default factory setting
79	Rotary axis mode selection	—	0: Normal Mode 1: Index Mode	In accordance with actuator

Sets rotary axis mode.
When parameter No. 78 “Axis operation type” is set to “1: Rotary axis,” the present value expression will be fixed to 0 to 359.99 by selecting index mode.
Selection of the index mode will enable shortcut control.

Index mode cannot be specified with an absolute specification actuator.

Default factory setting	Actuator
0 (Normal Mode)	• RCS2-RT6/RT6R/RT7/RT7R • Absolute Type in RS-30/60 and RCS2-RTC8L/RTC8HL/RTC10L/RTC12L • Multi-Rotation Absolute Type in DD Motor
1 (Index Mode)	• Incremental Type in RS-30/60 and RCS2-RTC8L/RTC8HL/RTC10L/RTC12L • Index Absolute Type in DD Motor

Caution

- Push-motion operation is not available during index mode. Even if data is input for the "push-motion" of position data, it will become invalid and normal travel will be executed. Also, the positioning band is the value set in Parameter No. 10 “Default positioning width”.
- Do not change the setting for DD motor as it is not capable to switch between normal mode and index mode in this parameter.

[62] Rotary axis shortcut selection (Parameter No.80)

No.	Name	Unit	Input Range	Default factory setting
80	Rotary axis shortcut selection	—	0: Disabled, 1: Enabled	In accordance with actuator

Select whether valid/invalid the shortcut when positioning is performed except for when having the relative position movement in the multiple rotation type rotary actuator.
The shortcut means that the actuator is rotated to the next position in the rotational direction of the smaller travel distance.

For details, refer to [Shortcut control of rotary actuator of multi-rotation specification in 4.2.4 Operation with the Position No. Input (PIO Patterns 0 to 3 and 6)].

[63] Fieldbus operation mode (Parameter No.84)

This parameter is exclusively used for the controller of field network specification.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

[64] Fieldbus node address (Parameter No.85)

This parameter is exclusively used for the controller of field network specification.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

[65] Fieldbus baud rate (Parameter No.86)

This parameter is exclusively used for the controller of field network specification.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

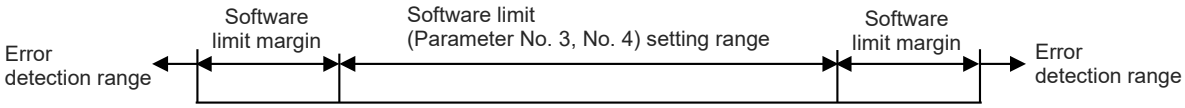
[66] Network type (Parameter No.87)

This parameter is exclusively used for the controller of field network specification.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

[67] Software limit margin (Parameter No.88)

No.	Name	Unit	Input Range	Default factory setting
88	Software limit margin	mm	0.00 to 9,999.99	In accordance with actuator

This is the parameter to set the amount of over error detection against the soft limit errors set in Parameters No.3 and No.4.
It is not necessary to change the setting in normal use.



[68] Allowable time of exceeding torque allowing continuous pressing (Parameter No.89)

No.	Name	Unit	Input Range	Default factory setting
89	Allowable time of exceeding torque allowing continuous pressing	s	0 to 300	In accordance with actuator

This is the parameter to limit the continuous pressing time when using RCS2-RA13R with the pressing setting of 71% or more.
When the unit is used beyond this limit, Alarm Code 0C4 “Exceeded allowable time of exceeding torque allowing continuous pressing” will be generated to prevent the temperature rise on the motor due to the continuous pressing operation. Refer to [10.3.2 Push Force and Current Limit Value].

Set Value	Description
0	Do not judge
1 to 300	Allowable time of continuous pressing (when pressing setting of 71% or more is used in RCS2-RA13R)

[69] Fieldbus I/O format (Parameter No.90)

This parameter is exclusively used for the controller of field network specification.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

[70] Current limit value at stopping due to miss-pressing (Parameter No.91)

No.	Name	Unit	Input Range	Default factory setting
91	Current limit value at stopping due to miss-pressing	—	0: Current limit value during movement 1: Current limit value during pressing	0

This parameter defines the restricted current value at stopping due to miss-pressing.
This restricted current value locks the servo till the next moving command.

Set Value	Description
0	Current limit value during movement (2.8 to 4 times of rating value depending on actuator characteristics)
1	Uses the current limit value during push-motion set in the position table.

[71] Use of loadcell (Parameter No.92)

No.	Name	Unit	Input Range	Default factory setting
92	Use of loadcell	—	0: Not Applicable 1: Use	In accordance with actuator

This parameter defines whether the loadcell (option) is used or not.

Set Value	Description
0	Does not use the loadcell (when standard actuator)
1	Use the loadcell (For the actuator with the loadcell)

Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)]

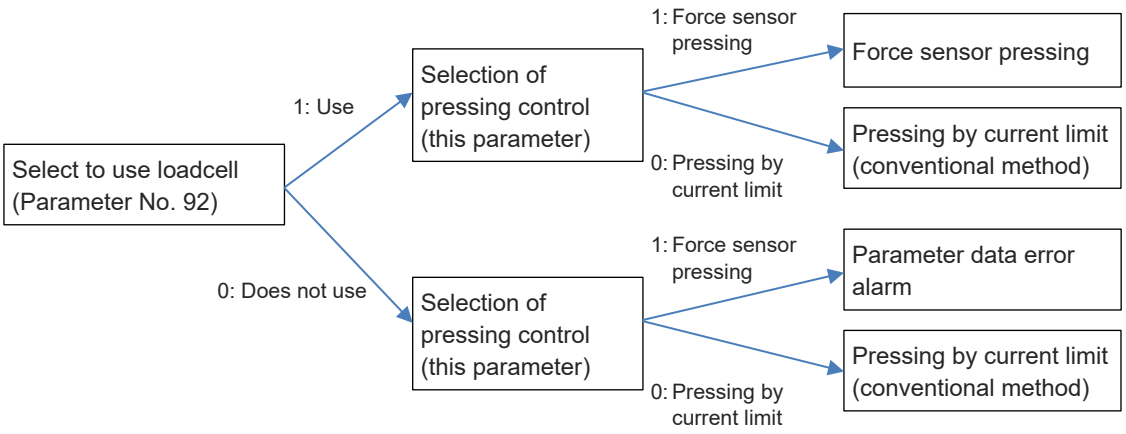
[72] Selection of pressing control (Parameter No.93)

No.	Name	Unit	Input Range	Default factory setting
93	Selection of pressing control	—	0: Current limit 1: Force sensor	In accordance with actuator

This parameter defines the pressing method.

Set Value	Description
0	Pressing by current limit (when standard actuator)
1	Force Sensor Used Pressing (for actuator equipped with loadcell)

Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)]



[73] Pressing operation using force sensor gain (Parameter No.94)

No.	Name	Unit	Input Range	Default factory setting
94	Pressing operation using force sensor gain	—	100 to 999,999	In accordance with actuator

This parameter defines the gain for pressing operation using force sensor.
The gain may be adjusted when the rigidity of the pressing target is extremely large or small.
The relation among the rigidity of pressing target, the response of pressing operation using force sensor system and pressing operation using force sensor gain differs depending on the actuator, and is as shown in the table below.

RA13R, RA10R (Default factory setting = 1,500)

	Rigidity of pressing target					
	Hard ← Rigidity → Soft					
Responsiveness of Control System High ← Response → Low	1,050	2,100	4,200	8,400	16,800	33,600
	1,200	2,400	4,800	9,600	19,200	38,400
	1,350	2,700	5,400	10,800	21,600	43,200
	1,500	3,000	6,000	12,000	24,000	48,000
	1,650	3,300	6,600	13,200	26,400	52,800
	1,800	3,600	7,200	14,400	28,800	57,600
	1,950	3,900	7,800	15,600	31,200	62,400

RA8R (Default factory setting = 3,000)

	Rigidity of pressing target					
	Hard ← Rigidity → Soft					
Responsiveness of Control System High ← Response → Low	2,100	4,200	8,400	16,800	33,600	67,200
	2,400	4,800	9,600	19,200	38,400	76,800
	2,700	5,400	10,800	21,600	43,200	86,400
	3,000	6,000	12,000	24,000	48,000	96,000
	3,300	6,600	13,200	26,400	52,800	105,600
	3,600	7,200	14,400	28,800	57,600	115,200
	3,900	7,800	15,600	31,200	62,400	124,800

RA7R (Default factory setting = 5,000)

Responsiveness of Control System: High ← Response → Low	Rigidity of pressing target: Hard ← Rigidity → Soft					
	3,500	7,000	14,000	28,000	56,000	112,000
	4,000	8,000	16,000	32,000	64,000	128,000
	4,500	9,000	18,000	36,000	72,000	144,000
	5,000	10,000	20,000	40,000	80,000	160,000
	5,500	11,000	22,000	44,000	88,000	176,000
	6,000	12,000	24,000	48,000	96,000	192,000
	6,500	13,000	26,000	52,000	104,000	208,000

RA6R (Default factory setting = 10,000)

Responsiveness of Control System: High ← Response → Low	Rigidity of pressing target: Hard ← Rigidity → Soft					
	7,000	14,000	28,000	56,000	112,000	224,000
	8,000	16,000	32,000	64,000	128,000	256,000
	9,000	18,000	36,000	72,000	144,000	288,000
	10,000	20,000	40,000	80,000	160,000	320,000
	11,000	22,000	44,000	88,000	176,000	352,000
	12,000	24,000	48,000	96,000	192,000	384,000
	13,000	26,000	52,000	104,000	208,000	416,000

[74] Force judgment margin + / - (Parameter No.95, No.96)

No.	Name	Unit	Input Range	Default factory setting
95	Force judgment margin +	%	0 to Maximum Pressing Force	In accordance with actuator
96	Force judgment margin -	%	0 to Maximum Pressing Force	In accordance with actuator

This parameter defines the pressing force range in which the completion of pressing by pressing operation using force sensor is assumed (to output PEND).
Refer to [4.2.4 [4] (2)] or [4.2.5 [3] (2) Force Sensor Used Pressing]

[75] Damping characteristic coefficient 1, 2 / Natural frequency / Notch filter gain (Parameter No.97 to No.108)

No.	Name	
97	Damping characteristic coefficient 1	Vibration suppress parameter set 1
98	Damping characteristic coefficient 2	
99	Natural frequency	
100	Notch filter gain	
101	Damping characteristic coefficient 1	Vibration suppress parameter set 2
102	Damping characteristic coefficient 2	
103	Natural frequency	
104	Notch filter gain	
105	Damping characteristic coefficient 1	Vibration suppress parameter set 3
106	Damping characteristic coefficient 2	
107	Natural frequency	
108	Notch filter gain	

This parameter is exclusively used for vibration suppress control.
Refer to [5.1 Vibration Suppress Control Function].

[76] Default vibration suppress No. (Parameter No.109)

No.	Name	Unit	Input Range	Default factory setting
109	Default vibration suppress No.	—	0 to 3	0

This parameter is exclusively used for vibration suppress control.
Refer to [5.1 Vibration Suppress Control Function].

[77] Stop method at servo OFF (Parameter No.110)

No.	Name	Unit	Input Range	Default factory setting
110	Stop method at servo OFF	—	0: Rapid stop 1: Deceleration to stop	0

Selects Servo OFF command, drive source cutoff, and stop mode of actuator during alarm generation (operation cancel level).

Stop command	Set value			
	0: Sudden stop		1: Decelerating stop	
	In Anti-Vibration Control Process	In Normal Position Control Process	In Anti-Vibration Control Process	In Normal Position Control Process
Pausing	Vibration Control Deceleration and Stop	Normal Deceleration and Stop	Vibration Control Deceleration and Stop	Normal Deceleration and Stop
Servo OFF	Sudden stop due to emergency stop torque			
Drive-source cutoff				
Alarm (Operation cancel level)				
Alarm (Cold start)	Sudden stop due to emergency stop torque			

[78] Calendar function (Parameter No.111)

No.	Name	Unit	Input Range	Default factory setting
111	Calendar function	—	0: Not Applicable 1: Use	1

This parameter defines whether the calendar function (RTC) is used or not.
Set the current time with using a teaching tool when the calendar function is used.
For details, please refer to the [instruction manual of each teaching tool].

In use of RTC, the alarm occurrence time in the alarm list is the time at which an alarm has occurred.
If RTC is not used, the time of alarm issuance shown in the alarm list counts the time passed since the power is supplied to the controller counted as 0 second.
The time data retainable duration with no power supply to the controller is approximately 10 days.

[79] Monitoring mode (Parameter No.112)

No.	Name	Unit	Input Range	Default factory setting
112	Monitoring mode	—	0: Disabled, 1: 4CH 2: 8CH, 3: 2CH	1

The controller can be connected with PC software to monitor the servo.
This parameter allows you to select a monitoring mode function (servo monitor).
Refer to [Help: Servo Monitoring] in IA-OS or [PC Software Instruction Manual (ME0155)] or detail.

Set Value	Description
0	Does not use
1	Sets the 4CH-30000 record mode.
2	Sets the 8CH-15000 record mode.
3	Sets the 2CH-60000 record mode.

[80] Monitoring Cycle (Parameter No.113)

No.	Name	Unit	Input Range	Default factory setting
113	Monitoring Cycle	ms	1 to 60,000	1

Sets initial value (Note 1) of time cycle (sampling cycle) to obtain data when monitoring mode is selected.
Data obtaining interval can be extended by increasing the value of this parameter.
It is set to 1 ms in the initial setting. Up to 60,000ms can be set.

Record mode	1ms frequency setting	1,000ms frequency setting
2CH-60000	Max. Obtainable Time 60 s	Max. Obtainable Time 60,000 s (1,000 minutes)
4CH-30000	Max. Obtainable Time 30 s	Max. Obtainable Time 30,000 s (500 minutes)
8CH-15000	Max. Obtainable Time 15 s	Max. Obtainable Time 15,000 s (250 minutes)

Note 1 Sampling cycle can be changed by using PC software.

[81] Selecting used feedback pulse gear ratio (Parameter No.114)

No.	Name	Unit	Input Range	Default factory setting
114	Selecting used feedback pulse gear ratio	—	0: Not Applicable 1: Use	0

Feedback pulse is available for the output also other than Pulse Train Control Mode.
In this case, select “1”.

Set Value	Description
0	Outputs feedback pulses using the electronic gear ratio defined by parameter No.65 and 66 (command pulse-train) (initial value)
1	Outputs feedback pulses using the electronic gear ratio defined by parameter No.115 and 116.

[82] Electronic gear numerator (Parameter No.115), Electronic gear denominator (Parameter No.116)

No.	Name	Unit	Input Range	Default factory setting
115	Electronic gear numerator (Feedback Pulse)	—	1 to 99,999,999	1
116	Electronic gear denominator (Feedback Pulse)	—	1 to 99,999,999	1

For details, refer to [4.3.5 Output Setting of Feeldback Pulse].
The setting is the same for the cases other than Pulse Train Control Mode.

[83] Automatic loadcell calibration at start (Parameter No.117)

No.	Name	Unit	Input Range	Default factory setting
117	Automatic loadcell calibration at start	—	0: Does not perform 1: Perform	1

This parameter is exclusively used for pressing operation using force sensor.
Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)].

[84] Pressing operation without completion of loadcell calibration (Parameter No.118)

No.	Name	Unit	Input Range	Default factory setting
118	Pressing operation without completion of loadcell calibration	—	0: Forbidden 1: Allow	0

This parameter is exclusively used for pressing operation using force sensor.
Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)].

[85] Loadcell calibration time (Parameter No.119)

No.	Name	Unit	Input Range	Default factory setting
119	Loadcell calibration time	ms	1 to 9,999	10

This parameter is exclusively used for pressing operation using force sensor. This parameter defines the adjustment data acquisition time in loadcell calibration. Normally, setting change is not necessary.
Refer to [4.2.7 Preparation for Operation in Force Sensor Pressing (Loadcell Calibration)].

[86] Servo gain switchover time constant (Parameter No.138)

No.	Name	Unit	Input Range	Default factory setting
138	Servo gain switchover time constant	ms	10 to 2,000	10

When a switchover of the servo gain set is commanded in the position table, the switchover process is completed after time more than 3 times of the time spent in the setting of this parameter is passed since the operation of the commanded position number has started.

Caution

- A time constant being rather short may cause the servo gain to change rapidly to have the operation of the actuator unstable.

[87] Home preset value (Parameter No.139)

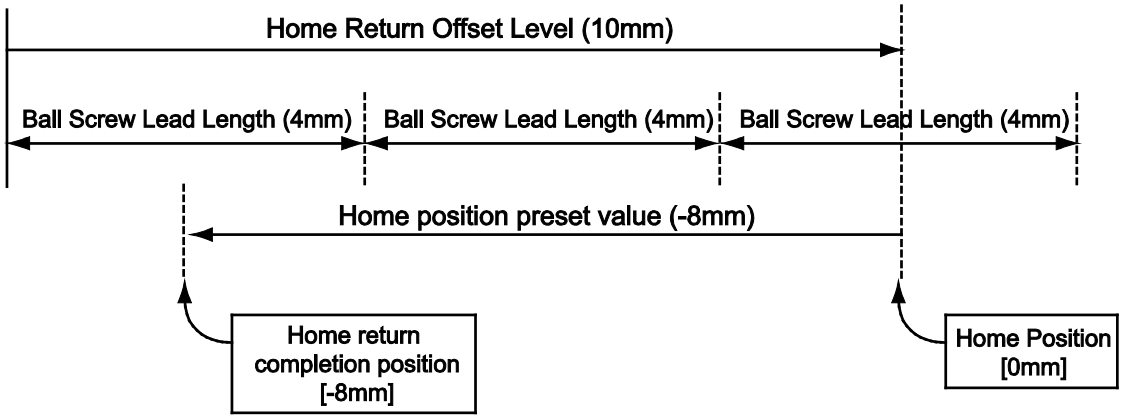
No.	Name	Unit	Input Range	Default factory setting
139	Home preset value	mm	-9,999.99 to 9,999.99	In accordance with actuator

For the actuator of absolute specification, set this parameter so that (home return offset + value of this parameter) is within the range between 0 and the ball screw lead. (as it is necessary to register the Z-phase nearest to the mechanical end as the datum)
The value should be an integer multiple of ± ball screw lead length including 0.00.
(If the home return offset is within the range between 0 and ball screw lead length, the value of this parameter is 0.00.)
Also, when a value other than 0.00 is set in this parameter, home-return complete position cannot be 0.00, and it gets to the positon of home position + this parameter.

Caution

- If the above condition is not satisfied, the home position at restart after home return may shift by an integer multiple of the ball screw lead.

<Setting example>
With ball screw lead length 4mm and home return offset level 10mm, set this parameter to -8mm.



[88] IP Address (Parameter No.140)

No.	Name	Unit	Input Range	Default factory setting
140	IP Address	—	0.0.0.0 to 255.255.255.255	192.168.0.1

It is the parameter dedicated for Field Network (EtherNet/IP).
For details, refer to [SCON2 Field Network Instruction Manual (ME0469)] provided separately.

[89] Subnet mask (Parameter No.141)

No.	Name	Unit	Input Range	Default factory setting
141	Subnet mask	—	0.0.0.0 to 255.255.255.255	255.255.255.0

It is the parameter dedicated for Field Network (EtherNet/IP).
For details, refer to [SCON2 Field Network Instruction Manual (ME0469)] provided separately.

[90] Default gateway (Parameter No.142)

No.	Name	Unit	Input Range	Default factory setting
142	Default gateway	—	0.0.0.0 to 255.255.255.255	0.0.0.0

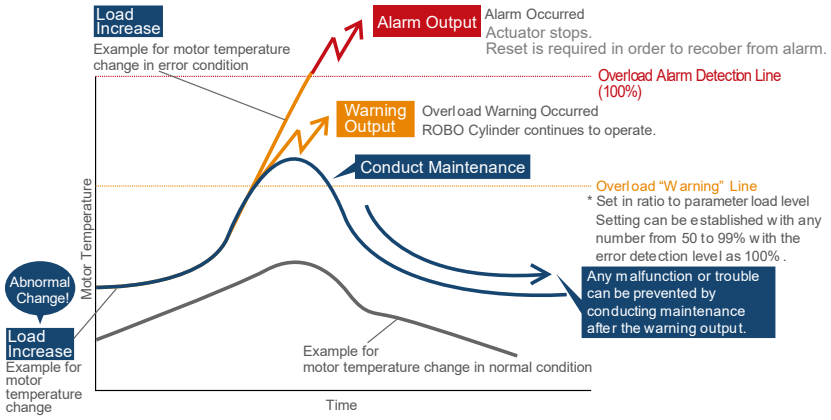
It is the parameter dedicated for Field Network (EtherNet/IP).
For details, refer to [SCON2 Field Network Instruction Manual (ME0469)] provided separately.

[91] Overload load level ratio (Parameter No.143)

No.	Name	Unit	Input Range	Default factory setting
143	Overload load level ratio	%	50 to 100	100

With the motor thrust increase temperature of when an overload alarm gets generated being set as 100%, alarm 048 “Driver Overload Alarm” (message level) is output when the motor temperature exceeds the rate set in this parameter.
The judgment would not be made if the value is set to 100%.

[Applied: prevention function]
By setting this parameter, warning output (*BALM/*OVLW/*ALML Signal) notifies you before the equipment stops by error in case that the motor temperature rises due to load condition change caused by dry-up of grease or wear-out of components.



Warning output enables detection of items such as those below.
- Time to supply grease
- Time to replace components
- Time to implement mechanical tuning

[92] Total travel count threshold (Parameter No.147)

No.	Name	Unit	Input Range	Default factory setting
147	Total travel count threshold	Times	0 to 999,999,999	0 (Disabled)

When total travel count exceeds the set value of this parameter, alarm 04E “Exceeded movement count threshold” will send a notification.
No judgment will be made when set as “0”.

[93] Total Travel Distance Threshold (Parameter No.148)

No.	Name	Unit	Input Range	Default factory setting
148	Total Travel Distance Threshold	m	0 to 999,999,999	0 (Disabled)

When total travel distance exceeds the set value of this parameter, alarm 04F “Exceeded operated distance threshold” will send a notification.
No judgment will be made when set as “0”.

[94] Zone output changeover (Parameter No.149)

No.	Name	Unit	Input Range	Default factory setting
149	Zone output changeover	—	0: PZON output select 1: ZONE1/ZONE2 output select	0 (Disabled)

When there is PZONE signal to the current PIO pattern or the Fieldbus Operation Mode and no ZONE1 or ZONE2 signal, it is available to change the PZONE signal to either ZONE1 or ZONE2 signal.

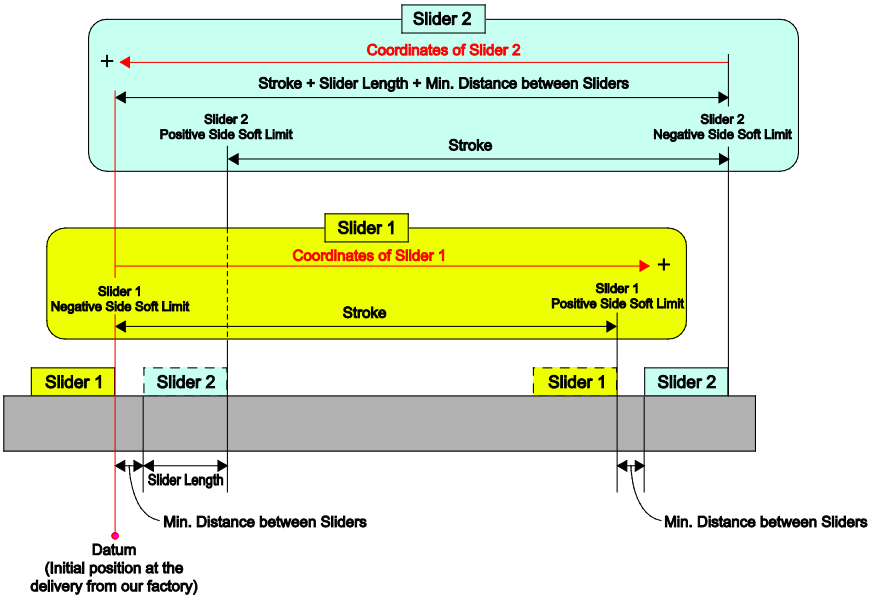
Caution

- ZONE1 signal is assigned prior to ZONE2 signal.
- It would not function in the pulse train mode.
- In the case there is no PZONE signal in PIO patterns, or both ZONE1 and ZONE2 signals exist, the setting would be invalid.

[95] Linear absolute home preset value (Parameter No.150)

No.	Name	Unit	Input Range	Default factory setting
150	Linear absolute home preset value	mm	-9,999.99 to 9,999.99	In accordance with actuator

This can set the home position of the actuator for Spurious Absolute Type.
The diagram below shows the position of each part related to the datum (the initial position at the delivery from our factory):



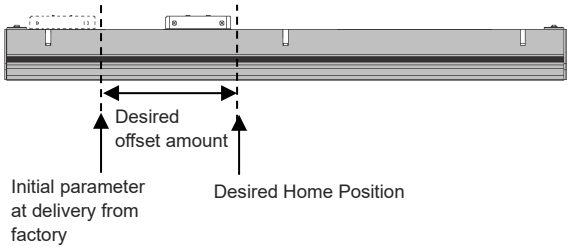
Caution

- Note the initial parameter at the delivery from our factory in a memo before changing the settings.
- Take the initial parameter at the delivery from our factory as the datum when giving a change to the settings.
- After having a change to the settings, make sure to have an operation check with low speed.
- For the spurious absolute type actuator, No.22: Home-return Offset Value and No.139: Home Preset Value are invalid.

When a change is required to the home position, do a calculation following the formula below and input the calculated value to the parameter.

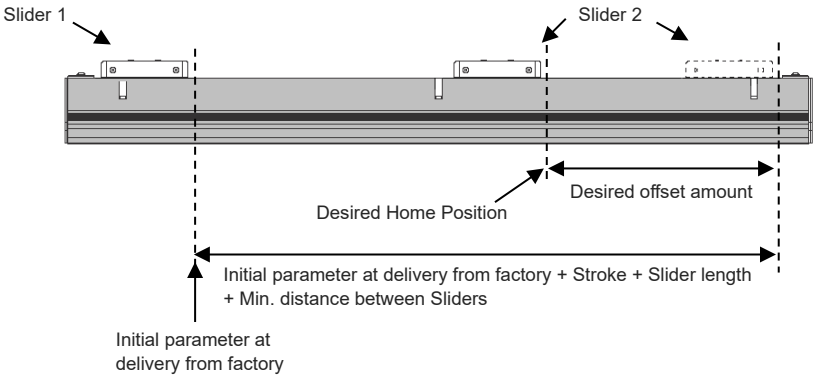
1. Setting for Single Slider Type:

   Parameter setting value = Initial parameter at delivery from factory (Parameter No.150)
   + Desired offset amount



2. Setting on Slider 2 for Multi Slider Type (Refer to 1) for Slider):

Parameter setting value = [Initial parameter at delivery from factory (Parameter No.150) + Stroke (value indicated when purchased) + Slider length (value shown in catalog) + Min. distance between Sliders (value shown in catalog)] – Desired offset amount



[96] Light error alarm output select (Parameter No.151)

No.	Name	Unit	Input Range	Default factory setting
151	Light error alarm output select	—	0: Battery Voltage Drop / Fan revolution drop / At overload warning output 1: Output when message level alarm is generated in addition to error in 0	0

If it is set to “0”, *ALML Signal should be output when there occurred the battery voltage drop or when it exceeded the setting set in Parameter No. 143 “Overloaded load level ratio”.
If “1” is set, when a message level alarm is generated, *ALML signal will be output.

[97] FB half direct mode speed unit (Parameter No.159)

No.	Name	Unit	Input Range	Default factory setting
159	FB half direct mode speed unit	—	0: 1mm/s Unit 1: 0.1mm/s Unit	0

These parameters are exclusively used for the field network type.
Check the applicable instruction manual number in [4.4 Operation of Field Network Type] and refer to each instruction manual.

[98] Nominal rigidity (Parameter No.163)

No.	Name	Unit	Input Range	Default factory setting
163	Nominal rigidity	N/mm	1 to 99,999	In accordance with actuator

It is the value of rigidity for actuator. Do not change the setting from the initial setting.

[99] Force control band (Parameter No.164)

No.	Name	Unit	Input Range	Default factory setting
164	Force control band	red/s	1 to 9	10

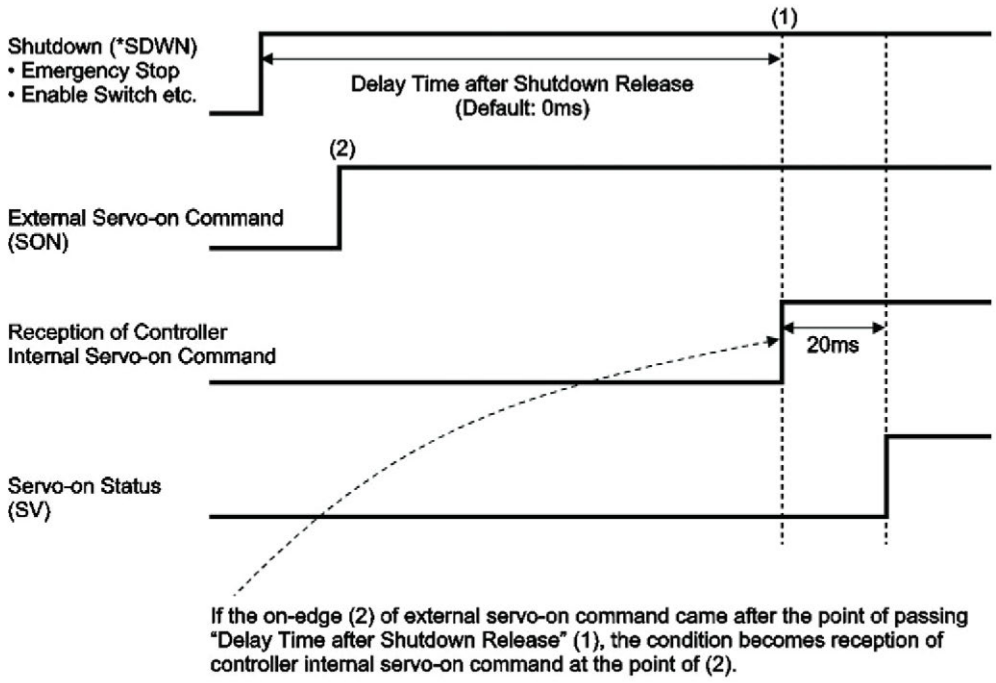
Setting is established for the band used as the force control.
Do not change the setting from the initial setting.

[100] Delay time after shutdown release (Parameter No.165)

No.	Name	Unit	Input Range	Default factory setting
165	Delay time after shutdown release	ms	0 to 10,000	0

Time setting before getting available to turn the servo ON when the startup of the drive source is slow due to a reason e.g. an external drive cutoff circuit after the emergency stop canceled should be established. There is no need to change the setting if the drive source is to be cut off only with the drive cutoff relay inside the controller.

Example of use) When drive cutoff is constructed externally



[101] Pulse train datum position (Parameter No.167) …Pulse train only

No.	Name	Unit	Input Range	Default factory setting
167	Pulse train datum position	mm	-9,999.99 to 9,999.99	0.00

When Pulse Train Control Mode (PIO Pattern 1) is selected in the absolute type, operation is made with the position set in this parameter as the datum position.
Movement command is to be made with the datum position movement command input (IN8).
Once reached the datum position, the datum position movement complete output (OUT13) will be output.
However, it is necessary that the value is set in the range from (soft limit negative side + 0.15) to (soft limit positive side – 0.15).

[102] Force control transition threshold (Parameter No.173)

No.	Name	Unit	Input Range	Default factory setting
173	Force control transition threshold	%	10 to 90	In accordance with actuator

It is a parameter dedicated for the force sensor used pressing. The threshold setting for transition from a normal movement to a force control movement considering the loadcell load data should be established.
The setting should be established in the ratio [%] of the pressing force with the pressing current limit as 100%.
Adjustment should be done in pitch from 5 to 10 and increase and decrease gradually.

[103] Force gains 1, 2, 3 (Parameter No.174 to176)

No.	Name	Unit	Input Range	Default factory setting
174	Force gains 1	—	100 to 999,999	In accordance with actuator
175	Force gains 2	—	100 to 999,999	In accordance with actuator
176	Force gains 3	—	100 to 999,999	In accordance with actuator

It is a parameter dedicated for the force sensor used pressing.
The gain may be adjusted when the rigidity of the pressing target is extremely large or small.
The relation among the rigidity of pressing target, the response of pressing operation using force sensor system and pressing operation using force sensor gain differs depending on the actuator. Refer to [6.1.2 [74]].

[104] Load data output (Parameter No.180)

No.	Name	Unit	Input Range	Default factory setting
180	Load data output	—	0: Enabled, 1: Disabled	0

Set if outputting in analog the load data from the multi-function connector.

[105] Network Number (Parameter No.188)

No.	Name	Unit	Input Range	Default factory setting
188	Network Number	—	1 to 239	1

This parameter is exclusively used for the Field Network (CC-Link IE Field).
Refer to separate volume, [SCON2 Field Nedwork Instruction Manual (ME0389)]

[106] Position data expansion function setting (Parameter No.191)

No.	Name	Unit	Input Range	Default factory setting
192	Position data expansion function setting	—	0: Disabled 1: Drive torque limit 2: Push speed	0

The "parameter selection area" function in the position data table can be selected.
Drive torque limit : Sets the travel current limit value during position travel. [%]
Push speed : Sets the push speed limit value during position travel. [mm/s]

Caution

- The drive torque limit in the position data or the pressing velocity should be initialized when this parameter is changed while the position data is registered. Set it up again.

[107] Actuator identification system (Parameter No.192)

No.	Name	Unit	Input Range	Default factory setting
192	Actuator identification system	—	0: Not Applicable 1: Use	In accordance with actuator

The following information saved in the actuator side should be read out.
It can also be checked in the PC teaching software and a teaching pendant.

1. Manufacturing Number / Model Code
2. User Memo (Domain available for User to Write)
3. Maintenance Data (Drive Distance, Movement Count, etc.)

[108] JOG switch (Parameter No.194)

No.	Name	Unit	Input Range	Default factory setting
194	JOG switch	—	0: Enabled, 1: Disabled	0

Enable/disable can be selected on the jog switch allocated on the front of the controller.
When Disabled is selected with this parameter, the actuator does not operate even if the JOG switch is operated.

[109] Virtual axis (Parameter No.195)

No.	Name	Unit	Input Range	Default factory setting
195	Virtual axis	—	0: Disabled, 1: Enabled	0

The feature capable of operation simulation with IA-OS or a teaching pendant without connecting an actuator should established.
Status data such as the current position and the current velocity should be generated “as if there was an actuator connected”.

[110] Virtual axis absolute initial position (Parameter No.196)

No.	Name	Unit	Input Range	Default factory setting
196	Virtual axis absolute initial position	mm (deg)	-9,999.99 to 9,999.99	0.00

The initial position of the simulation feature should be set up.

[111] Select enable/disable safety unit (Parameter No.199)

No.	Name	Unit	Input Range	Default factory setting
199	Select enable/disable safety unit	—	0: Disabled, 1: Enabled	0

Set whether to use / not to use the functional safety unit. If the setting in this parameter and the status of hardware do not match, Alarm 08B "Safety Unit Initialization Error" should occur.

[112] Velocity drop when SLS (Parameter No.200)

No.	Name	Unit	Input Range	Default factory setting
200	Velocity drop when SLS	—	0: Disabled, 1: Enabled	1

It is a parameter related to the SLS feature. Whether to receive the velocity limit command from the safety unit or not can be set.

* The velocity limit cannot be conducted regardless of this setting while in Pulse Train Mode, Motion Mode, RSEL Connection, Servo-Pressing Mode or during the home-return operation. Drop the velocity from the host device as necessary.

[113] Deceleration and stop when SS2 (Parameter No.201)

No.	Name	Unit	Input Range	Default factory setting
201	Deceleration and stop when SS2	—	0: Disabled, 1: Enabled	1

It is a parameter related to the SS2-t feature. Whether to receive the stop request from the safety unit or not can be set up. Also, any new position command should not be received during SS2 and SOS in the enabled setting.

* The velocity limit cannot be conducted regardless of this setting while in Pulse Train Mode, Motion Mode, RSEL Connection, Servo-Pressing Mode or during the home-return operation. Drop the velocity from the host device as necessary.

[114] Micro operation during safety stop (Parameter No.202)

No.	Name	Unit	Input Range	Default factory setting
202	Micro operation during safety stop	—	0: Disabled, 1: Enabled	1

It is a parameter related to the SOS, SLS, SLP, SDI+/- features.
Whether to receive micro operation request from the safety unit or not can be set up.

[115] Velocity drop ratio at SLS (Parameter No.203)

No.	Name	Unit	Input Range	Default factory setting
203	Velocity drop ratio at SLS	%	1 to 100	90

It is a parameter related to the SLS feature.
The command velocity when there is a velocity limit demand from the safety unit should be the value with the value indicated in Safety Parameter No. 24 to 26 ("Safety Mode 1 to 3 Velocity Limit" [mm/s]) multiplied by this ratio.

[116] Micro operation movement amount at safety stop (Parameter No.204)

No.	Name	Unit	Input Range	Default factory setting
204	Micro operation movement amount at safety stop	mm	0.01 to Ball screw lead length	1.00

It is a parameter related to the SOS, SLS, SLP, SDI+/- features.
The movement amount when there is a micro operation request from the safety unit is made can be set up.

[117] Pressing unit system selected (Parameter No.205)

No.	Name	Unit	Input Range	Default factory setting
205	Pressing unit system selected	—	0: % Unit system 1: N Unit system	1

It is a parameter dedicated for the force sensor used pressing.
When pressing is performed with the force control in the positioner mode, the pressing force should be able to input in [N] unit.
(Note) It should certainly be input in [%] unit when in the current control pressing.

[118] Min. unit of pressing force (Parameter No.206)

No.	Name	Unit	Input Range	Default factory setting
206	Min. unit of pressing force	—	2: 1N 3: 10N	In accordance with actuator

It is a parameter dedicated for the force sensor used pressing.
The set unit in the position data when “1” is selected in Parameter No. 205 “Pressing unit system selected” should be selected.

Set Value	Setting Range
2	0N to 65,535N
3	0N to 655,350N

[119] Position data unit (Parameter No.207)

No.	Name	Unit	Input Range	Default factory setting
207	Position data unit	—	0: 0.01mm 1: 0.001mm	In accordance with actuator

Input unit of the position data to be registered to the position data or direct command data (fieldbus / Modbus) should be set up.

The items that the unit can change in this parameter are as follows.

- Target position
- Positioning width
- Individual zone boundary +/- sides
- Current position for monitor data

[120] Port number for UDP search frame (Parameter No.208)

No.	Name	Unit	Input Range	Default factory setting
208	Port number for UDP search frame	—	49152 to 65535	49152

It is a port number that IA-OS searches the IP address of SCON2 in the Ethernet connection.

[121] System I/O enable feature (Parameter No.209)

No.	Name	Unit	Input Range	Default factory setting
209	System I/O enable feature	—	0: Always Enabled, 1: Disabled	0

Enable / disable of the enable terminal in the system I/O connector can be set up.

Enable / disable of the enable terminal in the system I/O connector is determined only with this parameter. It should not get impacted by the status of AUTO/MANU.

[122] Drive recorder mode select (Parameter No.210)

No.	Name	Unit	Input Range	Default factory setting
210	Drive recorder mode select	—	0: Disabled, 1: 4CH 2: 8CH, 3: 2CH	2

The number of data to be acquired in the drive recorder feature should be selected.

For details, refer to [8.4 Drive Recorder Feature]

[123] Drive recorder save history select (Parameter No.211)

No.	Name	Unit	Input Range	Default factory setting
211	Drive recorder save history select	—	0: 3 History, 1: 6 History, 2: 12 History	0

The count of alarm history available to save in the drive recorder can be set up.
For details, refer to [8.4 Drive Recorder Feature]

[124] Drive recorder sampling frequency (Parameter No.212)

No.	Name	Unit	Input Range	Default factory setting
212	Drive recorder sampling frequency	ms	1 to 1,000	10

The cycle to acquire data in the drive recorder feature should be changed.
For details, refer to [8.4 Drive Recorder Feature]

[125] Collision judgment current value 1, 2, 3 (Parameter No.213, 217, 221)

No.	Name	Unit	Input Range	Default factory setting
213	Collision judgment current value 1	%	0 to In accordance with actuator	100
217	Collision judgment current value 2	%		
221	Collision judgment current value 3	%		

Collision should be detected when the current value is above the setting and when the time reaches the setting in Parameter No. 215, 219 and 223 "Collision Judgment Time 1 to 3".
It should be disabled when the setting value is "0".
For details, refer to [5.3 Collision detection].

[126] Collision judgment distance 1, 2, 3 (Parameter No.214, 218, 222)

No.	Name	Unit	Input Range	Default factory setting
214	Collision judgment distance 1	mm	0.00 to In accordance with actuator	5.00
218	Collision judgment distance 2	mm		
222	Collision judgment distance 3	mm		

Parameter No. 215, 219 and 223 "Collision Judgment Time 1 to 3" should start counting when |Virtual Position Differential Value| (absolute value of gap between current position and virtual position) reaches the set collision judgment distance.
It should be disabled when the setting value is "0".
For details, refer to [5.3 Collision detection].

[127] Collision judgment time 1, 2 , 3 (Parameter No.215, 219, 223)

No.	Name	Unit	Input Range	Default factory setting
215	Collision judgment time 1	ms	1 to 65535	5
219	Collision judgment time 2	ms		
224	Collision judgment time 3	ms		

Time counting should start since it exceeds the setting in Parameter No. 213, 217 and 221 "Collision Judgment Current Value 1 to 3" or Parameter No. 214, 218 and 222 "Collision Judgment Distance 1 to 3", and collision should be detected once the set time is reached. When both Parameter No. 213, 217 and 221 "Collision Judgment Current Value 1 to 3" and Parameter No. 214, 218 and 222 "Collision Judgment Distance 1 to 3" are set, the time counting should start since the both setting are exceeded.

* When either of Parameter No. 213, 217 and 221 "Collision Judgment Current 1 to 3" or Parameter No. 214, 218 and 222 "Collision Judgment Distance 1 to 3" gets below the setting, counting should be deducted for the time that is below.

For details, refer to [5.3 Collision detection].

[128] Collision Detection 1,2,3 Evacuation Operation Position Number (Parameter No.216, 220, 224)

No.	Name	Unit	Input Range	Default factory setting
216	Collision Detection 1 Evacuation Operation Position Number	—	-1 to Depends on Controller Setting (Max. Number of Position Numbers)	-1
220	Collision Detection 2 Evacuation Operation Position Number	—		
224	Collision Detection 3 Evacuation Operation Position Number	—		

The evacuation movement when collision is detected should be set up.

