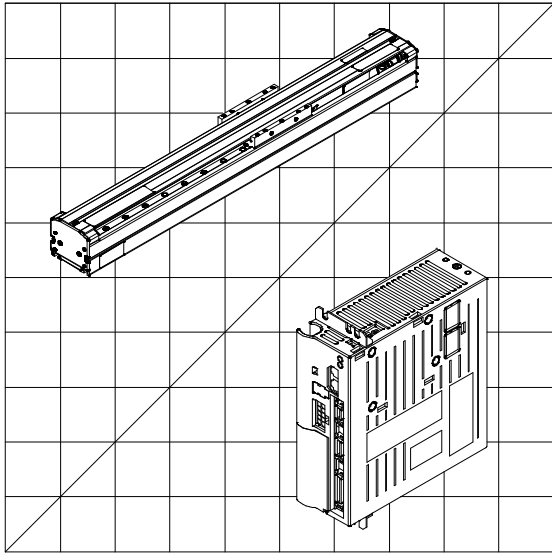


# Shibaura Machine

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## COMPO ARM

**BA-III** SERIES

**BA-II** SERIES

**BA-C** SERIES

## CONTROLLER

MODEL: CA25-M10/M40/M80  
CA25-S10/S40/S80

**Operating Manual (Basic Section)**

**SHIBAURA MACHINE CO., LTD.**

Keep this manual at hand after operators have read it thoroughly.



# Introduction

Thank you for selecting the COMPO ARM series.

To ensure correct usage, read this instruction manual before starting use of the COMPO ARM series.

For information on the actuators in COMPO ARM series, refer to the Actuator Operating Manual supplied with the actuator.

**⚠ CAUTION** Always set a robot type compatible with the axis type.  
A robot type includes the motor capacity information. If a wrong robot type is set, the specified torque cannot be reached or the motor may burn out.

## < PRECAUTION >

1. The contents of this manual are subject to change without prior notice.
2. An effort has been made to ensure the contents of this manual. If you have any questions, or find any mistakes, please contact us.
3. Regardless of item 2 above, we will not be held responsible for any effect caused by using this robot.

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# Chapter 1 Safety


## ■ 1.1 Cautions for safety


- To ensure operation safety of our Arm Robot of Compo Arm, be sure to read the Instruction Manual before starting installation, programming, operation, maintenance and inspection.
- After you have read the Manual, keep it near the machine or other place where you can refer to it whenever required.


**Be sure to observe the instructions for ensuring operation safety of the Arm Robot of Compo Arm.**


In order to protect you, other people and properties against possible injury or damage and to ensure operation safety of the machine, this product (machine) and Instruction Manual contain the following marks which indicate instructions to be observed and important precautions.

Read the main text after fully understanding these descriptions.

 **WARNING** : If you have neglected this instruction and caused a handling error, death or serious injury may occur.

 **CAUTION** : If you have neglected this instruction and caused a handling error, human injury or property damage (damages to houses, household goods and domestic animals) may occur.

 **NOTE** : This gives a brief description of the major points of operation procedures, precautions and method for effective use of the machine.

 : Indicates the description of glossaries and the corresponding pages.

**⚠ WARNING**

- A safety barrier shall be provided to prevent entry into the robot working area.  
When a safety barrier is equipped with a door, an interlock shall be provided so that the robot will be emergency-stopped by opening of the door.
- To provide against emergency, an emergency stop push button switch shall be connected to the emergency stop input terminal of the controller. This switch shall be installed where the operation is easy.  
The emergency stop pushbutton shall be structured in such a way that it is not automatically reset and cannot be reset carelessly.
- Safety and reliability shall be ensured in wiring work in conformity to the Electrical Appliance Technical Standards and Internal Wiring Standards.  
A wiring error may cause electric shock or fire.
- The machine shall never be repaired or modified without permission of the manufacturer.  
This may lead to accident or damage.
- Ground this equipment before use.  
Use of this equipment without grounding may cause electric shock and/or degradation of noise resistance performance.
- Before starting the maintenance or inspection, turn OFF the power supply switch of the controller, and measures shall be taken to ensure that the power will not be turned ON carelessly by a person other than the personnel in charge of the robot adjustment. (Locking shall be provided, or a signboard shall be provided to prevent the power from being turned ON.)  
The controller interior shall not be touched for ten minutes after power has been turned OFF.  
Electric shock may be caused by the residual voltage of the capacitor.
- Do not touch the heat sink inside the controller, cement resistor or motor.  
They have a high temperature, which may cause burns.  
Inspection shall be after the temperature has been sufficiently reduced.
- Do not block the ventilator on this machine.  
A blocked ventilator leads to heat accumulation inside this machine and may cause fire.
- Do not spray water inside or outside the machine. Do not wipe it with wet cloth.  
An electric shock or trouble may occur.  
( If the machine is contaminated, use sufficiently squeezed cloth to remove the contaminant. )  
( Do not use a thinner or benzene. )
- Do not insert or drop metals, flammable objects or foreign substances in the ventilator of the machine.  
Fire or electric shock may occur.