[129] Select Collision Detection Feature Output (Parameter No.225)

No.	Name	Unit	Input Range	Default factory setting
225	Select Collision Detection Feature Output	—	0: Alarm 1: Warning	0

A type of alarm generated when collision is detected should be selected.

6.2 Servo Adjustment

At shipment from factory, parameters are set so that operation at rated load (maximum) is within the payload capacity of the actuator and with stable operating characteristics.
However, at the actual usage sites, it may be necessary to perform servo adjustment.
This section explains the basic servo adjustment method.

Caution

- It is dangerous to make excessive settings suddenly. Damage to the equipment or the actuator or injury may occur, so proceed with caution.
  Also, make sure to keep a record as you work so that it can be restored at any time.
- If you face problems which cannot be resolved, contact IAI.

Adjustment method

No.	Problems	Adjustment method
1	• Positioning takes time • Positioning accuracy is insufficient • Tact time needs to be shorter	• Set Parameter No. 55 “Position-command primary filter time constant” to “0” if it is set. • Increase Parameter No. 7 “Servo gain number”. The increased set value improves tracking of position command. As a guideline for setting, set 3 to 10, at most 15 or less. If it is too high, overshoot may occur, which will cause sound and vibration. • When increasing Parameter No. 7 “Servo gain number”, Parameter No. 31 “Velocity loop proportional gain” should also be increased accordingly in order to ensure stability of the control system. • When increasing Parameter No. 31 “Velocity loop proportional gain”, make sure to set it to about 20% of the initial value. Adjust Parameter No. 7 “Servo gain number” as a priority.
2	• Vibration occurs during acceleration/deceleration	• This may be caused by excessive “Acceleration/Deceleration Setting,” or inadequate rigidity of the device on which the actuator is mounted. • Lower “Acceleration/Deceleration Setting”. • Lower Parameter No. 7 “Servo gain number”. However, if Parameter No. 7 “Servo gain number” is too low, convergence will take longer. • Consider reinforcing the device.

No.	Problems	Adjustment method
3	• Speed irregularity occurs during travel • Speed accuracy is insufficient	• Increase Parameter No. 31 “Velocity loop proportional gain”. The increased set value improves tracking of speed command. If it is too large, mechanical system vibration may occur. As a setting guideline, try to increase the initial values by about 20% respectively.
4	• Abnormal noise in particular, high-pitched noise occurs when stopping or at low speed (50mm/s or less).	• Enter Parameter No. 33 “Torque filter time constant”. As a setting guideline, try to increase by 50 respectively. If it is too large, stability of the control system may be impaired and vibration may occur. [Important] Before adjustment This phenomenon is likely to occur when the rigidity of the mechanical system is not maintained. Even with the actuator alone, resonance may occur in the belt drive or if the stroke exceeds 600mm. Before adjustment, make sure that: 1. Parameter No. 7 “Servo gain number”, Parameter No. 31 “Velocity loop proportional gain” and Parameter No. 32 “Velocity loop integral gain” are not set too high. 2. Rigidity of the load is maintained as much as possible. Mounting is not loose and there is no play, etc. 3. The actuator body has been installed firmly with the prescribed torque. 4. There is no waviness on the actuator mounting surface.
5	• Trajectory accuracy needs to be higher • Constant speed needs to be higher • Response needs to be better	• Refer to adjustment methods No. 1 to 3 described above and adjust Parameter No. 7 “Servo gain number” and Parameter No. 31 “Velocity loop proportional gain” to optimize the conditions. [Reference] Selection of the actuator (motor) is the most important factor. The servo motor is very sensitive to the magnitude of load inertia. If the moment of inertia on the load side (load inertia) is too large with respect to the moment of inertia of the motor itself (motor inertia), the servo motor will cause the motor to be wagged by the load, as it were, resulting in unstable control. Therefore, in order to improve trajectory, position, speed, response, etc., it is necessary to reduce the load inertia ratio. For applications such as coating, if trajectory accuracy, constant velocity, response, etc. are called for, it is recommended to make the actuator ball screw lead as small as possible and to select an actuator with a higher motor capacity.

No.	Problems	Adjustment method
6	• The static friction of the load is large and travel start is slow • The load inertia is large and response is poor when stopping • Operation time needs to be shorter	• Set Parameter No. 71 “Positional feedforward gain”. Estimated setting is from 10 to 50. As the set value increases, the deviation amount is reduced and responsiveness improves. Setting a high value may cause vibration or noise. • Adjust Parameter No. 7 “Servo gain number” and Parameter No. 31 “Velocity loop proportional gain” to further improve responsiveness.
7	• There is a shock when starting or stopping	• Set Parameter No. 55 “Position-command primary filter time constant” to about 50 ms. If no improvement is observed, increase gradually. If improvement is observed, gradually lower the set value to the limit. If this setting is made, the settling time will be extended and the tact time will increase. Positioning accuracy also deteriorates.

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Chapter 7

Maintenance and Inspection

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7.1 Periodic Inspection

In order to use the Controller functions in the best possible condition, it is necessary to perform daily or periodic inspections.
Refer to an instruction manual for each Actuator for the maintenance for Actuator.

Danger

- Do not touch the terminal while live. This may result in electric shock.
- Connect the absolute battery correctly. Do not charge, disassemble, heat, throw into fire, short-circuit or solder. Incorrect handling of the absolute battery may cause injury or fire due to heating, rupturing or ignition.
- Always shut off the Controller power supply before cleaning or assembling/disassembling the unit. Electric shocks may result if the power is not shut off.
- Malfunctions may result if the unit connections are tightened loosely.

Caution

- Do not disassemble or modify the controller. This may result in breakdowns, malfunctions, injury or fire.
- Always shut off the Controller power supply before attaching or removing motor encoder cables. If not shut off, controller breakdowns or malfunctions may result.
- Do not apply shocks to or drop the absolute battery.
  Drops and shocks can damage the absolute battery, causing the liquid inside to leak. If the absolute battery is dropped or suffers impact, do not use and instead discard.
- Before touching a controller, always touch a grounded metallic part to discharge any static electricity accumulated on the body. If static electricity is not discharged, controller breakdowns or malfunctions may result.

7.1.1 Periodic Inspection Items

This product contain electronic components that may degrade due to the operating environment and require periodic inspection.
It is standard to conduct periodic inspection once every 6 months to one year, but the interval should be shortened in accordance with operating environment.

No.	Inspection items	Inspection details	Judgment criteria	Countermeasures
1	Power supply	Measure between the power supply terminal block to check that the voltage fluctuation is within the reference range	Within voltage fluctuation range 100/200V AC ±10%	Adjust so that the power supply voltage falls within the judgment criteria.
2	Power supply for brake	Measuring at terminal on the brake power supply connector, is the voltage fluctuation within the standard range?	Within voltage fluctuation range 24V DC±10%	
3	Operating environment	Ambient temperature (If used in a panel, the panel temperature is the ambient temperature)	0 to 40°C	Measure the operating temperature with a thermometer and adjust the environment so that it falls within the ambient operating temperature.
		Operating humidity (Panel humidity if using in a panel)	5%RH to 85%RH Non-condensing or freezing	Measure the operating humidity with a hygrometer and adjust the environment so that it falls within the ambient operating humidity.
		Atmosphere	No corrosive or flammable gas	Check with an odor or gas sensor.
			No splatters of water, oil, or chemicals	Remove and shield.
			No accumulated dust, debris, salt, or metal powder	Remove and shield.
		Directly exposed to sunlight?	Out of direct sunlight	Shield.
		Subjected to direct vibrations or impacts?	Vibration damping and shock-resistant specifications should be within the range	Install a cushion, etc., for vibration damping and shock resistance.
		Close to a noise source?	None	Move the noise source further away or take shielding countermeasures.
4	Mounting status	Mounting status	Attachment not loosened	Affix it again.

No.	Inspection items	Inspection details	Judgment criteria	Countermeasures
5	Connection status	Wiring connectors loose? (Motor encoder cable, field network cable, stop circuit and absolute battery, etc.)	No looseness	Insert until the lock engages.
		Wiring cable frayed?	No visual abnormalities	Check visually and replace the cable.
6	Absolute battery	Absolute battery (AB-5) beyond expiry date or lifespan?	The expiry date is 3 years and should not exceed the date written on a sticker adhered to the battery body	Even if the absolute battery is free of errors, replace it if the expiry date has passed. Refer to [7.4.1 Replacement of Absolute Battery] for how to make replacement.
7	Preventive/ predictive maintenance function	Preventive/predictive maintenance alarms generated?	No alarm generated	Refer to [7.5 Preventive Maintenance Function], [7.6 Predictive Maintenance Function] for countermeasures.

7.2 Requests When Replacing Units

Pay attention to the following precautions when replacing units after discovering a fault during inspection.

- Unit replacement should be conducted with the power off.
- After replacement, check that the new unit does not have any errors.
- If returning a faulty unit for repairs, write out the nature of the error in as much detail as possible and attach it to the product.
- Be sure to back up position data, parameters and PLC data just in case something goes wrong.

[Items for Reference]

- How to Replace Absolute Battery
  [7.4.1 Replacement of Absolute Battery]

- How to Replace Fan Unit
  [7.4.2 Fan Unit Replacing Procedure]

7.3 Consumable Parts

The life of components used in this product system is as follows. Refer to [7.5 Preventive Maintenance Function] and [7.6 Predictive Maintenance Function] for information about preventive and predictive maintenance.

Item	Guidelines for life	Preventative maintenance function	Predictive maintenance function	Condition
Electrolytic capacitor	5 years	○	—	Ambient temperature 0 to 40°C, rated operating mode
Backup capacitor for calendar functions	5 years	○	—	12 h/day ON time at 40°C environment 12 h 20°C environment when stopped (power OFF)
Driving source cutoff relay	25,000 times	—	—	It highly depends on how to use. Refer to [13. Handling of Built-in Drive Cutoff Relay and Cautions in Caution in Handling]

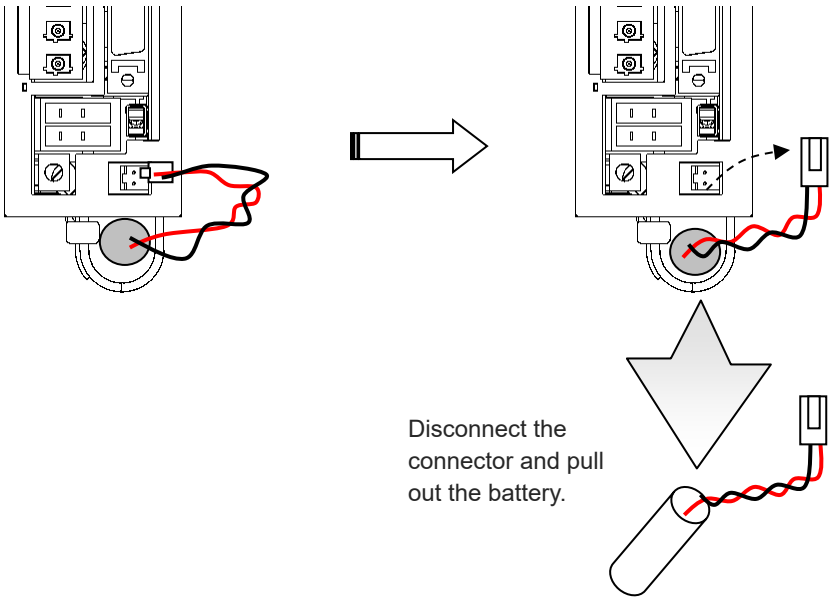
7.4 Component Replacement

7.4.1 Replacement of Absolute Battery

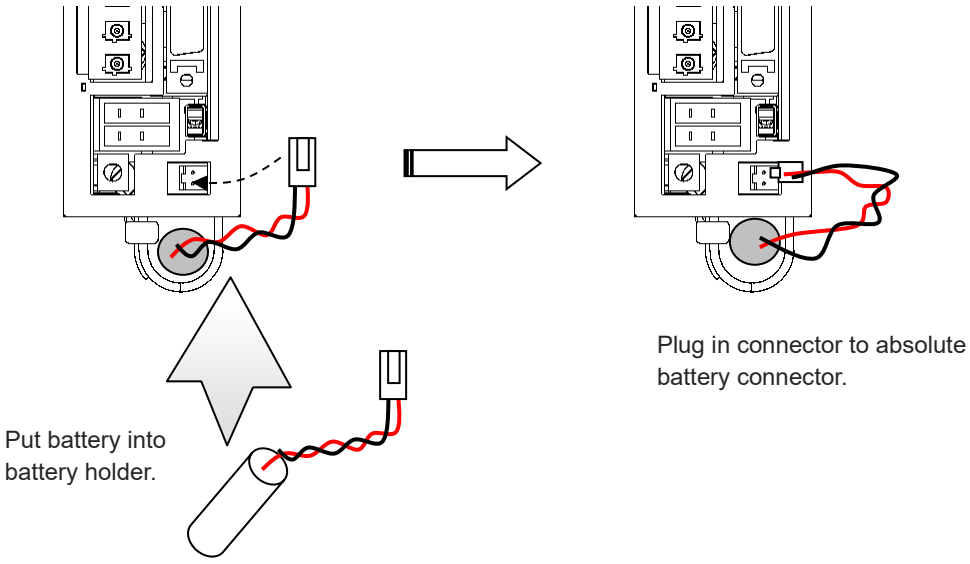
When replacing the battery, leave the power to the controller ON, remove the battery connector and replace with a new battery.

To replace the old absolute battery with a new one with the controller power being OFF, complete the replacement within 15 minutes from the removal of the old battery. The absolute data may get lost if it exceeds 15 minutes.

[Removal]



[Attachment]

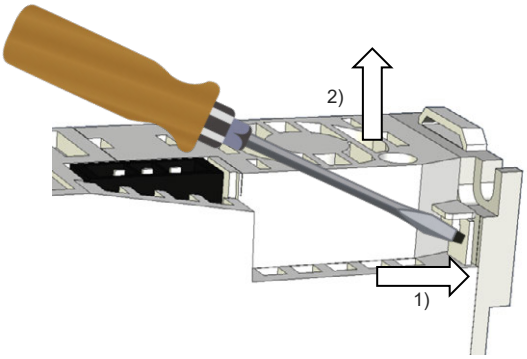


7.4.2 Fan Unit Replacing Procedure

Fan Unit for Replacement: SCON2-FU

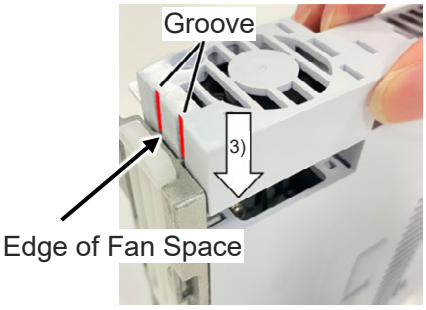
1. Take off the Fan unit

Release the lock feature by pressing the snap feature on the fan unit with a tool such as a flathead screwdriver.
Once the locking feature is released, pull the unit upwards.



2. Set a fan unit for replacement on.

Insert it along the grooves on the fan unit, and push it from the top.
Note: Pay attention to cables so they would not get pinched.



7.5 Preventive Maintenance Function

7.5.1 Maintenance Information

The times of actuator run and distance of operation can be summed up and recorded in the controller.
The contents recorded by PC Software, Modbus and Field Network can be checked.

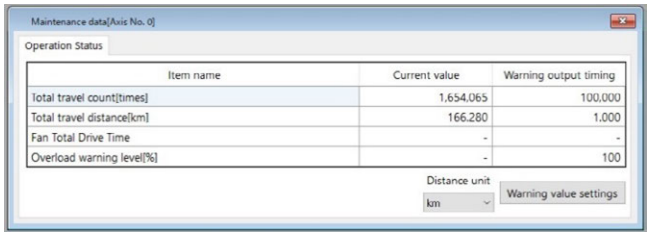
• Total moving count (The number of times the actuator has moved)

Name	Unit	Input range	Default initial value setting
Total moving count	time	0 to 999,999,999	0 (disabled setting)

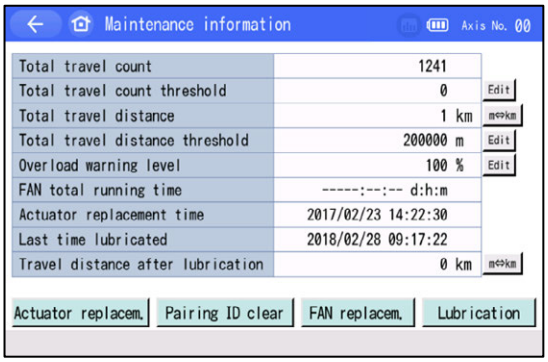
• Total moving distance (The number of times the travel distance)

Name	Unit	Input range	Default initial value setting
Total moving distance	m km	0 to 999,999,999	0 (disabled setting)

If the set count or distance (Note 1) is exceeded, an alarm (Note 2) and external signal (Note 3) can be output. This enables checking the timing for lubrication and periodic inspection.
The recorded data should be able to be checked in a teaching tool.



IA-OS Maintenance Information screen



TB-02 Maintenance Information screen

Note 1: Setting should be established in the following parameters or the maintenance information screen in the teaching tool.
- Parameter No. 147 “Total travel count threshold”
- Parameter No. 148 “Total travel distance threshold”

Note 2: Outputs a message level alarm 04E “Exceeded movement count threshold” or alarm 04F “Exceeded operated distance threshold”.
For details, refer to [Chapter 8 Troubleshooting].

Note 3: Outputs a minor malfunction alarm (*ALML).

[Maintenance Information Setting in Teaching Tool]

Maintenance information can be checked and set with the following procedures.

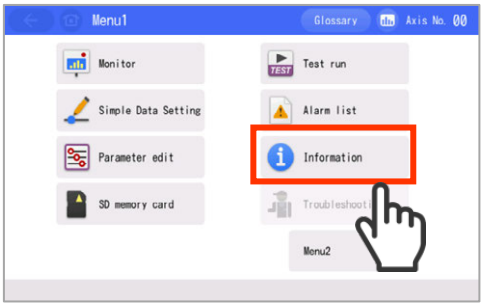
- TB-02/TB-03 Information → Maintenance information
- PC software Monitor → Maintenance information → Axis selection

As a reference, shown below is how to operate using a teaching pendant TB-03 (TB-02).
Refer to an instruction manual for each teaching tool for detail.

● Switchover to Maintenance Information Screen Using TB-02

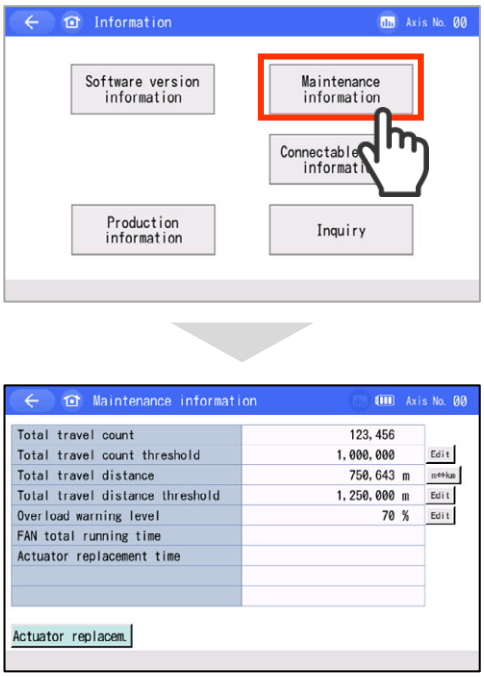
1. Touch Information on the Menu 1 screen.

The screen will switch to the Information screen.
If the TP operation mode is not Monitor mode,
a confirmation screen will appear for
switching to Monitor mode.



2. Touch Maintenance information on the Information screen.

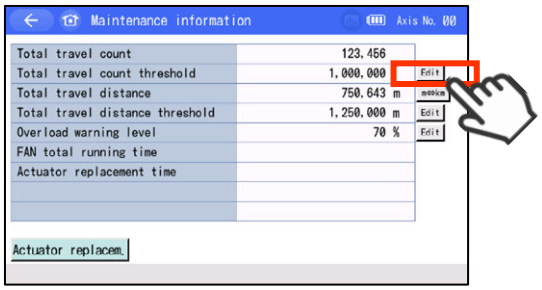
The maintenance information screen opens.



● Basic Operation in Maintenance Information Screen Using TB-03 (TB-02).

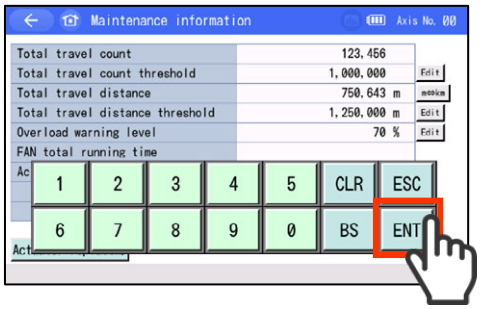
1. To set the target value,
touch the [Edit] button of the relevant item.

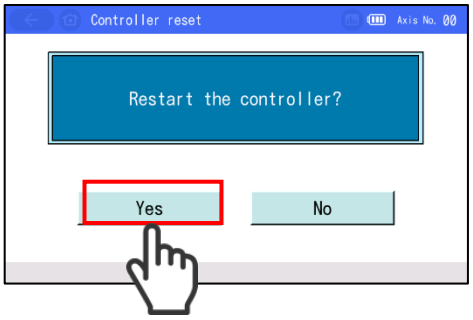
The set value will blink and Ten Key screen will open.



2. Enter the value with the Ten Key pad
and touch the [ENT] key.

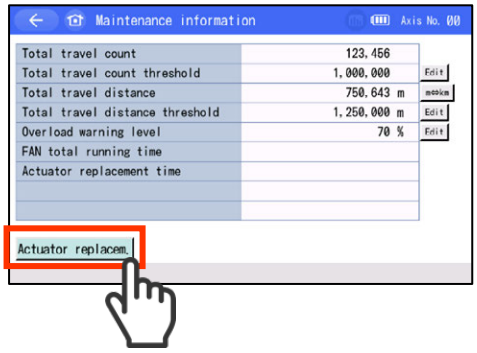
- The target value will change.
  If you touch [ESC] ,
  the target value will not be changed and
  the original screen will return.
- A confirmation message will be displayed
  to reboot the controller when leaving the
  maintenance screen.
  The setting change will take effect
  after rebooting.





3. If the actuator has been replaced,
touch the [Actuator replacem.] button.

"Total travel count" and "Total travel distance"
will be cleared to "0".



7.6 Predictive Maintenance Function

7.6.1 Fan

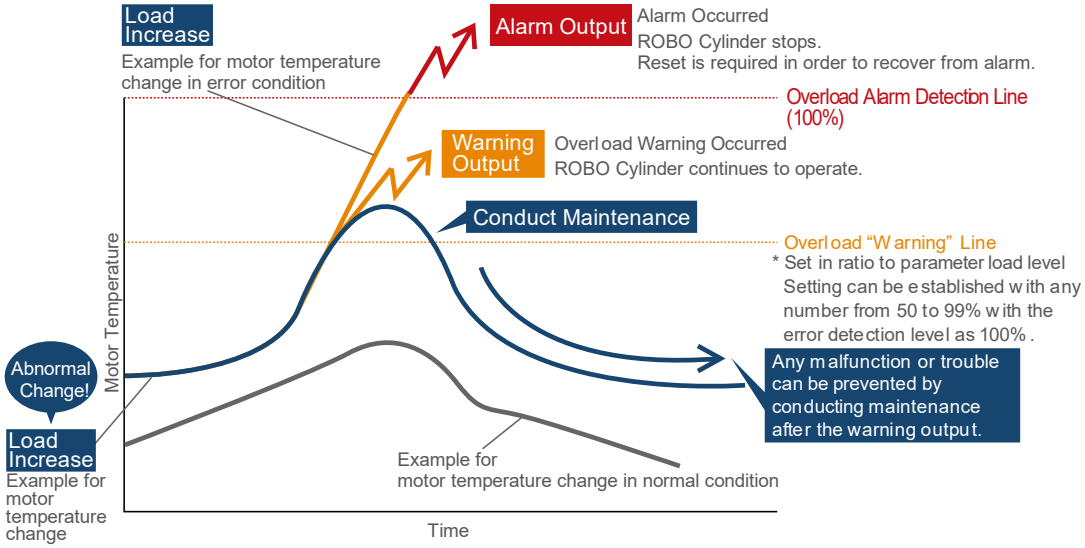
SCON2 monitors the revolution of fan.

A message level alarm is generated (alarm 04C “Drop in number of fan revolution”) and a light error alarm *ALML when the fan rotation speed decreases 30%. When an alarm is generated, although the fan will not have stopped completely, we recommend replacing it as soon as possible.
When the fan rotation speed drops 50%, an operation cancel level alarm (alarm 0D6 “FAN error detection”) is generated, and the actuator stops. Replace the fan and reset the alarm to resume operation.

Refer to [7.4.2 Fan Unit Replacing Procedure] for the replacement method.

7.6.2 Overload Warning

Using this function enables monitoring of motor temperature changes caused by dried-up grease or wear and tear on parts. A warning is output when the preset value is exceeded. This enables detection of abnormalities before a breakdown or a malfunction occurs.



Warning output enables detection of items such as those below.

- Time to supply grease
- Time to replace components
- Time to implement mechanical tuning

Parameters related are as follows.

[Overload load level ratio (Parameter No.143)]

No.	Name	Unit	Input range	Default initial value setting
143	Overload load level ratio	%	50 to 100	100

Outputs alarm 048 "Driver overload alarm (message level)" when motor temperature exceeds the ratio set in this parameter if motor temperature under rated operation is set as 100%.
No judgment will be made when set as 100%.
The ratio also can be set in the maintenance information screen in the teaching tool.

[Light error alarm output select (Parameter No.151)]

No.	Name	Unit	Input range	Default initial value setting
151	Light error alarm output select	–	0: Battery Voltage Drop Overload Warning Fan revolution drop 1: Output when message level alarm is generated in addition to error in 0	1

If “0” is set, when overload load level ratio (Parameter No. 143) is exceeded, a light error alarm signal *ALML will be output.
If “1” is set, also in the event of a message level alarm, *ALML signal will be output.

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Chapter 8

Troubleshooting

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8.1 Action to Be Taken upon Occurrence of Problem

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

(1) Status Display LED on Controller and PIO Check

LED	Indication	Status
PWR	Green Light is turned ON.	System ready (normal CPU operation)
	OFF	Power OFF
SV	Green Light is turned ON.	Servo ON (operation available)
	Flashing in Green	Automatic servo is OFF
	OFF	Servo OFF
ALM	Orange Light is turned ON.	Alarm being generated (operation release or cold start level alarm)
STOP	Red Light is turned ON.	Emergency stop (regardless of alarms)
WRG	Flashing in Orange	Message alarm being generated
SAFE	Red Light is turned ON.	SS1-t being input

(2) Check whether an alarm occurs on the host controller (PLC, etc.).
(3) Check the voltage of the main power supply.
(4) Check the voltage of power supply (24V DC) for the PIO.
(5) Check the voltage (24V DC) of the power supply for brake (For the actuator with the brake).
(6) Alarm Check (Note 1)
Check the alarm code on the teaching tool such as IA-OS.
(7) Check the connectors for disconnection or connection error.
(8) Check the cables for connection error, disconnection or pinching.
Before performing a continuity check, turn off the power (to prevent electric shocks) and disconnect the cables of measuring instruments (to prevent accidental power connection due to sneak current path).
(9) Check the I/O signals.
Using the host controller (PLC, etc.) or a teaching tool such as IA-OS, check the presence of inconsistency in I/O signal conditions.
(10) Check the noise elimination measures (grounding, installation of surge killer, etc.).
(11) Check the events leading to the occurrence of problem (Note 1), as well as the operating condition at the time of occurrence.
(12) Analyze the cause.
(13) Treatment

Note 1 If parameter No.111 (Calendar function) is set to “1” (use), it is possible to know the date and time at which the alarm occurred.
Set the date and time from the teaching tool such as PC software at the first power-on of the controller.
The date and time data set once is retained for about 10 days if the power supply of the controller is OFF. If the setting is not conducted or the time data is lost, it will be the time passed since 0 second when the power is turned ON. Even if the date and time data is lost, the generated error code is retained.
Alarms subject to this function only include those in [8.3 About Alarms] but do not include errors in the teaching tool such as PC software.

Notice:

- When proceeding with troubleshooting, exclude normally functioning parts from the targets to narrow down the causes.
- First, check (1) to (11) so that countermeasures can be taken swiftly.

8.2 Fault Diagnosis

This section describes faults largely divided into four types as follows:

- Impossible operation of controller
- Positioning and speed of poor precision (incorrect operation)
- Generation of noise and/or vibration
- Impossible Communication.

8.2.1 Impossible Communication

Situation	Possible cause	Check/Treatment
At power-on, PWR on the status indicator LEDs does not go ON.	Proper power is not supplied.	Check the voltage. If the PWR LED does not go on despite normal power voltage and correct wiring, Please contact IAI. Refer to [3.3.1 Wiring of Power Circuit].
STOP on the status indicator LEDs lights.	During emergency-stop. 1. Was the emergency-stop switch. 2. The emergency stop release circuit is OFF to make the connection between STOP+ and STOP- of the system I/O connector open. 3. STOP+/- of the system I/O connector are not connected.	1. Release the emergency stop switch. 2. Check the emergency stop circuit. 3. Check the wiring of system I/O. Refer to [3.3.2 Wiring for Emergency Stop Circuit (System I/O)].
ALM in the status display LEDs turns on when the power is supplied.	Occurrence of alarm	Check the error code with the teaching tool being connected and remove the cause by referring the alarm list. Refer to [8.3.2 Alarm Details].
The host controller (PLC) sends servo ON signal to the controller, but SV LED does not go ON. The host controller (PLC) cannot control PIO (24V DC I/O).	PIO signal communication is disabled. 1. 24V DC power for PIO is not supplied. 2. Poor contact of flat cable 3. The operation mode setting switch on the front panel is on “MANU” side. 4. The +/- pins of 24V DC power for PIO are connected inversely.	1. Check the PIO power voltage. If a single power supply is connected with large load, the power supply voltage may drop or the output may be shut down depending on power units. 2. Are the PIO cable connectors inserted to the mating connectors securely? Check the input signals on the I/O monitor of the teaching tool such as PC software. ⚠ Caution In I/O cable conduction check, do not widen female pins of the connectors. Failure to follow this may cause poor contact. 3. Can such operation as jogging be performed from the teaching tool such as PC software? Set the operation mode setting switch on the front panel and restart the controller. Refer to [1.3 Name for Each Parts and Their Functions]. 4. Reverse connection of the PIO power supply does not affect the input circuit but makes the output circuit faulty. Check if the I/O of the host controller (PLC) operates normally.

Situation	Possible cause	Check/Treatment
SAFE on the status indicator LEDs lights.	1. The dummy plug for I/O connector for safety function is not connected. 2. In the condition of SS1-t Signal being input and between /SRT1+/- or /SRT2+/- released	1. Check the dummy plug. 2. Check the SS1-t circuit.

[1] In the case of Positioner Mode

Situation	Possible cause	Check/Treatment
Both position No. and start signal are input to the controller, but the actuator does not move.	There is a problem either in PIO signal treatment, position table setting or operation mode selection. 1. Servo OFF condition 2. The pause signal is OFF. 3. Positioning command is issued to a stop position. 4. There is no positioning data set to the commanded position number. 5. Target position number and the start signal commanded at the same time.	1. Is the status display LED SV turned ON? Refer to [1.3 Name for Each Parts and Their Functions] Turn ON the servo-on signal SON of PIO. 2. Operation is available when PIO pause signal *STP is ON and pause when it is OFF. Turn it ON. 3. Check the sequence or the settings of the position table. 4. It will generate Alarm 0A2 “Position Data Error”. Conduct the position table setting. 5. Have 6ms or more between the target position number command and start signal command.

Refer to [3.1.2 PIO Pattern Selection and PIO Signal] for PIO signal.

[2] In the case of Pulse String Control Mode

Situation	Possible cause	Check/Treatment
In spite of inputting pulse-train to the controller, the actuator does not move.	PIO signal processing or parameter setting is incorrect. 1. Servo OFF state 2. The pause signal is OFF. 3. The pulse-train type, a parameter, is selected incorrectly. 4. The positive/negative logic of pulse-train, a parameter, is selected inversely. 5. The unit moving distance per pulse, which is a setting condition of electronic gear ratio, a parameter, is too small.	1. Is the status display LED SV turned ON? Refer to [1.3 Name for Each Parts and Their Functions] Turn ON the servo-on signal SON of PIO. 2. Operation is available when PIO pause signal *STP is ON and pause when it is OFF. Turn it ON. 3. Check the pulse train type. Refer to [4.3.4 [2] Format Settings of Command Pulse Train.] 4. Check the positive/negative logic of pulse-train. (Host units supplied by some manufacturers have positive/negative logic opposite to our logic. Reserve the logic setting and try the operation.) Refer to [4.3.4 [2] Format Settings of Command Pulse Train.] 5. Do not make the unit moving distance less than the resolution of the encoder. The actuator does not move unless pulses by the resolution of the encoder are input. Refer to [4.3.4 [1] Electrical Gear Setting] Note In case of 3 or 4, the actuator may not sometimes operate smoothly. You may not find case 5 when the actuator is moved for a long distance at a high frequency.

Refer to [3.3.2 I/O Signals in Pulse Train Control Mode] for PIO signal.

[3] Startup Adjustment with Teaching Tool when Control Circuit Incomplete

Situation	Possible cause	Check/Treatment
Operation is not performed even though the teaching tool is connected, and power to the controller motor and control circuit is supplied. (the stop switch is released on the teaching tool)	Cable treatment or mode selection. 1. Emergency stop condition 2. Servo OFF condition 3. In pause	1. Supply 24V DC to STOP terminal of the power connector. ⚠ Warning If the process is conducted, put back the setting as soon as the adjustment work is finished. Starting the operation without putting it back may cause a serious accident since the emergency stop is set invalid. 2.3. Put the operation mode switch on the front panel of the controller to “MANU” side, and select the teach mode on the teaching tool.

8.2.2 Positioning and Speed of Poor Precision (Incorrect Operation)

Situation	Possible cause	Check/Treatment
Positioning and Speed of Poor Precision (Incorrect Operation)	In the home return of our standard specification, the actuator is first pressed to the mechanical end, moved oppositely, and subject to positioning stop at the home position. Therefore, the product may judge as the mechanical end even though it is still on the way when the load is large and interfere with surrounding object. 1. A load exceeding its rating weight is installed on the actuator. 2. It is touched to interference in the way of the run. 3. Torsion stress is applied to guide due to improper fixing method of the actuator or uneven fastening of bolts. 4. The sliding resistance of the actuator itself is large.	1. Reduce the load. 2. Remove the interference. 3. Loosen the fixing bolts once and check whether the slider can move smoothly. If the slider can move smoothly, check if there is a deformation on the attached surface, and install the actuator again following the instructions stated in Instruction Manual. 4. Have a grease-up or 3 conducted. Also, some actuators may be heavy in sliding operation.
Shocks at start and/or stop.	Acceleration/deceleration is set too high.	Decrease the settings of acceleration/deceleration.
Overshoot during deceleration to stop.	1. The load inertia is large 2. Deceleration setting is too high 3. Servo gain is too high	1., 2. Decrease the setting of deceleration. 3. Make a change to the setting
Positioning of poor precision	Refer to [6.2 Servo Adjustment.] Note When the pulse-train operation mode is selected, first adjust pulse-train commands.	
Uneven speed during movement		
Acceleration/deceleration not smooth (bad speed response)		
Trace of poop precision		

[1] In the case of Positioner Mode

Situation	Possible cause	Check/Treatment
Positioning at a position different from that of commanded position No.	PIO signal processing is incorrect. 1. Start signal CSTR is input too early after position No. command. Or position No. command and start signal are input concurrently. 2. The correct position No. is not specified due to PIO signal disconnection or poor connector contact.	1. Input the start signal after the controller fully reads the position number. Refer to [4.2.4 Operation with the Position No. Input] and [10.2 Example of Basic Positioning Sequence]. 2. Check the input signal on I/O monitor on the teaching tool.
Complete signal PEND is not output even though positioning process is completed.	PIO signal processing is incorrect. • Start signal CSTR is not turned OFF.	Make the start signal CSTR turned OFF before completing the positioning process by the turn-off of positioning complete signal PEND after starting operation, and so on.

[2] In the case of Pulse String Control Mode

Situation	Possible cause	Check/Treatment
The actuator does not stop at the command position.	PIO signal processing or parameter setting is incorrect. 1. Incorrect electronic gear ratio 2. Acceleration/deceleration is set incorrectly in the host controller. 3. Noise 4. The pulse-train type, a parameter, is selected incorrectly. 5. The unit moving distance per pulse, which is a setting condition of electronic gear ratio, a parameter, is too small.	1. Check the setting of electronic gear ratio. The host controller also has the electronic gear ratio parameter. Set the electronic gear ratio not to be inconsistent with that of the host controller. In addition, reduce the electronic gear ratio as much as possible. If not, data overflow may occur in arithmetic processing to disable correct positioning. Refer to [4.3.4 [1] Electrical Gear Setting.] 2. The operates at the speed and acceleration/deceleration based on the frequency of input pulses. Check if the acceleration/deceleration set in the host controller exceed the rating acceleration/deceleration of the actuator. 3. Noise can be misread as the pulse if it jumps into the pulse train. Take proper measures against noise. Refer to [2.8 Noise Elimination and Mounting Method.] Check the cable connection between the controller and AK-04 if AK-04 is used. • Cable length : 50mm or shorter recommended (as short as possible) • Shield treatment : Use the shield treatment wire. 4. Check the pulse-train type. Refer to [4.3.4 [2] Format Settings of Command Pulse Train.] 5. Do not make the unit moving distance less than the resolution of the encoder. The actuator does not move unless pulses by the resolution of the encoder are input. Note In case of 2 or 3, the actuator may not sometimes operate. You may not find case 4 when the actuator is moved for a long distance at a high frequency.
There is an impact at start or stop		Refer to [6.2 Servo Adjustment No.7]

8.2.3 Generation of Noise and/or Vibration

Situation	Possible cause	Check/Treatment
Generation of noise and/or vibration from actuator.	Condition of load, condition actuator installation, stiffness of device for the actuator to be mounted to, etc.	Servo adjustment may improve the situation. Refer to [6.2 Servo Adjustment.]

[1] In the case of Positioner Mode

Situation	Possible cause	Check/Treatment
Vibrations of load	1. Acceleration/deceleration is set too high. 2. The installation structure and/or the installed load are easily affected by acceleration/deceleration.	1. Decrease the settings of acceleration/deceleration. Set S-shape acceleration/deceleration. 2. Refer to [6.1.2 [40] S-motion ratio setting.] 3. Use the vibration suppress control function. Refer to [Chapter 5.]

[2] In the case of Pulse String Control Mode

Situation	Possible cause	Check/Treatment
Vibrations of actuator or load	Acceleration/deceleration is set too high.	Decrease the setting of acceleration/deceleration in the host controller.
Generation of noise during acceleration	The host controller has no acceleration/deceleration function or does not have acceleration/deceleration function from speed 0. (Some positioning units have acceleration/deceleration function but cannot use the function from speed 0. Note this when you select a positioning unit.)	Refer to [6.2 Servo Adjustment No.4]

8.2.4 Impossible Communication

Situation	Possible cause	Check/Treatment
• Not connectable with host machine	1. Communication rates do not match. 2. The machine number (station number) is set to be duplicate with that of another unit or out of the range. 3. Parameter No.17 “Minimum delay time for slave transmitter activation” is set incorrectly. 4. Poor wiring or disconnection of communication cable.	1. Set the communication rate to match that of the host machine. Refer to the [Instruction Manual of the host unit.] 2. Correct the unit number (station number) setting. Machine numbers (station numbers) vary depending on communication modes. Refer to the Instruction Manual of each communication mode. (Note 1) 3. If the host device is that RS-485 is used, and the host is in the response timeout error, adjust Parameter No.17 to a smaller value (2 as reference). In any other cases, increase or decrease the value at will to change the send/receive timing. (If the operation is performed properly, the transmission cycle of the host is too fast. Always check the response of controller before next transmission.) If the controller is connected to each of field network (other than RS-485), it is unnecessary to take the value of parameter No.17 into account. 4. Review the wiring again. Check if termination resistances are connected to network terminals with correct values.

(Note 1) Refer to the following Instruction Manual for communications:

Field network name	Referance
CC-Link	Separate volume ME0698
CC-Link IE Field	
DeviceNet	
EtherCAT	
EtherNet/IP	
MECHATROLINK-III (Standard I/O Profile)	
PROFINET IO	
EtherCAT (CiA401 Drive Profile)	Separate volume ME0472
MECHATROLINK-III (Standard Servo Profile)	Separate volume ME0471
RS-485	Separate volume ME0162

8.3 About Alarms

8.3.1 Alarm Level

The alarms are classified to 3 types of levels by the content of the error.

Alarm level	ALM lamp	ALM signal	Status when an error occurred	Content of alarm
Message	Illuminated in green*	No output (Note 1)	No stop	Maintenance output such as battery voltage drop or light contents such as an alarm in teaching tool. It can be released with an alarm reset. Refer to [Instruction Manual of each tool] for details.
Operation release	Illuminated in Orange	Output	Servo OFF after deceleration to stop (Note 2)	It is a medium class content. Reset the alarm by the PIO or teaching tool.
Cold start	Illuminated in Orange	Output	Servo OFF after deceleration to stop (Note 2)	Software reset or power reconnection by teaching tool. Home return is required for any actuators of incremental specification.

* The WRG lamp flashes orange.

Note 1 When Parameter No. 151 “Light error alarm output select” is set to 1, *ALML should occur.

Note 2 The servo should turn off immediately in a certain alarms.

Caution

- Reset each alarm after identifying and removing the cause.
  If the cause of the alarm cannot be removed or when the alarm cannot be reset after removing the cause, please contact IAI.
- If the same error occurs again after resetting the alarm, it means that the cause of the alarm has not been removed.
- If a controller or actuator is found malfunctioned, consider to repair or replace it.
  You will be able to apply for a repair in the IAI homepage.
  https://www.iai-robot.co.jp/support/repair/index.html

8.3.2 Alarm Details

If corresponding controller are limited, a symbol for the type of the corresponding controller is indicated in the alarm code column. Alarm codes with no symbols indicated are common to all controllers.

[1] Message level

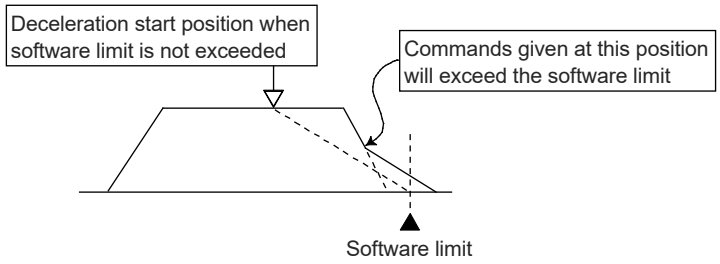
Alarm Code	Alarm Name	Cause/Treatment
1012	Calendar function related command in calendar function invalid status	Cause : An attempt was made to use the calendar in the state where the RTC (calendar) function was made ineffective. Treatment : Set parameter No.111 (Selection of use of calendar function) to “1” (“0”: no use).
048	Driver Overload Alarm	Cause : The load current exceeded the value set in Parameter No.143 “Overload load level ratio”. This alarm is kept alarm condition until reset is made. Treatment : Lower the setting of acceleration/deceleration. Also, increase the frequency of pause.
049	Collision warning	Cause : Collision detection has detected a collision during operation to a set position. Treatment : 1. Remove the obstruction that causes collision. 2. If the setting for collision detection is strict, it may cause detection error in normal operation. Revise the setting values.
04A	Estimated life exceeded warning	Cause : The motor power supply capacitor has exceeded the product life mathematically. Treatment : Replace the controller as soon as possible.
04C	Drop in Number of Fan Revolution	Cause : The number of the FAN revolution has dropped to the warning level. Treatment : Degradation of the fan can be considered. Replace the FAN.
04D	Excess Fan Total Operational Duration	Cause : The total operation duration of the FAN has exceeded the reference timing for replacement. This alarm is not purposed to indicate an error. Treatment : Utilize this alarm as a reference for the timing to replace the FAN.
04E	Exceeded movement count threshold	Cause : The total number of the operation times exceeded the value set in Parameter No.147 “Total travel count threshold”.
04F	Exceeded operated distance threshold	Cause : The total number of the operation distance exceeded the value set in Parameter No.148 “Total travel distance threshold”.
069	Detection of realtime clock oscillation stop	Cause : The calendar function is stopped and the current time data is lost. Treatment : Set the time again. (Note) This error is not registered in the alarm list.
06A	Realtime clock access error	Cause : The calendar function is not working properly because of noise or malfunction of consisting parts. Treatment : 1. Take proper measures against noise. 2. When the calendar function is not used, set parameter No.111 “Calendar function” to “0”. 3. If the operation is not improved in use of the calendar function in spite of measures against noise, Please contact IAI.

Alarm Code	Alarm Name	Cause/Treatment
06B	Maintenance information data error	Cause : The maintenance information (total movement count, total operated distance) is lost. Treatment : Please contact IAI.
100 to 1FF	Alarm on teaching tool	Refer to the [Instruction Manual of teaching tool.]

[2] Operation cancel level

Alarm Code	Alarm Name	Cause/Treatment
080	Travel command during servo OFF	Cause : Travel command was issued in servo OFF status. Treatment : Execute travel commands after confirming servo ON status (servo ON signal SV or position complete signal (PEND) is ON).
082	Position command in incomplete home return	Cause : A position move command was issued before home return was completed. Treatment : Execute travel commands after confirming the home return complete signal HEND is ON.
083	Numerical command in incomplete home return	Cause : An absolute position command was issued by numerical specification before home return was completed (direct command from Field Network). Treatment : Perform home return motion, confirm the home return complete signal HEND, and then perform direct numerical command.
084	Absolute position move command when home return is not yet completed	Cause : A move command was issued when home return was still in progress. Treatment : Perform home return motion, confirm the home return complete signal HEND, and then perform travel command.
085	Position No. error during movement	Cause : A non-existing (invalid) position number was specified in the positioner mode. Treatment : Check the position table again and indicate an effective position number.
086	Move command while pulse train input is effective	Cause : An actuator operation command was issued from the serial communication while the pulse train input enabled or the motion command is enabled. Treatment : Do not attempt to issue any actuator operation command from the serial communication in the pulse train control mode and the motion mode.
087	Moving command during loadcell calibration	Cause : A move command was issued during loadcell calibration. Treatment : After confirming the loadcell calibration is completed with the calibration complete (CEND) signal, and confirming CLBR Signal is turned OFF, perform the movement command.
088	Force sensor pressing command when loadcell is disabled	Cause : Pressing command with force control was executed with the loadcall inactivated. Treatment : Reboot the controller to activate the loadcell before executing the pressing command with force control.
090	Software reset command in servo ON status	Cause : A software reset command was issued in servo ON status. Treatment : Check that servo is in OFF status (SV signal is OFF status) and issue a software reset command.
091	Position No. error in teaching	Cause : The position number out of the available range was selected in the teaching. Treatment : Select the position number from 63 or smaller.

<table>
<tr><th>Alarm Code</th><th>Alarm Name</th><th>Cause/Treatment</th></tr>
<tr><td>092</td><td>PWRT signal detection during movement</td><td>Cause : The current position write signal (PWRT) was input in the teaching mode of PIO pattern 1 while the actuator was jogging.
Treatment : Confirm the status of stop (the movement in process signal MOVE is off) before inputting.</td></tr>
<tr><td>093</td><td>PWRT signal detection in incomplete home return</td><td>Cause : The current position write signal (PWRT) was input in the teaching mode of PIO pattern 1 when home return was not yet completed.
Treatment : Input the home-return signal HOME first, confirm the status of the home-return complete (HEND Signal is on) before inputting.</td></tr>
<tr><td>095</td><td>DCLR signal detection with datum position movement command</td><td>Cause : 1. Datum position movement command (RSTR) signal was turned on while deviation counter clear (DCLR) signal was ON.
2. DCLR signal was turned ON during datum position movement
Treatment : Turn ON DCLR signal in the right timing.</td></tr>
<tr><td>097</td><td>Software Reset Command with Software Reset Prohibited</td><td>Cause : Software reset was performed while the software reset is prohibited.
Treatment : Reboot the power supply.
As the software reset is prohibited, it is necessary to reboot the power supply.</td></tr>
<tr><td>0A2</td><td>Position data error</td><td>Cause : 1. A movement command was attempted to an empty position.
2. The value of the target value in the “Position” field exceeded the Parameter No.3 and 4 “Soft limit set value”.
3. A target position was specified in the “Position” field by relative coordinate in the solenoid valve mode 2 of PIO pattern 5.
4. Pressing operation was specified while the vibration suppress control function remained effective.
Treatment : 1. Set the position data.
2. Change the target position value to the one within the soft limit set value.
3. The target position cannot be set by relative coordinate (incremental feed).
4. The vibration suppress control function and pressing operation cannot be used concurrently.
Provide setting so that either of the functions is effective.</td></tr>
<tr><td>0A3</td><td>Position command data error</td><td>Cause : 1. The command value during direct numeric specification exceeded the maximum set value.
2. Pressing operation was specified in the field network type while the vibration suppress function remained effective.
Treatment : 1. Exceeded command item code is displayed in the detailed code. Input an appropriate value by referring to these values.
<table>
<tr><th>Detailed Code (Command Item Code)</th><th>Command Item</th></tr>
<tr><td>0</td><td>Target Position</td></tr>
<tr><td>2</td><td>Command Speed</td></tr>
<tr><td>4</td><td>Acceleration</td></tr>
<tr><td>6</td><td>Deceleration</td></tr>
<tr><td>8</td><td>Positioning Width</td></tr>
<tr><td>C</td><td>Pressing Current Limit Value</td></tr>
<tr><td>D</td><td>Control Signal</td></tr>
</table>
2. The vibration suppress control function and pressing operation cannot be used concurrently. Provide setting so that either of the functions is effective.</td></tr>
</table>

Alarm Code	Alarm Name	Cause/Treatment
0A4	Command counter overflow	Cause : The calculated number of the command pulse input has exceeded +/-134217728 (H'F8000000 to H'08000000) in Pulse Train Control Mode. Treatment : Attempt to make the value of the electrical gear ratio smaller (make the movement against the unit bigger).
0A5	Electromagnetic brake unreleased error	Cause : The brake cannot be released. Treatment : Supplied the 24V power unit for the electromagnetic brake.
0A7	Command deceleration error	Cause : Because there is not enough deceleration distance when the deceleration is changed to a lower setting during the operation, the actuator exceeded the soft limit when deceleration was made from the current position with the deceleration after the change.  Treatment : The calculated number of the command pulse input has exceeded +/-134217728 (H'F8000000 to H'08000000) in Pulse Train Control Mode.
0AB	Command speed error	Cause : A command from PLC exceeds the maximum velocity of an actuator in the motion network. Treatment : Revise the parameters and programs in PLC.
0B5	Z-Phase position error	Cause : The position where the Z-phase is detected before the home return operation, is out of the specified range. Treatment : There is a concern of an encoder error. Please contact IAI.
0BA	Home sensor non-detection	Cause : This indicates that the home-return operation of the actuator equipped with origin sensor (option except rotary actuator) is not completed in normal condition. 1. Work is interfering with peripheral equipment in the middle of home return. 2. Large slide resistance of the actuator itself 3. Installation failure, breakdown or disconnection of the home sensor Treatment : In the case that the work does not interfere with anything, the cause 2. or 3. is supposed. In such case, please contact IAI.
0BE	Home return timeout	Cause : Home return does not complete after elapse of a certain period after the start of home return. Treatment : This error does not occur in normal operation. The combination of the controller and actuator may be incorrect.

Alarm Code	Alarm Name	Cause/Treatment
0BF	Creep sensor not detected	Cause : The actuator detected the creep sensor (option) before detecting the origin sensor (option except for rotary actuator), or the actuator reached the mechanical end (or the actuator cannot move anymore because the load is too large). 1. The position to apply the creep sensor is not appropriate. 2. The creep sensor is faulty. 3. The cable is disconnected or the connector is not plugged in properly. 4. The actuator cannot move due to heavy load caused by interference. Treatment : 1. Readjust the sensor installation position. 2. Replace the creep sensor. 3. Perform continuity check to see if the connector is plugged in properly. 4. Check the interference and the transportable weight and make sure there is no external force applied.
0C0	Actual speed excessive	Cause : This indicates the number of motor rotation exceeded the number of allowable rotation. 1. The slide resistance of the actuator is locally high. 2. The load is increased too much due to an external force. With the reasons above, it can be considered a sudden speed increase has occurred before detecting the servo error. Treatment : Even though this would not occur in normal operation, check if there is any abnormality in the parts assembly condition. Also check if there is a possibility that an external force may be applied in the direction of the actuator movement.
0C1	Servo error	Cause : 2 or more seconds have passed without being able to move after receiving the travel command. 1. Stopped due to setting of the drive torque control [%] in the position table too low. 2. Connection failure or disconnection of the motor connecting cable. 3. The brake cannot be released (for models with brake). 4. The load on the motor is large due to external force. 5. The sliding resistance of the actuator is excessive. Treatment : 1. Set the drive torque control [%] in the position table high. 2. Check the wiring status of the motor connecting cable. 3. Supply 24V DC 150mA to the BKRLS terminal on the power supply connector and if you can see an improvement, it is considered the controller failure. 4. Confirm that there is no error in the mechanical part assembly condition. 5. If the loaded weight is within the allowable range, turn the power OFF and check the resistance in sliding operation by moving the slider with hand.

Alarm Code	Alarm Name	Cause/Treatment
0C2	Overrun sensor detected	Cause : OT sensor (option) mounted on the mechanical end side was detected. 1. The actuator was moved by hand or received external force while the servo was OFF (normal detection). 2. The actuator was jogged or operated by pulse-train in a condition where the home coordinates were not yet established and thus the soft stroke limit did not function correctly (normal detection). 3. The home position achieved by home return is not correct, or in the case of an absolute type controller the coordinates have shifted due to an inappropriate absolute reset position. 4. There is a mismatch between the sensor characteristics and the setting in Parameter No.19 “Overrun sensor input polarity”, or the wiring layout is wrong. 5. There is a mistake in the mating of the controller and actuator, or the settings in Parameters No.3 and 4 “Soft limit value” and Parameter No.77 “Ball screw limit length” are not appropriate. Treatment : 1., 2. Move the actuator in the opposite direction by hand. If this error occurred inside the effective stroke range, 3., 4., or 5. is a likely cause. 3. Check the home position. Conduct the absolute reset again if it is the absolute type. 4., 5. is suspected, please contact IAI.
0C5	Illegal transition command in control system	Cause : 1. Change the operation from the vibration suppress control operation to the normal position control operation. 2. Change the operation from the normal position control operation to the vibration suppress control operation. Treatment : Change the sequence so the next action is conducted after confirming the positioning complete signal (PEND) is turned ON for both cases 1. and 2.
0CF	I/O 24V power supply error	Cause : 24V power supply for PIO is not connected. The voltage is extremely low. Treatment : Check the connection and voltage.
0D6	FAN error detection	Cause : Error detected on heatsink fan inside the controller. Treatment : It can be considered the end of fan life. Replace the fan. Refer to [7.4.2 Fan Unit Replacing Procedure]
0D8	Deviation overflow	Cause : This alarm indicates that the position deviation counter has overflowed. 1. The speed dropped or the actuator stopped due to the effect of external force or overload. 2. The excited-phase detection operation following the power-on is unstable. 3. The power supply voltage dropped. 4. Servo gain number is too small 5. There is a concern of malfunction in controller component (IPM). Treatment : 1. This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 2. Overload can be concerned. Revise the transportable weight and redo the home-return operation. 3. Check for the source voltage. 4. Revise the setting of the servo gain number. 5. Replace the controller (PC board).

Alarm Code	Alarm Name	Cause/Treatment
0D9	Software stroke limit over error	Cause : The current position of the actuator exceeds the software stroke limit. Treatment : Return the actuator to be within the range of the software stroke limit.
0DA	Feedback pulse error	Cause : Feedback pulse data cannot be output within the cycle. Treatment : Take proper measures against noise.
0DC	Pressing motion range over error	Cause : 1. After the pressing operation has complete, the force to push back is too large and the pushed back to the pressing start position (“Position” in the position table). 2. The actuator touched the work during the approach movement before the pressing movement. Treatment : 1. Revise the setting and adjust it so the force to push back gets smaller. 2. Set the “Position” setting in front in the position table to shorten the approach distance.
0DF	Collision warning	Cause : Collision detection has detected a collision during operation to a set position. Treatment : 1. Remove the obstruction that causes collision. 2. If the setting for collision detection is strict, it may cause detection error in normal operation. Revise the setting values.
0E1	Loadcell calibration error	Cause : 1. Calibration command is issued during actuator operation, temporary stop or pressing operation. 2. A calibration error occurs when calibration command is issued. 3. The calibration command signal CLBR is set to OFF before the completion of calibration. 4. Pressing command is issued without calibration. Treatment : 1. Conduct the calibration in the actuator stop condition. 2. Check whether a large load is applied to the loadcell due to biting. Effect of noise is suspected. Check the presence of noise source around the loadcell. 3., 4. Check the sequence in either case. Also, there is a concern of a malfunction of the loadcell. Replace the loadcell. Refer to "Loadcell-equipped Actuator Instruction Manual" for how to replace a loadcell.
200 to 2FF	Teaching tool alarm	Refer to [teaching tool instruction manual]

[3] Cold start level

Alarm Code	Alarm Name	Cause/Treatment
08B	Safety Unit Initializing Error	Cause : 1. The connection status and the settings in the parameters in a controller and the safety unit do not match with each other. 2. A parameter on an encoder not available to use in the safety unit is set. 3. An encoder not available to use in the safety unit is connected. 4. It is set to Rotary Axis Index Mode. 5. The safety parameters and the controller parameters do not match with each other. Treatment : 1. Have the connection status and the setting in the parameters in the controller and the safety unit matched with each other. Related parameter: Controller parameter No.199 2. Have the correct settings of the parameters. 3. Connect an encoder (actuator) supported by the safety unit. 4. Change the parameter to Rotary Axis Normal Mode. 5. Establish the setting in Safety Parameter No. 3 to 8 “Safety Setting 1 to 6” again.
08C	Safety Unit Usage Conditional Error	Cause : Such as the dummy plug (DP-6) is connected to the I/O connector for safety function while a safety unit is connected to a controller. Treatment : Have the I/O connector for safety function disconnected on the controller side.
08D	Safety Unit Error	Cause : It is an error in communication between a controller and the safety unit, or a hardware error on the safety unit. Treatment : 1. Effect of noise is suspected Take proper measures against noise 2. In case the condition would not recover even after reboot of the power, it is necessary to replace either the controller or the safety unit.
08E	Safety Unit Microcomputer A Error	Cause : Microcomputer A on the safety unit has detected an error. Treatment : 1. The safety input signals in duplication do not match. (On one side, off on one side) Check on wiring and signals. 2. Check the power to the safety input and output connectors. 3. Conduct SLS, SLP SDI+, SDI-, SS1-t and SS2-t after the home-return operation is completed. 4. Check in the safety parameters or rewrite them. 5. This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 6. In case the condition would not recover even after reboot of the power, it is necessary to replace either the controller, the safety unit or the motor unit.

Alarm Code	Alarm Name	Cause/Treatment
08F	Safety Unit Microcomputer B Error	Cause : Microcomputer B on the safety unit has detected an error. Treatment : 1. The safety input signals in duplication do not match. (On one side, off on one side) Check on wiring and signals. 2. Check the power to the safety input and output connectors. 3. Conduct SLS, SLP SDI+, SDI-, SS1-t and SS2-t after the home-return operation is completed. 4. Check in the safety parameters or rewrite them. 5. This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 6. In case the condition would not recover even after reboot of the power, it is necessary to replace either the controller, the safety unit or the motor unit.
09B	Internal communication error	Cause : There was an internal communication error occurred between the R-Unit gateway unit and driver unit. 1. Installation error or contact error on the link connector between gateway unit and driver unit. 2. Influence of noise generated by a peripheral device 3. Malfunction of gateway unit or driver unit Treatment : 1. Disconnect and then connect the link between the gateway unit and driver unit to see if the alarm gets generated. 2. Shut down the power on peripheral devices and operate only with the controller and actuators to see if this alarm gets generated again. If the alarm does not get generated, there is a concern of influence of noise from a peripheral device. Revise the noise prevention on peripheral devices such as grounding and electrostatic shielding. 3. Replace the gateway unit or driver unit.
09C	Servo-on Command after Encoder FRAM Readout and Write-in	Cause : Servo-on was conducted without reboot or the power supplied again after the memo was input using the user memo edit feature. Treatment : Reboot or supply the power again.
09E	Actuator Error Connection Detected	Cause : Parameter in controller and actuator in connection not matched. Treatment : Reconnect it in the correct combination of an actuator.
09F	Frequency Synchronizing Error	Cause : There is a communication error to R-Unit 1. Link connector or SCON connector may not be connected properly. 2. There is a line breakage in internal signal lines or on SCON connection cable. 3. There is no terminal unit or terminal connector (for SCON) connected. 4. Communication error due to noise influence Treatment : 1., 2. Confirm that the units are firmly linked with each other. Release the link of the units once and link them back. In case the phenomenon occurs again, consult with IAI. 3. Attach the terminal unit or terminal connector. 4. Have a noise countermeasure such as a change in the cable layout.

Alarm Code	Alarm Name	Cause/Treatment
0A1	Parameter data error	Cause : The data input range in the parameter area is not appropriate. This error occurs when the magnitude relationship is apparently inappropriate such as when 300mm was incorrectly input as the value of the soft limit negative side while the value of the soft limit positive side was 200.3mm. Treatment : Change the value to the appropriate one.
0A6	Dynamic brake not released	Cause : The dynamic brake cannot be released when the servo is ON due to noise and electrostatic, etc. Treatment : Implement measures to eliminate noise or electrostatic. There is a concern of circuit breakdown. Please contact IAI.
0A8	Unsupported motor/encoder types	Cause : A motor or an encoder not applicable to this controller has been connected. Or the type of a motor or an encoder set in the parameter is undefined. Treatment : If this alarm occurs on an actuator subject to control or the phenomenon occurs even after the power is rebooted, it is necessary to replace the controller.
0A9	Loadcell data error	Cause : The data acquired from loadcell at power-on or software reset is incorrect. Treatment : Repeating of power reboot and still the phenomenon occurs, and then there is a concern of the loadcell malfunction. Consider to repair or replace it.
0B3	Linear spurious absolute error	Cause : Home-return operation was not performed properly. 1. Work is interfering with peripheral equipment in the middle of home return. 2. Encoder Error Treatment : 1. Remove the interference. 2. Please contact IAI.
0B4	Electric angling mismatching	Cause : This alarm indicates that the position deviation counter has overflowed. Treatment : The alarm occurs when the actuator cannot be operated. Confirm about the load conditions, that the work does not interfere with any object nearby or the brake has been released, etc. If the error occurs even when the servo is ON, the cable breakage or disconnection is considered. Check the cable connection. Please contact IAI if there is no failure in the cable and connector connections.

Alarm Code	Alarm Name	Cause/Treatment
0B7	Magnetic pole indeterminacy	Cause : The controller detects the magnetic pole phase when the servo is tuned ON for the first time after turning ON the power. This error indicates that the magnetic pole phase cannot be detected after the specified period. 1. Contact error or breakage at the connector of the motor relay cable. 2. Brake cannot be released on a controller equipped with a brake. 3. Detection of the motor is not performed properly because an external force is applied. 4. Large slide resistance of the actuator itself Treatment : 1. Check the wiring condition of the motor relay cable. 2. Check the wiring condition of the brake cable, and also turn on/off the brake release switch to see if the brake makes a “clicking” sound. If the brake is not making any noise, check if the power is supplied to the brake properly. 3. Check for abnormality in the assembly condition. 4. If the loaded weight is within the allowable range, cut off the power to check the slide resistance manually by moving with hand. If the actuator itself is suspected to be the cause, please contact IAI.
0C4	Exceeded allowable time of exceeding torque allowing continuous pressing	Cause : The continuous pressing time at a pressing force setting exceeding 70% exceeded the time set in parameter No. 89 "Allowable time exceeding continuous pressing torque". Treatment : Check the sequence again. Set the pressing time to be within the setting time.
0C6	Torque current • Mismatching force feed back	Cause : The feedback from the loadcell has continuously been larger than the rating motor output for 256ms or longer. Treatment : 1. Check that there is no external force applied in the direction to push back from the load side. 2. Review wiring of actuator and loadcell cables. 3. The actuator, controller or loadcell may be faulty. Please contact IAI.
0C8	Overcurrent	Cause : 1. The output current in the power circuit section is increased abnormally. 2. Error in relative resistor of motor Treatment : This alarm will not be generated in normal operation. It can be considered as the insulation degradation of the motor winding or malfunction of the RCON system. Please contact IAI. ⚠ Caution Before resuming operation, make sure to remove the cause of the error. Turning the power on and off repeatedly without removing the cause could burnout of the motor coil.

Alarm Code	Alarm Name	Cause/Treatment
0CA	Overheat	Cause : The temperature of the controller internal parts has exceeded the temperature defined for each actuator. 1. Operation is performed with the load condition exceeding the specified range. 2. High temperature around the controller. 3. Lack of regenerative resistor units. 4. A faulty part inside the controller. Treatment : 1. Revise the operation condition such as decreasing the speed. 2. Lower the ambient temperature of the controller. 3. Add a regenerative resistor unit. Note This error does not normally occur. If it occurs, confirm that it is not 1 to 3 above. If the phenomenon occurs even after confirmation, it can be concerned about malfunction of controller. Replace or repair the controller. ⚠ Caution Before resuming operation, make sure to remove the cause of the error. Turning the power on and off repeatedly without removing the cause could burnout of the motor coil.
0CB	Current sensor offset adjustment error	Cause : 1. An error was found to the sensor in the status check of the current detection sensor conducted at the initializing process in the startup. 2. The current detection sensor or any of its surrounding parts is faulty. Treatment : In case this occurs again even after the power supply is rebooted, it is necessary to replace and adjust the PC board. Have the controller replaced or repaired.
0CD	Drive source cutoff relay welding detection	Cause : 1. Failure of the drive source cutoff relay inside the controller. 2. The motor power is supplied while the emergency stop is input. Treatment : 1. The relay or controller must be replaced. Please contact IAI. 2. Construct the circuit to have the motor power supply cut off while the emergency stop is being input.
0CE	Drop in control supply voltage	Cause : The AC power voltage supplied to the controller has dropped. 1. The voltage of 24V DC power supply is low. 2. A faulty part inside the controller. Treatment : 1. Check the voltage of the input power supply. 2. Replace the controller.
0D2	Motor power source voltage excessive	Cause : A breakdown of the part inside the controller is considered. Treatment : If this error occurs frequently, the controller may be faulty at high probability. Please contact IAI.
0D3	Motor power supply voltage low	Cause : 1. If the power source is shut off in the controller external circuit, servo-on command was made during the power is shut. 2. There is a concern of a malfunction of the controller internal components. Treatment : 1. Check the controller external circuit. 2. If this error occurs often, there is a concern of a controller malfunction. Please contact us.

Alarm Code	Alarm Name	Cause/Treatment
0D7	Belt breaking sensor detected	Cause : The belt of the ultra-high thrust RCS2-RA13R is broken. Treatment : Belt must be replaced. Please contact IAI.
0DD	Drive mode error	Cause :1. Linear ABS Actuator was used in Pulse Train Control Mode. 2. The actuator of field network specification is started after it is set to the pulse-train control mode. Treatment :1. When it is necessary to have the linear ABS actuator in the pulse train control, change the PIO pattern to "1". 2. The actuator of field network specification and R-Unit connection specification cannot be set to the pulse-train control mode. Set the operation mode changeover switch on the front panel to OFF.
0E0	Overload	Cause :1. The work weight exceeds the rated weight, or an external force is applied and the load increased. 2. If the actuator is equipped with a brake, the brake is not released. 3. The slide resistance of the actuator is locally high. Treatment :1. Check the work and its surrounding area to remove the cause. 2. Turn on the brake release switch to see if the brake is released. If the brake is not released, the brake itself may be faulty, cable may be disconnected, or the controller may be faulty. 3. If the work piece is in a condition that it can be moved manually with hand, try to move it to check if there is any spot that the sliding resistance is large. Check if there is any deformation on the attachment surface. If there is any point with high sliding resistance on the actuator itself, it is necessary to have an overhaul or replacing conducted. ⚠ Caution Restart the operation after making sure to remove the cause. If you cannot determine that the cause is removed completely, wait for at least 30 minutes before turning on the power to prevent the motor coil from burning.
0E2	Loadcell communication error	Cause : There was a communication error during the communication with the loadcell. Treatment :1. Review wiring of loadcell cables and others. 2. Effect of noise is suspected. Check the presence of noise source around the loadcell. 3. Replace the loadcell if it may be faulty. 4. Replace the controller if it may be faulty.
0E3	Loadcell error	Cause :1. Excess load was applied to the loadcell. 2. A hardware error such as a power supply error or overheat of the PC board on the loadcell or EEPROM error has occurred. Treatment :1. Check if there is high load applied to the loadcell. Also, make sure that there is no momentary impact such as collision to a workpiece applied to the loadcell. 2. There is a concern of noise influence. Check if there is a source of noise nearby. 3. There is a concern of a malfunction of the loadcell. Please contact IAI.

Alarm Code	Alarm Name	Cause/Treatment
0E4	Encoder send error	Cause : The data sent from the controller was not received properly by the encoder side. 1. Encoder cable is partially disconnected, or connector is not connected properly. 2. Influence from noise. 3. Failure of communication IC mounted on the encoder circuit board. 4. Failure of communication IC mounted on the driver unit circuit board. Treatment : 1. Confirm that there is no failure in the cable and connector coupler. 2. Try turning OFF power to all peripheral devices and moving only the controller and actuator. If no error is generated, the culprit may be noise. Take measures against noise. 3., 4. It is replace the motor unit or controller.
0E5	Encoder receipt error	Cause : The controller could not receive normal data from the encoder. 1. Breakage of encoder cable or connection error on connectors (If the detail code in the alarm list of the teaching tool is 0001_H.) 2. Effect of noise (Detail Code 0002_H) 3. A faulty part inside the actuator (communication part). 4. A faulty part inside the controller (communication part). Treatment : 1. Check if any wire breakage on a connector and the condition of wire connections. 2. Interrupt the power to the peripheral equipment and activate only the actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. 3., 4. It is necessary to replace the actuator (motor part) or controller.
0E6	Encoder count error	Cause : This error code appears when the encoder cannot detect the position information properly. 1. The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 2. Foreign matter is deposited on the code wheel. 3. The position relationship between the code wheel and photo sensor changed due to shaft center shift caused by application of excessive external force, etc. 4. Faulty encoder board component Treatment : 1. Check if any wire breakage on a connector and the condition of wire connections. 2., 3., 4. It is necessary either to clean the code wheel, adjust the installation position, replace the motor unit or replace the actuator. In any case, please contact IAI.
0E7	A-, B- and Z-phase wire breaking	Cause : Encoder signals cannot be detected correctly. 1. The actuator Connection cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 2. The encoder itself is faulty. Treatment : 1. Check if any wire breakage on a connector and the condition of wire connections. If the cables are normal, faulty encoder is suspected. 2. Please contact IAI.

Alarm Code	Alarm Name	Cause/Treatment
0EB	Battery-less absolute encoder error detected	Cause : It is a condition that the battery-less absolute encoder has not detected the position information properly. Treatment : Check if there is any breakage on the connectors and the condition of connections. Malfunction of the encoder can be considered if the cables are in the normal condition. Please contact IAI.
0EE	Absolute encoder error detection 2	Cause : This is the condition where the position information cannot be detected in the absolute encoder. 1. Voltage drop of absolute battery. 2. The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. Treatment : 1. Check the light malfunction alarm output (*ALML) at the power booting, and if it is off, replace the absolute battery. 2. Check if any wire breakage on a connector and the condition of wire connections. Whichever action is taken under 1. or 2., an absolute reset must be performed. If the cables are normal, faulty encoder is suspected. Please contact IAI.
0EF	Absolute encoder error detection 3	Cause : Absolute encoder is not detecting the position information properly. (ABS encoder overspeed error) This error occurs in such cases as the speed exceeded the tracing acceleration speed limit in the drop by the brake release at the power cutoff of the absolute type vertical axis. (This condition should not occur in normal conditions of use. Take sufficient note on forced brake release.) Treatment : If the error is occurred, it is necessary to absolute reset.
0F0	Driver logic error	Cause : Exceeded load, parameter (motor type) mismatched, noise, malfunction of controller, etc. Treatment : Please contact IAI.
0F2	Field bus module error	Cause : Error detected in field network circuit board. Treatment : Check the parameter settings.
0F3	Field bus module not detected	Cause : Field network circuit board could not be detected. Treatment : Reboot the power. Replace the controller incase the phenomenon would not be solved.
0F5	Nonvolatile memory write verify error	Cause : Un match was detected when the data was written to the nonvolatile memory and comparison (verification) was made to see if the data inside the memory matches with the written data. (Failure of non-volatile memory) Treatment : If the same phenomenon occurs even after the power is rebooted, it is necessary to replace the controller.
0F6	Nonvolatile memory write timeout	Cause : There is no response when writing data in non-volatile memory. Failure of non-volatile memory. Treatment : If the same phenomenon occurs even after the power is rebooted, it is necessary to replace the controller.
0F8	Non-volatile memory data destruction	Cause : Abnormal data was detected by non-volatile memory check at startup. (Failure of non-volatile memory) Treatment : If the same phenomenon occurs even after the power is rebooted, it is necessary to replace the controller.
0FA	CPU error	Cause : The CPU operation is not normal. 1. Faulty CPU 2. Malfunction due to noise Treatment : When the error is caused even when the power is re-input, please contact IAI.

Alarm Code	Alarm Name	Cause/Treatment
0FB	FPGA error (Faulty component)	Cause : The FPGA is not operating properly. 1. Malfunction due to the effect of noise, etc. 2. Faulty FPGA 3. Faulty circuit component around the FPGA. 4. Inappropriate board installation in the controller. Treatment : Turn the power off and reboot. If the error occurs again, check for presence of noise. If a spare controller is available, replace the problem controller with the spare controller. A recurring error with the spare controller suggests presence of noise. If the cause cannot be identified, please contact IAI.
0FC	Logic error	Cause : The CPU operation is not normal. 1. Faulty CPU 2. Malfunction due to noise Treatment : Turn the power off and reboot. If the error occurs again, check for presence of noise. If a spare controller is available, replace the problem controller with the spare controller. A recurring error with the spare controller suggests presence of noise. If the cause cannot be identified, please contact IAI.
0FD	Expanded device error	Cause : Error in component for load data analog output. Or error in external wiring at analog output. (Note) Error will not be detected when Parameter No. 180 “DAC Output” is set invalid. Treatment : Check in wiring for analog output. Contact IAI if no failure is found in wiring.
300 to 3FF	Alarm on teaching tool	Refer to [teaching tool instruction manual]

8.4 Drive Recorder Feature

The drive recorder feature is a feature to support cause analysis and early recovery of machinery by recording behavior of an actuator when an alarm is generated.
This feature should be categorized into the following two features.

1) Graph Display Feature
   It is a feature to save the operation data for a few tens of seconds before an alarm is generated and show it in a graph.
2) Data Display at Alarm Generation Feature
   It is a feature to save the data at the moment of an alarm generated and show it in a graph.

8.4.1 Graph Display Feature

The graph display feature is capable of displaying the sampling data for 149 seconds before an alarm is generated until 1 second after the alarm with the alarm generation as a trigger and show it in a graph. However, generation of a message level alarm should not trigger the feature.

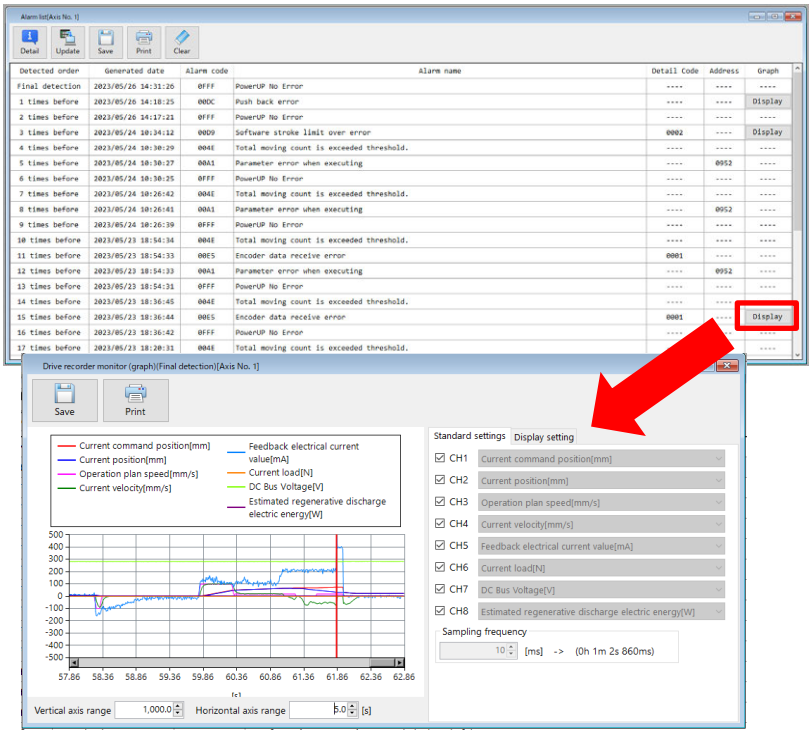
- **The initial setting to use this feature is not necessary.**
- **The frequency for data acquirement is 10ms.**
  It is available to change in the range from 1 to 1,000ms in the parameter.
  The data acquirement available time, acquirement time after alarm generation and data saving available time should vary proportionately to the data acquirement frequency.
- **The history available for saving to a controller should be three histories.**
  6 histories and 12 histories are available to select in the parameter. Histories are deleted automatically from old ones.
- **The number of data channels available for saving is 8CH.**
  2CH and 4CH modes are also available in the parameter. The data acquirement available time, acquirement time after alarm generation and data saving available time should change in inverse proportion to the channel count.

Caution

- As it uses the same memories as the servomotor, do not attempt to use this feature while the servomotor is in use.
- The operation data should not be acquired with any alarm in the message level or those generated during controller startup.

8.4.2 How to Display Graph

Select Display in “Alarm Monitor” in the teaching tool, and a graph should appear.



8.4.3 Parameter

The parameters related to the drive recorder feature should be as follows.

[1] Drive recorder mode select (Parameter No.210)

No.	Name	Unit	Input Range	Default factory setting
210	Drive recorder mode select	—	0: Disabled, 1: 4CH 2: 8CH, 3: 2CH	2

The number of data to be acquired in the drive recorder feature should be selected. The data types available to acquire should be as follows (change not available).

Parameter No.210			CH	Data type	Unit
0			Drive Recorder Feature Disabled		
3	2	1	1	Current Position	mm or pulse
			2	Feedback Current Value	% or mA
			3	Current Command Position	mm or pulse
			4	Current Velocity	mm/s or pps
			5	Operation Plan Velocity	mm/s or pps
			6	Current Load	N
			7	DC Bus Voltage	V
			8	Estimated Regenerative Electric Discharge Wattage	W

The time available for data acquirement should differ depending on number of channels to acquire data.

Number of Channels	Time Available for Acquirement	
2	600s	
4	300s	
8	150s	← Default

* When data acquirement frequency is set to 10ms

[2] Drive recorder save history select (Parameter No.211)

No.	Name	Unit	Input Range	Default factory setting
211	Drive recorder save history select	—	0:3 history 1:6 history 2:12 history	0

The count of alarm history available to save in the drive recorder can be set up.

The time available for saving to a controller may differ depending on number of channels and number of histories.

Number of Histories \ Number of Channels	2CH	4CH	8CH
3 history	40s	20s	10s ← Default
6 history	20s	10s	5s
12 history	10s	5s	2.5s

* When data acquirement frequency is set to 10ms

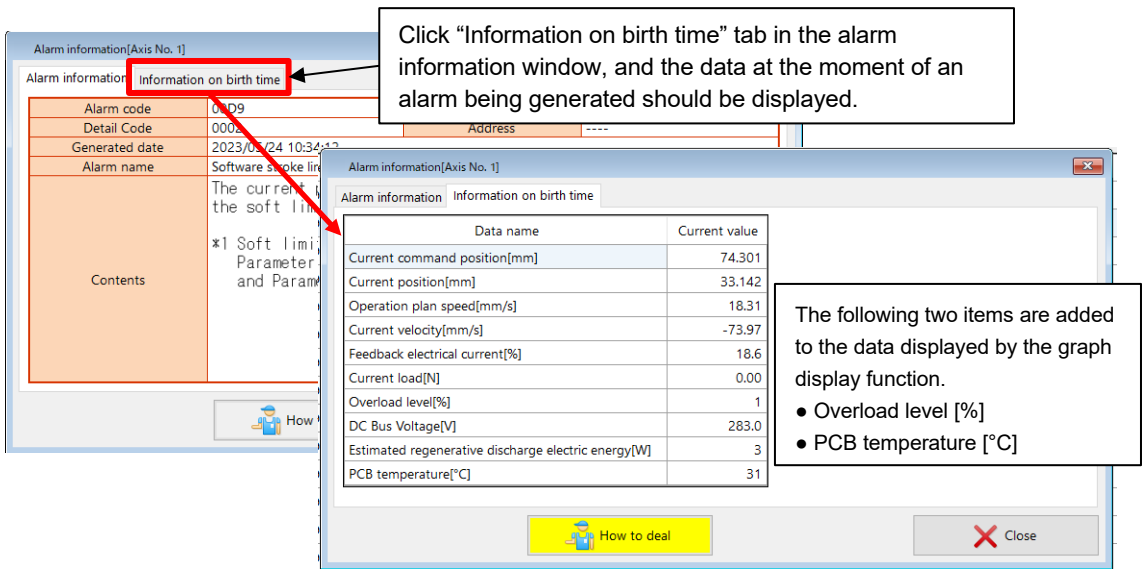
[3] Drive recorder save history select (Parameter No.212)

No.	Name	Unit	Input Range	Default factory setting
212	Drive recorder save history select	ms	1 to 1,000	10

The cycle to acquire data in the drive recorder feature should be changed. The data acquirement available time, acquirement time after alarm generation and data saving available time should vary proportionately to the data acquirement frequency.

8.4.4 Data Display at Alarm Generation Feature

The data inside a controller at the moment of an alarm being generated should be displayed. It should certainly be saved in each alarm history.



* For an alarm generated at the controller startup should be displayed as 0 for all the data.

8.4.5 Caution

The data saved in the drive recorder should deleted when a certain sorts of operation is made. The deleted data could be both the graph displayed data and data at alarm generation, or it could be the graph displayed data only, depending on what operation has been made.
Below describes the certain sorts of operation and the deleted data at that time.

- **When Alarm List Cleared**
  As the relation among the alarm history, graph display data and the data at alarm generation should be cleared when the alarm list gets cleared, both the graph display data and the data at alarm generation should be deleted.

- **When Alarm Generated**
  As the relation between the alarm history and the graph display data should change when a new alarm (exclude message level) is generated during readout of the graph display data, readout of the graph display data after that should become invalid.

  By making the following operation, readout of the graph display data should get available again.

  <Countermeasure>
  Perform operation in the following order.
  1) Close the graph display window and alarm list window
  2) Display again the latest alarm list
  3) Display the required history data

- **When Parameter for Graph Display Feature Changed**
  As the internal structure of the graph display data will change and becomes unable to read out properly or the result of data calculation acquired by a tool will change when either of the three parameters, Parameter No. 210 to 212, is changed, the graph display data should be deleted.
  * The data at alarm generation should not be deleted.

- **When Firmware Version Changed**
  When the internal structure of the graph display data is changed due to the change in the firmware version, the graph display data should be deleted.
  * The data at alarm generation should not be deleted.

If a tool gets disconnected while the servo monitoring window is in display, the controller should get remained in the servo monitoring mode, and the record data gets unable to be recorded when an alarm is generated. Close the servo monitoring window before disconnecting the tool. In case a tool is disconnected while the servo monitoring window is in display, reconnect the tool or reboot the controller and the status gets back to the graph display feature.