**⚠ CAUTION**

- **Input the correct robot type and initialize the memory correctly.**  
If a wrong robot type is input or the memory is initialized incorrectly, the robot may move in an unexpected direction, resulting in injury. Also the specified torque may not be generated or the motor may burn out.
- **Do not insert your finger in the movable parts or openings.**  
You may be injured.
- **Use a shaft with brake when you want to use the shaft proper except in horizontal installation.**  
When the power is off, the slider may fall down and you may be injured.
- **When using an axis equipped with brake, periodically inspect the brake function.**  
Failure of the brake could cause the slider to drop unexpectedly and lead to injuries.
- **In case of power failure, turn OFF the breaker or activate the emergency stop.**  
Otherwise the robot could start moving suddenly at restoration of the power failure. This could lead to injuries or property damage.
- **The product is heavy. If you want to carry it, check for the weight and position of center gravity, and remove the cable.**  
Further, do not hold the slider when you carry it.  
The slider may be moved and you may be injured.
- **Do not use this machine on your body as a massage machine.**  
You may be injured by a teaching error or operation error.
- **This product is not designed in a sealed structure.**  
Ball screw grease or belt abrasion may fly out of the opening during use.  
If used for food or medicine, measures shall be taken to protect against possible mixture.
- **Do not throw a battery or an electrolytic capacitor into the flames.**  
Explosion may be caused.
- **Install the supplied terminal block cover onto the power terminal block.**  
If the power terminal block is not covered, electric shock may occur when you touch it.
- **Do not use the product in the presence of flammable gas or in an explosive atmosphere.**  
This product is not designed in an explosion proof structure. Explosion may occur.
- **Do not scratch, damage, process, unduly bend or pull the cables (power cable, controller cable, inter-shaft cable, and flexible duct cable). Do not put a heavy object on these cables or allow the cables to be caught by such an object.**  
Fire or electric shock may occur.
- **If an abnormal condition such as smoke or unexpected smell has been found out, turn OFF the power immediately and stop the operation.**  
If you continue to operate, fire or electric shock may occur.
- **If you want to use the motor shuttling shaft in the vertical position, be sure to inspect the belt on a periodic basis. Replace the belt periodically at intervals of 3000 hours of operations.**  
If you use the belt beyond the specified service life of the belt, the belt may break and the slider may fall down unexpectedly. This may injure you.
- **Do not place the product where the ambient temperature exceeds 40°C or there is such a severe change in temperature as to cause dew condensation. Do not place the product where it is exposed to direct sunshine.**  
If it is placed in a very limited space, the ambient temperature will be raised by the heat generated by the controller or external equipment. This may cause damage or operation error.