SCON2-CG

Chapter 9

Construction of Safety Circuit

9.1 Conformity to Safety Category ····· 9-1

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9.1.2 Wiring and Setting of Safety Circuit ····· 9-2

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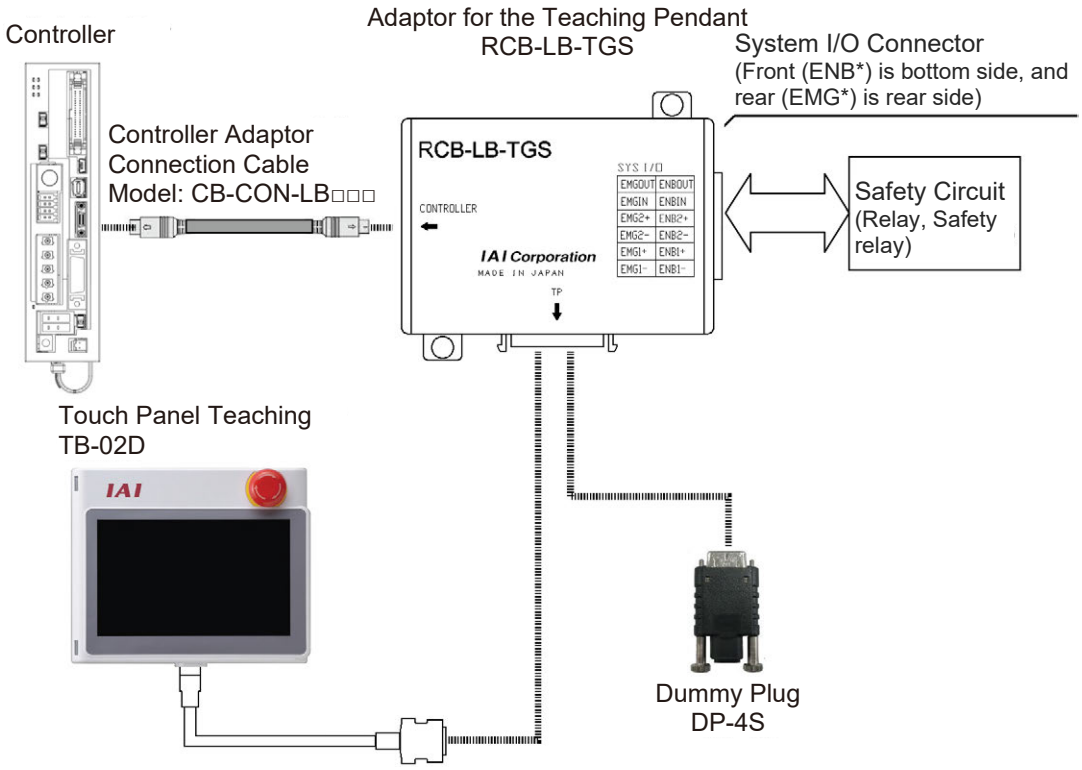
9.1 Conformity to Safety Category

In this section shows an example of a circuit using the dedicated teaching pendant. However, it is not possible for us to check the conformity of our product to the condition of your system. Therefore, it is necessary that the user construct the circuit considering the condition of use and the categories to be applied.

9.1.1 System Configuration

When it is necessary to construct a system complied with Safety Category (ISO12100-1), use TB-02D for a teaching pendant.
Also, TP adapter (Model: RCB-LB-TGS) is required.
The system can conform to up to safety category B to 4 (ISO13849-1) by changing connections of system I/O connectors.



Caution

- Make sure to put in the dummy plug DP-4S to the adapter for a teaching pendant when a teaching pendant is not connected.

9.1.2 Wiring and Setting of Safety Circuit

[1] Power supply

To use safety relays and/or contactors of 24V DC specification in the safety circuit, the control power supply should be used only for the circuit as much as possible. For example, to supply power to the safety circuit, do not use the power supply driving our robo-cylinder controller ACON or PCON.

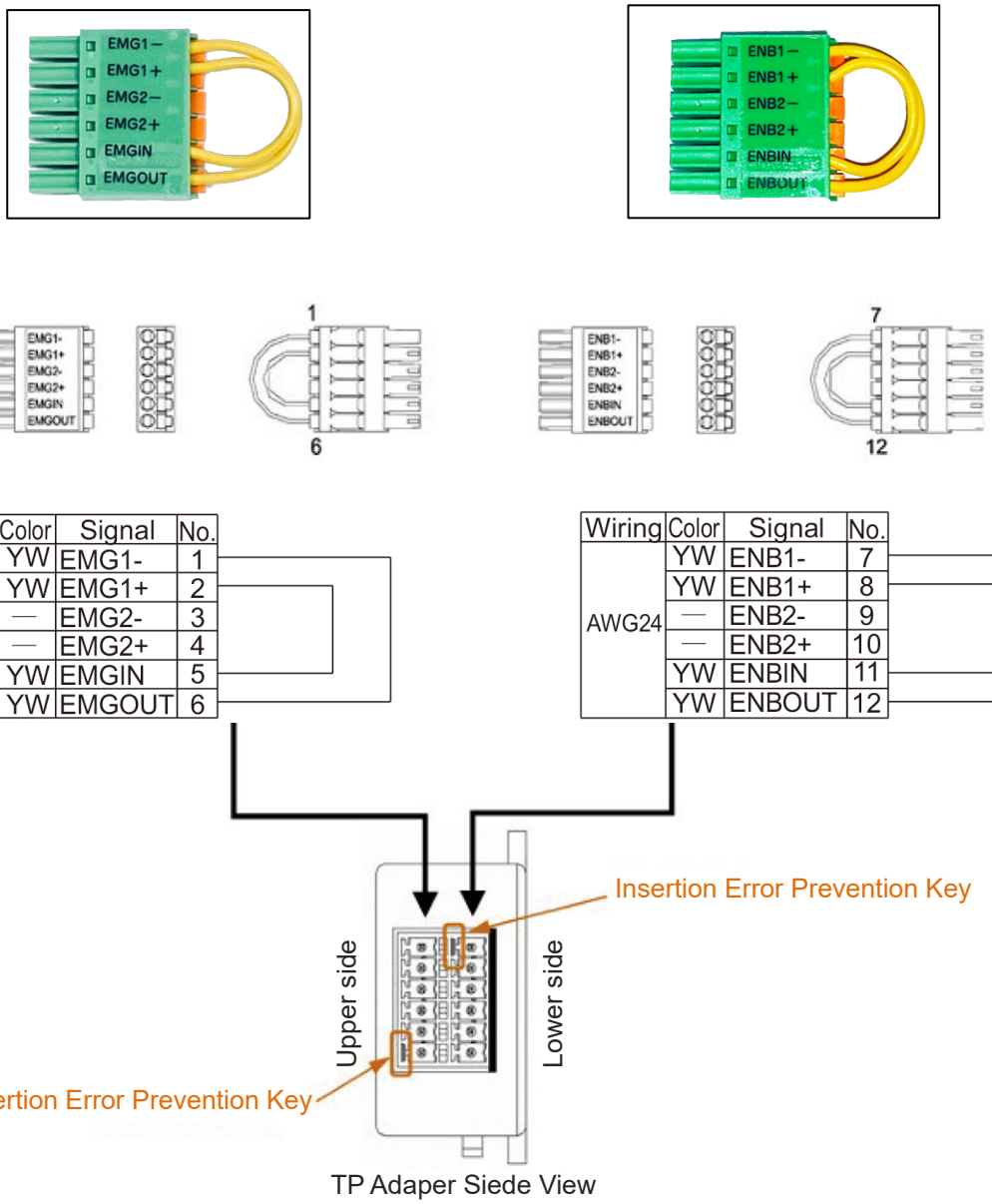
It is the risk prevention treatment preparing for the cases such as the operation error of the safety circuit caused by not enough power capacity.

[2] Specification of system I/O connector for TP adapter

Connector Name		System I/O Connector		Applicable Wire
Upper side (EMG side)	Cable side	FMC1.5/6-ST-3.5 (Note 1)	Phoenix Contact	AWG24 to 16 (0.2 to 1.25m^2)
	TP adapter side	MCDN1.5/6-G1-3.5P26THR		
Lower side (ENB side)	Cable side	FMC1.5/6-ST-3.5 (Note 1)		
	TP adapter side	MCDN1.5/6-G1-3.5P26THR		

	Pin No.	Signal name	Description
Upper side (EMG side)	1	EMG1-	Emergency stop contact 1 (30V DC or less, 100mA or less)
	2	EMG1+	
	3	EMG2-	Emergency stop contact 2 (30V DC or less, 100mA or less)
	4	EMG2+	
	5	EMGIN	Emergency stop detection input
	6	EMGOUT	24V power supply output for emergency stop detection input
Lower side (ENB side)	7	ENB1-	Enable contact 1 (30V DC or less, 100mA or less)
	8	ENB1+	
	9	ENB2-	Enable contact 2 (30V DC or less, 100mA or less)
	10	ENB2+	
	11	ENBIN	Enable detection input
	12	ENBOUT	24V power supply output for enable detection input

Note 1 Connectors on the cable side are attached under conditions where initial wiring has been conducted.
In order to support each category, remove the initial wiring and wire your safety circuit.



TP Adaper Siede View

[3] Connection of dummy plug of TP adapter

When operating the controller with AUTO Mode, make sure to connect the enclosed dummy plug (DP-4S).

[4] Enable function*

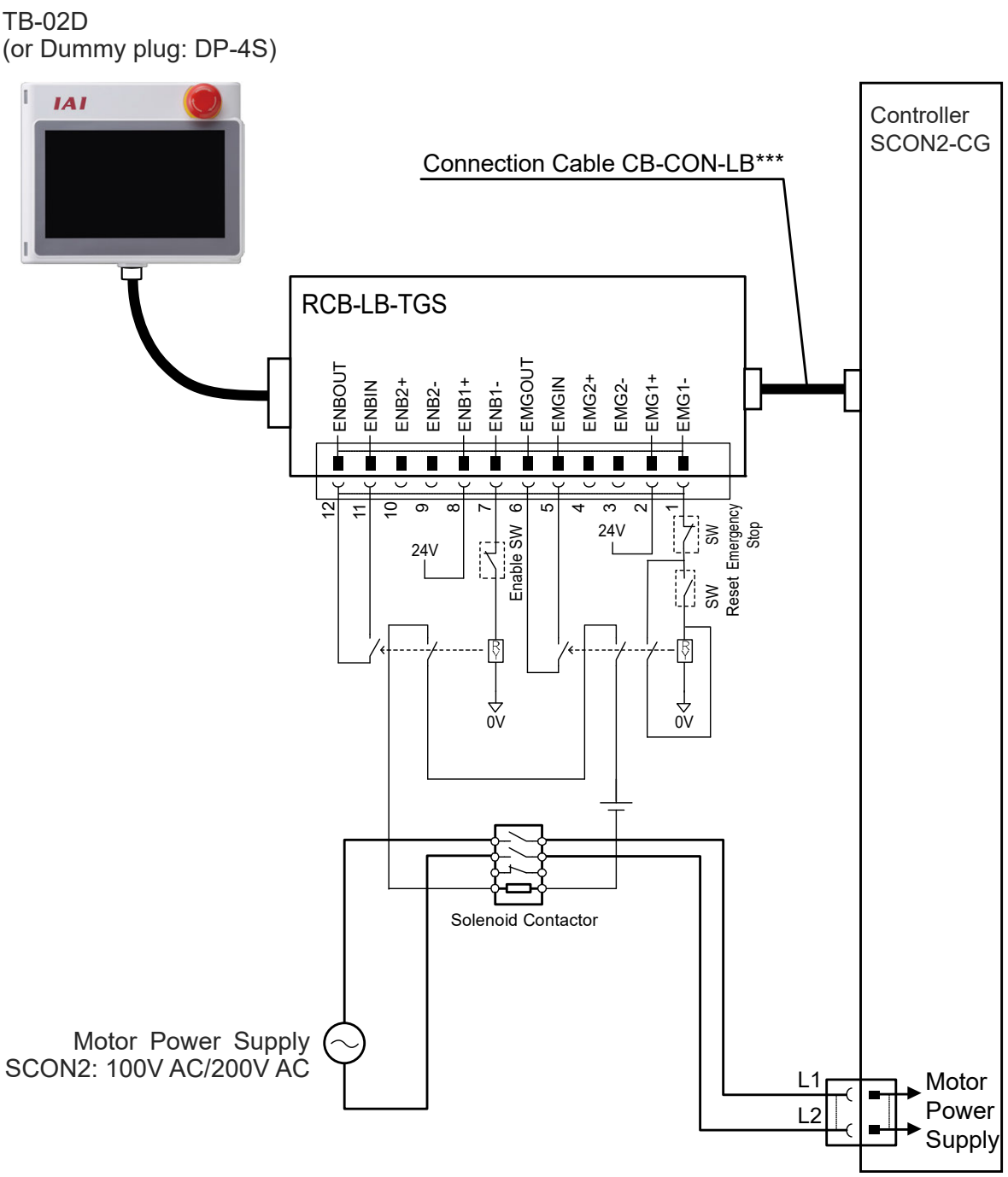
If you are using the enable function, set it to Enable using the controller parameter.

No.	Name	Unit	Input range	Default initial value setting
42	Enable function	—	0: Enable, 1: Disable	1

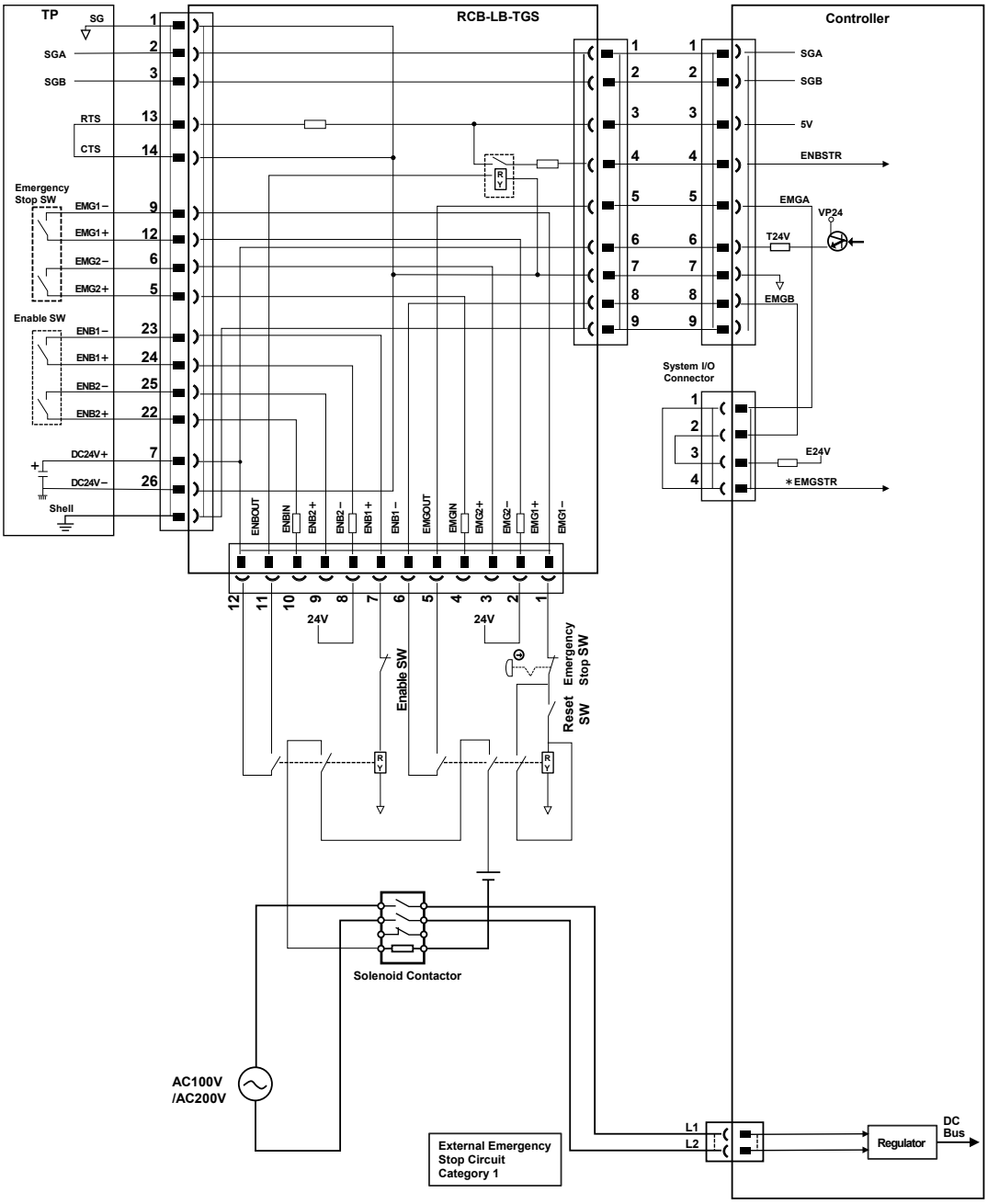
* Enable function : It is the function to monitor the status of the signal (safety switch, dead man's switch on teaching pendant, etc.) to permit the devices to operate.

9.1.3 Examples of Safety Circuits

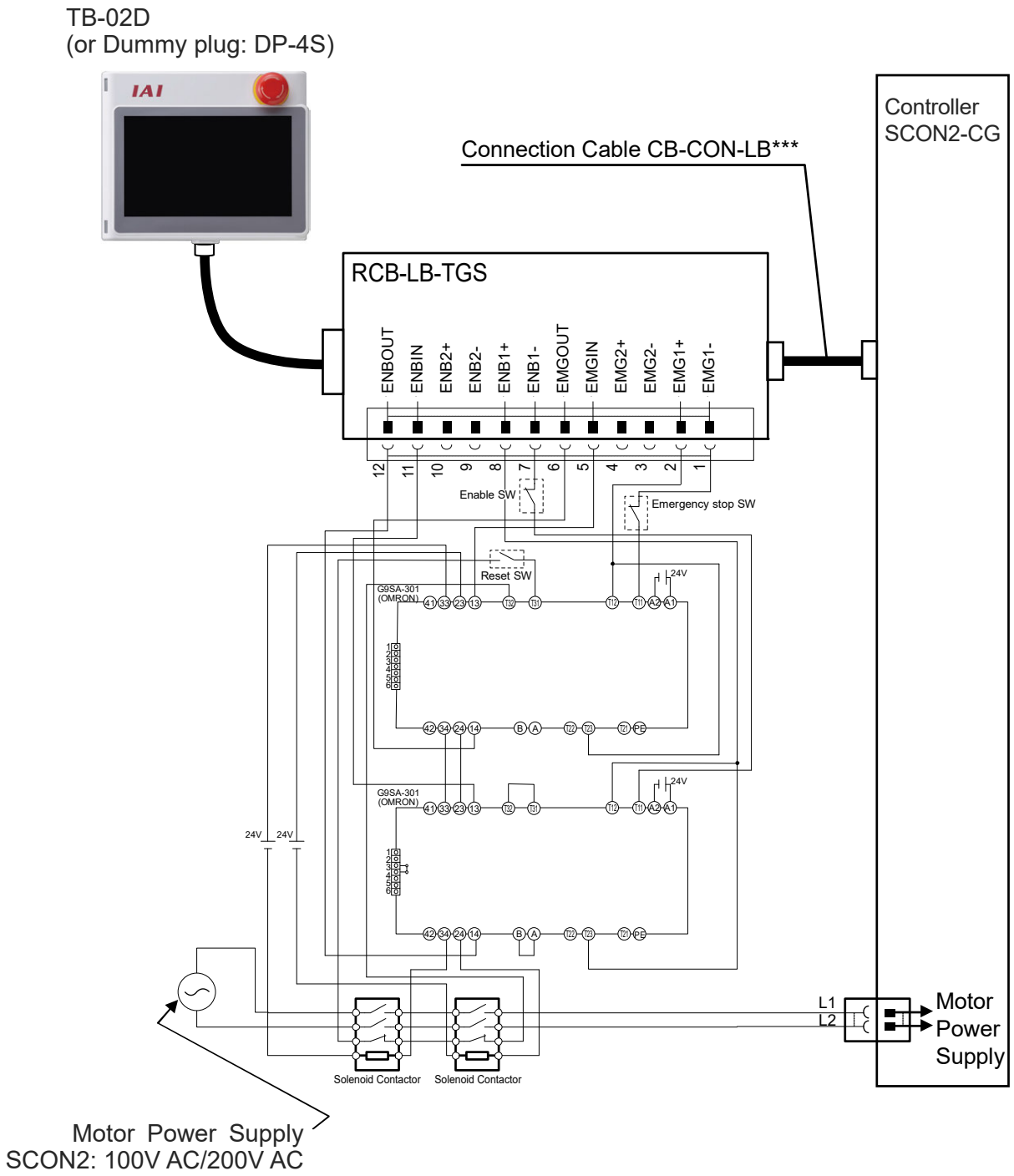
[1] In case of category 1



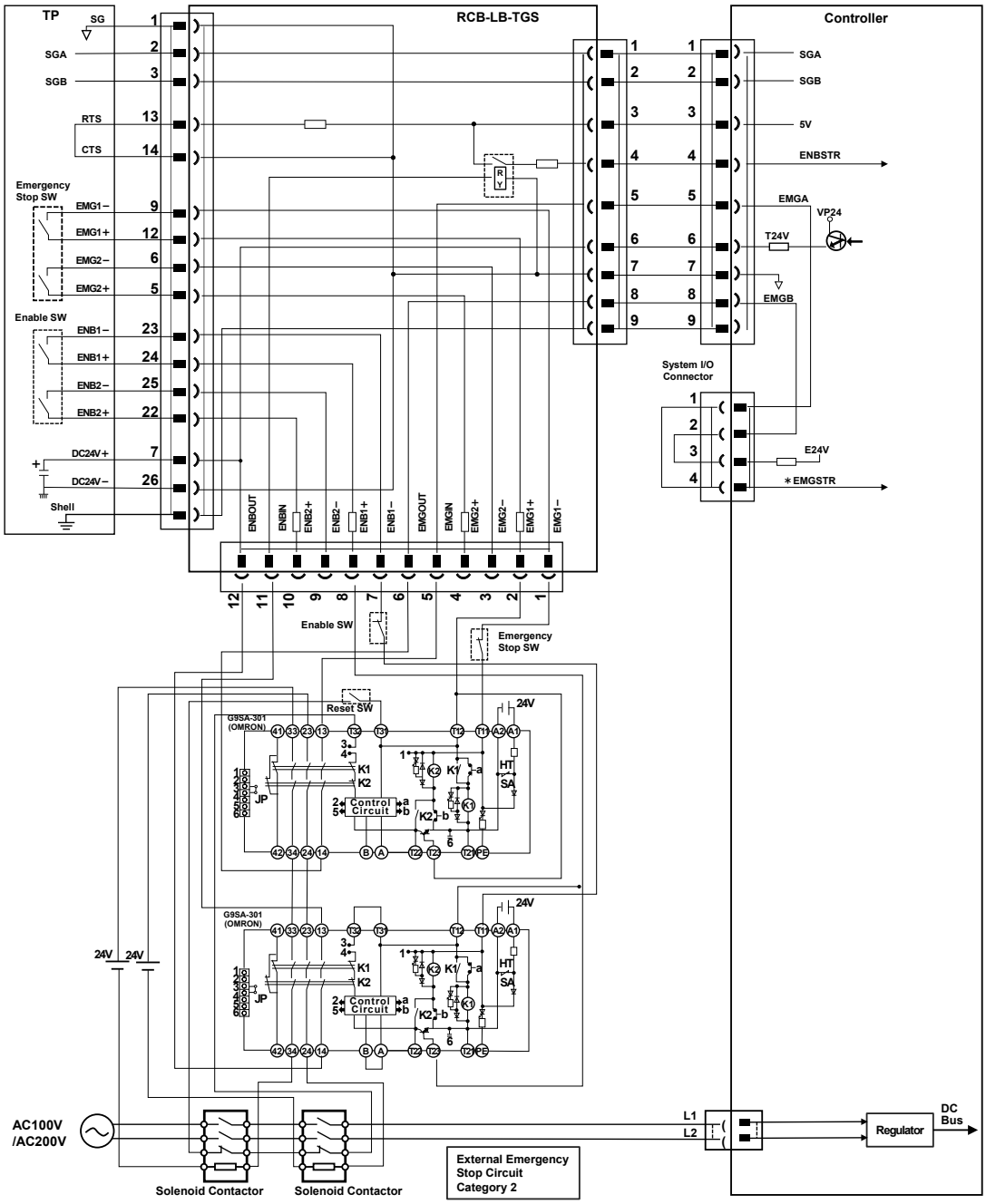
• Detailed category 1 circuit example



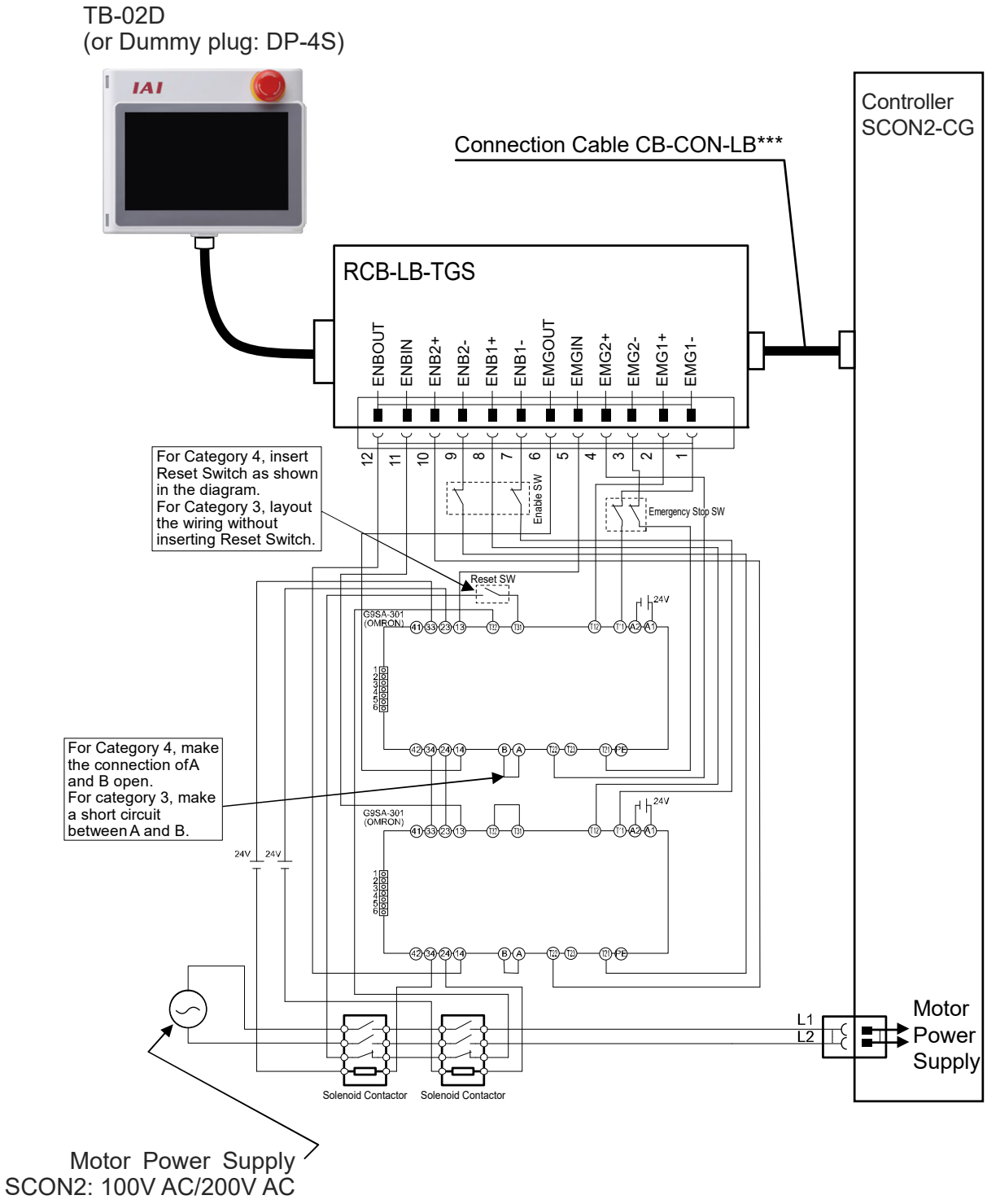
[2] In case of category 2



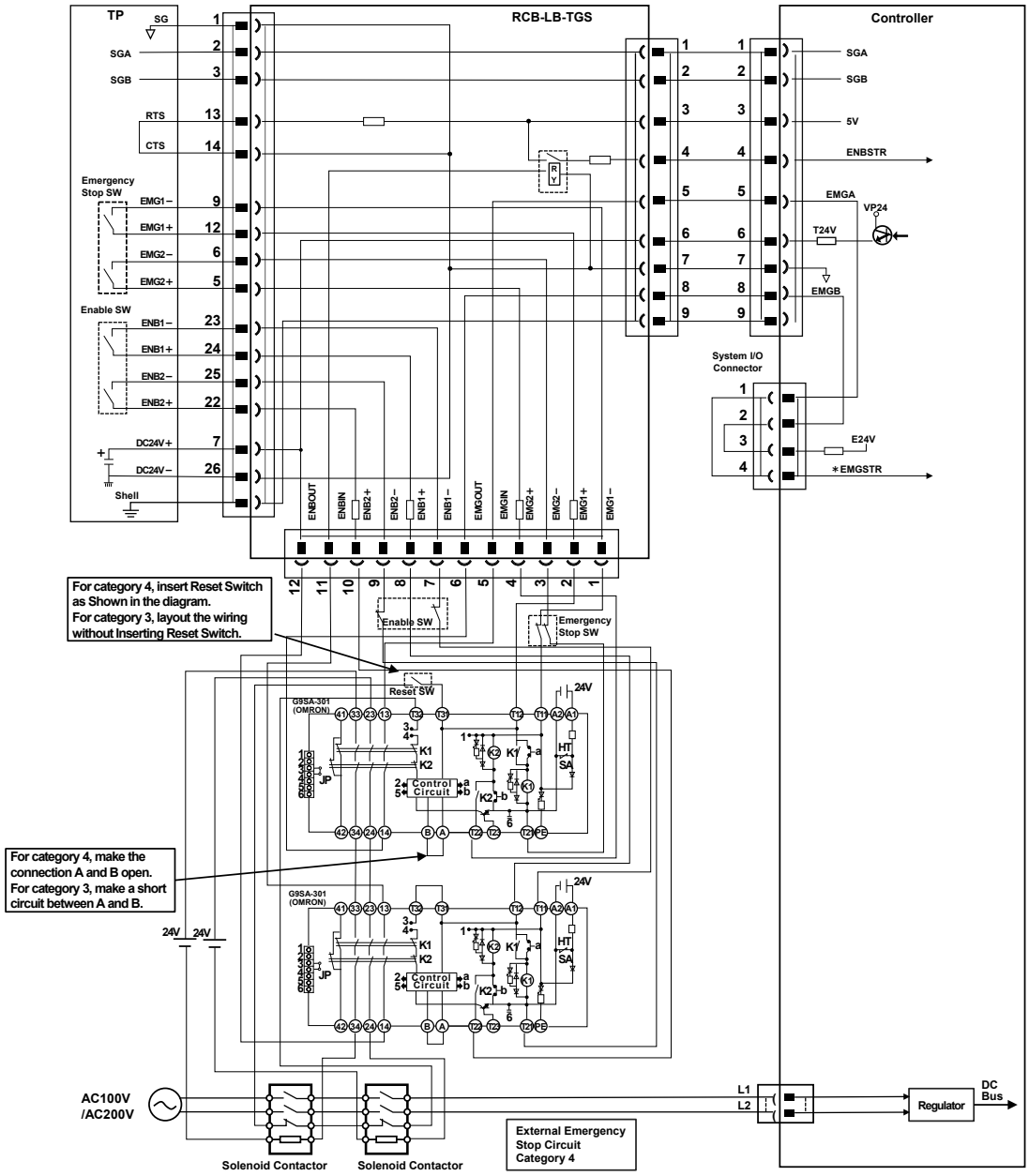
• Detailed category 2 circuit example



[3] In case of category 3 or 4

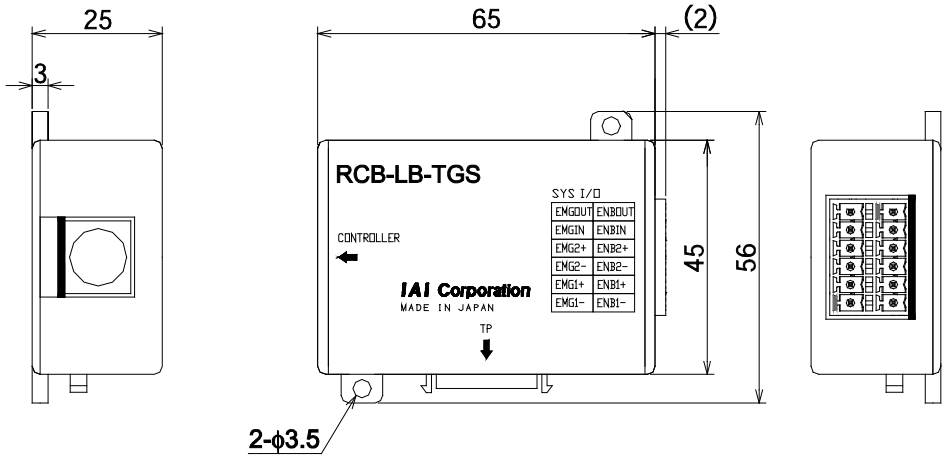


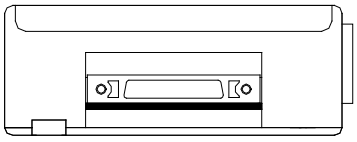
• Detailed category 3 or 4 circuit example

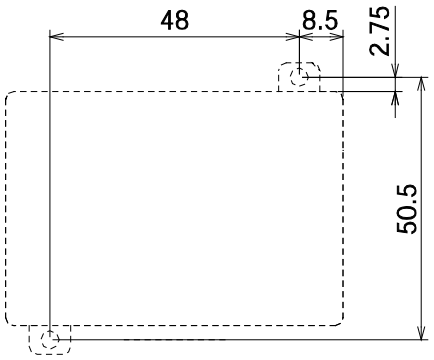


9.1.4 TP Adapter and Related Components

[1] TP adapter external dimensions





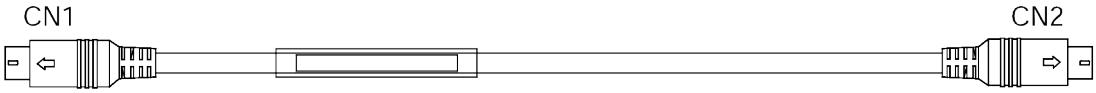


[2] Connection Cable

• Controller/TP Adaptor Connection Cable

Use this cable to connect the controller and TP adapter (RCB-LB-TG).

Model : CB-CON-LB005 (standard cable length : 0.5m)



CB-CON-LB□□□

CN1			CN2		
Color	Signal	No.	No.	Signal	Color
BR	SGA	1	1	SGA	BR
YW	SGB	2	2	SGB	YW
RD	5V	3	3	5V	RD
OR	ENBL	4	4	ENBL	OR
BL	EMGA	5	5	EMGA	BL
GN	24V	6	6	24V	GN
PL	GND	7	7	GND	PL
GY	EMGB	8	8	EMGB	GY
Shield	FG			FG	Shield

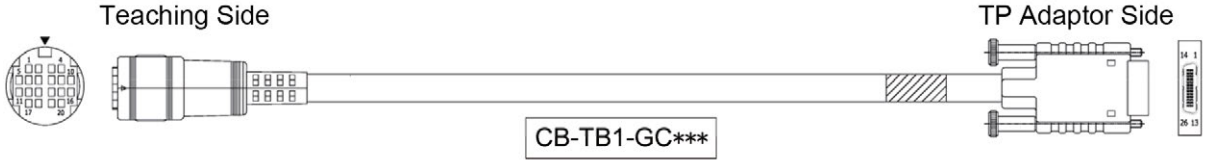
8PIN MIN DIN Connector (overmolded) 8PIN MIN DIN Connector (overmolded)

• Teaching pendant/TP Adaptor Connection Cable

Use this cable to connect the teaching pendant and TP adapter.

Model : CB-TB1-GC□□□

Maximum cable length : 10.0m, Minimum cable length : 0.2m



Cable Color		Signal name	No.
	YW / BK1	SRD+	1
	PK / BK1	SRD−	2
—	—	N. C	3
AWG28	BR	ENB2+	4
	GY	T24V	5
	RD	EMG1−	6
	BK	EMG2+	7
	YW	EMG2−	8
	PK	ENB1+	9
	PL	T24G	10
	WH	GND	11
	BL / WH1	ENB2−	12
	OR / WH1	EMG1+	13
	GN / WH1	ENB1−	14
—	—	N. C	15
—	—	N. C	16
—	—	N. C	17
—	—	N. C	18
—	—	N. C	19
AWG28	UL1571 Compatible wire	FG	20

No.	Signal name	Cable Color	
2	SRD+	YW / BK1	AWG28
3	SRD−	PK / BK1	
4	N. C	—	—
22	ENB2+	BR	AWG28
7	DC24V+	GY	
9	EMG1−	RD	
5	EMG2+	BK	
6	EMG2−	YW	
24	ENB1+	PK	
26	DC24V−	PL	
1	SG	WH	
25	ENB2−	BL / WH1	
12	EMG1+	OR / WH1	
23	ENB1−	GN / WH1	
8	N. C	—	—
10	N. C	—	—
11	N. C	—	—
13	RTS	UL1571 Compatible wire	AWG28
14	CTS		
15	N. C	—	—
16	N. C	—	—
17	N. C	—	—
18	N. C	—	—
19	N. C	—	—
20	N. C	—	—
21	N. C	—	—

Plug : RP13A-12PH-20SC (71) (HIROSE ELECTRIC CO., LTD.) × 1
Contact : RP19-SC-222 (HIROSE ELECTRIC CO., LTD.) × 14

Plug : HDR-E26MSG1 + (Honda Tsushin Kogyo Col.,Ltd.)
Case : HDR-E26LPH (Honda Tsushin Kogyo Col.,Ltd.)

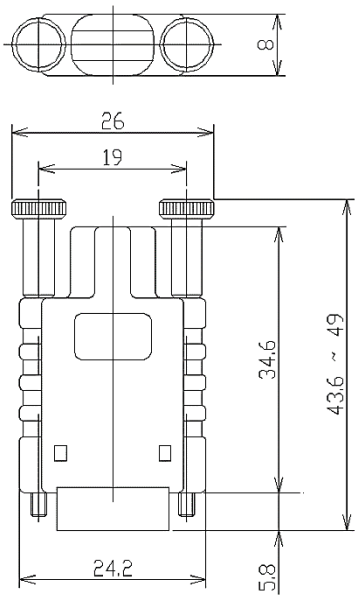
[3] Dummy plug

Connect a dummy plug to the teaching pendant connecting connector.
Make sure to connect a dummy plug if the AUTO mode is specified.
Without the connection, it will be the emergency stop condition.

Model : DP-4S

DP-4S

Plug : HDR-E26MAG1+



Signal	No.
GND	1
EMGS	2
VCC	3
DTR	4
EMGOUT2	5
EMGIN2	6
NC	7
RSVCC	8
EMGIN1	9
NC	10
NC	11
EMGOUT1	12
RTS	13
CTS (GND)	14
TXD	15
RXD	16
DSR	17
NC	18
NC	19
RSVTBX1	20
RSVTBX2	21
ENBVCC2	22
ENBTBX1	23
ENBVCC1	24
ENBTBX2	25
GND	26

Short-circuit processing

9.2 Specifications for Safety Function SS1-t

9.2.1 About SS1-t Function

SS1-t feature is a feature that turns OFF (shuts off) the motor energy supply on the electronic circuit inside the controller. In purpose of such as vertical axis, use SS1-t type which has long reaction time, and a workpiece can be prevented from dropping due to delay of retaining brake operation during the safety torque cutoff feature operation.
Shown below is about SS1-t features.

Type	Contents	Remarks
SS1-t	It cuts off the energy supply to the motor at the cutoff circuit inside the controller after the reaction time has passed (500ms or less) by controlling the motor in response to the condition of the input signal.	This control operation should not be included to the safety features.

The behavior of SS1-t follows the stop category “1” in IEC/EN 60204-1.

9.2.2 Applicable Standards

The SS1-t function should be applicable for the safety standards stated below.

- ISO/EN ISO 13849-1:2015 Category 3 PL e
- IEC 61508 SIL3
- IEC/EN61800-5-2
- IEC/EN62061 SIL CL3
- IEC/EN 61326-3-1

9.2.3 Caution

In order to prevent injury or damage to peripherals, read the following basic caution notes related to safety carefully.

- Installation, startup, repair and other related works of the equipment that this device is installed should only be permitted to a qualified operator (Note 1).
- The qualified operator (Note 1) should be familiar with the law of the country where the equipment that this device is installed is to be installed, especially with the standards described in this technical document.
- In order to perform startup of the equipment, programing, setup and maintenance in conformity with the safety standards, the staff who works on the equipment has to be permitted by the company which he/she belongs to.

Note 1: An operator who is capable for construction of equipment and maintenance

Warning

- Installing inappropriately the safety related device and systems could lead the operation condition not guaranteed in safety, which could end up with a serious accident or a fatal accident.

9.2.4 Residual Risk

In order to ensure the safety, it is necessary that you have the risk evaluations and determine the residual risks on the whole mechanical equipment. The equipment organizer should take all the responsibility for the risk evaluation and the related residual risks. Below shows the residual risks related to SS1-t function. IAI will not take any responsibility on damage or injury caused by the residual risks.

(Note) In order to satisfy PL e in EN ISO 13849-1 and SIL3 in IEC 61508, it is necessary to have the host device monitor the EDM signals. It should be categorized as PL c and SIL1 if EDM signals are not monitored by the host device.

(1) SS1-t function is the functions to disable the performance to supply energy to the servomotor electrically, but not to shut off the connection between the controller and the servomotor physically. Therefore, SS1-t function are not capable of removing the risk of electric shock.

(2) SS1-t function is the functions to disable the performance to supply energy to the servomotor electrically, but not to guarantee the process of stopping control or speed reducing control of the servomotor.

(3) SS1-t function would not guarantee that the motor should not be moved by an external force or other influences. Power supply to the servomotor should be cut off when this feature gets activated while the servomotor is in rotating operation, however, the servomotor may continue to rotation due to force of inertia. It is required to have a system designed to consider safety to avoid any danger before the servomotor completely stops.

(4) The servomotor should move due to gravity when it is used on a vertical axis. In such a case, it is recommended to select an option equipped with a brake. Also, note that the brake circuit, dynamic brake and retaining brake on the controller are not the safety related parts.

(5) Read carefully the instruction manuals for individual safety related devices so installation, wiring and adjustment can be performed appropriately.

(6) Make sure to use products that safety is confirmed or satisfy the safety standards for the components (devices) used in the safety circuit.

(7) Safety would not be guaranteed unless installation or adjustment of the safety related components in the system completes.

(8) When replacing the controller, make sure the new one is the same model as the one before replacing. Make sure to check the performance of the functions before starting the system after installation is complete.

(9) Make sure that risk assessment is conducted on devices or on the whole equipment.

(10) In order to avoid accumulation of failures, it is recommended to check that there is no loss of function in a certain period of time based on the risk assessment on the device or equipment.
- ■ Once or more in every three months in order to satisfy SIL3 PL e Cat. 3
- ■ Once or more in every one year in order to satisfy SIL2 PL d Cat. 3

(11) If the power module inside the controller causes a vertical short-circuit fault, the servomotor axis would turn for 0.5 times at the maximum. If it is a linear motor, it would move for distance of a magnetic pole pitch.