**⚠ CAUTION**

- Do not use the product where it is exposed to impact or vibration. Do not use it in the atmosphere containing a conductive dust, corrosive gas, oil and other mists. Fire, electric shock, trouble or operation error may occur.
- Do not use it in a dusty place.  
This product is not designed with a dust proof structure. Damage may occur.
- Use only the repair parts specified by the manufacturer.  
Otherwise, sufficient performance may not be achieved. Not only that, damage may occur.
- Use a robot proper installation base with a sufficient rigidity.  
If the installation base has no sufficient rigidity, vibration (resonance) may occur during the robot operation. This may cause adverse effect on work.
- In the case of power failure, this equipment becomes a free running state. When devices or workpieces may be damaged by free running of this machine, use an axis equipped with brake even if the axis is installed horizontally.  
This machine does not have a dynamic brake function.
- Do not connect or disconnect a connector with the controller turned ON.  
Malfunction may be caused.
- Take safety measures against fall and scatter of a workpiece.  
If collision occurs, the axis decelerates suddenly and a workpiece may fall and scatter.
- Perform risk assessment for entire equipment and take required protective measures.
- When discarding this product, dispose correctly as an industrial waste.
- Do not connect or disconnect the motor output connector with the servo locked.  
Connection or disconnection of the motor output connector with the servo locked may cause surge voltage resulting in unstable operation.
- Connect the controller with the power supply which is not over 240V breaking capacity 5KA.
- Never fail to connect the circuit breaker of IEC standard and UL certified product (LISTED mark product) between a power supply and the controller.
- Use the controller in the environment that the pollution level provided by IEC60664-1 is more than 2.  
The protective construction of this controller is IP 10.

For safety precautions of particularly importance, the following warning label is adhered on the equipment.

	<b>注意</b> <b>CAUTION</b>	電源ON中及びOFFして暫くはヒートシンクに触るな！火傷の恐れあり。 Do not touch heatsink when power is ON and for a while after power turned OFF. May cause burn.
	<b>危険</b> <b>WARNING</b>	10分間放電するまで端子や内部に触るな！感電の恐れあり。 Allow 10 minutes discharge time before access to terminals or internal parts. May cause electric shock.
	<b>注意</b> <b>CAUTION</b>	必ずアース線を接続せよ！ Connect the grounding line without fail.
Design notice: Where residual-current-operated protective device (RCD) is used for protection in case of direct or indirect contact, only RCD of Type B is allowed on the supply side of the Electronic Equipment (EE).		

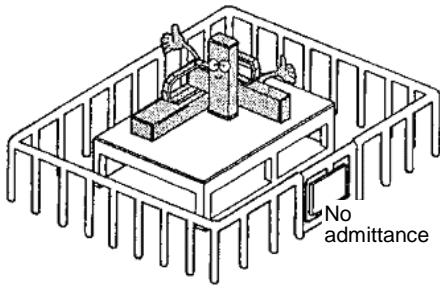
## ■ 1.2 For your safe operation

When you use the COMPO ARM Series, be sure to take the measures in conformity to the following instruction:

This machine is an industrial robot in conformance to the provisions of Paragraph 31 of Article 36 of the Ordinance on Industrial Safety and Hygiene. Necessary cautions are specified in the "Selection", "Installation", "Use", "Periodic Inspection, etc." and "Education" of the "Technical Guideline on Safety Standards for Use of Industrial Robot" conforming to the Article 28 of the Industrial Safety and Health Law. You are requested to read them carefully and to observe the instructions. The following introduces some of them.

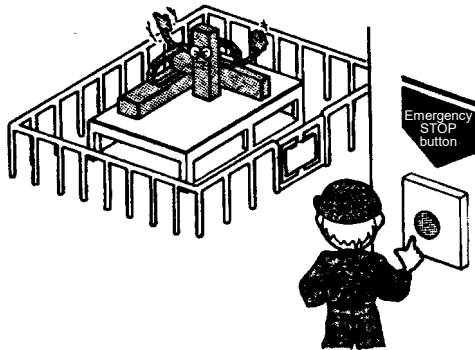
### ■ 1.2.1 Safety measures

- (1) A safety barrier shall be provided to ensure that any person cannot enter the working area of a robot.



1. The barrier shall have sufficient strength to withstand the force generated during the work or environmental conditions. The barrier shall have such a structure that cannot be easily adjusted, removed or cleared.
2. The safety barrier shall be free from any serrated or sharp edge or protrusions.
3. The safety barrier shall be designed in a stationary structure.
4. When a safety barrier is equipped with a door, an interlock shall be provided so that the robot will be stopped by opening of the door.

- (2) An emergency stop device shall be installed where the robot can be easily stopped by the operator immediately in the event of emergency.



1. The emergency stop function shall ensure immediate and reliable stop of a robot when the emergency stop button switch has been operated by an operator.
2. The emergency stop button shall be red.
3. The emergency stop device shall be located so that it can be easily pulled, pressed or touched by the operator, and it can block a beam of light.
4. The emergency stop button shall be structured in such a way that it is not automatically reset after having been operated, and cannot be reset carelessly.

- (3) For safety, never modify the robot main unit or control device.

### ■ 1.2.2 Precautions for installation

Observe the following instructions when installing a robot:

- (1) The robot shall be laid out to ensure the work space required for robot teaching, maintenance and inspection.
- (2) The robot controller, other controllers and stationary operation panel shall be installed outside the movable range and where the operator can watch the robot operations.
- (3) The pressure gauge, hydraulic pressure gauge and other instruments shall be installed in clearly visible positions.
- (4) The electric wiring and hydraulic/pneumatic piping shall be provided with protective covers if they may be damaged.
- (5) To ensure effective operation of the emergency stop device in the event of emergency, emergency stop device switches shall be installed on locations other than the operation panel, as required.



### ■ 1.2.3 Precautions for use

Observe the following instructions when using a robot:

[Work within the movable range]

(1) Work provisions

Determine provisions for the following items and perform the work in conformity to them:

1. Root operation methods and procedures required in the work such as startup method and switch handling method.
2. Speed of robot main unit in teaching.
3. Signaling method for work adjustment among more than one operator.
4. Action to be taken by the operator for each problem.
5. Procedures for confirming the release of the emergency and safety when restarting the robot operation after the robot operation has been stopped due to the operation of the emergency stop device.
6. Measures to protect against the hazard due to unexpected operation of the robot described below (in addition to the above items), or the hazard caused by a robot operation error.
  - Indication on the operation panel.
  - Measures to ensure safety of the operator working within the movable range.
  - Working position and posture.
  - Prevention of operation error due to noise.
  - Signaling method for work adjustment with operators of related devices.
  - Error type and evaluation procedure.
7. The work provisions shall meet the requirements of the robot type, installation site and work.
8. The work provisions shall be prepared by consultation with the related operators, manufacturer's engineers and industrial safety consultant.

(2) Indication on the operation panel

To ensure that the start switch and selector switch will not be carelessly operated by a person other than the personnel in charge of this work, the switch shall be provided with an easy-to-read indication to show that the work is in progress. Alternatively, the operation panel cover shall be provided with locking or other means.

(3) Measures to ensure the operation safety of the personnel working within the movable range

Any one of the following measures or other measures on the equal or higher level shall be taken so that you can stop the robot operation immediately in the event of an error when working within the movable range:

1. An adequately authorized supervisor shall be assigned outside the movable range and where the robot operations can be observed. This supervisor shall be exclusively in charge of the supervision and shall be responsible for the following:
  - The supervisor shall cause the emergency stop device to be operated immediately in the event of an error.
  - The supervisor shall ensure that a person other than the personnel in charge of this work is kept outside the movable range.
2. The emergency stop device switch shall be placed under the control of the person working within the movable range.
3. A portable operation panel having a structure capable of on/off operation of the power source, oil hydraulic or pneumatic source shall be used in the work.

(4) Inspection prior to start of the work such as teaching

Prior to start of the work such as teaching, the following items shall be inspected. If any error is detected, immediately repair the trouble or take other required action.

1. Check if the covering or sheathing of the external power source is damaged or not. (This check must be made after the power has been turned OFF).
2. Check if the operation of the robot proper is faulty.
3. Check for the functions of the braking device and emergency stop device.
4. Check if there is any leakage of air or oil from the piping.

(5) Cleaning of working tools

When such working tools as a painting nozzle are mounted on the robot proper, and these working tools must be cleaned, it is preferred that these tools should be automatically cleaned so that the number of occasions of personnel entering the movable range can be minimized.

- (6) Release of residual pressure  
Before disassembling the pneumatic components or replacing their parts, release the residual pressure in the drive cylinder.
- (7) Operation check  
Perform the verification operation without entering the movable range, wherever possible.
- (8) Illuminance  
The illuminance required for operation safety shall be maintained.