(12) The input and output signals of SS1-t function should be supplied from the power source of SELV (separated/safety extra-low voltage) isolated with reinforced isolation.

9.2.5 Specifications

[1] Safety Parameters

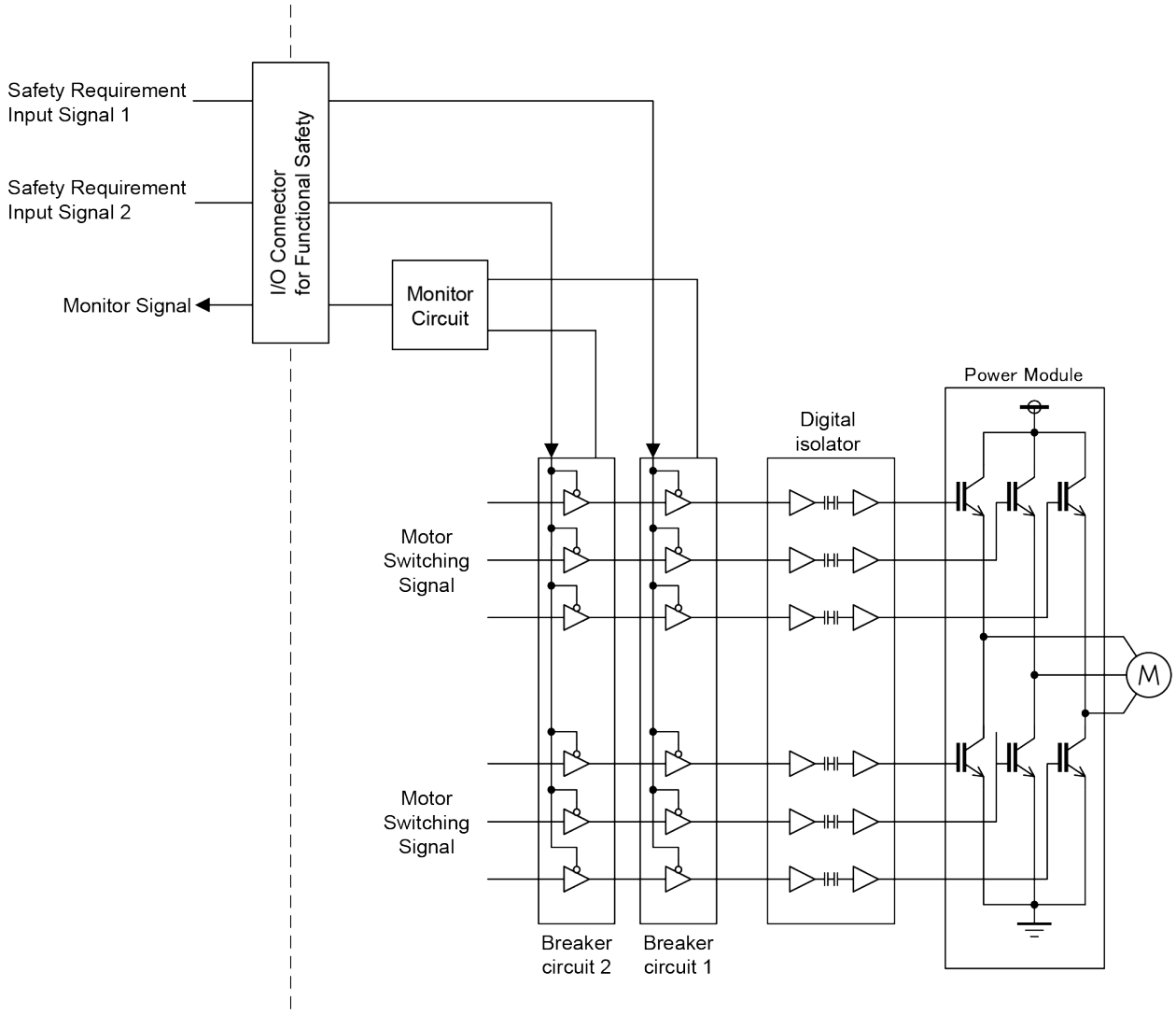
As our product will be a part of the constructions in an equipment, calculation of SIL/PL of the whole equipment should consider the values stated in this section.

Item	Standard	Performance Level
Safety Integrity Level	IEC 61508	SIL3
	IEC 62061	SIL CL3
Probability of dangerous failure per hour	IEC 61508 IEC 62061	PFH = 2.4×10^{-9} [1/h]
Performance Level	EN ISO 13849-1	PL e (Category 3)
Mean time to dangerous failure of each channel	EN ISO 13849-1	MTTFd: High (≥100 years) (788a)
Average diagnostic coverage	EN ISO 13849-1	DCavg: Medium (97.7%)
Stop category	IEC 60204-1	Stop category 1
Safety function	IEC/EN 61800-5-2	SS1-t
Mission time	IEC 61508	20 years
Hardware Fault Tolerance	IEC 61508	1
Category	EN ISO 13849-1	3

(Note) In order to satisfy PL e in EN ISO 13849-1 and SIL3 in IEC 61508, it is necessary to have the host device monitor EDM signals.

The values in the safety parameters should be applicable only when SCON2 is used individually. When it is to be used with a functional safety unit connected, refer to [Functional Safety Unit Instruction Manual (ME0459)].

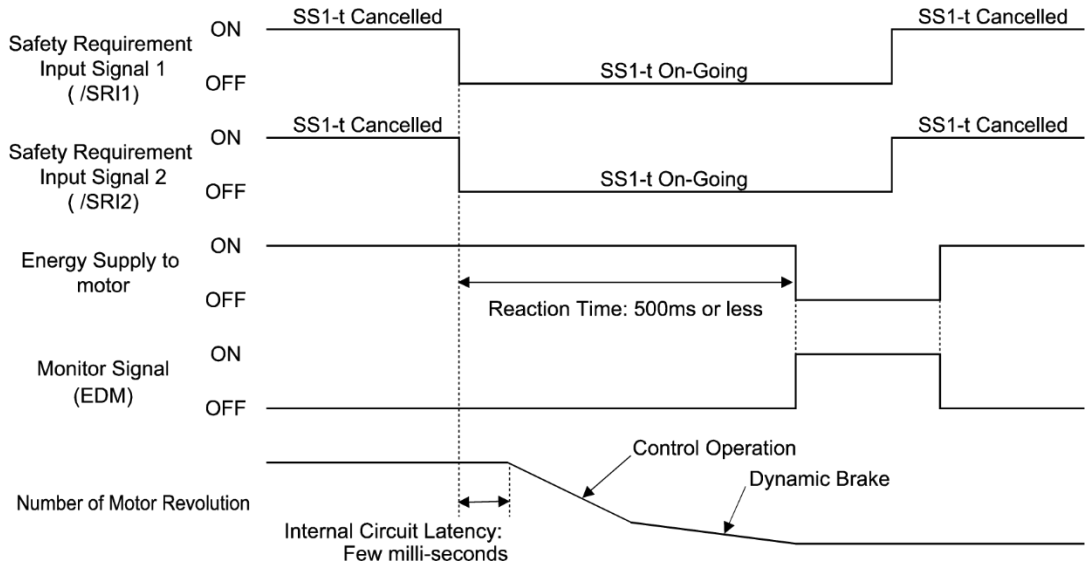
[2] Functional Block Diagram



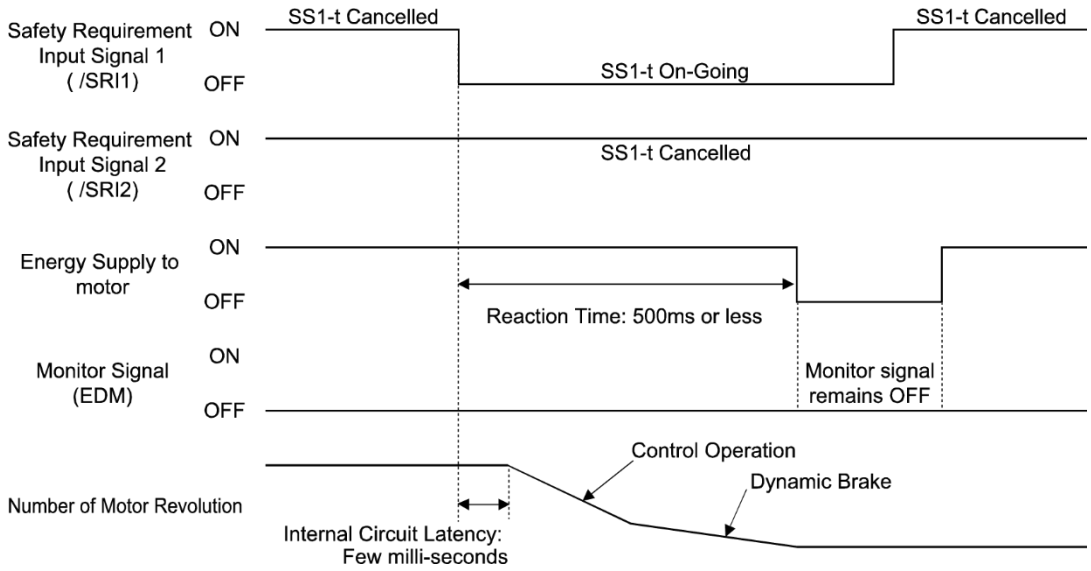
9.2.6 Operating Sequence

[1] SS1-t Type Operating Sequence

[Normal Operation]



[Operation in Fault]

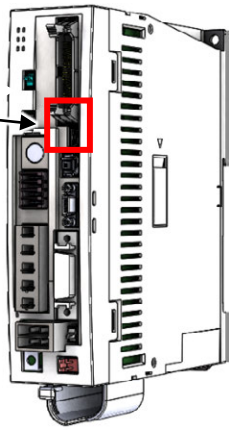


* As SS1-t type activates the retaining brake during the reaction time, it is capable to prevent workpiece from dropping.

9.2.7 I/O Connector for Safety Function

[1] Name for Each Parts and Their Functions

I/O Connector for Safety Function



It is a connector that realizes SS1-t function.
By joining in external safety related devices to this connector, energy supply to the servomotor can be shut off safely.

* This connector is dedicated for SS1-t type.

Model	Supplier	Remarks
2294417-1	Tyco Electronics	Controller side

Signals for Safety Function I/O Connector

Pin No.	Signal Name	Name	Description
1	NC	—	Do not wire.
2	NC	—	Do not wire.
3	/SRI1-	Safety Requirement Input Signal 1	Safety requirement input signal should be input. ON (Conducted): Cancel operation requirement for safety function OFF (Released): Require operation for safety function
4	/SRI1+		
5	/SRI2-	Safety Requirement Input Signal 2	Safety requirement input signal should be input. ON (Conducted): Cancel operation requirement for safety function OFF (Released): Require operation for safety function
6	/SRI2+		
7	EDM-	External Device Monitor Output Signal	It is an output signal showing there is no fault in operation of safety function.
8	EDM+		

[2] Electric Specifications

Item	Type	Remarks
Safety Requirement Input Signal (SRI)		
ON-Input Voltage Range	24V±10%	
OFF-Input Voltage Range	0-2V	
Input Current	7.6mA (Typ)	It is a value for 1ch.
Reaction Time	500ms or less	SS1-t Type
External Device Monitor Output Signal (EDM)		
Voltage Range	24V±10%	
Output Current	100mA (Max.)	

[3] Test Pulse for Safety Input Signal

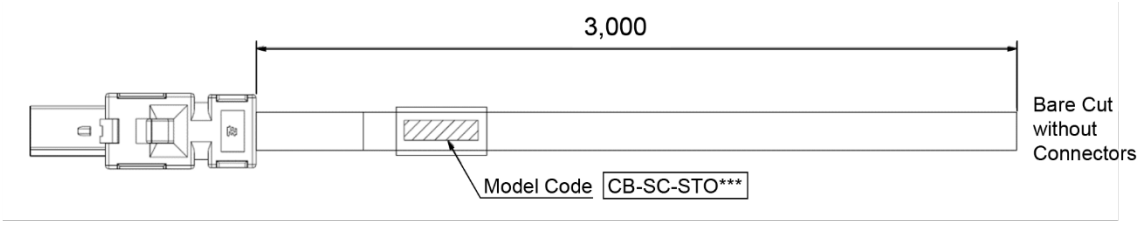
Set the test pulse off time input from external device at 1ms or less.

[4] I/O Cable for Safety Function (Sold Separately)

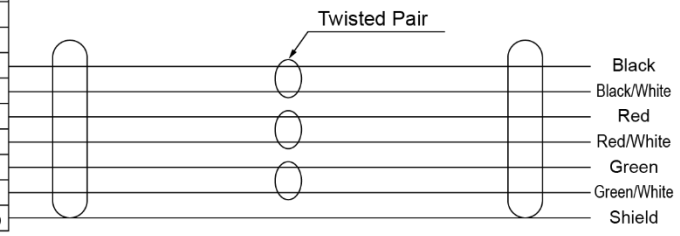
Cable for Connection between Safety Feature I/O Connector and Safety Device

Cable length: 3.0m

CB-SC-STO030



Wiring	Color	Signal	No.
AWG26	—	—	1
	—	—	2
	Black	/SRI1-	3
	Black/White	/SRI1+	4
	Red	/SRI2-	5
	Red/White	/SRI2+	6
	Green	EDM-	7
	Green/White	EDM+	8
Shield is connected to the cable clamp			



* Color of Lines: eg.) Black/White indicates black insulator with white line on.

[5] I/O Connector for Safety Function Dummy Plug (Enclosed)

It is a short plug in order to inactivate the feature by plugging into the safety feature I/O connector when SS1-t feature is not to be in use.

Model: DP-6

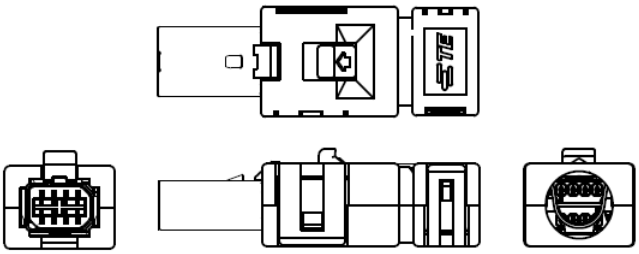
DP-6

[6] I/O Connector for Safety Function (Cable Side) (To be Prepared by User)

When a system is to be built without using the safety feature I/O cable described in [4], there are following models prepared as a connector itself on the cable side.

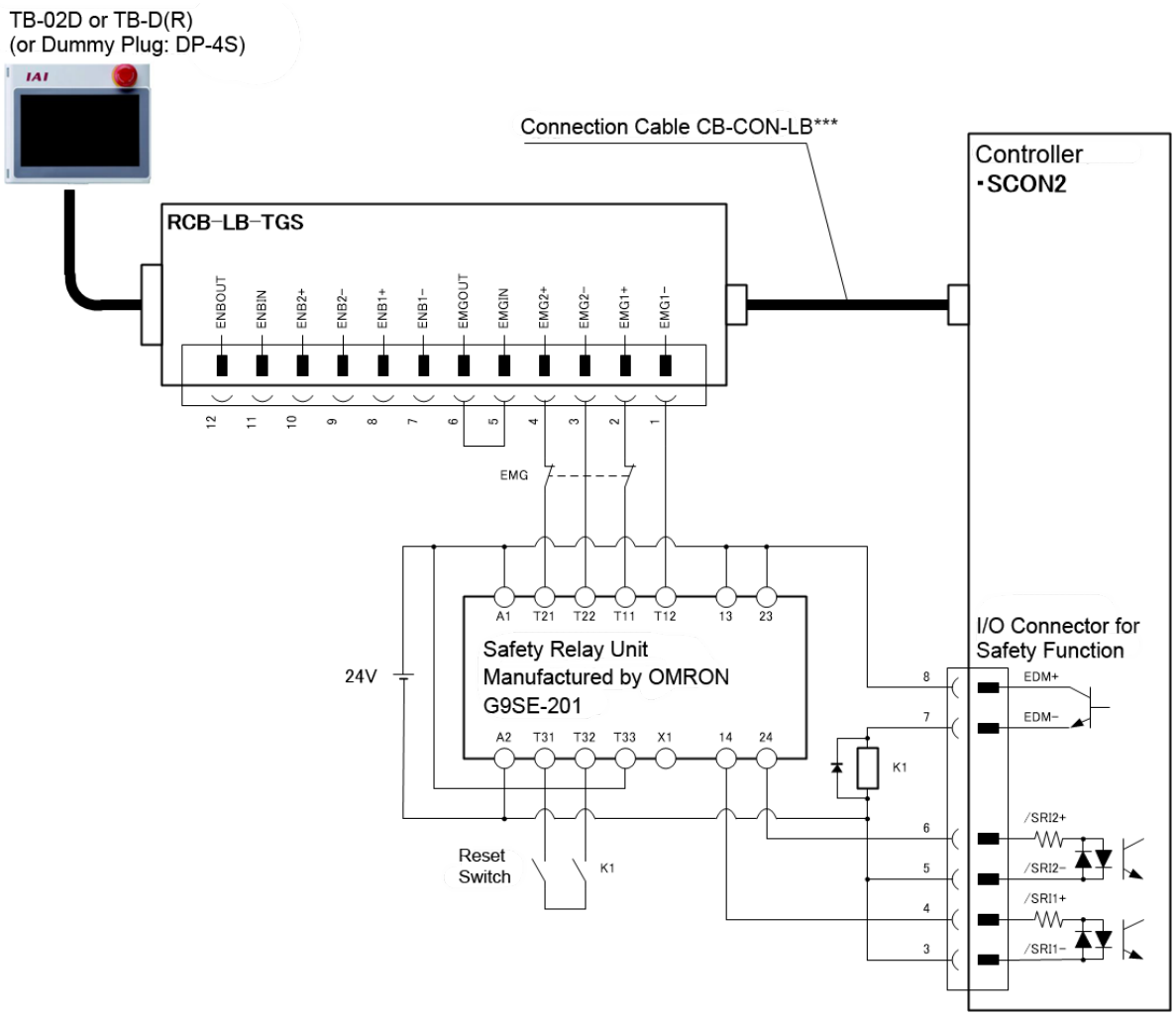
Supplier: Tyco Electronics

Model: 2013595-1 (soldering type) * There is also press welding type available.
It is necessary to use a swagging tool 2229737-1 (for both soldering and press welding types).



Swagging Tool
2229737-1

9.2.8 Example for Connection



(Note) In order to satisfy PL e in EN ISO 13849-1 and SIL3 in IEC 61508, it is necessary to have the host device monitor EDM signals. It should be categorized as PL c and SIL1 if EDM signals are not monitored by the host device.

9.2.9 Maintenance and Preservation

When the controller is replaced in the startup, maintenance or inspection of the equipment, make sure to check the following operations after wiring is finished. In case of use in wrong way may cause injury or damage on devices.

- If /SRI1 and /SRI2 Signals are OFF, confirm that EDM Signal turns ON after the setting period of time has passed.
  ⇒ In case that ON/OFF of the signals do not match, or the signals do not work, there may be a concern of cut off or short circuit of the external wirings or malfunction of the safety devices or controller. Find the cause and take a counteraction.

- If /SRI1 and /SRI2 Signals turn ON, confirm that the motor operates fine with the commands from the host system.

SCON2-CG

Chapter 10

Appendix

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10.1 Way to Set Multiple Controllers with 1 Teaching Tool

It is usually necessary to connect the teaching tool to the controllers one by one when making a setup to multiple controllers with one unit of teaching tool. In this section, explains how to perform the settings without connecting and disconnecting the plug.

- Requisite devices
  (1) SIO Converter (RCB-TU-SIO-A or RCB-TU-SIO-B) : 1 unit
  (2) Controller Link Cable (CB-RCB-CTL002) : Required by the number of controllers

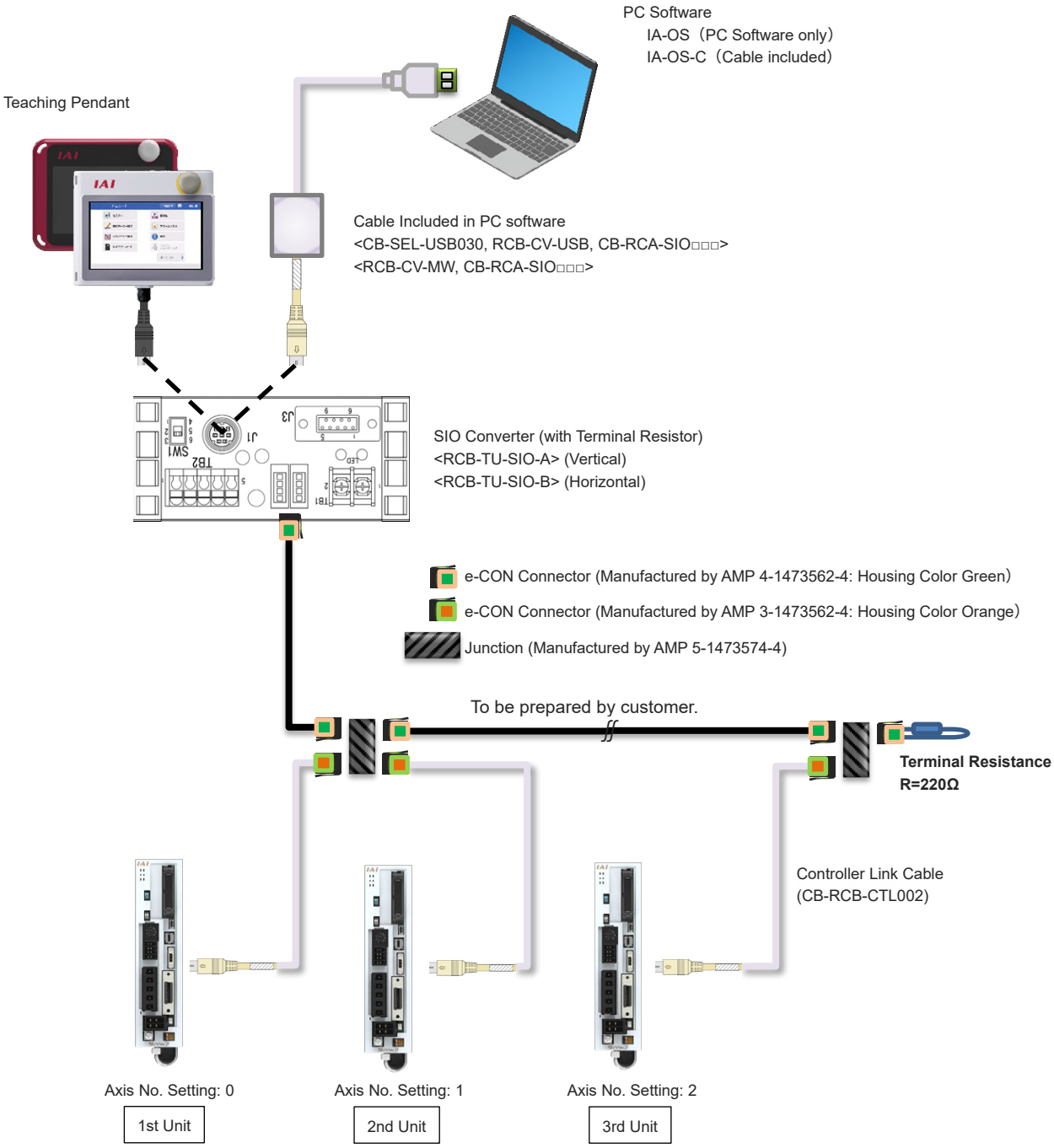
  Accessories
  1) 4-way junction (Manufactured by AMP 5-1473574-4) : 1 unit
  2) e-CON Connector (Manufactured by AMP 4-1473562-4) : 1 unit
  3) Terminal Resistance (220Ω, with a e-CON connector) : 1 unit

Instead of the e-CON cable attached to the controller link cable, a terminal block may be used. In this configuration, disconnect the e-CON connector from the controller link cable.

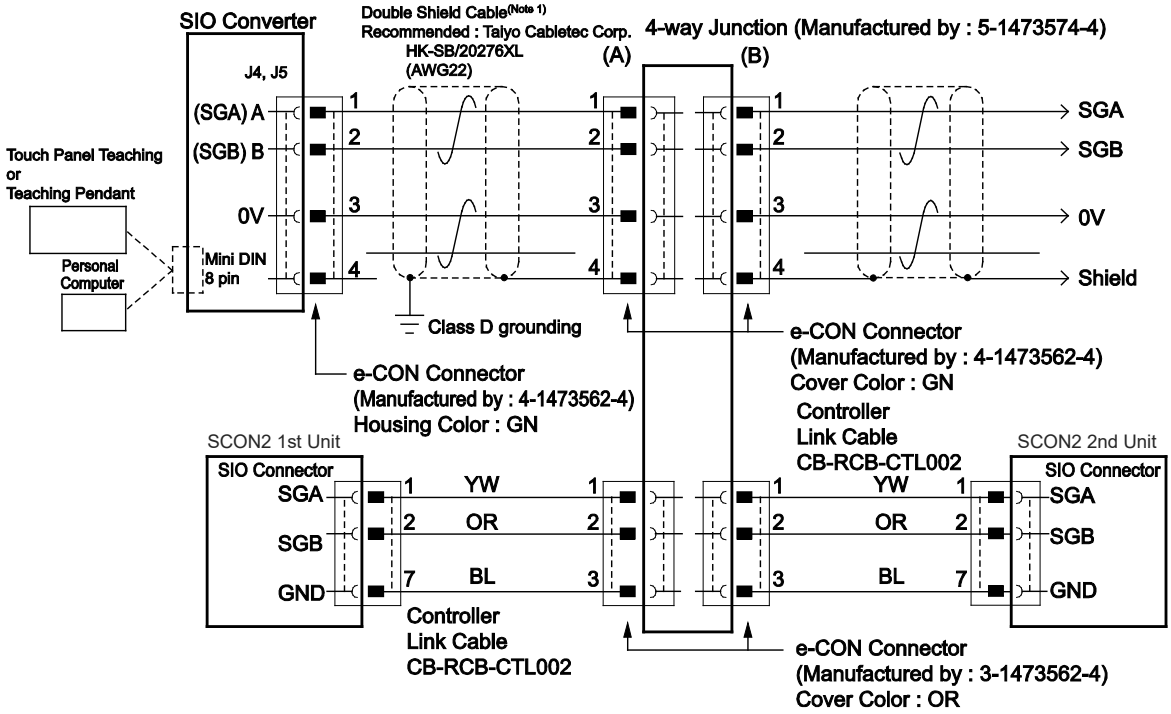
10.1.1 Connecting Example

Caution

- Supply 0V to the SIO converter and each controller from the same power source.



10.1.2 Detailed Connection Diagram of Communication Lines



Note 1 Apply a 2-pair shielded cable.

When connecting a cable other than recommended to (A) and (B), make sure to use a hard-cored cable equivalent to the vinyl cable (KIV) dedicated for control devices with the sheath outer diameter from 1.35 to 1.60mm. Using cables with outer diameter out of the specification may cause poor contact to occur.

Caution

- When cables with outer diameter out of the specification are used, use a terminal block nstead of 4-direction junction. In this configuration, disconnect the e-CON connector of he link cable. If an error possibly caused by poor contact occurs frequently, replace the junction with the terminal block.

10.1.3 Axis No. Setting

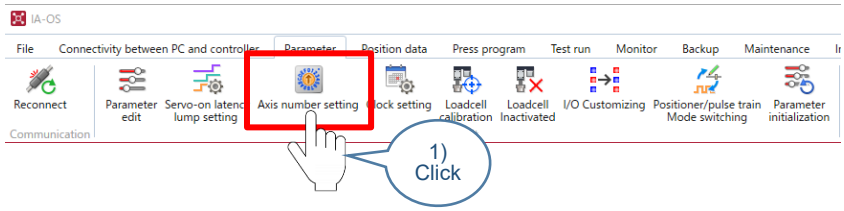
Setup should be conducted in the PC teaching software or teaching pendant.
Possible axis numbers range from 0 to 15 by 16 axes.
After the setting, turn off the power of SCON2 and then on it again.

Caution

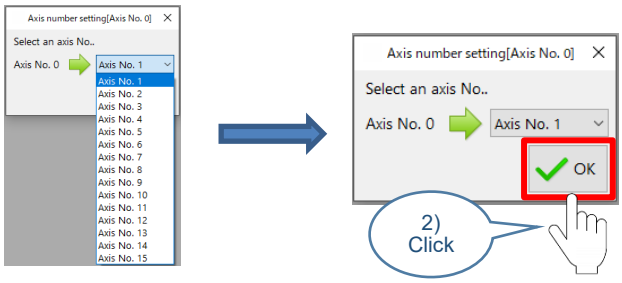
- The axis number must be unique.

[For IA-OS]

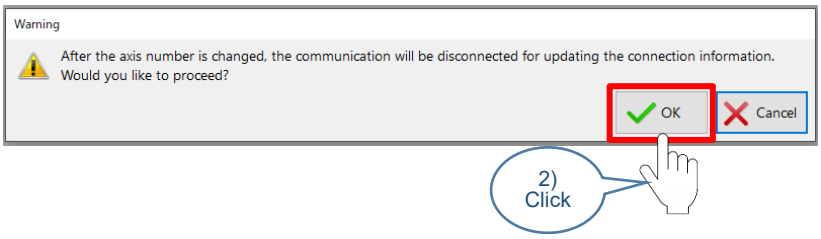
1. Click in menu [Parameter] in IA-OS.



2. Select an axis number to change from the pulldown menu and click OK .



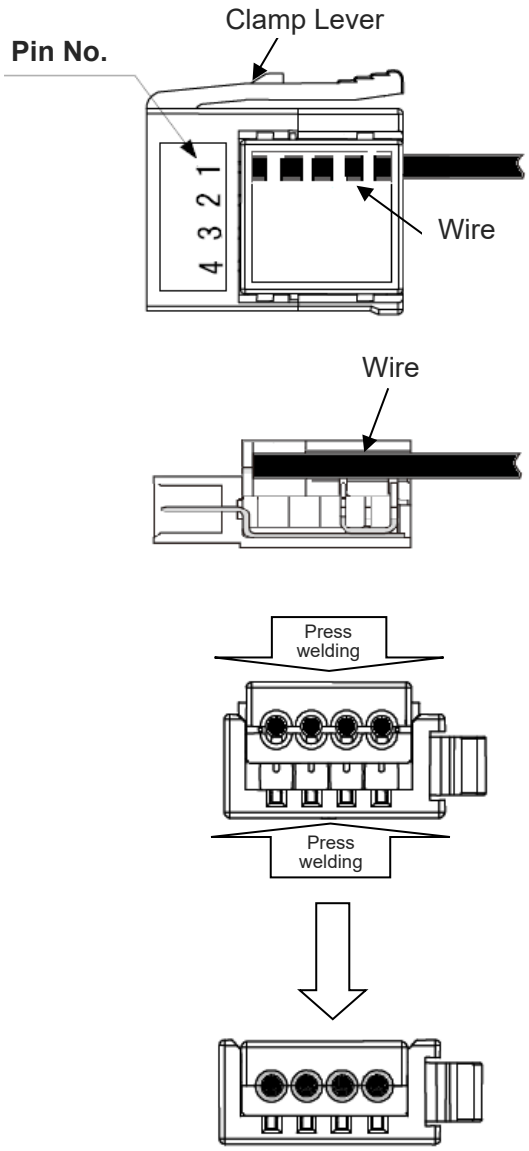
3. A “Warning” window should appear. Click OK .



[For teaching pendant (TB-02/TB-03)]

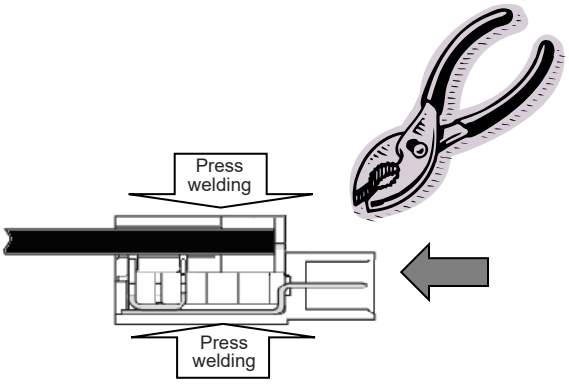
Refer to [an instruction manual of a teaching pendant].

10.1.4 Handling of e-CON Connector (How to Connect)



1) Check the applicable cable size.
Check the applicable cable. If it is not applicable, it may cause a connection failure or a breakage of the connector.

2) Check the pin numbers, do not reveal the sheath, and insert the cable till it reaches the end.
Revealing the sheath may cause a failure such as short circuit or cable fall out.



3) Use a (generally purposed) parallel plier with the width of 10mm or more to press-weld the cable from top and bottom.
Use the parallel plier from the direction of ⇦, grip it while checking the condition of press-welding to make sure the press is in right angle and press it until it becomes completely flat to the housing.
If the inserting is not enough, it may not be able to attach to the socket or may cause a contact failure.

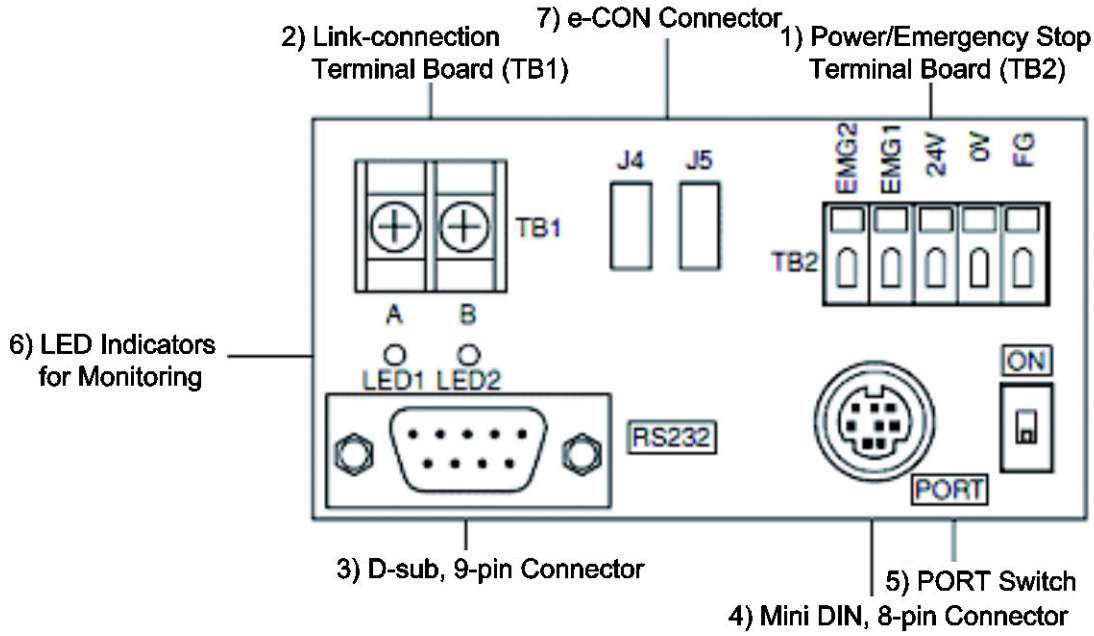
4) After finishing the press-welding, pull the cable lightly to confirm that won't come out.

Caution

- e-CON connector cannot be reused once the press-welding is failed. Use a new connector to retry the press-welding.
- When connecting to the socket, hold the connector with care not to touch the clamp lever, insert the connector in parallel to the socket until the clamp lever makes a "click" sound.
- After joining to the socket, do not pull the cables or pull the connector without releasing the lock of the clamp lever.

10.1.5 SIO Converter

The SIO converter converts the communication mode from RS-232C to RS-485 or vice versa.



1) Power/Emergency Stop Terminal Board (TB2)

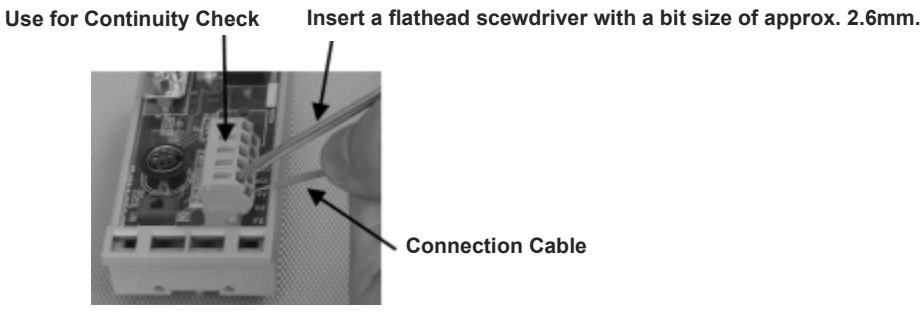
Symbol	Description
EMG1, EMG2	Turn the PORT switch ON to output the emergency stop switch signal, OFF to short-circuit EMG1 and EMG2. When applying the emergency stop switch of the teaching pendant to the emergency stop of the system, obtain the signal from here.
24V	Positive side of the 24V DC power supply (Power supply for the teaching pendant and conversion circuit.)
0V	Negative side of the 24V DC power supply
FG	Frame ground

Note 0V is connected to the pin No. 7 (GND) on the communication connector for the controller.

• Connection method

Use a connection cable satisfying the following specifications :

Item	Specification
Applicable wire	Solid Wire : Φ0.8 to 1.2mm/Stranded : AWG Size 20 to 18 (0.5 to 0.75mm^2)
Stripped wire length	10mm



2) Link-connection Terminal Board (TB1)
   This is the connection port to obtain communication connection with the controller.
   Connect terminal “A” on the left side to communication line SGA of the controller. (Terminal A is connected to pin 1 of 7) internally.)
   Connect terminal “B” on the right side to communication line SGB of the controller. (Terminal B is connected to pin 2 of 7) internally.)
   Use a twisted pair shielded cable for the connection of SGA and SGB to TB1.

3) D-sub, 9-pin connector
   A connection port with the PC. (RS-232C)
   It is used when the operation is conducted with using SIO communication.

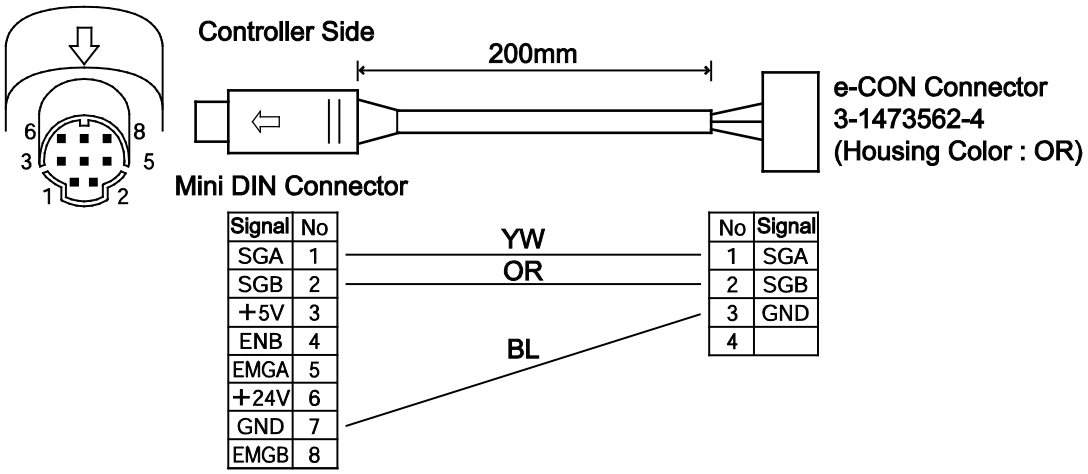
4) Mini DIN, 8-pin connector
   This connector is connected to PC software, teaching pendant.

5) PORT Switch
   The PORT switch is used to exchange enable/disable of connector 4).
   Set the switch to ON if connector 4) is used or OFF if not used.
   The switchover of valid/invalid on the teaching pendant is held at the same time as the emergency stop button switch signal output (between EMG1 and 2).

6) LED Indicators for Monitoring
   LED1 : Lights/blinks while the controller sends signals.
   LED2 : Lights/blinks while signals are sent from the RS-232C connector.

7) e-CON Connector
   It is used when connecting to the controller with e-CON connector without using 2).

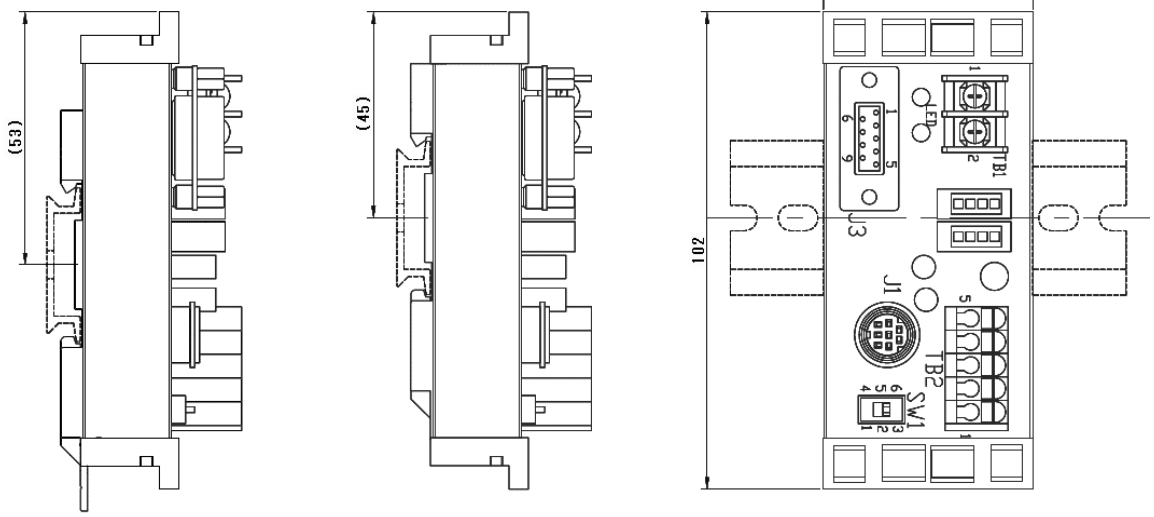
10.1.6 Communications Cable



Signal	No
SGA	1
SGB	2
+5V	3
ENB	4
EMGA	5
+24V	6
GND	7
EMGB	8

No	Signal
1	SGA
2	SGB
3	GND
4	

10.1.7 External Dimension



(Leg Element Bottom Side) (Leg Element Top Side)

10.2 Example of Basic Positioning Sequence (PIO Pattern 0 to 3)

This section shows an example in which a simple operation box directs SCON2 to move the actuator successively to three positions on an axis.