[For automatic operation]

- (1) Action before startup  
Before starting the robot, check for the following items in advance and determine a signaling method for work adjustment among related operators.
  1. Make sure that there is no person within the movable range.
  2. The movable operation panel and tools shall be located at specified positions.
  3. There shall be no error indication for the robot or related devices.
- (2) Action for automatic operation and in the event of an error
  1. Make sure that there is an indication to show that the automatic operation is now in progress, after the robot has been started.
  2. When a problem has occurred to the robot or related device and you have to enter the movable range to take emergency measures, stop the robot operation, for example, by operating the emergency stop device before entering the movable range. At the same time, carry a safety plug with you, and ensure that the start switch is provided with the indication to show that the work is now in progress. Take measures so that any other person than the operator in charge of the emergency measures cannot operate the robot.

[Inspection before operations]

- (1) Make the following inspections before start of operations using the robot.
  1. Inspect the control devices.
  2. Inspect the emergency stop devices.
  3. Inspect the contact prevention device and the interlocks of the robot.
  4. Inspect the interlocks between the robot and auxiliary devices.
  5. Check the external power cable and pipings for damage.
  6. Check the supply voltage, supply oil pressure, and supply air pressure for abnormality.
  7. Test the robot to make sure it moves properly.
  8. Check for abnormal noise or vibration.
  9. Check the contact prevention device for abnormality.
- (2) Do not enter the actuator's operating area to perform inspections if possible.

[Notes for inspection and maintenance work]

- (1) Notes for inspection and maintenance work  
Note the following precautions for inspection and maintenance work.
  1. Inspection and maintenance work of the robot must be performed by an operator who has sufficient knowledge and experience. If there is no such an operator available, consult the manufacturer to ask them to perform that workers or to train operators who are responsible to that work.
  2. Use appropriate lightings.
  3. Put the warning board indicating that inspection or maintenance work is being performed on the start switch on the fixed control panel. Before entering the inside of the fence or the guard, shut off the power supply by locking the opened power supply breaker and carry the plugs for the fence or the guard if equipped.
  4. Before entering the inside of the fence or the guard for inspection or maintenance of the control circuit, shut off the power supply for drive mechanism.
  5. When the robot needs to be moved for inspection or maintenance work performed inside the fence or the guard, the following precautions should be obeyed.
    - Perform work by two persons.  
One person performs work, and the other person performs watching.
    - Determine the appropriate speed according to the details of the work so that the operator can avoid contact with the robot even if the robot moves accidentally.
    - Pay much attention to behavior of the robot during work. If the robot moves accidentally, press the emergency stop button immediately.

6. Before disassembly, part replacement, or other similar work of the air pressure gauge or the like, release the remaining pressure in the cylinder.
7. When performing disassembly, part replacement, or other similar work of the hydraulic or pneumatic system, take care not to allow foreign matters including dust to adhere to or enter into the system.

(2) Procedures after inspection or maintenance

1. The inspection or maintenance operator must return the tools to the original position after completion of the inspection or maintenance work.
2. Perform a test run whenever maintenance work is completed. This must be performed outside the fence or guard as a rule.
3. After the step 2, the inspection or maintenance operator who completed the work must inform the supervisor about the completion.

[Periodic inspection]

Determine the inspection items, the inspection method, the judgment standard, implementation interval, and other inspection details for the following issues in consideration of installation location, frequency of usage, durability of parts of the robot, and other relevant factors.

1. Check for looseness of main components.
2. Check for the lubrication state of movable parts and abnormality related to movable parts.
3. Check for abnormality of the power transmission parts.
4. Check for abnormality of the hydraulic and pneumatic systems.
5. Check for abnormality of the electric system.
6. Check for malfunction of the operating abnormality detecting function.
7. Check for abnormality of the encoder.
8. Check for abnormality of the servo system.

[Controller inspection issues]