10.2.1 I/O Assignment

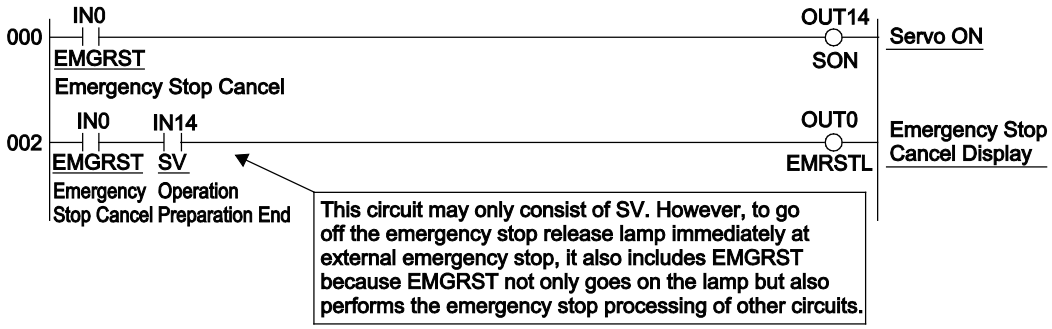
* in codes above shows the signal of the active low. Input signal is processed with it is turned OFF and output signal is usually ON when the power is supplied and is OFF when signal output.

10.2.2 Ladder Sequence

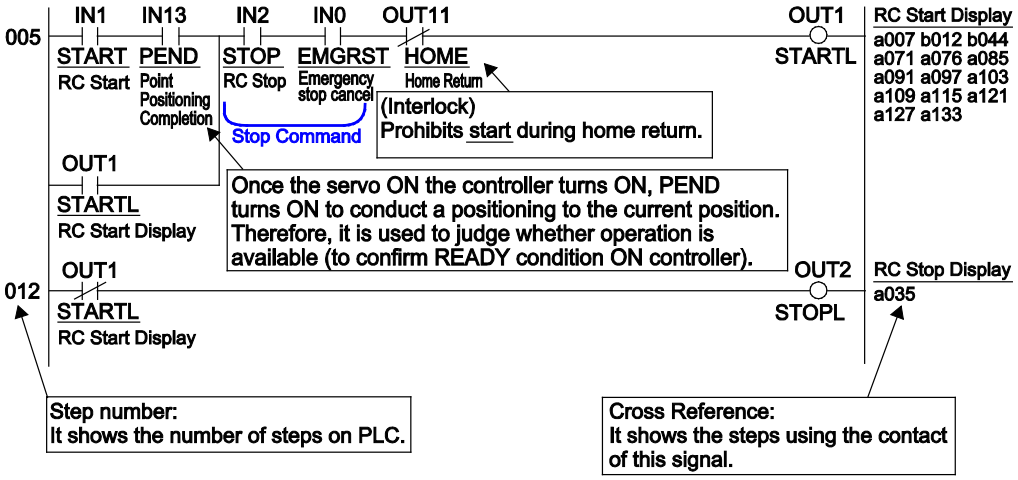
[1] Servo ON (Emergency Stop) Circuit

1) It is presumed that the emergency stop release circuit installed in the operation box possesses the self-retaining circuit as shown in [3.1.3 [3] Actuator emergency stop circuit]. When it comes to the emergency stop release condition, “Servo-on” signal from PLC to SCON2 turns ON.

2) Then if the emergency stop release state continues, the operation ready complete signal (sent from SCON2 to PLC) is turned on to go on the “Emergency stop release” lamp, which indicates that the actuator can be operated.

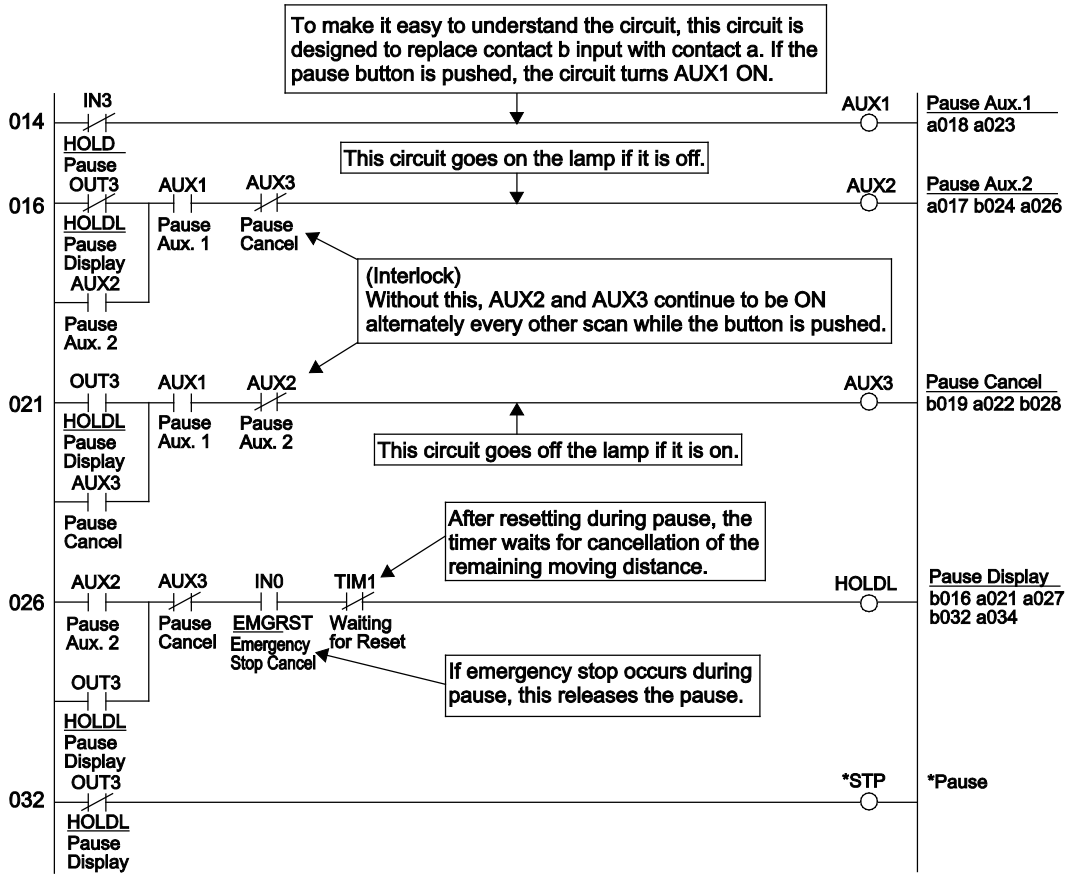


[2] Operation and Stop Circuit



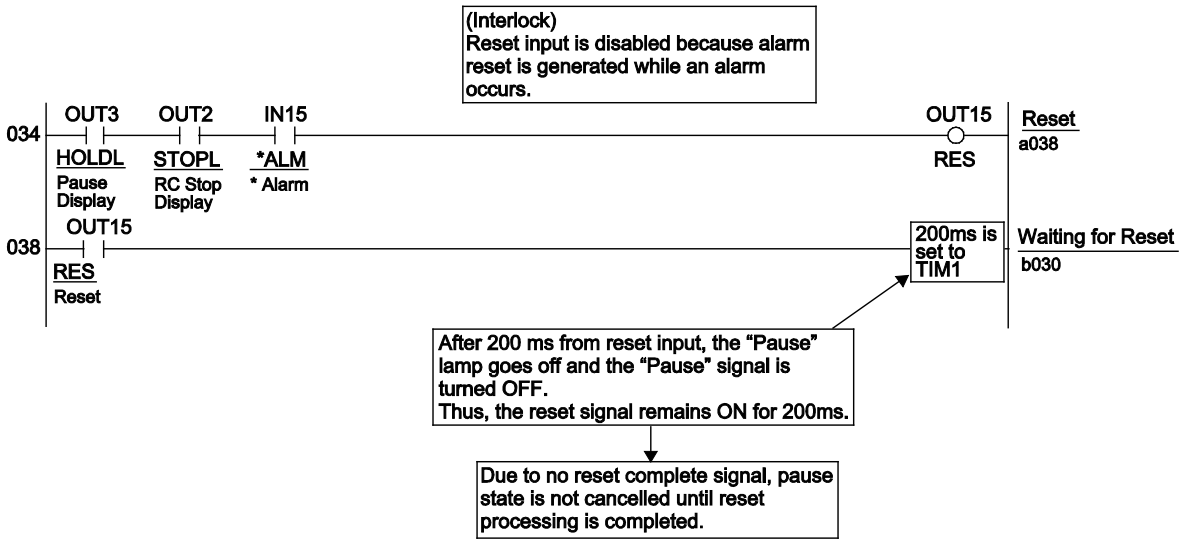
[3] Pause Circuit

Pause is provided by a single pushbutton. In a similar way as use of an alternate switch, push the button to make the actuator pause and push it again to release the pause of the actuator. Pushing the pushbutton leads the “pause command and pause lamp ON” state and pushing the pushbutton again brings “pause release command and pause lamp OFF”.

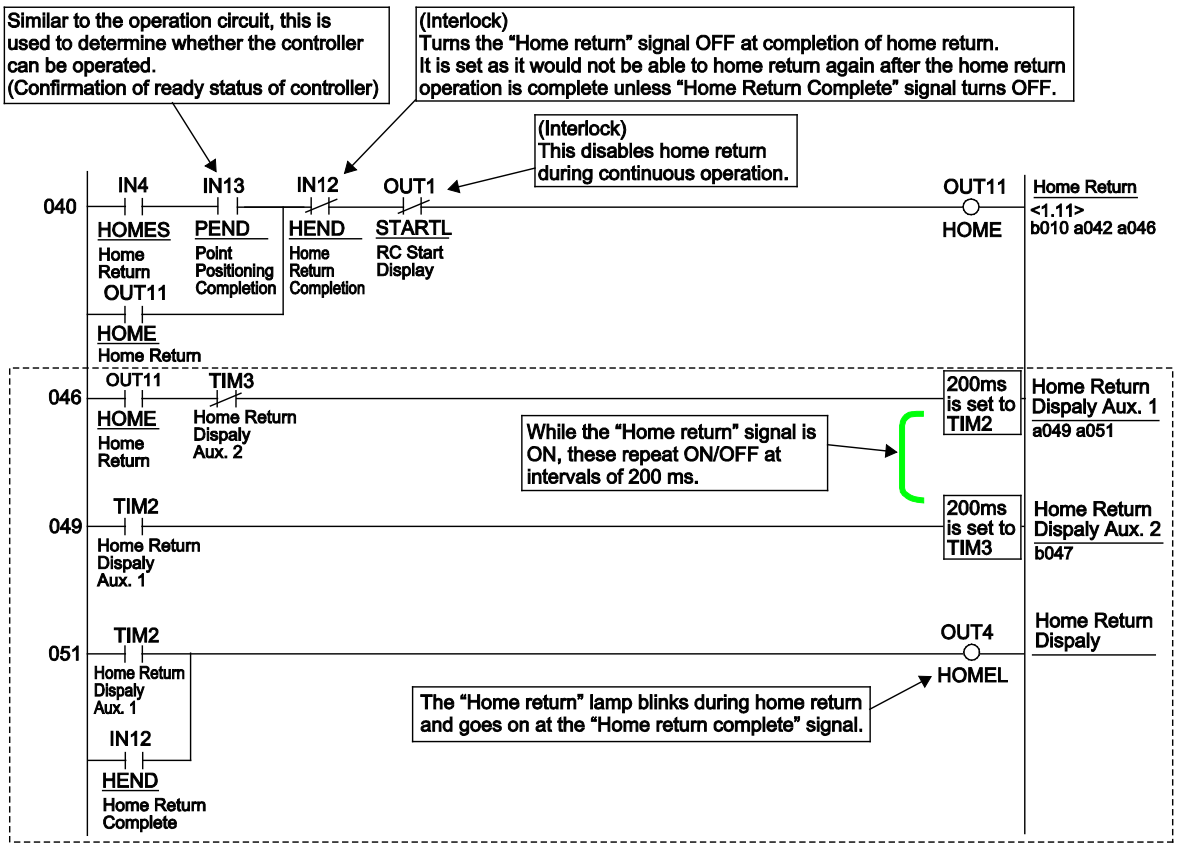


[4] Reset Circuit

If the Stop button on the operation box is pushed during pause, the Reset signal sent from PLC to SCON2 is turned ON and the remaining moving distance is cancelled. In addition, this operation releases the pause. (It is because the pause is not required with no remaining moving distance.)

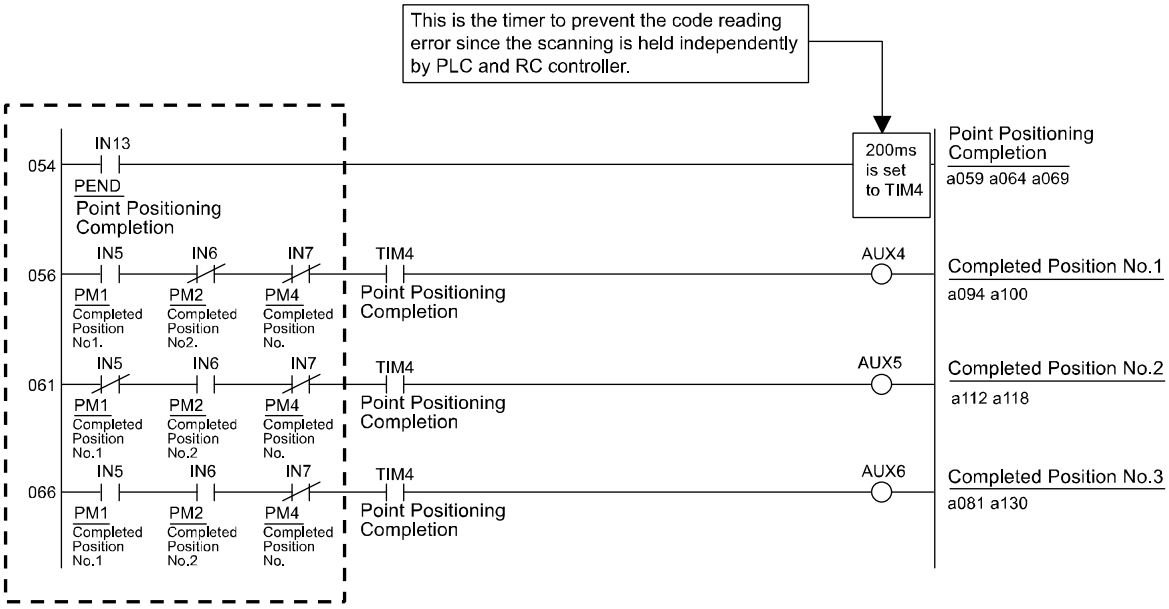


[5] Home Return Circuit



[6] Decode Circuit of Positioning Complete Position No.

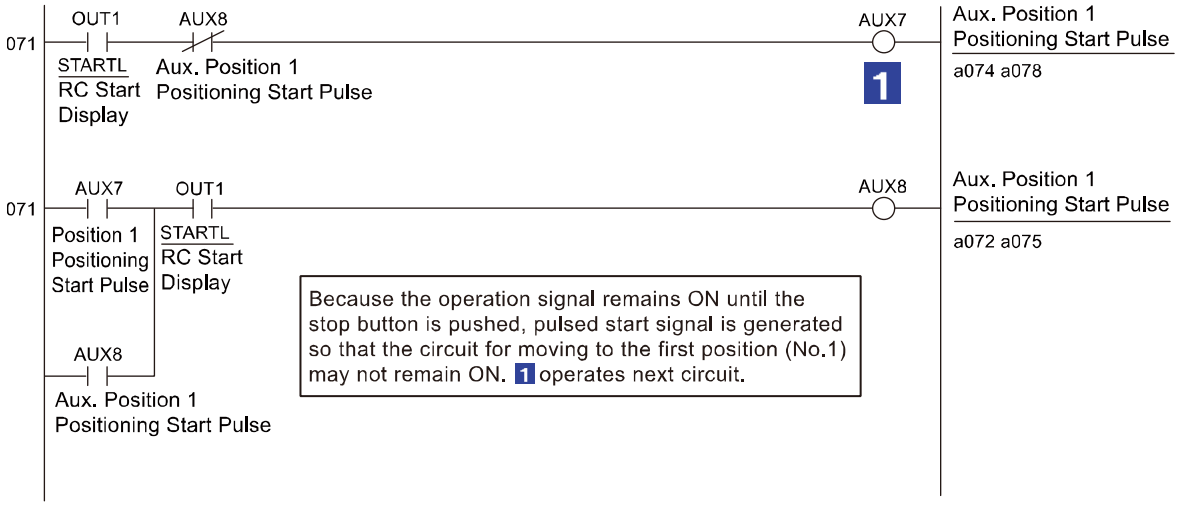
The decode circuit converts the binary data of positioning complete position No. sent from SCON2 to PLC into the corresponding bit data.



[7] Actuator Start Circuit

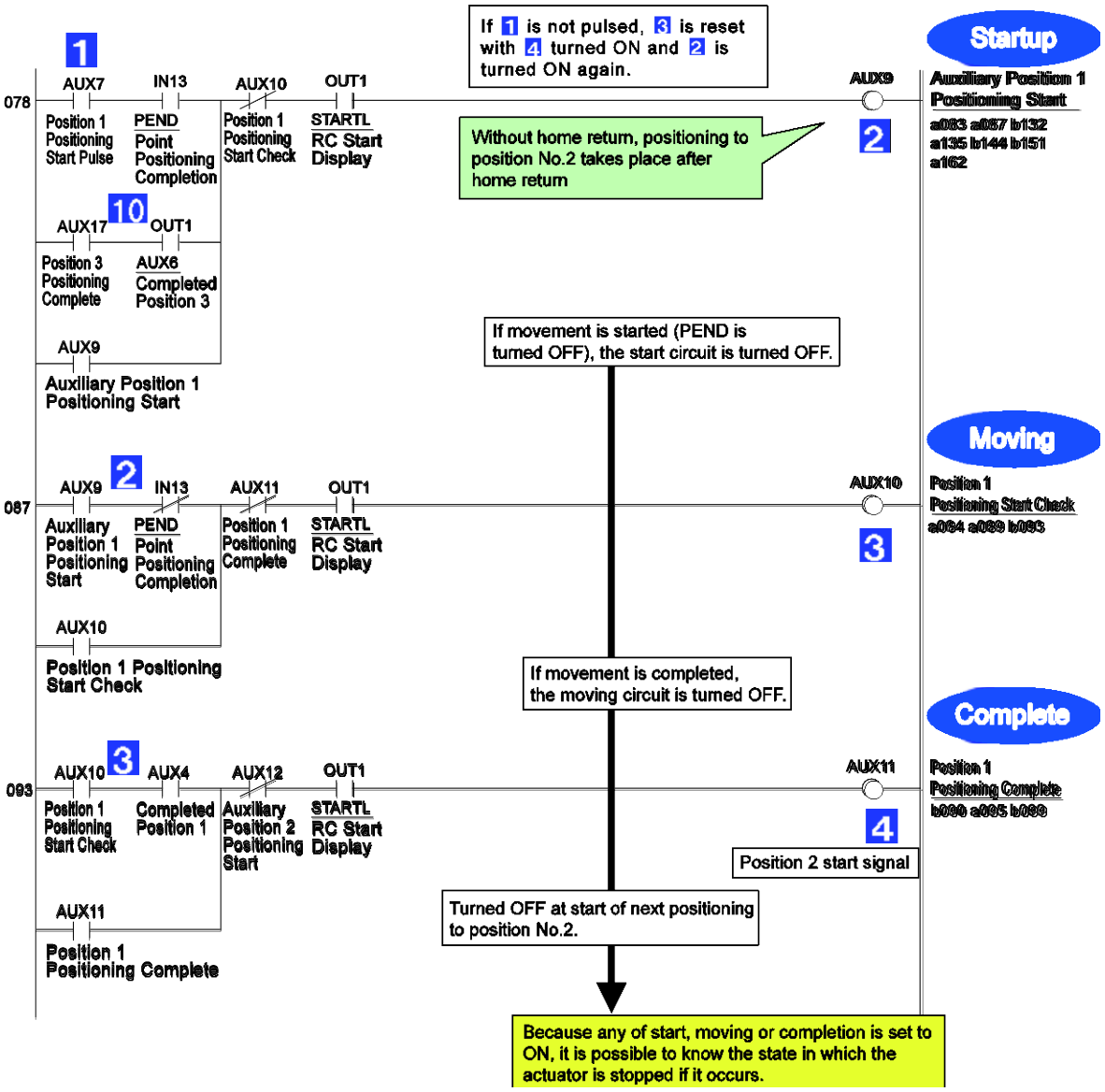
If the “Operation” switch on the operation box is pushed, the lamp of the “Operation” pushbutton switch described in [2] Operation and Stop Circuit goes on and, at the same time, the actuator starts successive positioning of position No. 1→2→3→1→2•••.

The circuit below is intended for the activation.



[8] Position 1 Operation Circuit

The main circuit is designed to process and manage signals “start” → “moving” → “positioning complete” to move the actuator to position No.1.

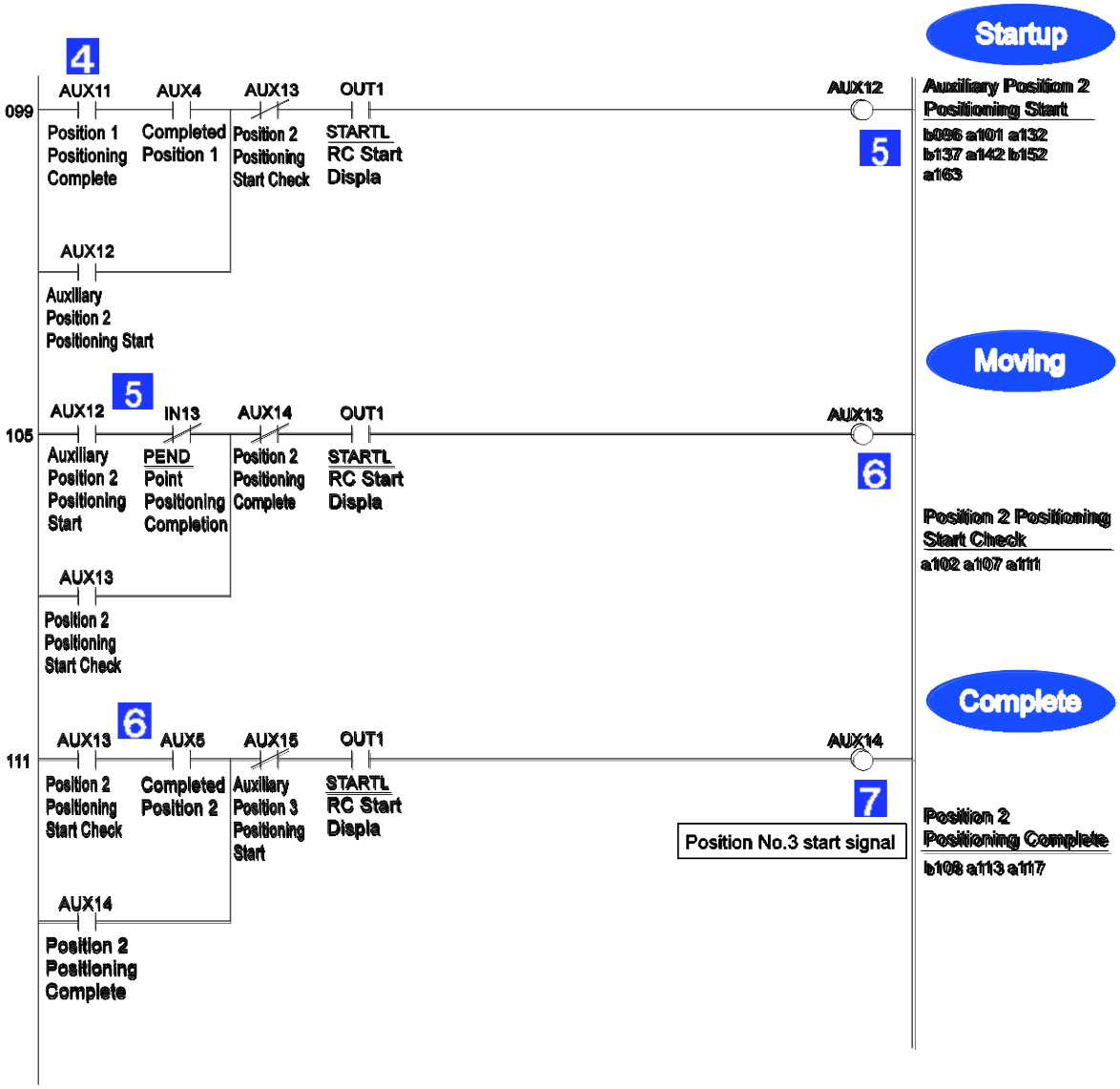


Complement

- Circuit 10 is designed to start positioning to position No.1 again after positioning to position No.3 is completed.
- If the “Operation” lamp goes off, the operation circuit is reset entirely. When the Stop button is pushed, the actuator will stop at completion of the operation being executed.
  At emergency stop, the actuator is stopped immediately (which is the function of Controller).

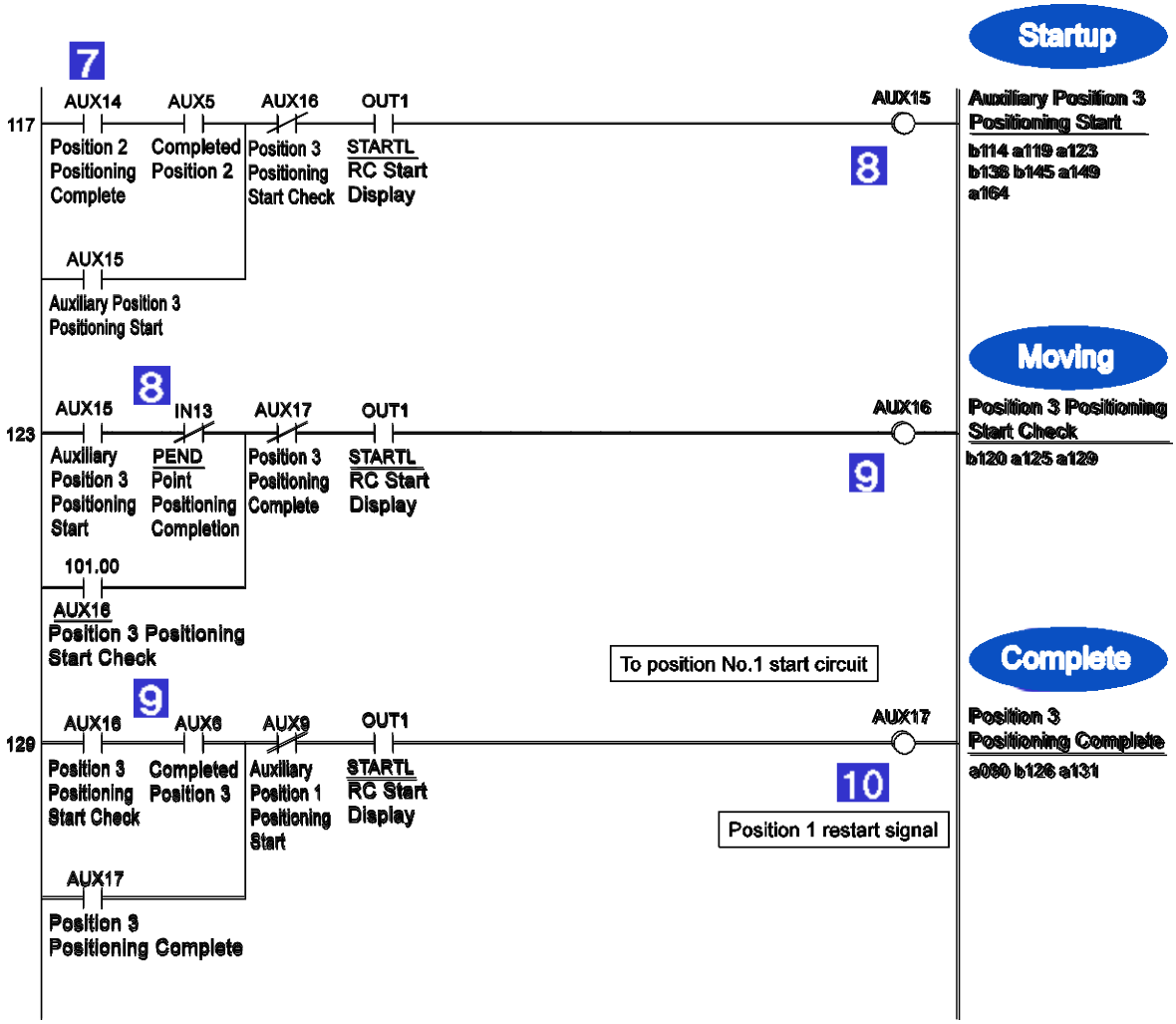
[9] Position 2 Operation Circuit

The main circuit is designed to process and manage signals “start” → “moving” → “positioning complete” to move the actuator to position No.2. This circuit indicates the same sequence as that of position No.1.



[10] Position 3 Operation Circuit

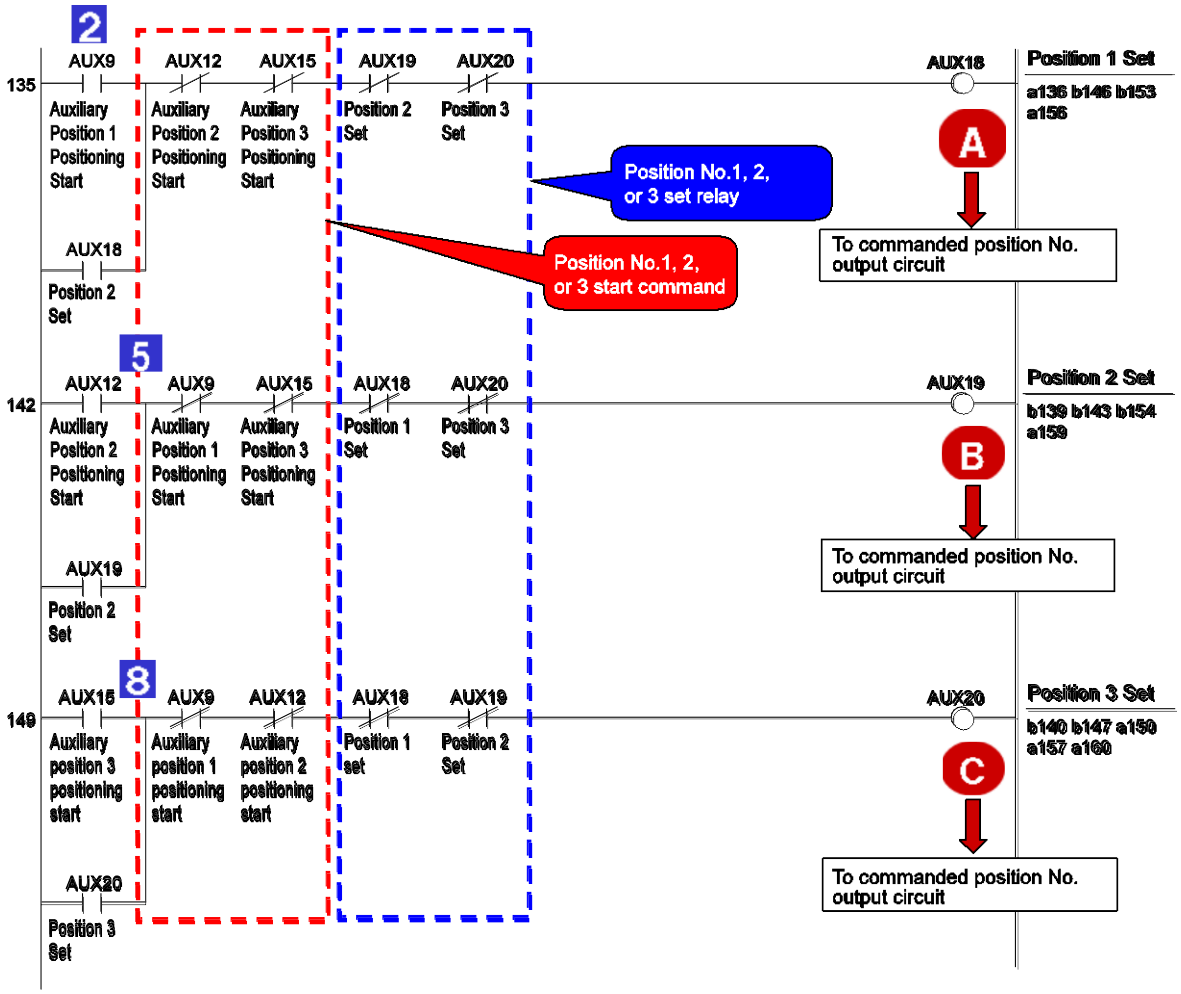
The main circuit is designed to process and manage signals “start” → “moving” → “positioning complete” to move the actuator to position No.3. This circuit indicates the same sequence as that of position No.1.



[11] Commanded Position No. Output Ready Circuit

The ready circuit is designed to hold start command and output commanded position No. in the binary code.

Interlock is taken so that position No. command may not be specified incorrectly.

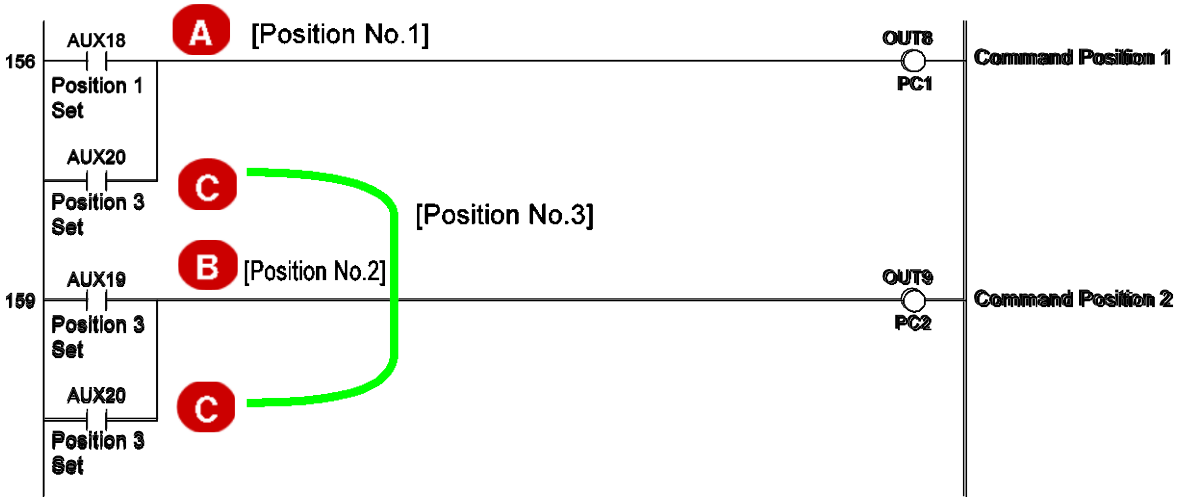


Point !

- Once a moving command to a position is issued, any of circuits A, B and C is turned ON to remember it unless a moving command to another position is issued. The operation circuit is cancelled by a stop command such as an emergency stop command. However, the circuit remembers the positions to which the actuator moved and the positions at which the actuator stopped until the cancellation. Such sequence design is also intended to cope with errors occurred and helpful to find the causes of the errors from circuit status, stop position inconsistency and other conditions.
- Taking interlock in both commands and results is usual means in circuit design to prevent results from being ON simultaneously. For example, if both SOLs in a solenoid valve of double SOL type are turned ON simultaneously, the coils are burned instantly. In another case, PLC executes a program in descending order but operations are not always done in the order. If you create a sequence program taking operation order into account, circuit change and/or addition due to debugging and specification change may cause the operation order to be modified without intention. Take interlock securely.

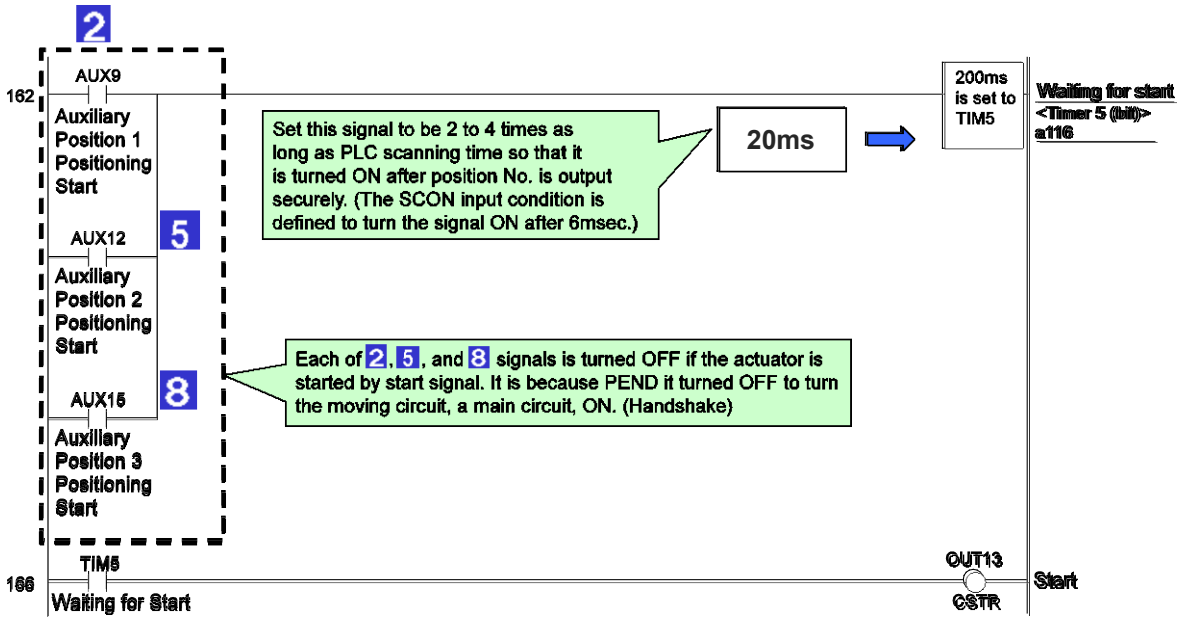
[12] Commanded Position No. Output Circuit

Depending on the result of the ready circuit, this circuit converts position No. to the binary code and outputs the data from PLC to SCON2.

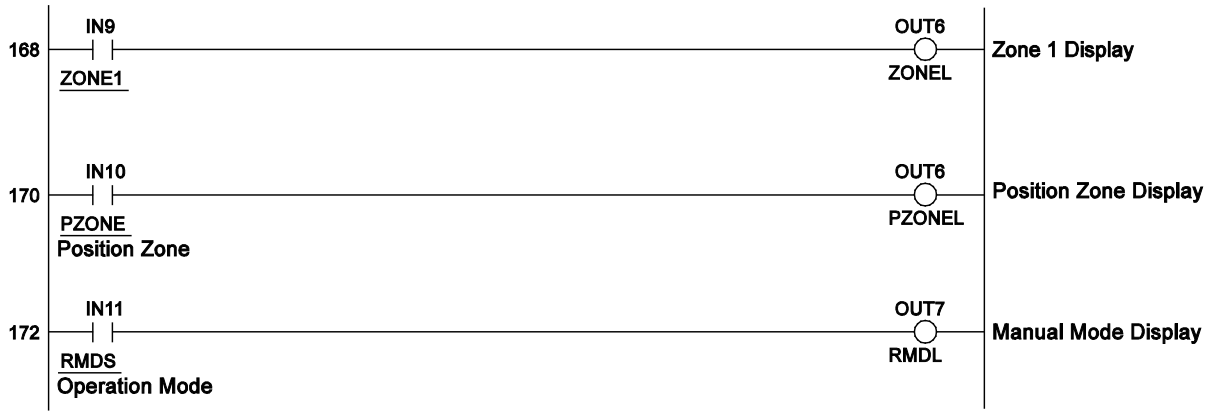


[13] Start Signal Output Circuit

After 20ms from the output of position No., this circuit outputs the start signal from PLC to SCON2.



[14] Other Display Circuits (Zone 1, Position Zone, and Manual Mode)



Reference

- Programs and functions of PLC are expressed differently depending on manufacturers. However, the contents of sequence designs do not vary fundamentally.
  Though arithmetic and data processing commands seem differently, any manufacturer defines command words executing the same functions as those of other manufacturers.

10.3 List of Specifications of Connectable Actuators

Specifications described in the specification list are limited to the information required to set operation conditions and parameters. For other detailed specifications, refer to brochures and Instruction Manuals of actuators.

Caution

- When operation is conducted in the pulse train control, it is required to pay attention not to have the commands from the host controller for the movement amount, velocity and acceleration/deceleration exceed the actuator specifications (for stroke, maximum velocity, maximum acceleration/deceleration). Also, make sure to set the pressing operation velocity to the rated pressing velocity when the pressing operation is to be conducted. Use in higher than the specifications could cause an error or malfunction.

10.3.1 List of Specifications for Actuator Operation Conditions

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Slider Type)	SA4C SA4R	60	16384	16	Horizontal/ Vertical	960(at 50 to 450st) 875(at 500st)	SA4C:1.2 SA4R:1	-	-	-
				10		600(at 50 to 450st) 555(at 500st)	SA4C:1.2 SA4R:1			
				5		300(at 50 to 450st) 275(at 500st)	1			
				2.5		150(at 50 to 450st) 135(at 500st)	0.7			
	SA6C SA6R	100	16384	30	Horizontal/ Vertical	1600(at 50 to 550st) 1450(at 600st) 1260(at 650st) 1100(at 700st) 970(at 750st) 860(at 800st)	SA6C:1.2 SA6R:1	-	-	-
				20		1200(at 50 to 500st) 1130(at 550st) 970(at 600st) 840(at 650st) 735(at 700st) 650(at 750st) 575(at 800st)	SA6C:1.2 SA6R:1	-	-	-
				12		720(at 50 to 500st) 620(at 550st) 535(at 600st) 460(at 650st) 405(at 700st) 355(at 750st) 315(at 800st)	SA6C:1.2 SA6R:1	-	-	-
				6		360(at 50 to 500st) 305(at 550st) 265(at 600st) 230(at 650st) 200(at 700st) 175(at 750st) 155(at 800st)	1	-	-	-
				3		180(at 50 to 500st) 150(at 550st) 130(at 600st) 115(at 650st) 100(at 700st) 85(at 750st) 75(at 800st)	0.7	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Slider Type)	SA7C SA7R	200	16384	36	Horizontal/ Vertical	1800(at 50 to 600st) 1620(at 650st) 1420(at 700st) 1260(at 750st) 1120(at 800st)	SA7C:1.2 SA7R:1	-	-	-
				24		1500(at 50 to 500st) 1440(at 550st) 1240(at 600st) 1095(at 650st) 965(at 700st) 850(at 750st) 760(at 800st)	SA7C:1.2 SA7R:1	-	-	-
				16		1000(at 50 to 500st) 965(at 550st) 830(at 600st) 720(at 650st) 635(at 700st) 560(at 750st) 500(at 800st)	SA7C:1.2 SA7R:1	-	-	-
				8		500(at 50 to 500st) 475(at 550st) 410(at 600st) 355(at 650st) 315(at 700st) 275(at 750st) 245(at 800st)	1	-	-	-
				4		240(at 50 to 500st) 235(at 550st) 205(at 600st) 175(at 650st) 155(at 700st) 135(at 750st) 120(at 800st)	0.7	-	-	-
	SA8C	400	16384	48	Horizontal	2200(at 50 to 700st) 2180(at 750st) 1950(at 800st) 1760(at 850st) 1590(at 900st) 1450(at 950st) 1320(at 1000st) 1210(at 1050st) 1110(at 1100st)	1.2	-	-	-
				30	Horizontal/ Vertical	1800(at 50 to 600st) 1640(at 650st) 1440(at 700st) 1280(at 750st) 1155(at 800st) 1040(at 850st) 940(at 900st) 855(at 950st) 780(at 1000st) 715(at 1050st) 660(at 1100st)	1.2	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Slider Type)	SA8C	400	16384	20	Horizontal/ Vertical	1200(at 50 to 600st) 1090(at 650st) 960(at 700st) 860(at 750st) 770(at 800st) 695(at 850st) 630(at 900st) 570(at 950st) 520(at 1000st) 480(at 1050st) 440(at 1100st)	1.2	-	-	-
				10		600(at 50 to 600st) 540(at 650st) 480(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 285(at 950st) 260(at 1000st) 235(at 1050st) 220(at 1100st)	1	-	-	-
				5		300(at 50 to 600st) 270(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 175(at 850st) 155(at 900st) 140(at 950st) 130(at 1000st) 120(at 1050st) 110(at 1100st)	0.7	-	-	-
	SA8R	400	16384	48	Horizontal	2100(at 50 to 750st) 1950(at 800st) 1760(at 850st) 1590(at 900st) 1450(at 950st) 1320(at 1000st) 1210(at 1050st) 1110(at 1100st)	1	-	-	-
				30	Horizontal/ Vertical	1800(at 50 to 600st) 1640(at 650st) 1440(at 700st) 1280(at 750st) 1155(at 800st) 1040(at 850st) 940(at 900st) 855(at 950st) 780(at 1000st) 715(at 1050st) 660(at 1100st)	1	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Slider Type)	SA8R	400	16384	20	Horizontal/ Vertical	1200(at 50 to 600st) 1090(at 650st) 960(at 700st) 860(at 750st) 770(at 800st) 695(at 850st) 630(at 900st) 570(at 950st) 520(at 1000st) 480(at 1050st) 440(at 1100st)	1	-	-	-
				10		600(at 50 to 600st) 540(at 650st) 480(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 285(at 950st) 260(at 1000st) 235(at 1050st) 220(at 1100st)	1	-	-	-
				5		300(at 50 to 600st) 270(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 175(at 850st) 155(at 900st) 140(at 950st) 130(at 1000st) 120(at 1050st) 110(at 1100st)	1	-	-	-
[Cleanroom Type] RCS4CR (Slider Type)	SA4C	60	16384	16	Horizontal/ Vertical	960(at 50 to 450st) 875(at 500st)	1.2	-	-	-
				10		600(at 50 to 450st) 555(at 500st)	1.2			
				5		300(at 50 to 450st) 275(at 500st)	1			
				2.5		150(at 50 to 450st) 135(at 500st)	0.7			
	SA6C	100	16384	20	Horizontal/ Vertical	1200(at 50 to 500st) 1130(at 550st) 970(at 600st) 840(at 650st) 735(at 700st) 650(at 750st) 575(at 800st)	1.2	-	-	-
				12		720(at 50~500st) 620(at 550st) 535(at 600st) 460(at 650st) 405(at 700st) 355(at 750st) 315(at 800st)	1.2	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] RCS4CR (Slider Type)	SA6C	100	16384	6	Horizontal/ Vertical	360(at 50 to 500st) 305(at 550st) 265(at 600st) 230(at 650st) 200(at 700st) 175(at 750st) 155(at 800st)	1	-	-	-
				3		180(at 50 to 500st) 150(at 550st) 130(at 600st) 115(at 650st) 100(at 700st) 85(at 750st) 75(at 800st)	0.7	-	-	-
	SA7C	200	16384	24	Horizontal/ Vertical	1500(at 50 to 500st) 1440(at 550st) 1240(at 600st) 1095(at 650st) 965(at 700st) 850(at 750st) 760(at 800st)	1.2	-	-	-
				16		1000(at 50 to 500st) 965(at 550st) 830(at 600st) 720(at 650st) 635(at 700st) 560(at 750st) 500(at 800st)	1.2	-	-	-
				8		500(at 50 to 500st) 475(at 550st) 410(at 600st) 355(at 650st) 315(at 700st) 275(at 750st) 245(at 800st)	1	-	-	-
				4		240(at 50 to 500st) 235(at 550st) 205(at 600st) 175(at 650st) 155(at 700st) 135(at 750st) 120(at 800st)	0.7	-	-	-
	SA8C	400	16384	20	Horizontal/ Vertical	1200(at 50 to 600st) 1090(at 650st) 960(at 700st) 860(at 750st) 770(at 800st) 695(at 850st) 630(at 900st) 570(at 950st) 520(at 1000st) 480(at 1050st) 440(at 1100st)	1.2	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] RCS4CR (Slider Type)	SA8C	400	16384	10	Horizontal/ Vertical	600(at 50 to 600st) 540(at 650st) 480(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 285(at 950st) 260(at 1000st) 235(at 1050st) 220(at 1100st)	1	-	-	-
				5		300(at 50 to 600st) 270(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 175(at 850st) 155(at 900st) 140(at 950st) 130(at 1000st) 120(at 1050st) 110(at 1100st)	0.7	-	-	-
RCS4 (High Stiffness Slider Type)	HSA6C	100	16384	24	Horizontal/ Vertical	1500(at 50 to 500st) 1440(at 550st) 1240(at 600st) 1095(at 650st) 965(at 700st) 850(at 750st) 760(at 800st)	1.2	-	-	-
				16		1000(at 50 to 500st) 965(at 550st) 830(at 600st) 750(at 650st) 635(at 700st) 560(at 750st) 500(at 800s)	1.2	-	-	-
				8		500(at 50 to 500st) 475(at 550st) 410(at 600st) 355(at 650st) 315(at 700st) 275(at 750st) 245(at 800st)	1	-	-	-
				4		240(at 50 to 500st) 135(at 550st) 205(at 600st) 175(at 650st) 155(at 700st) 135(at 750st) 120(at 800st)	0.7	-	-	-
	HSA7C	200	16384	30	Horizontal/ Vertical	1800(at 50 to 600st) 1640(at 650st) 1440(at 700st) 1280(at 750st) 1155(at 800st) 1040(at 850st) 940(at 900st) 855(at 950st) 780(at 1000st)	1.2	-	-	-
				20		1200(at 50 to 600st) 1090(at 650st) 960(at 700st) 860(at 750st) 770(at 800st) 695(at 850st) 630(at 900st) 570(at 950st) 520(at 1000st)	1.2	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (High Stiffness Slider Type)	HSA7C	200	16384	10	Horizontal/ Vertical	600(at 50 to 600st) 540(at 650st) 480(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 285(at 950st) 260(at 1000st	1	-	-	-
				5		300(at 50 to 600st) 270(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 175(at 850st) 155(at 900st) 140(at 950st) 130(at 1000st)	0.7	-	-	-
RCS4 (Wide Slider Type)	WSA10C WSA10R	60	16384	16	Horizontal	960(at 50 to 350st) 930(at 400st) 775(at 450st) 660(at 500st)	WSA10C:1.2 WSA10R:1	-	-	-
				10	Horizontal/ Vertical	600(at 50 to 350st) 590(at 400st) 490(at 450st) 415(at 500st)	WSA10C:1.2 WSA10R:1	-	-	-
				5		300(at 50 to 350st) 290(at 400st) 245(at 450st) 205(at 500st)	1	-	-	-
				2.5		150(at 50 to 350st) 145(at 400st) 120(at 450st) 100(at 500st)	0.7	-	-	-
	WSA12C WSA12R	100	16384	30	Horizontal	1600(at 50 to 500st) 1450(at 550st) 1260(at 600st) 1100(at 650st) 970(at 700st) 860(at 750st) 770(at 800st)	WSA12C:1.2 WSA12R:1	-	-	-
				20	Horizontal/ Vertical	1200(at 50 to 450st) 1130(at 500st) 970(at 550st) 840(at 600st) 740(at 650st) 650(at 700st) 580(at 750st) 520(at 800st)	WSA12C:1.2 WSA12R:1	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Wide Slider Type)	WSA12C WSA12R	100	16384	12	Horizontal/ Vertical	720(at 50 to 450st) 610(at 500st) 535(at 550st) 465(at 600st) 405(at 650st) 355(at 700st) 315(at 750st) 285(at 800st)	WSA12C:1.2 WSA12R:1	-	-	-
				6		360(at 50 to 450st) 310(at 500st) 265(at 550st) 230(at 600st) 200(at 650st) 175(at 700st) 155(at 750st) 140(at 800st)	1	-	-	-
				3		180(at 50 to 450st) 150(at 500st) 130(at 550st) 115(at 600st) 100(at 650st) 85(at 700st) 75(at 750st) 70(at 800st)	0.7	-	-	-
	WSA14C WSA14R	200	16384	36	Horizontal	WSA14C: 1710(at 50 to 550st) 1590(at 600st) 1400(at 650st) 1240(at 700st) 1110(at 750st) 990(at 800st)	WSA14C:1.2 WSA14R:1	-	-	-
						WSA14R: 1710(at 50 to 550st) 1590(at 600st) 1400(at 650st) 1240(at 700st) 1110(at 750st) 990(at 800st)		-	-	-
				24	Horizontal/ Vertical	1440(at 50 to 450st) 1420(at 500st) 1220(at 550st) 1060(at 600st) 930(at 650st) 830(at 700st) 740(at 750st) 665(at 800st)	WSA14C:1.2 WSA14R:1	-	-	-
				16	Horizontal/ Vertical	480(at 50 to 450st) 460(at 500st) 400(at 550st) 350(at 600st) 305(at 650st) 270(at 700st) 240(at 750st) 215(at 800st)	WSA14C:1.2 WSA14R:1	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Wide Slider Type)	WSA14C WSA14R	200	16384	8	Horizontal	1440(at 50 to 450st) 1420(at 500st) 1220(at 550st) 1060(at 600st) 930(at 650st) 830(at 700st) 740(at 750st) 665(at 800st)	1	-	-	-
				4	Horizontal/ Vertical	240(at 50 to 450st) 230(at 500st) 200(at 550st) 170(at 600st) 150(at 650st) 135(at 700st) 120(at 750st) 105(at 800st)	0.7	-	-	-
	WSA16C WSA16R	400	16384	30	Horizontal/ Vertical	1800(at 50 to 550st) 1680(at 600st) 1480(at 650st) 1320(at 700st) 1180(at 750st) 1060(at 800st) 960(at 850st) 870(at 900st) 790(at 950st) 730(at 1000st) 670(at 1050st) 620(at 1100st)	WSA16C:1.2 WSA16R:1	-	-	-
				20		1200(at 50 to 550st) 1120(at 600st) 990(at 650st) 880(at 700st) 780(at 750st) 715(at 800st) 645(at 850st) 590(at 900st) 535(at 950st) 490(at 1000st) 450(at 1050st) 415(at 1100st)	WSA16C:1.2 WSA16R:1	-	-	-
				10		600(at 50 to 550st) 560(at 600st) 490(at 650st) 440(at 700st) 395(at 750st) 355(at 800st) 320(at 850st) 290(at 900st) 265(at 950st) 240(at 1000st) 225(at 1050st) 205(at 1100st)	1	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Wide Slider Type)	WSA16C WSA16R	400	16384	5	Horizontal/ Vertical	300(at 50 to 550st) 280(at 600st) 240(at 650st) 220(at 700st) 195(at 750st) 175(at 800st) 160(at 850st) 145(at 900st) 130(at 950st) 120(at 1000st) 110(at 1050st) 100(at 1100st)	0.7	-	-	-
RCS4 (Wide Slider Type)	WSA10C	60	16384	16	Horizontal	960(at 50 to 350st) 930(at 400st) 775(at 450st) 660(at 500st)	1.2	-	-	-
				10	Horizontal/ Vertical	600(at 50 to 350st) 590(at 400st) 490(at 450st) 415(at 500st)	1.2	-	-	-
				5		300(at 50 to 350st) 290(at 400st) 245(at 450st) 205(at 500st)	1	-	-	-
				2.5		150(at 50 to 350st) 145(at 400st) 120(at 450st) 100(at 500st)	0.7	-	-	-
	WSA12C	100	16384	20	Horizontal/ Vertical	1200(at 50 to 450st) 1130(at 500st) 970(at 550st) 840(at 600st) 740(at 650st) 650(at 700st) 580(at 750st) 520(at 800st)	1.2	-	-	-
				12		720(at 50 to 450st) 610(at 500st) 535(at 550st) 465(at 600st) 405(at 650st) 355(at 700st) 315(at 750st) 285(at 800st)	1.2	-	-	-
				6		360(at 50 to 450st) 310(at 500st) 265(at 550st) 230(at 600st) 200(at 650st) 175(at 700st) 155(at 750st) 140(at 800st)	1	-	-	-
				3		180(at 50 to 450st) 150(at 500st) 130(at 550st) 115(at 600st) 100(at 650st) 85(at 700st) 75(at 750st) 70(at 800st)	0.7	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] RCS4CR (Wide Slider Type)	WSA14C	200	16384	24	Horizontal/ Vertical	1440(at 50 to 450st) 1420(at 500st) 1220(at 550st) 1060(at 600st) 930(at 650st) 830(at 700st) 740(at 750st) 665(at 800st)	1.2	-	-	-
				16		960(at 50 to 450st) 920(at 500st) 790(at 550st) 690(at 600st) 610(at 650st) 550(at 700st) 490(at 750st) 440(at 800st)	1.2	-	-	-
				8		480(at 50 to 450st) 460(at 500st) 400(at 550st) 350(at 600st) 305(at 650st) 270(at 700st) 240(at 750st) 215(at 800st)	1	-	-	-
				4		240(at 50 to 450st) 230(at 500st) 200(at 550st) 170(at 600st) 150(at 650st) 135(at 700st) 120(at 750st) 105(at 800st)	0.7	-	-	-
	WSA16C	400	16384	20	Horizontal/ Vertical	1200(at 50 to 550st) 1120(at 600st) 990(at 650st) 880(at 700st) 780(at 750st) 715(at 800st) 645(at 850st) 590(at 900st) 535(at 950st) 490(at 1000st) 450(at 1050st) 415(at 1100st)	1.2	-	-	-
				10		600(at 50 to 550st) 560(at 600st) 490(at 650st) 440(at 700st) 395(at 750st) 355(at 800st) 320(at 850st) 290(at 900st) 265(at 950st) 240(at 1000st) 225(at 1050st) 205(at 1100st)	1	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] RCS4CR (Wide Slider Type)	WSA16C	400	16384	5	Horizontal/ Vertical	300(at 50 to 550st) 280(at 600st) 240(at 650st) 220(at 700st) 195(at 750st) 175(at 800st) 160(at 850st) 145(at 900st) 130(at 950st) 120(at 1000st) 110(at 1050st) 100(at 1100st)	0.7	-	-	-
RCS4 (Rod Type)	RA4C RA4R	60	16384	16	Horizontal/ Vertical	800	RA4C:1.2 RA4R:1	-	-	-
				10		500	RA4C:1.2 RA4R:1			
				5		250	1			
				2.5		125	0.7			
	RA6C RA6R	100	16384	20	Horizontal/ Vertical	800	RA6C:1.2 RA6R:1	-	-	-
				12		500	RA6C:1.2 RA6R:1			
				6		250	1			
				3		125	0.7			
	RA7C RA7R	200	16384	24	Horizontal/ Vertical	1200	RA7C:1.2 RA7R:1	-	-	-
				16		800	RA7C:1.2 RA7R:1			
				8		400	1			
				4		200	0.7			
	RA8C RA8R	400	16384	20	Horizontal/ Vertical	1000	RA8C:1.2 RA8R:1	-	-	-
				10		500	1			
				5		250	0.7			
RCS4 (Radial Cylinder)	RRA4C RRA4R	60	16384	16	Horizontal/ Vertical	960	RRA4C:1.2 RRA4R:1	-	-	-
				10		600	RRA4C:1.2 RRA4R:1			
				5		300	1			
				2.5		150	0.7			
	RRA6C RRA6R	100	16384	20	Horizontal/ Vertical	1200	RRA6C:1.2 RRA6R:1	-	-	-
				12		720	RRA6C:1.2 RRA6R:1			
				6		360	1			
				3		180	0.7			
	RRA7C RRA7R	200	16384	24	Horizontal/ Vertical	1440	RRA7C:1.2 RRA7R:1	-	-	-
				16		960	RRA7C:1.2 RRA7R:1			
				8		480	1			
				4		240	0.7			

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Radial Cylinder)	RRA8C	400	16384	30	Horizontal/ Vertical	1500(at 50 to 300st) 1230(at 350st) 970(at 400st) 790(at 450st) 650(at 500st) 540(at 550st) 460(at 600st) 400(at 650st) 350(at 700st)	1.2	-	-	-
				20		1100(at 50 to 250st) 1070(at 300st) 820(at 350st) 650(at 400st) 520(at 450st) 430(at 500st) 360(at 550st) 310(at 600st) 260(at 650st) 230(at 700st)	1.2	-	-	-
				10		550(at 50 to 250st) 520(at 300st) 400(at 350st) 310(at 400st) 250(at 450st) 210(at 500st) 180(at 550st) 150(at 600st) 130(at 650st) 110(at 700st)	1	-	-	-
				5		275(at 50 to 250st) 250(at 300st) 190(at 350st) 150(at 400st) 120(at 450st) 100(at 500st) 80(at 550st) 70(at 600st) 60(at 650st) 55(at 700st)	0.7	-	-	-
	RRA8R	400	16384	30	Horizontal/ Vertical	1300(at 50 to 300st) 1230(at 350st) 970(at 400st) 790(at 450st) 650(at 500st) 540(at 550st) 460(at 600st) 400(at 650st) 350(at 700st)	1	-	-	-
				20		1000(at 50 to 300st) 820(at 350st) 650(at 400st) 520(at 450st) 430(at 500st) 360(at 550st) 310(at 600st) 260(at 650st) 230(at 700st)	1	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Radial Cylinder)	RRA8R	400	16384	10	Horizontal/ Vertical	550(at 50 to 250st) 520(at 300st) 400(at 350st) 310(at 400st) 250(at 450st) 210(at 500st) 180(at 550st) 150(at 600st) 130(at 650st) 110(at 700st)	1	-	-	-
				5		275(at 50 to 250st) 250(at 300st) 190(at 350st) 150(at 400st) 120(at 450st) 100(at 500st) 80(at 550st) 70(at 600st) 60(at 650st) 55(at 700st)	0.7	-	-	-
RCS4 (Wide Radial Cylinder)	WRA10C WRA10R	60	16384	16	Horizontal	800(at 50 to 450st) 770(at 500st)	WRA10C:1.2 WRA10R:1	-	-	-
				10	Horizontal/ Vertical	600(at 50 to 400st) 580(at 450st) 490(at 500st)	WRA10C:1.2 WRA10R:1	-	-	-
				5		300(at 50 to 400st) 290(at 450st) 240(at 500st)	1	-	-	-
				2.5		150(at 50 to 400st) 145(at 450st) 120(at 500st)	0.7	-	-	-
	WRA12C WRA12R	100	16384	20	Horizontal/ Vertical	1000	WRA12C:1.2 WRA12R:1	-	-	-
				12		720	WRA12C:1.2 WRA12R:1			
				6		360	1			
				3		180	0.7			
	WRA14C WRA14R	200	16384	24	Horizontal/ Vertical	1200	WRA14C:1.2 WRA14R:1	-	-	-
				16		800	WRA14C:1.2 WRA14R:1			
				8		480(at 50 to 500st) 450(at 550st) 390(at 600st)	1			
				4		240(at 50 to 500st) 220(at 550st) 190(at 600st)	0.7			
	WRA16C WRA16R	400	16384	30	Horizontal/ Vertical	1300(at 50 to 300st) 1050(at 350st) 860(at 400st) 710(at 450st) 600(at 500st) 510(at 550st) 440(at 600st) 390(at 650st) 340(at 700st) 300(at 750st) 270(at 800st)	WRA16C:1.2 WRA16R:1	-	-	-

[RCS4 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS4 (Wide Radial Cylinder)	WRA16C WRA16R	400	16384	20	Horizontal/ Vertical	1000(at 50 to 250st) 880(at 300st) 700(at 350st) 570(at 400st) 470(at 450st) 400(at 500st) 340(at 550st) 295(at 600st) 260(at 650st) 225(at 700st) 200(at 750st) 180(at 800st)	WRA16C:1.2 WRA16R:1	-	-	-
				10		500(at 50 to 250st) 430(at 300st) 340(at 350st) 280(at 400st) 230(at 450st) 195(at 500st) 165(at 550st) 145(at 600st) 125(at 650st) 110(at 700st) 100(at 750st) 90(at 800st)	1	-	-	-
				5		250(at 50 to 250st) 210(at 300st) 170(at 350st) 130(at 400st) 115(at 450st) 95(at 500st) 80(at 550st) 70(at 600st) 60(at 650st) 55(at 700st) 50(at 750st) 45(at 800st)	0.7	-	-	-
RCS4 (Table Type)	TA4C (Single Block Type)	60	16384	16	Horizontal/ Vertical	900	1.2	-	-	-
				10		600	1.2			
				5		300	1			
				2.5		150	0.7			
	TA4C (Double Block Type)	60	16384	10	Horizontal/ Vertical	600	1.2	-	-	-
				5		300	1			
				2.5		150	0.7			
	TA6C (Single Block Type)	100	16384	20	Horizontal/ Vertical	1100	1.2	-	-	-
				12		720	1.2			
				6		360	1			
				3		180	0.7			
	TA6C (Double Block Type)	100	16384	12	Horizontal/ Vertical	720(at 45 to 270st) 575(at 320st)	1.2	-	-	-
				6		360(at 45 to 270st) 285(at 320st)	1			
				3		180(at 45 to 270st) 140(at 320st)	0.7			
	TA7C (Single Block Type)	200	16384	24	Horizontal/ Vertical	1300	1.2	-	-	-
				16		960	1.2			
				8		480	1			
				4		240	0.7			
	TA7C (Double Block Type)	200	16384	16	Horizontal/ Vertical	960(at 40 to 290st) 730(at 340st) 600(at 390st)	1.2	-	-	-
				8		480(at 40 to 290st) 365(at 340st) 300(at 390st)	1			
				4		240(at 40 to 290st) 180(at 340st) 150(at 390st)	0.7			

[RCS4 Series]

Actuator Series	Type	Motor Output	No. of Encoder Pluses	Lead	Oriented Direction	Maximum Speed	Maximum Acceleration/ Deceleration Speed	Minimum Pressing Force	Maximum Pressing Force	Rated Pressing Speed
		[W]		[mm]		[mm/s]	[G]	[N]	[N]	[mm/s]
RCS4 (Table Type)	TA4R (Single Block Type)	400	16384	16	Horizontal/ Vertical	800	1	-	-	-
				10		600	1			
				5		300	1			
				2.5		150	0.7			
	TA4R (Double Block Type)	400	16384	10	Horizontal/ Vertical	600	1	-	-	-
				5		300	1			
				2.5		150	0.7			
	TA6R (Single Block Type)	100	16384	20	Horizontal/ Vertical	1100	1.2	-	-	-
				12		720	1.2			
				6		360	1			
				3		180	0.7			
	TA6R (Double Block Type)	100	16384	12	Horizontal/ Vertical	720(at 45 to 270st) 575(at 320st)	1.2	-	-	-
				6		360(at 45 to 270st) 285(at 320st)	1			
				3		180(at 45 to 270st) 140(at 320st)	0.7			
	TA7R (Single Block Type)	200	16384	24	Horizontal/ Vertical	1300	1.2	-	-	-
				16		960	1.2			
				8		480	1			
				4		240	0.7			
	TA7R (Double Block Type)	200	16384	16	Horizontal/ Vertical	960(at 40 to 290st) 730(at 340st) 600(at 390st)	1.2	-	-	-
				8		480(at 40 to 290st) 365(at 340st) 300(at 390st)	1			
				4		240(at 40 to 290st) 180(at 340st) 150(at 390st)	0.7			

[RCS3 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3/ RCS3P (Slider Type)	SA8C SA8R	100 150	16384	30	Horizontal/ Vertical	1800(at 50 to 650st) 1610(at 700st) 1420(at 750st) 1260(at 800st) 1120(at 850st) 1010(at 900st) 910(at 950st) 830(at 1000st) 760(at 1050st) 690(at 1100st)	Horizontal:1 Vertical:0.7	-	-	-
				20		1200(at 50 to 650st) 1070(at 700st) 940(at 750st) 840(at 800st) 750(at 850st) 670(at 900st) 610(at 950st) 550(at 1000st) 500(at 1050st) 460(at 1100st)	0.7	-	-	-
				10		600(at 50 to 650st) 530(at 700st) 470(at 750st) 410(at 800st) 370(at 850st) 340(at 900st) 310(at 950st) 270(at 1000st) 250(at 1050st) 230(at 1100st)	0.5	-	-	-
		100		5		300(at 50 to 650st) 260(at 700st) 230(at 750st) 200(at 800st) 180(at 850st) 170(at 900st) 150(at 950st) 135(at 1000st) 120(at 1050st) 110(at 1100st)	0.3	-	-	-
	SS8C SS8R	100 150	16384	30	Horizontal/ Vertical	1800(at 50 to 600st) 1660(at 650st) 1460(at 700st) 1295(at 750st) 1155(at 800st) 1035(at 850st) 935(at 900st) 850(at 950st) 775(at 1000st)	Horizontal:1 Vertical:0.7	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS3 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS3/ RCS3P (Slider Type)	SS8C SS8R	100 150	16384	20	Horizontal/ Vertical	1200(at 50 to 600st) 1105(at 650st) 970(at 700st) 860(at 750st) 770(at 800st) 690(at 850st) 625(at 900st) 565(at 950st) 515(at 1000st)	0.7	-	-	-
				10		600(at 50 to 600st) 550(at 650st) 485(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 280(at 950st) 255(at 1000st)	0.5	-	-	-
		100		5		300(at 50 to 600st) 275(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 170(at 850st) 150(at 900st) 140(at 950st) 125(at 1000st)	0.3	-	-	-
[Cleanroom Type] RCS3CR/ RCS3PCR (Slider Type)	SA8C	100 150	16384	30	Horizontal/ Vertical	1800(at 50 to 650st) 1510(at 700st) 1340(at 750st) 1190(at 800st) 1070(at 850st) 960(at 900st) 870(at 950st) 790(at 1000st) 720(at 1050st) 660(at 1100st)	Horizontal:1 Vertical:0.7	-	-	-
				20		1200(at 50 to 650st) 1010(at 700st) 890(at 750st) 790(at 800st) 710(at 850st) 640(at 900st) 580(at 950st) 530(at 1000st) 480(at 1050st) 440(at 1100st)	0.7	-	-	-
				10		600(at 50 to 650st) 500(at 700st) 440(at 750st) 390(at 800st) 350(at 850st) 320(at 900st) 290(at 950st) 260(at 1000st) 240(at 1050st) 220(at 1100st)	0.5	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS3 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] RCS3CR/ RCS3PCR (Slider Type)	SA8C	100	16384	5	Horizontal/ Vertical	300(at 50 to 650st) 250(at 700st) 220(at 750st) 190(at 800st) 170(at 850st) 160(at 900st) 140(at 950st) 130(at 1000st) 120(at 1050st) 110(at 1100st)	0.3	-	-	-
	SS8C	100 150	16384	30		1800(at 50 to 600st) 1660(at 650st) 1460(at 700st) 1295(at 750st) 1155(at 800st) 1035(at 850st) 935(at 900st) 850(at 950st) 775(at 1000st)	Horizontal:1 Vertical:0.7	-	-	-
				20		1200(at 50 to 600st) 1105(at 650st) 970(at 700st) 860(at 750st) 770(at 800st) 690(at 850st) 625(at 900st) 565(at 950st) 515(at 1000st)	0.7	-	-	-
				10		600(at 50 to 600st) 550(at 650st) 485(at 700st) 430(at 750st) 385(at 800st) 345(at 850st) 310(at 900st) 280(at 950st) 255(at 1000st)	0.5	-	-	-
		100		5		300(at 50 to 600st) 275(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 170(at 850st) 150(at 900st) 140(at 950st) 125(at 1000st)	0.3	-	-	-
RCS3 (High-Speed Type)	CTZ5C	60	16384	10	Horizontal/ Vertical	833	3.2	-	-	-
	CT8C	400	16384	30	Horizontal	2500	3.2	-	-	-
RCS3 (Rod Type)	RA6R	60	16384	1.5	Horizontal/ Vertical	75	0.3	60	600	10
	RA7R	100		2		100	0.3	200	1200	10
	RA8R	200		2.5		125	0.2	200	2000	10
	RA10R	400		2.5		125	0.2	600	6000	10

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS2 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SA7C	60	16384	24	Horizontal/ Vertical	1200(at 50 to 600st) 1150(at 650st) 960(at 700st) 890(at 750st) 720(at 800st)	0.3 High Accel/Decel Type: 0.8	-	-	-
				16		800(at 50 to 600st) 745(at 650st) 640(at 700st) 575(at 750st) 480(at 800st)	0.3 High Accel/Decel Type: 1	-	-	-
				8		400(at 50 to 600st) 370(at 650st) 320(at 700st) 285(at 750st) 240(at 800st)	0.3 High Accel/Decel Type: 0.8	-	-	-
				4		200(at 50 to 600st) 185(at 650st) 160(at 700st) 140(at 750st) 120(at 800st)	0.2	-	-	-
	SA7R	60	16384	16	Horizontal/ Vertical	800(at 50 to 600st) 745(at 650st) 640(at 700st) 575(at 750st) 480(at 800st)	0.3	-	-	-
				8		400(at 50 to 600st) 370(at 650st) 320(at 700st) 285(at 750st) 240(at 800st)	0.3	-	-	-
				4		200(at 50 to 600st) 185(at 650st) 160(at 700st) 140(at 750st) 120(at 800st)	0.2	-	-	-
	SS7C	60	16384	20	Horizontal/ Vertical	1000(at 50 to 550st) 830(at 600st)	0.3	-	-	-
				12		600(at 50 to 500st) 580(at 550st) 470(at 600st)	0.3			
				6		300(at 50 to 500st) 290(at 550st) 230(at 600st)	0.3			
	SS7R	60	16384	12	Horizontal/ Vertical	600(at 50 to 500st) 580(at 550st) 470(at 600st)	0.3	-	-	-
				6		300(at 50 to 500st) 290(at 550st) 230(at 600st)	0.3			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS2 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Slider Type)	SS8C	100 150	16384	20	Horizontal/ Vertical	1000(at 50 to 600st) 960(at 700st) 765(at 800st) 625(at 900st) 515(at 1000st)	0.3	-	-	-
				10		500(at 50 to 600st) 480(at 700st) 380(at 800st) 310(at 900st) 255(at 1000st)	0.3			
	SS8R	100 150	16384	20	Horizontal/ Vertical	1000(at 50 to 600st) 960(at 700st) 765(at 800st) 625(at 900st) 515(at 1000st)	0.3	-	-	-
				10		500(at 50 to 600st) 480(at 700st) 380(at 800st) 310(at 900st) 255(at 1000st)	0.3			
RCS2 (Rod Type)	RA5C	60	16384	16	Horizontal/ Vertical	800(at 50 to 250st) 755(at 300st)	0.3	-	-	-
				8		400(at 50 to 250st) 377(at 300st)	0.3			
				4		200(at 50 to 250st) 188(at 300st)	0.2			
		100		16		800(at 50 to 250st) 755(at 300st)	0.3 High Accel/Decel Type: 1	-	-	-
				8		400(at 50 to 250st) 377(at 300st)	0.3 High Accel/Decel Type: 1			
				4		200(at 50 to 250st) 188(at 300st)	0.2			
	RGS5C RGD5C	60	16384	16	Horizontal/ Vertical	800(at 50 to 250st) 755(at 300st)	0.3	-	-	-
				8		400(at 50 to 250st) 377(at 300st)	0.3			
				4		200(at 50 to 250st) 188(at 300st)	0.2			
		100		16		800(at 50 to 250st) 755(at 300st)	0.3 High Accel/Decel Type: 1	-	-	-
				8		400(at 50 to 250st) 377(at 300st)	0.3 High Accel/Decel Type: 1			
				4		200(at 50 to 250st) 188(at 300st)	0.2			
	RA5R	60	16384	16	Horizontal/ Vertical	800(at 50 to 250st) 755(at 300st)	0.3	-	-	-
				8		400(at 50 to 250st) 377(at 300st)	0.3			
				4		200(at 50 to 250st) 188(at 300st)	0.2			

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[RCS2 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Rod Type)	RN5N RP5N GS5N GD5N	60	Incremental 1600	10	Horizontal	380(at 75st) 280(at 50st)	0.3	-	-	-
					Vertical	330(at 75st) 230(at 50st)	0.2			
				5	Horizontal	250	0.3			
					Vertical	250(at 75st) 230(at 50st)	0.2			
				2.5	Horizontal/ Vertical	125	0.2			
	SD5N	60	1600	10	Horizontal	380(at 75st) 280(at 50st)	0.3	-	-	-
					Vertical	330(at 75st) 230(at 50st)	0.2			
				5	Horizontal	250	0.3			
					Vertical	250(at 75st) 230(at 50st)	0.2			
				2.5	Horizontal/ Vertical	125	0.2			
	RA7AD RGS7AD RGD7AD	60	3072	12	Horizontal/ Vertical	600(at 50 to 250st) 505(at 300st)	0.15	-	-	-
				6		300(at 50 to 250st) 250(at 300st)	0.1			
				3		150(at 50 to 250st) 125(at 300st)	0.05			
		100		12		600(at 50 to 250st) 505(at 300st)	0.2			
				6		300(at 50 to 250st) 250(at 300st)	0.1			
	SRA7BD SRGS7BD SRGD7BD	60	3072	16	Horizontal/ Vertical	800	0.35	-	-	-
				8		400	0.25			
				4		200	0.15			
		100 150		16		800	0.4			
				8		400	0.3			
				4		200	0.2			
	RA13R	750	16384	2.5	Horizontal/ Vertical	85(at 50st) 120(at 100st) 125(at 150 to 200st)	0.02	1000	9800	10
				1.25		62	0.01	2000	19600	10
[Cleanroom Type] [Dust and Drip Proof Type] RCS2CR/ RCS2W (Rod Type)	RN5NB RP5NB GS5NB GD5NB SD5NB	60	Incremental 1600	10	Horizontal	380(at 75st) 280(at 50st)	0.3	-	-	-
					Vertical	330(at 75st) 230(at 50st)	0.2			
				5	Horizontal	250	0.3			
					Vertical	250(at 75st) 230(at 50st)	0.2			
				2.5	Horizontal/ Vertical	125	0.2			
RCS2 (Table Type)	TCA5N TWA5N TFA5N	60	Incremental 1600	10	Horizontal	380(at 75st) 280(at 50st)	0.3	-	-	-
					Vertical	330(at 75st) 230(at 50st)	0.2			
				5	Horizontal	250	0.3			
					Vertical	250(at 75st) 230(at 50st)	0.2			
				2.5	Horizontal/ Vertical	125	0.2			

[RCS2 Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
RCS2 (Gripper Type)	GR8	60	16384	Gear Ratio 1/5	-	400	0.3	-	-	-
RCS2 (Flat Type)	F5D	60 100	16384	16	Horizontal/ Vertical	800	0.3	-	-	-
				8		400	0.3			
				4		200	0.2			
RCS2 (Rotary Type)	RT6	60	16384	Gear Ratio 1/18	-	500 deg/s	-	-	-	-
	RT6R	60	16384	Gear Ratio 1/18	-	500 deg/s	-	-	-	-
	RT7R	60	16384	Gear Ratio 1/4	-	500 deg/s	-	-	-	-
	RTC10L	60	16384	Gear Ratio 1/15	-	1200 deg/s	0.3	-	-	-
				Gear Ratio 1/24		750 deg/s				
	RTC12L	150	16384	Gear Ratio 1/18	-	800 deg/s	0.3	-	-	-
				Gear Ratio 1/30		600 deg/s				

[ISB/ISPB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB/ISPB (Slider Type)	SXM	60	Battery-less Absolute 131072 Incremental /Absolute 16384	16	Horizontal/ Vertical	960(at 100 to 600st) 655(at 700st) 515(at 800st) 415(at 900st)	Horizontal:1.2 Vertical:0.8	-	-	-
				8		480(at 100 to 600st) 330(at 700st) 260(at 800st) 210(at 900st)	Horizontal:0.7 Vertical:0.6	-	-	-
				4		240(at 100 to 600st) 165(at 700st) 130(at 800st) 100(at 900st)	Horizontal:0.5 Vertical:0.4	-	-	-
		100 (Only ISB)	131072	36		1100(at 100st) 1425(at 150st) 1700(at 200st) 1925(at 250st) 2075(at 300st) 2125(at 350st) 2160(at 400 to 550st) 2000(at 600st) 1740(at 650st) 1520(at 700st) 1340(at 750st) 1190(at 800st) 1065(at 850st) 960(at 900st) 865(at 950st) 790(at 1000st) 721(at 1050st) 660(at 1100st)	Horizontal:2 Vertical:1.6	-	-	-
ISB/ISPB (Slider Type)	SXL	60	Battery-less Absolute 131072 Incremental /Absolute 16384	16	Horizontal/ Vertical	960(at 130 to 580st) 655(at 680st) 515(at 780st) 415(at 880st)	1.2	-	-	-
				8		480(at 130 to 580st) 330(at 680st) 260(at 780st) 210(at 880st)	0.7	-	-	-
				4		240(at 130 to 580st) 165(at 680st) 130(at 780st) 100(at 880st)	0.5	-	-	-
		100 (Only ISB)	131072	36		1425(at 130st) 1700(at 180st) 1925(at 230st) 2075(at 280st) 2125(at 330st) 2160(at 380 to 530st) 2000(at 580st) 1740(at 630st) 1520(at 680st) 1340(at 730st) 1190(at 780st) 1065(at 830st) 960(at 880st) 865(at 930st) 790(at 980st) 721(at 1030st) 660(at 1080st)	Horizontal:2 Vertical:1.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISB/ISPB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB/ISPB (Slider Type)	MXM	100 200	Battery-less Absolute 131072 Incremental /Absolute 16384	30	Horizontal/ Vertical	1800(at 100 to 700st) 1290(at 800st) 1045(at 900st) 860(at 1000st) 690(at 1100st)	1.2	-	-	-
				20		1200(at 100 to 700st) 860(at 800st) 695(at 900st) 570(at 1000st) 460(at 1100st)	Horizontal:1.2 Vertical:1	-	-	-
				10		600(at 100 to 700st) 430(at 800st) 345(at 900st) 280(at 1000st) 230(at 1100st)	Horizontal:0.7 Vertical:0.6	-	-	-
				5		300(at 100 to 700st) 215(at 800st) 170(at 900st) 140(at 1000st) 115(at 1100st)	Horizontal:0.5 Vertical:0.4	-	-	-
		400 (Only ISB)	131072	48		1025(at 100st) 1325(at 150st) 1575(at 200st) 1825(at 250st) 2025(at 300st) 2200(at 350st) 2350(at 400st) 2400(at 450st) 2500(at 500 to 700st) 2270(at 750st) 2030(at 800st) 1825(at 850st) 1645(at 900st) 1495(at 950st) 1365(at 1000st) 1250(at 1050st) 1150(at 1100st) 1060(at 1150st) 980(at 1200st) 910(at 1250st) 845(at 1300st)	Horizontal:2 Vertical:1.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISB/ISPB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB/ISPB (Slider Type)	MXL	100 200	Battery-less Absolute 131072 / Incremental /Absolute 16384	30	Horizontal/ Vertical	1800(at 120 to 670st) 1290(at 770st) 1045(at 870st) 860(at 970st) 690(at 1070st)	1.2	-	-	-
				20		1200(at 120 to 670st) 860(at 770st) 695(at 870st) 570(at 970st) 460(at 1070st)	Horizontal:1.2 Vertical:1	-	-	-
				10		600(at 120 to 670st) 430(at 770st) 345(at 870st) 280(at 970st) 230(at 1070st)	Horizontal:0.7 Vertical:0.6	-	-	-
				5		300(at 120 to 670st) 215(at 770st) 170(at 870st) 140(at 970st) 115(at 1070st)	Horizontal:0.5 Vertical:0.4	-	-	-
		400 (Only ISB)	131072	48		1325(at 120st) 1575(at 170st) 1825(at 220st) 2025(at 270st) 2200(at 320st) 2350(at 370st) 2400(at 420st) 2500(at 470 to 670st) 2270(at 720st) 2030(at 770st) 1825(at 820st) 1645(at 870st) 1495(at 920st) 1365(at 970st) 1250(at 1020st) 1150(at 1070st) 1060(at 1120st) 980(at 1170st) 910(at 1220st) 845(at 1270st)	Horizontal:2 Vertical:1.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISB/ISPB Series]

Actuator Series	Type	Motor Output	No. of Encoder Pluses	Lead	Oriented Direction	Maximum Speed	Maximum Acceleration/ Deceleration Speed	Minimum Pressing Force	Maximum Pressing Force	Rated Pressing Speed
		[W]		[mm]		[mm/s]	[G]	[N]	[N]	[mm/s]
ISB/ISPB (Slider Type)	MXMX	200	Battery-less Absolute 131072 Incremental /Absolute 16384	30	Horizontal	1800(at 800 to 1100st) 1650(at 1150st) 1500(at 1250st) 1425(at 1350st) 1200(at 1450st) 1050(at 1550st) 900(at 1650st) 825(at 1750st) 750(at 1850st) 675(at 1950st)	0.4	-	-	-
				20		1200(at 800 to 1100st) 1100(at 1150st) 1000(at 1250st) 950(at 1350st) 800(at 1450st) 700(at 1550st) 600(at 1650st) 550(at 1750st) 500(at 1850st) 450(at 1950st)	0.4	-	-	-
		400 (Only ISB)	131072	48		1700(at 800st) 1750(at 850st) 1800(at 900st) 1850(at 950st) 1900(at 1000st) 1950(at 1050st) 2000(at 1100st) 2050(at 1150st) 2100(at 1200st) 2150(at 1250st) 2200(at 1300st) 2065(at 1350st) 1925(at 1400st) 1805(at 1450st) 1690(at 1500st) 1590(at 1550st) 1495(at 1600st) 1410(at 1650st) 1335(at 1700st) 1265(at 1750st) 1195(at 1800st) 1135(at 1850st) 1080(at 1900st) 1025(at 1950st) 980(at 2000st)	0.4	-	-	-