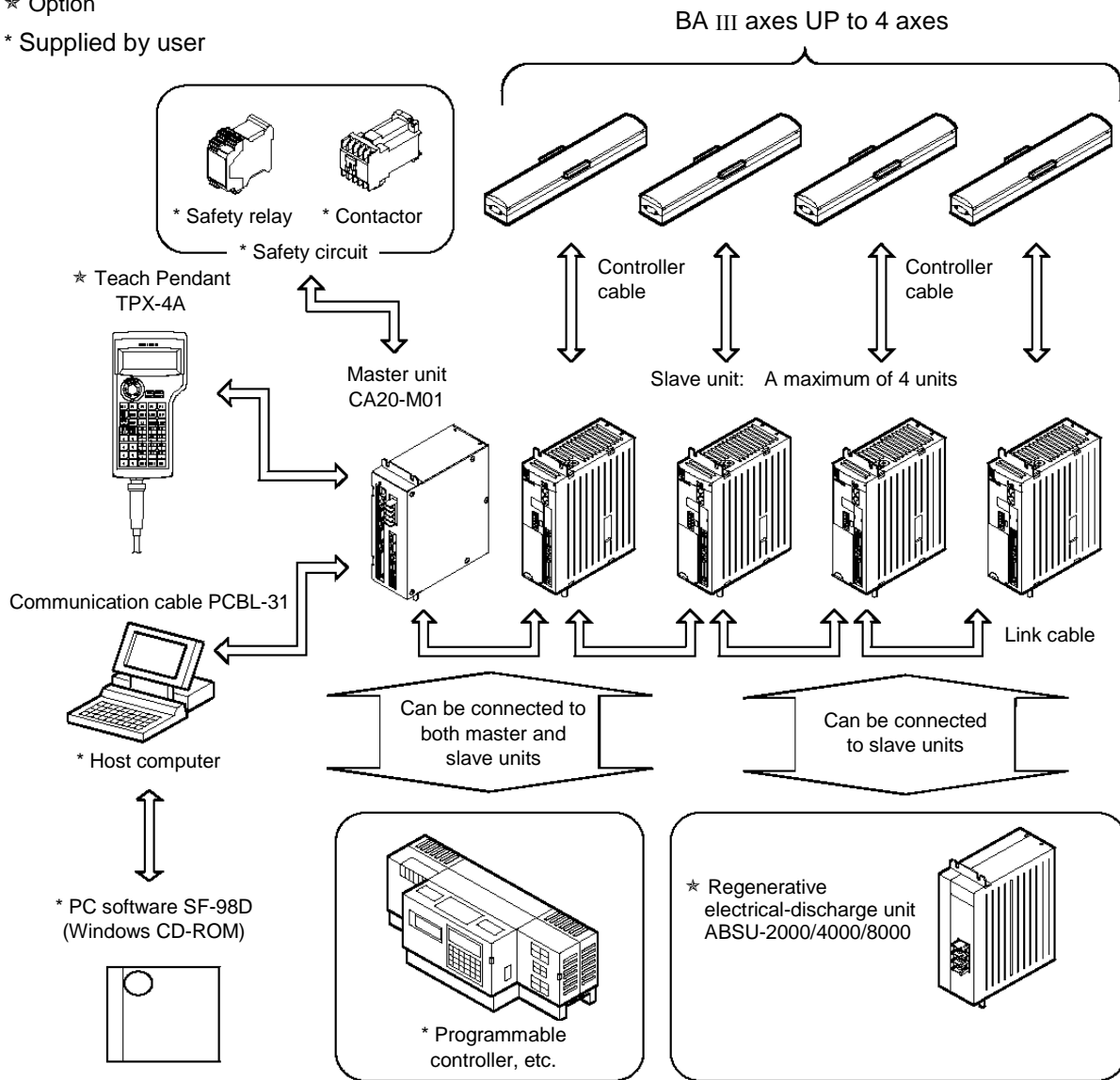
9. Check that the supply voltage to the controller is within the specified range (the rated voltage  $\pm 10\%$ ).
10. Check the ventilating holes for the controller and remove adhering dirt and dust.
11. Check the controller cables between the controller and the axes for looseness of screws.
12. Check for looseness of mounting screws for the controller.
13. Check connectors (motor output connector, encoder input connector, and teach pendant connector) for looseness.

## ■ 1.2.4 Safety category 3 support

CA25-M10 cannot support safety Category 3. CA20-M01 is used as master unit to support safety Category 3 with BA III. The system constitution using CA20-M01 is the chart below.

★ Option

\* Supplied by user



## ■ 1.3 Warranty

### ■ 1.3.1 Warranty period

This product is warranted for one of the following periods whichever comes first.

- (1) For 24 months after shipment from our factory.
- (2) For 18 months after installation at the customer's factory.
- (3) For 4000 hours of operation.