[ISB/ISPB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB/ISPB (Slider Type)	LXM	200 400	Battery-less Absolute 131072 Incremental /Absolute 16384	40	Horizontal/ Vertical	2400(at 100 to 800st) 1840(at 900st) 1530(at 1000st) 1290(at 1100st) 1100(at 1200st) 880(at 1300st)	1.2	-	-	-
				20		1200(at 100 to 800st) 920(at 900st) 765(at 1000st) 645(at 1100st) 550(at 1200st) 440(at 1300st)	Horizontal:1.2 Vertical:1	-	-	-
				10		600(at 100 to 800st) 460(at 900st) 380(at 1000st) 320(at 1100st) 270(at 1200st) 220(at 1300st)	Horizontal:0.7 Vertical:0.6	-	-	-
	LXL	200 400	Battery-less Absolute 131072 Incremental /Absolute 16384	40	Horizontal/ Vertical	2400(at 120 to 770st) 1840(at 870st) 1530(at 970st) 1290(at 1070st) 1100(at 1170st) 880(at 1270st)	1.2	-	-	-
				20		1200(at 120 to 770st) 920(at 870st) 765(at 970st) 645(at 1070st) 550(at 1170st) 440(at 1270st)	Horizontal:1.2 Vertical:1	-	-	-
				10		600(at 120 to 770st) 460(at 870st) 380(at 970st) 320(at 1070st) 270(at 1170st) 220(at 1270st)	Horizontal:0.7 Vertical:0.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISB/ISPB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISB/ISPB (Slider Type)	LXMX	400	Battery-less Absolute 131072	40	Horizontal	2400(at 1000 to 1200st) 2300(at 1300st) 2000(at 1400st) 1900(at 1500st) 1660(at 1600st) 1480(at 1700st) 1300(at 1800st) 1180(at 1900st) 1080(at 2000st) 980(at 2100st) 900(at 2200st) 820(at 2300st) 740(at 2400st) 680(at 2500st)	0.4	-	-	-
		200 400	Incremental /Absolute 16384	20	Horizontal	1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 460(at 2200st) 410(at 2300st) 370(at 2400st) 340(at 2500st)	0.4	-	-	-
	LXUWX	400	Battery-less Absolute 131072	40	Horizontal	2400(at 1000 to 1200st) 2300(at 1300st) 2000(at 1400st) 1900(at 1500st) 1660(at 1600st) 1480(at 1700st) 1300(at 1800st) 1180(at 1900st) 1080(at 2000st) 980(at 2100st) 880(at 2200st) 840(at 2300st) 740(at 2400st) 680(at 2500st)	0.4	-	-	-
		200 400	Incremental /Absolute 16384	20	Horizontal	1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 440(at 2200st) 430(at 2300st) 370(at 2400st) 340(at 2500st)	0.4	-	-	-

[ISB/ISPB Series]

Actuator Series	Type	Motor Output	No. of Encoder Pluses	Lead	Oriented Direction	Maximum Speed	Maximum Acceleration/ Deceleration Speed	Minimum Pressing Force	Maximum Pressing Force	Rated Pressing Speed
		[W]		[mm]		[mm/s]	[G]	[N]	[N]	[mm/s]
ISB/ISPB (Slider Type)	WXM	750	131072	50	Horizontal/ Vertical	2500(at 100 to 900st) 2260(at 950 to 1000st) 1840(at 1050 to 1100st) 1570(at 1150 to 1200st) 1360(at 1250 to 1300st)	Horizontal:1.5 Vertical:1	-	-	-
				25	Horizontal/ Vertical	1250(at 100 to 900st) 1130(at 950 to 1000st) 920(at 1050 to 1100st) 785(at 1150 to 1200st) 680(1250 to 1300st)	Horizontal:1.5 Vertical:1	-	-	-
				10	Horizontal/ Vertical	600(at 100 to 800st) 450(at 850 to 900st) 380(at 950 to 1000st) 320(at 1050 to 1100st) 270(at 1150 to 1200st) 2350(at 1250 to 1300st)	Horizontal:0.6 Vertical:0.5	-	-	-
	WXMX			50	Horizontal/ Vertical	2500(at 900 to 3000st)	Horizontal:1.2 Vertical:1	-	-	-
				25	Horizontal/ Vertical	1250(at 900 to 3000st)	Horizontal:1.2 Vertical:0.6	-	-	-

[ISDB/ISPDB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB(CR)/ ISPDB(CR) (Slider Type) * Cleanroom type included	S	60	Battery-less Absolute 131072 Incremental /Absolute 16384	16	Horizontal/ Vertical	960(at 100 to 500st) 920(at 550st) 795(at 600st) 690(at 650st) 610(at 700st) 540(at 750st) 480(at 800st)	Horizontal:1 Vertical:0.8	-	-	-
				8		480(at 100 to 500st) 460(at 550st) 400(at 600st) 345(at 650st) 305(at 700st) 270(at 750st) 240(at 800st)	Horizontal:0.7 Vertical:0.6	-	-	-
				4		240(at 100 to 500st) 230(at 550st) 200(at 600st) 170(at 650st) 150(at 700st) 135(at 750st) 120(at 800st)	Horizontal:0.5 Vertical:0.4	-	-	-
		100 (Only ISDB)	131072	36	Horizontal/ Vertical	1075(at 100st) 1370(at 150st) 1620(at 200st) 1830(at 250st) 1940(at 300st) 1980(at 350st) 2000(at 400 to 550st) 1825(at 600st) 1590(at 650st) 1400(at 700st) 1240(at 750st) 1105(at 800st)	Horizontal:2 Vertical:1.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISDB/ISPDB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB(CR)/ ISPDB(CR) (Slider Type) * Cleanroom type included	M	100 200	Battery-less Absolute 131072 Incremental /Absolute 16384	30	Horizontal/ Vertical	1800(at 100 to 600st) 1630(at 650st) 1440(at 700st) 1280(at 750st) 1150(at 800st) 1035(at 850st) 935(at 900st) 850(at 950st) 780(at 1000st) 715(at 1050st) 660(at 1100st)	1	-	-	-
				20		1200(at 100 to 600st) 1085(at 650st) 960(at 700st) 855(at 750st) 765(at 800st) 690(at 850st) 625(at 900st) 570(at 950st) 520(at 1000st) 475(at 1050st) 440(at 1100st)	1	-	-	-
				10		600(at 100 to 600st) 545(at 650st) 480(at 700st) 430(at 750st) 380(at 800st) 345(at 850st) 310(at 900st) 285(at 950st) 260(at 1000st) 240(at 1050st) 220(at 1100st)	Horizontal:0.7 Vertical:0.6	-	-	-
				5		300(at 100 to 600st) 270(at 650st) 240(at 700st) 215(at 750st) 190(at 800st) 170(at 850st) 155(at 900st) 140(at 950st) 130(at 1000st) 120(at 1050st) 110(at 1100st)	Horizontal:0.5 Vertical:0.4	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISDB/ISPDB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB(CR)/ ISPDB(CR) (Slider Type) * Cleanroom type included	M	400 (Only ISDB)	131072	48	Horizontal/ Vertical	980(at 100st) 1270(at 150st) 1520(at 200st) 1740(at 250st) 1930(at 300st) 2050(at 350st) 2125(at 400st) 2200(at 450 to 700st) 2145(at 750st) 1920(at 800st) 1730(at 850st) 1570(at 900st) 1430(at 950st) 1305(at 1000st) 1195(at 1050st) 1105(at 1100st)	Horizontal:1.8 Vertical:1.6	-	-	-
	MX	200	Battery-less Absolute 131072 Incremental /Absolute 16384	30	Horizontal	1800(at 800 to 1100st) 1650(at 1200st) 1500(at 1300st) 1425(at 1400st) 1200(at 1500st) 1050(at 1600st) at 1650st and higher: For cleanroom type only 900(at 1700st) 825(at 1800st) 750(at 1900st) 675(at 2000st)	0.4	-	-	-
				20		1200(at 800 to 1100st) 1100(at 1200st) 1000(at 1300st) 950(at 1400st) 800(at 1500st) 700(at 1600st) at 1650st and higher: For cleanroom type only 600(at 1700st) 550(at 1800st) 500(at 1900st) 450(at 2000st)	0.4	-	-	-
		400 (Only ISDB)	131072	48	Horizontal	1700(at 800st) 1750(at 850st) 1800(at 900st) 1850(at 950st) 1900(at 1000st) 1950(at 1050st) 2000(at 1100st) 2050(at 1150st) 2100(at 1200st) 2150(at 1250st) 2200(at 1300st) 1990(at 1350st) 1860(at 1400st) 1745(at 1450st) 1640(at 1500st) 1540(at 1550st) 1450(at 1600st)	0.4	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISDB/ISPDB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB(CR)/ ISPDB(CR) (Slider Type) * Cleanroom type included	L	200 400	Battery-less Absolute 131072 Incremental /Absolute 16384	40	Horizontal/ Vertical	1800(at 100 to 800st) 1700(at 850st) 1540(at 900st) 1410(at 950st) 1290(at 1000st) 1185(at 1050st) 1095(at 1100st) 1015(at 1150st) 940(at 1200st) 875(at 1250st) 815(at 1300st)	1	-	-	-
				20		1200(at 100 to 650st) 1165(at 700st) 1045(at 750st) 940(at 800st) 850(at 850st) 770(at 900st) 705(at 950st) 645(at 1000st) 595(at 1050st) 545(at 1100st) 505(at 1150st) 470(at 1200st) 440(at 1250st) 410(at 1300st)	1	-	-	-
				10		600(at 100 to 650st) 585(at 700st) 520(at 750st) 470(at 800st) 425(at 850st) 385(at 900st) 350(at 950st) 320(at 1000st) 295(at 1050st) 275(at 1100st) 255(at 1150st) 235(at 1200st) 220(at 1250st) 205(at 1300st)	Horizontal:0.7 Vertical:0.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[ISDB/ISPDB Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDB(CR)/ ISPDB(CR) (Slider Type) * Cleanroom type included	LX	200 400	Battery-less Absolute 131072 Incremental /Absolute 16384	40	Horizontal	1800(at 1000 to 1500st) 1660(at 1600st) at 1650st and higher: For cleanroom type only 1480(at 1700st) 1300(at 1800st) 1180(at 1900st) 1080(at 2000st) 980(at 2100st) 880(at 2200st) 820(at 2300st) 740(at 2400st) 680(at 2500st)	0.4	-	-	-
				20		1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) at 1650st and higher: For cleanroom type only 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 440(at 2200st) 410(at 2300st) 370(at 2400st) 340(at 2500st)	0.4	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	SXM SYM	60	16384	16	Horizontal/ Vertical	960	Horizontal:1 Vertical:0.7	-	-	-
				8		480	Horizontal:0.6 Vertical:0.5			
				4		240	Horizontal:0.5 Vertical:0.3			
	SZM	60	16384	8	Vertical	480	0.3	-	-	-
				4		240	0.3			
	MXM MYM	100	16384	30	Horizontal	1800(at 100 to 700st) 1290(at 800st) 1045(at 900st) 860(at 1000st)	1	-	-	-
				20	Horizontal/ Vertical	1200(at 100 to 700st) 860(at 800st) 695(at 900st) 570(at 1000st)	Horizontal:1 Vertical:0.8	-	-	-
				10		600(at 100 to 700st) 430(at 800st) 345(at 900st) 280(at 1000st)	Horizontal:0.6 Vertical:0.5	-	-	-
				5		300(at 100 to 700st) 215(at 800st) 170(at 900st) 140(at 1000st)	Horizontal:0.5 Vertical:0.3	-	-	-
		200	16384	30	Horizontal/ Vertical	1800(at 100 to 700st) 1290(at 800st) 1045(at 900st) 860(at 1000st)	1	-	-	-
				20		1200(at 100 to 700st) 860(at 800st) 695(at 900st) 570(at 1000st)	Horizontal:1 Vertical:0.8	-	-	-
				10		600(at 100 to 700st) 430(at 800st) 345(at 900st) 280(at 1000st)	Horizontal:0.6 Vertical:0.5	-	-	-
	MZM	100 200	16384	10	Vertical	600(at 100 to 700st) 430(at 800st) 345(at 900st) 280(at 1000st)	0.5	-	-	-
				5 (Only 100W)		300(at 100 to 700st) 215(at 800st) 170(at 900st) 140(at 1000st)	0.3	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	MXMX	200	16384	30	Horizontal	1800(at 800 to 1100st) 1650(at 1200st) 1500(at 1300st) 1425(at 1400st) 1200(at 1500st) 1050(at 1600st) 900(at 1700st) 825(at 1800st) 750(at 1900st) 675(at 2000st)	0.3	-	-	-
				20		1200(at 800 to 1100st) 1100(at 1200st) 1000(at 1300st) 950(at 1400st) 800(at 1500st) 700(at 1600st) 600(at 1700st) 550(at 1800st) 500(at 1900st) 450(at 2000st)	0.3	-	-	-
	LXM LYM	200	16384	20	Horizontal/ Vertical	1200(at 100 to 800st) 920(at 900st) 765(at 1000st) 645(at 1100st) 550(at 1200st)	Horizontal:1 Vertical:0.8	-	-	-
				10		600(at 100 to 800st) 460(at 900st) 380(at 1000st) 320(at 1100st) 270(at 1200st)	Horizontal:0.6 Vertical:0.5			
		400	16384	40	Horizontal/ Vertical	2400(at 100 to 800st) 1840(at 900st) 1530(at 1000st) 1290(at 1100st) 1100(at 1200st)	1	-	-	-
				20		1200(at 100 to 800st) 920(at 900st) 765(at 1000st) 645(at 1100st) 550(at 1200st)	Horizontal:1 Vertical:0.8			
	LZM	200 400	16384	10	Vertical	600(at 100 to 800st) 460(at 900st) 380(at 1000st) 320(at 1100st) 270(at 1200st)	0.5	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	LXMX	200	16384	20	Horizontal	1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 460(at 2200st) 410(at 2300st) 370(at 2400st) 340(at 2500st)	0.3	-	-	-
		400	16384	40	Horizontal	2400(at 1000 to 1200st) 2300(at 1300st) 2000(at 1400st) 1900(at 1500st) 1660(at 1600st) 1480(at 1700st) 1300(at 1800st) 1180(at 1900st) 1080(at 2000st) 980(at 2100st) 900(at 2200st) 820(at 2300st) 740(at 2400st) 680(at 2500st)	0.3	-	-	-
				20		1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 460(at 2200st) 410(at 2300st) 370(at 2400st) 340(at 2500st)	0.3	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	LXUWX	200	16384	20	Horizontal	1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 440(at 2200st) 430(at 2300st) 370(at 2400st) 340(at 2500st)	0.3	-	-	-
		400	16384	40	Horizontal	2400(at 1000 to 1200st) 2300(at 1300st) 2000(at 1400st) 1900(at 1500st) 1660(at 1600st) 1480(at 1700st) 1300(at 1800st) 1180(at 1900st) 1080(at 2000st) 980(at 2100st) 880(at 2200st) 840(at 2300st) 740(at 2400st) 680(at 2500st)	0.3	-	-	-
				20		1200(at 1000 to 1200st) 1150(at 1300st) 1000(at 1400st) 950(at 1500st) 830(at 1600st) 740(at 1700st) 650(at 1800st) 590(at 1900st) 540(at 2000st) 490(at 2100st) 440(at 2200st) 430(at 2300st) 370(at 2400st) 340(at 2500st)	0.3	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	WXM	600	16384	40	Horizontal/ Vertical	2400(at 100 to 800st) 1840(at 900st) 1530(at 1000st) 1290(at 1100st) 1100(at 1200st) 950(at 1300st)	1	-	-	-
				20		1200(at 100 to 800st) 920(at 900st) 765(at 1000st) 645(at 1100st) 550(at 1200st) 475(at 1300st)	Horizontal:1 Vertical:0.8	-	-	-
				10		600(at 100 to 800st) 460(at 900st) 380(at 1000st) 320(at 1100st) 270(at 1200st) 235(at 1300st)	Horizontal:0.6 Vertical:0.5	-	-	-
		750	16384	50	Horizontal/ Vertical	2000(at 100 to 1000st) 1840(at 1100st) 1570(at 1200st) 1360(at 1300st)	1	-	-	-
				25		1250(at 100 to 900st) 1090(at 1000st) 920(at 1100st) 785(at 1200st) 680(at 1300st)	Horizontal:1 Vertical:0.8	-	-	-
	WXMX	600	16384	40	Horizontal	2400(at 900 to 1200st) 2200(at 1300st) 1965(at 1400st) 1725(at 1500st) 1530(at 1600st) 1365(at 1700st) 1225(at 1800st) 1110(at 1900st) 1005(at 2000st) 915(at 2100st) 840(at 2200st) 770(at 2300st) 710(at 2400st) 695(at 2500st)	0.3	-	-	-
				20		1200(at 900 to 1200st) 1100(at 1300st) 980(at 1400st) 860(at 1500st) 765(at 1600st) 680(at 1700st) 610(at 1800st) 555(at 1900st) 500(at 2000st) 455(at 2100st) 420(at 2200st) 385(at 2300st) 355(at 2400st) 325(at 2500st)	0.3	-	-	-

[ISA/ISPA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISA/ISPA (Slider Type)	WXMX	750	16384	50	Horizontal	2000(at 900 to 1700st) 1930(at 1800st) 1740(at 1900st) 1580(at 2000st) 1440(at 2100st) 1320(at 2200st) 1210(at 2300st) 1115(at 2400st) 1035(at 2500st)	0.3	-	-	-
				25		1250(at 900 to 1500st) 1200(at 1600st) 1075(at 1700st) 965(at 1800st) 870(at 1900st) 790(at 2000st) 720(at 2100st) 660(at 2200st) 605(at 2300st) 555(at 2400st) 515(at 2500st)	0.3	-	-	-

[ISDA/ISPDA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
ISDA(CR)/ ISPDA(CR) (Slider Type) * Cleanroom type included	S	60	16384	16	Horizontal/ Vertical	800(at 100 to 500st) 760(at 600st)	Horizontal:1 Vertical:0.7	-	-	-
				8		400(at 100 to 500st) 380(at 600st)	Horizontal:0.6 Vertical:0.5			
				4		200(at 100 to 500st) 190(at 600st)	Horizontal:0.5 Vertical:0.3			
	M	100	16384	20	Horizontal/ Vertical	1000(at 100 to 600st) 915(at 700st) 735(at 800st) 600(at 900st) 500(at 1000st)	Horizontal:1 Vertical:0.8	-	-	-
				10		500(at 100 to 600st) 455(at 700st) 365(at 800st) 300(at 900st) 250(at 1000st)	Horizontal:0.6 Vertical:0.5	-	-	-
				5		250(at 100 to 600st) 225(at 700st) 180(at 800st) 150(at 900st) 125(at 1000st)	Horizontal:0.5 Vertical:0.3	-	-	-
		200	16384	20	Horizontal/ Vertical	1000(at 100 to 600st) 915(at 700st) 735(at 800st) 600(at 900st) 500(at 1000st)	Horizontal:1 Vertical:0.8	-	-	-
				10		500(at 100 to 600st) 455(at 700st) 365(at 800st) 300(at 900st) 250(at 1000st)	Horizontal:0.6 Vertical:0.5	-	-	-
	MX	200	16384	20	Horizontal	1000(at 800 to 1300st) 950(at 1400st) 800(at 1500st) 700(at 1600st)	0.3	-	-	-
	L	200	16384	20	Horizontal/ Vertical	1000(at 100 to 700st) 930(at 800st) 765(at 900st) 640(at 1000st) 545(at 1100st) 465(at 1200st)	Horizontal:1 Vertical:0.8	-	-	-
				10		500(at 100 to 700st) 465(at 800st) 380(at 900st) 320(at 1000st) 270(at 1100st) 230(at 1200st)	Horizontal:0.6 Vertical:0.5	-	-	-
		400	16384	20	Horizontal/ Vertical	1000(at 100 to 700st) 930(at 800st) 765(at 900st) 640(at 1000st) 545(at 1100st) 465(at 1200st)	Horizontal:1 Vertical:0.8	-	-	-
	LX	200 400	16384	20	Horizontal	1000(at 1000 to 1400st) 950(at 1500st) 830(at 1600st)	0.3	-	-	-

[ISDA/ISPDA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] ISDACR/ ISPDACR (Slider Type)	W	600	16384	40	Horizontal/ Vertical	2000(at 100 to 700st) 1965(at 800st) 1605(at 900st) 1335(at 1000st) 1130(at 1100st) 970(at 1200st) 840(at 1300st)	1	-	-	-
				20		1000(at 100 to 700st) 980(at 800st) 800(at 900st) 665(at 1000st) 565(at 1100st) 485(at 1200st) 420(at 1300st)	Horizontal:1 Vertical:0.8	-	-	-
				10		500(at 100 to 700st) 490(at 800st) 400(at 900st) 330(at 1000st) 280(at 1100st) 240(at 1200st) 210(at 1300st)	Horizontal:0.6 Vertical:0.5	-	-	-
		750	16384	50	Horizontal/ Vertical	2000(at 100 to 1000st) 1780(at 1100st) 1525(at 1200st) 1320(at 1300st)	1	-	-	-
				25		1250(at 100 to 900st) 1050(at 1000st) 890(at 1100st) 760(at 1200st) 660(at 1300st)	Horizontal:1 Vertical:0.8	-	-	-
	WX	600	16384	40	Horizontal	2000(at 900 to 1300st) 1965(at 1400st) 1725(at 1500st) 1530(at 1600st) 1365(at 1700st) 1225(at 1800st) 1110(at 1900st) 1005(at 2000st) 915(at 2100st) 840(at 2200st) 770(at 2300st) 710(at 2400st) 655(at 2500st)	0.3	-	-	-
				20		1000(at 900 to 1300st) 980(at 1400st) 860(at 1500st) 765(at 1600st) 680(at 1700st) 610(at 1800st) 555(at 1900st) 500(at 2000st) 455(at 2100st) 420(at 2200st) 385(at 2300st) 355(at 2400st) 325(at 2500st)	0.3	-	-	-

[ISDA/ISPDA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] ISDACR/ ISPDACR (Slider Type)	WX	750	16384	50	Horizontal	2000(at 900 to 1700st) 1930(at 1800st) 1740(at 1900st) 1580(at 2000st) 1440(at 2100st) 1320(at 2200st) 1210(at 2300st) 1115(at 2400st) 1035(at 2500st)	0.3	-	-	-
				25		1250(at 900 to 1500st) 1200(at 1600st) 1075(at 1700st) 965(at 1800st) 870(at 1900st) 790(at 2000st) 720(at 2100st) 660(at 2200st) 605(at 2300st) 555(at 2400st) 515(at 2500st)	0.3	-	-	-

[ISWA/ISPWA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Dust and Drip Proof Type] ISWA/ ISPWA (Slider Type)	S	60	16384	16	Horizontal	800(at 100 to 500st) 760(at 600st)	0.3	-	-	-
				8		400(at 100 to 500st) 380(at 600st)	0.3			
				4		200(at 100 to 500st) 190(at 600st)	0.15			
	M	100	16384	10	Horizontal	500(at 100 to 600st) 455(at 700st) 365(at 800st) 300(at 900st) 250(at 1000st)	0.3	-	-	-
				5		250(at 100 to 600st) 225(at 700st) 180(at 800st) 150(at 900st) 125(at 1000st)	0.15	-	-	-
		200	16384	20	Horizontal	1000(at 100 to 600st) 915(at 700st) 735(at 800st) 600(at 900st) 500(at 1000st)	0.3	-	-	-
				10		500(at 100 to 600st) 455(at 700st) 365(at 800st) 300(at 900st) 250(at 1000st)	0.3	-	-	-
	L	200	16384	20	Horizontal	1000(at 100 to 700st) 930(at 800st) 765(at 900st) 640(at 1000st) 545(at 1100st) 465(at 1200st)	0.3	-	-	-
				10		500(at 100 to 700st) 465(at 800st) 380(at 900st) 320(at 1000st) 270(at 1100st) 230(at 1200st)	0.3	-	-	-
		400	16384	20	Horizontal	1000(at 100 to 700st) 930(at 800st) 765(at 900st) 640(at 1000st) 545(at 1100st) 465(at 1200st)	0.3	-	-	-

[SSPA/FS/RS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
SSPA (Slider Type)	SXM	200	16384	30	Horizontal/ Vertical	1800(at 100 to 600st) 1680(at 650st) 1480(at 700st) 1320(at 750st) 1180(at 800st) 1060(at 850st) 960(at 900st) 870(at 950st) 790(at 1000st) 730(at 1050st) 670(at 1100st)	1.2	-	-	-
				20		1200(at 100 to 600st) 1120(at 650st) 990(at 700st) 880(at 750st) 780(at 800st) 710(at 850st) 640(at 900st) 580(at 950st) 530(at 1000st) 480(at 1050st) 440(at 1100st)	1	-	-	-
				10		600(at 100 to 600st) 560(at 650st) 490(at 700st) 440(at 750st) 390(at 800st) 350(at 850st) 320(at 900st) 290(at 950st) 260(at 1000st) 240(at 1050st) 220(at 1100st)	Horizontal:0.7 Vertical:0.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[SSPA/FS/RS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
SSPA (Slider Type)	MXM	400	16384	40	Horizontal/ Vertical	2400(at 100 to 700st) 2150(at 750st) 1930(at 800st) 1740(at 850st) 1580(at 900st) 1440(at 950st) 1320(at 1000st) 1210(at 1050st) 1120(at 1100st) 1030(at 1150st) 960(at 1200st) 890(at 1250st) 830(at 1300st)	1.2	-	-	-
				20		1200(at 100 to 700st) 1070(at 750st) 960(at 800st) 870(at 850st) 790(at 900st) 720(at 950st) 660(at 1000st) 600(at 1050st) 560(at 1100st) 510(at 1150st) 480(at 1200st) 440(at 1250st) 410(at 1300st)	1	-	-	-
				10		600(at 100 to 700st) 530(at 750st) 480(at 800st) 430(at 850st) 390(at 900st) 360(at 950st) 330(at 1000st) 300(at 1050st) 280(at 1100st) 250(at 1150st) 240(at 1200st) 220(at 1250st) 200(at 1300st)	Horizontal:0.7 Vertical:0.6	-	-	-
	LXM	750	16384	50	Horizontal/ Vertical	2500(at 100 to 900st) 2320(at 1000st) 1950(at 1100st) 1660(at 1200st) 1440(at 1300st) 1250(at 1400st) 1100(at 1500st)	1.2	-	-	-
				25		1250(at 100 to 900st) 1160(at 1000st) 970(at 1100st) 830(at 1200st) 720(at 1300st) 620(at 1400st) 550(at 1500st)	1.2	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[SSPA/FS/RS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] SSPDACR	S	200	16384	30	Horizontal/ Vertical	1600(at 100 to 600st) 1450(at 650st) 1290(at 700st) 1160(at 750st) 1040(at 800st) 940(at 850st) 860(at 900st) 780(at 950st) 720(at 1000st) 660(at 1050st) 610(at 1100st)	1.2	-	-	-
				20		1100(at 100 to 550st) 1090(at 600st) 970(at 650st) 860(at 700st) 770(at 750st) 690(at 800st) 630(at 850st) 570(at 900st) 520(at 950st) 480(at 1000st) 440(at 1050st) 400(at 1100st)	1	-	-	-
				10		600(at 100 to 550st) 540(at 600st) 480(at 650st) 430(at 700st) 380(at 750st) 340(at 800st) 310(at 850st) 280(at 900st) 260(at 950st) 240(at 1000st) 220(at 1050st) 200(at 1100st)	Horizontal:0.7 Vertical:0.6	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[SSPA/FS/RS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
[Cleanroom Type] SSPDACR	M	400	16384	40	Horizontal/ Vertical	1600(at 100 to 800st) 1540(at 850st) 1410(at 900st) 1290(at 950st) 1180(at 1000st) 1100(at 1050st) 1010(at 1100st) 940(at 1150st) 880(at 1200st) 820(at 1250st) 760(at 1300st)	1.2	-	-	-
				20		1100(at 100 to 650st) 1040(at 700st) 940(at 750st) 850(at 800st) 770(at 850st) 700(at 900st) 640(at 950st) 590(at 1000st) 550(at 1050st) 500(at 1100st) 470(at 1150st) 440(at 1200st) 410(at 1250st) 380(at 1300st)	1	-	-	-
				10		600(at 100 to 600st) 580(at 650st) 520(at 700st) 470(at 750st) 420(at 800st) 380(at 850st) 350(at 900st) 320(at 950st) 290(at 1000st) 270(at 1050st) 250(at 1100st) 230(at 1150st) 220(at 1200st) 200(at 1250st) 190(at 1300st)	Horizontal:0.7 Vertical:0.6	-	-	-
	L	750	16384	50	Horizontal/ Vertical	1600(at 100 to 1100st) 1550(at 1200st) 1340(at 1300st) 1170(at 1400st) 1040(at 1500st)	1.2	-	-	-
				25		1100(at 100 to 900st) 1060(at 1000st) 900(at 1100st) 770(at 1200st) 670(at 1300st) 580(at 1400st) 520(at 1500st)	1.2	-	-	-

(Note) The model stated in the hatched area is applicable for the offboard tuning function (except for the setting for the high acceleration/deceleration type if any).
For the offboard tuning function, refer to the [Help window of IA-OS].

[SSPA/FS/RS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
IF	SA	60 100	16384	35	Horizontal	1750	0.3	-	-	-
	MA	200 400	16384	35	Horizontal	1750	0.3			
IFA	SA	100	16384	28	Horizontal	2000	2.0	-	-	-
	MA	200 400	16384	42	Horizontal	3000	2.0	-	-	-
FS	NM	60 100	16384	25	Horizontal	1250	0.3	-	-	-
	WM	100 200	16384	25	Horizontal	1250	0.3			
	LM	400	16384	25	Horizontal	1250	1			
	HM	400	16384	40	Horizontal	2000	0.3			
RS	30	30	16384	Gear Ratio 1/50	Horizontal/ Vertical	360	0.2	-	-	-
				Gear Ratio 1/100		180				
	60	60	16384	Gear Ratio 1/50	Horizontal/ Vertical	360	0.2			
				Gear Ratio 1/100		180				

[NS/NSA Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
NS	SXMS SXMM	60	Incremental 2400 Absolute 16384	12	Horizontal	720	0.8	-	-	-
	SZMS SZMM	60	Incremental 2400 Absolute 16384	12	Vertical	600	0.7	-	-	-
	MXMS MXMM	200	16384	30	Horizontal	1800	1	-	-	-
				20		1200	0.8			
	MXMXS	200	16384	30	Horizontal	1800	0.3	-	-	-
				20		1200	0.3			
	MZMS MZMM	200	16384	20	Vertical	1000	0.5	-	-	-
	LXMS LXMM	400	16384	40	Horizontal	2400	1	-	-	-
				20		1300	1			
	LXMXS	400	16384	40	Horizontal	2400	0.3	-	-	-
				20		1300	0.3			
	LZMS LZMM	400	16384	20	Vertical	1000	0.8	-	-	-
NSA	MXMS MXMM	200	131072	30	Horizontal	1800	0.5	-	-	-
				20		1200	0.6			
	LXMS LXMM	400	131072	40	Horizontal	2400	0.8	-	-	-
				20		1300	0.9			
	LXMXS LXMXM	400	131072	40	Horizontal	2400	0.8	-	-	-
				20		1300	0.9			
	WXMS WXMM	750	131072	50	Horizontal	2500	0.9	-	-	-
				25		1300	1	-	-	-
	WXMXS WXMXM	750	131072	50	Horizontal	2500	0.9	-	-	-
				25		1300	1			

[LSA/LSAS Series]

Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
LSA	S6SS S6SM	100	48000	48	Horizontal	2500	3	-	-	-
	S8SS S8SM S8HS S8HM	100	60000	60	Horizontal	2500	3	-	-	-
	S10SS S10SM	200	90000	90	Horizontal	2500	3	-	-	-
	S10HS S10HM	200S	90000	90	Horizontal	2500	3	-	-	-
	H8SS H8SM H8HS H8HM	200	50000	50	Horizontal	2500	3	-	-	-
	N10SS N10SM	100S	50000	50	Horizontal	2500	3	-	-	-
	L15SS L15SM	200	50000	50	Horizontal	2500	3	-	-	-
	N15SS N15SM N15HS N15HM	200S	50000	50	Horizontal	2500	3	-	-	-
	N19SS N19SM	300S	72000	72	Horizontal	2500	3	-	-	-
	W21SS W21SM	400	45000	45	Horizontal	2500	3	-	-	-
LSAS	N10SS N10SM	100S	50000	50	Horizontal	2500	3	-	-	-
	N15SS N15SM N15HS N15HM	200S	50000	50	Horizontal	2500	3	-	-	-

[DD/DDA Series]

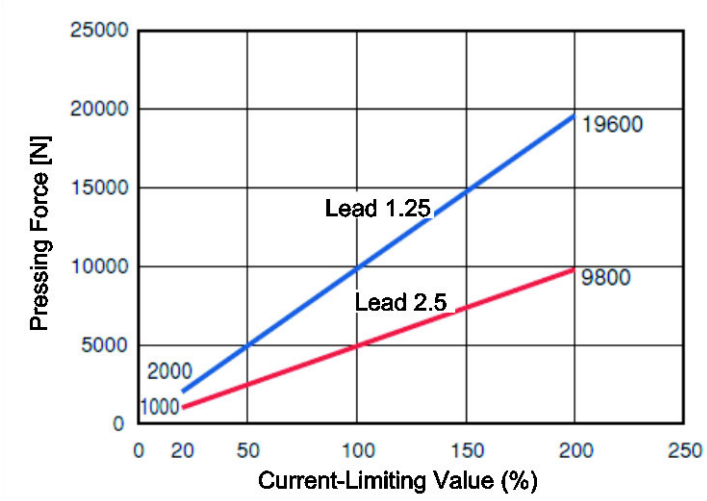
Actuator Series	Type	Motor Output [W]	No. of Encoder Pluses	Lead [mm]	Oriented Direction	Maximum Speed [mm/s]	Maximum Acceleration/ Deceleration Speed [G]	Minimum Pressing Force [N]	Maximum Pressing Force [N]	Rated Pressing Speed [mm/s]
DD(CR) * Cleanroom type included	LT18S LT18CS	200	131072	Gear Ratio 1/1	Horizontal/ Vertical	1800 deg/s	-	-	-	-
	LT18P LT18CP	200	1048576	Gear Ratio 1/1		1800 deg/s	-	-	-	-
	LH18S LH18CS	600	131072	Gear Ratio 1/1		1440 deg/s	-	-	-	-
	LH18P LH18CP	600	1048576	Gear Ratio 1/1		1440 deg/s	-	-	-	-
DDA(CR) * Cleanroom type included	LT18CS	200	131072	Gear Ratio 1/1	Horizontal/ Vertical	1800 deg/s	9.99	-	-	-
	LT18CP		1048576							
	LH18CS	600	131072			1440 deg/s	9.99	-	-	-
	LH18CP		1048576							
[Dust and Drip Proof Type] DDW	LH18CS	600	131072	Gear Ratio 1/1	Horizontal/ Vertical	1440 deg/s	9.99	-	-	-
	LH18CP		1048576					-	-	-

10.3.2 Push Force and Current Limit Value

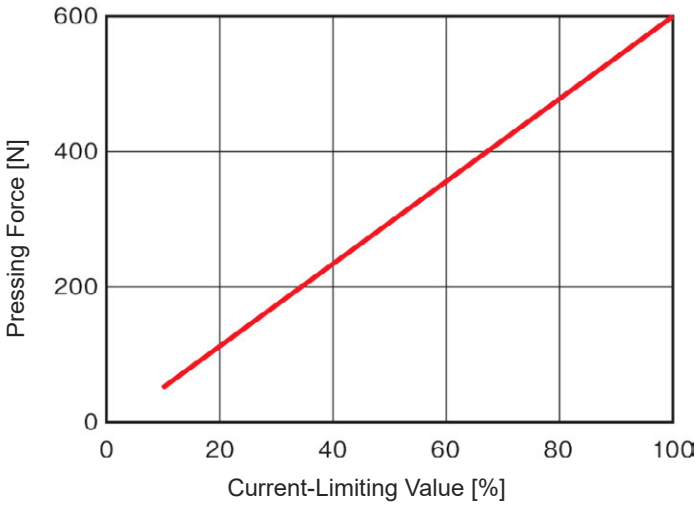
Caution

- The correlation of the push force and the current limit value is the rated push speed (in the setting at the delivery) and is a reference value.
- Use the actuator with the setting above the minimum push force value. The push force will be unstable if it is below the minimum push force value.
- If the positioning speed setting in the operation condition is made lower than the push speed, the push speed will follow that speed, thus cannot perform the expected push force.

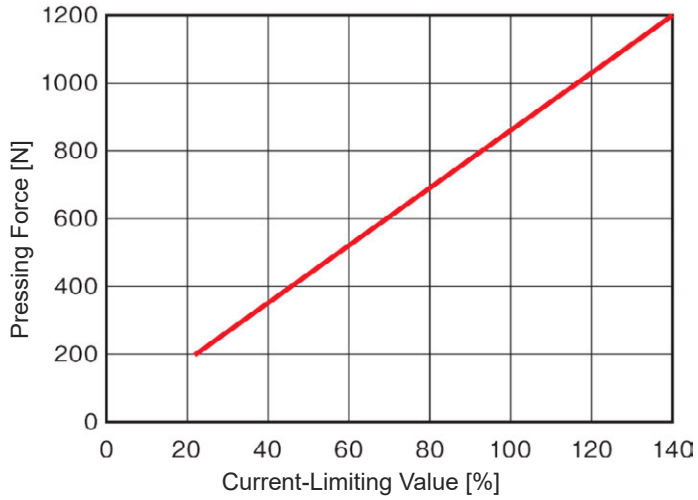
■ Figure of mutual relation between pressing force and current limit value of RCS2-RA13R



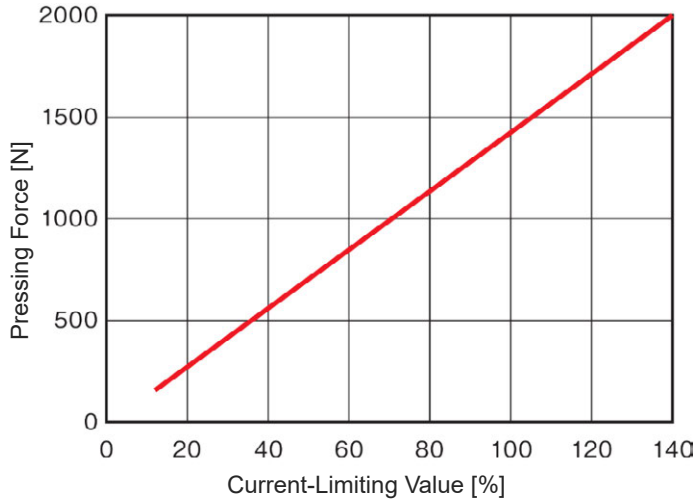
■ Figure of mutual relation between pressing force and current limit value of RCS3-RA6R



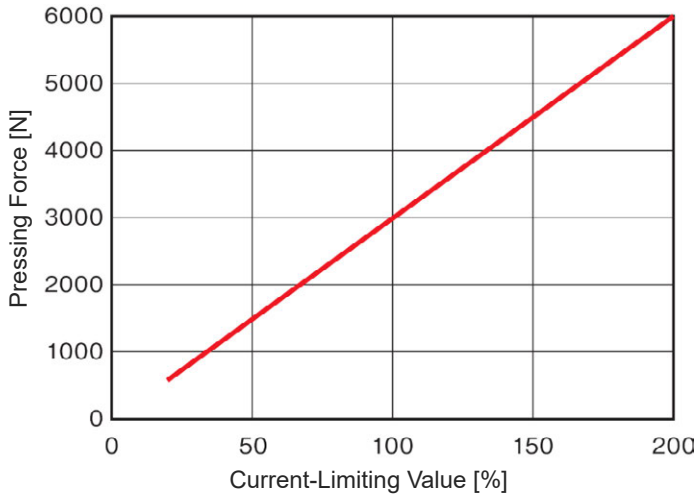
■ Figure of mutual relation between pressing force and current limit value of RCS3-RA7R



■ Figure of mutual relation between pressing force and current limit value of RCS3-RA8R



■ Figure of mutual relation between pressing force and current limit value of RCS3-RA10R



[2] Limitation in Operation

Make sure to check the way to make selection for the operational condition and so on described in RCS2-RA13R and RCS3 Rod Type Instruction Manual, and use the unit in the range of the specifications.

SCON2-CG

Chapter 11

Warranty

11.1 Warranty Period ····· 11-1

11.2 Scope of the Warranty ····· 11-1

11.3 Honoring the Warranty ····· 11-1

11.4 Limited Liability ····· 11-2

11.5 Conformance with Applicable Standards/Regulations, etc., and Application Conditions ····· 11-2

11.6 Other Items Excluded from Warranty ····· 11-2

11.1 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

11.2 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.

11.3 Honoring the Warranty

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

11.4 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.

11.5 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.

11.6 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

Revision History

Revision date	Revised content	
2023.06	First Edition	
2023.07	1B Edition	
	2.3.1	Correction made to corresponding motor capacity
	6.1.1, 6.1.2	Delete description of parameter No. 75
	Other	Correction made, Terms unified, Notation unified
2023.10	1C Edition	
	Intro-14	Content partially deleted in “Regarding Battery-less Absolute Type Actuator” Correction made to contents in accordance with release of Functional Safety Units
	3.3.7	Correction made regarding e-CON Connector (Enclosed)
	4.3	“■ Process to Switch Over to Pulse Train Control Mode” added
	9.1.3	Correction made in circuit diagram
	Other	Notation unified
2024.04	1D Edition	
	Intro-15	Change made to situation of compliance to UL in international standard compliance list
	3.1.3	Correction made in Figures [1] and [3]
	5.3	[Collision Detection Feature] added
	7.4.2	Correction made in Fan Replacement Process
	Other	Correction made
2025.01	1E Edition	
	Prelims-	Correction made to structure, names and control numbers in instruction manuals related to SCON2 ・ EtherCAT ・ MECHATROLINK-Ⅲ
	1.3	16. Brake Release Switch (BK RLS/NOM) explanation added
	2.4.1	Dimensions corrected in appearance drawing
	2.6.3	Caution note related to thermal sensor deleted
	3.3.7	Note added for Pin No. 1 and 2 of multiple function connector
	3.4	Modbus/TCP added
	4.2.3	[3] Servo-on correction made to content described in Timing Chart
	4.3.2	[5] Servo-on Timing Chart swapped (as it was wrongly transferred)
	4.3.5	[3] correction made to subject name (as it was wrongly transferred)

Revision date	Revised content	
	4.4	Modbus/TCP added
	5.3	Correction made and condition cannot be used added to caution related to collision detection feature at beginning part
	6.1.1	No. 84 Fieldbus Operation Mode correction made to input range

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IAI
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