### ■ 1.3.2 Details of warranty

- (1) This product is warranted. The scope of the warrant includes the specifications and functions described in the Specification, catalog and Instruction Manual. We are not responsible for any secondary or incidental damages caused by the trouble of this product.
- (2) We will repair, on a free-of-charge basis, the trouble caused in the handling or use of the product within the warranty period of this product as described in the Instruction Manual attached to this product. Alternatively, such trouble will be repaired after the product has been returned to our factory. If the problem is solved by a dispatch of service personnel to meet the convenience of the customer, we may claim payment from your company regarding the transportation expenses, lodging expenses or other expenditures not directly related to the repair of the product.

### ■ 1.3.3 Exemption from responsibility

The following cases shall be excluded from the scope of warrant.

- (1) The trouble and damage caused by the use of the product according to a method not described in the Instruction Manual, or by a careless error in use.
- (2) Problems caused by chronological changes or wear by use (such as natural fading of paints, deterioration of the consumable parts \*1).
- (3) Problems caused by sensory phenomena (e.g. generated noise without affecting the function).
- (4) Modification or disassembling not authorized by our company.
- (5) Troubles or damages caused by inadequate maintenance and inspection or improper repair.
- (6) Troubles or damages caused by natural disaster, fire and other external factors.
- (7) Internal data such as programs and points created or modified by the customer.
- (8) Problems caused when this product purchased in Japan is brought to an overseas country.

\*1: Consumable parts are defined as the parts maintenance replacement parts (spare parts) described in the Instruction Manual of each product, and the parts (e.g. backup battery) that must be replaced on a periodic basis.

### ■ 1.3.4 Precautions

- (1) When you have used the product beyond the specifications of the product, we cannot warrant the basic performances of the product.
- (2) Should you fail to observe the instructions given in "WARNING" and "CAUTION" described in the Instruction Manual, we are not responsible for any personal injury, damages or trouble that may occur.
- (3) Please note that the "WARNING" and "CAUTION" described in the Instruction Manual, and other descriptions are within the scope assumed by our company.

The numerical values given as technical data are theoretical values as a guideline showing the durability and others. They shall not be construed as indicating warranty. Note that these values are subject to change according to the conditions of use.

## Chapter 2 Devices

### ■ 2.1 Features

This machine is a new concept arm robot controller for which the Built Block System (BBS) idea has been incorporated to the popular "COMPO ARM Series".

[Features of axis unit]

- Combinations with BBS method

A built block method (building block method) combination is possible by selecting unit parts such as the axis unit, angle bracket and cable. A system upgrade is possible by further adding optional parts.

- Importance on basic functions

Importance has been laid on achievements and reliability for the main components that configure the robot axis such as the compact AC servo, highly rigid linear guide and grinding ball screw, etc. Downsizing has been pursued amid accurate movement.

- Cable connection

Inter-axis cables are necessary but often become obstacles.

With the CN box and special shape flexible tube, the wiring and piping can be stored and vertical or horizontal layout is possible.

\* Robot cables with excellent bending resistance are used for cables between axes.

- Corresponding to the needs of the time - Q. C. D.

High quality, low cost and short delivery is realized by the units standardized with the BBS method.

- Absolute encoder compatible

BA III Series mounts the motor with absolute encoder as a standard. The absolute encoder will constantly monitor the motor operation through battery backup even when the power is shut off, so return to origin does not need to be repeated when the system is started.

[Features of controller]

- Hardware high performance servo control engine

Newly developed hardware high performance servo control engine is employed for control of speed and current. 20 times higher speed control frequency and 25 times higher current control frequency is attained in comparison to our conventional machines. Also 10 times higher software positional control frequency is attained.

- Compact appearance

The controller at 55(W) × 160(H) × 150(D) is as small as the compact AC servo driver that fits neatly into a panel.

\* CA25-M40/M80/S40/S80 is at 85(W) × 160(H) × 150(D), and CA01-S05 is at 31(W) × 146(H) × 89(D).

- Corresponding to globalized production bases

Input voltages from 100 to 115 VAC or 200 to 230 VAC can be handled.

\* CA25-M40/M80/S40/S80 handle 200 to 230 VAC. CA01-S05 handle 24 VDC.

Both NPN and PNP input/output signals can be supported.

- Incorporation of COMPO ARM language popular for its simple teaching method

Besides teaching with a personal computer, the COMPO ARM Series Teach Pendant (TPH-4C) can be used to overcome the COMPO ARM language and correspond to multitasking.

- Extension of maximum task control axes number and axis control with multiple tasks

The maximum task control axes number is extended to 4 from the conventional 2. This enables more complex action such as three-dimensional circular move. Axes can be controlled by multiple tasks and this enables flexible system configuration such as 2 axes + 1 axis + 1 axis.

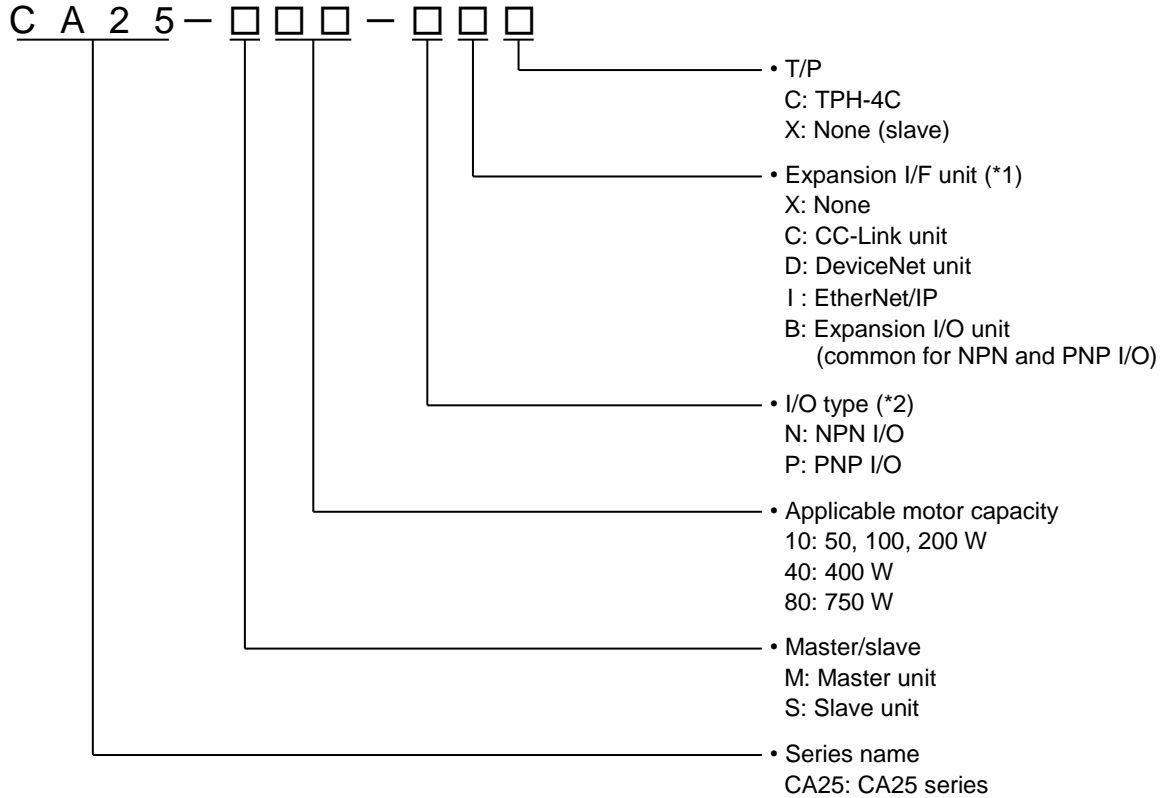
- Connectability to BA-C series and BA II series

The robot can be connected to CA01-S05 of BA-C series or CA20-S10 of BA II series. (Refer to section ■ 2.5.4.) Refer to Chapter 3 for the details of CA01-S05. Refer to the manual of Q3139 or Q3178 for the details of CA20-S10.

## ■ 2.2 Controller type

A controller type is specified as the following.

For descriptions in this instruction manual, however, the I/O type and the subsequent items are omitted. In addition, when the individual description does not depend on the corresponding motor capacity, not all items such as CA25-M10/S10, CA25-M40/S40, or CA25-M80/S80 are shown, but CA25-M10/S10 represents.

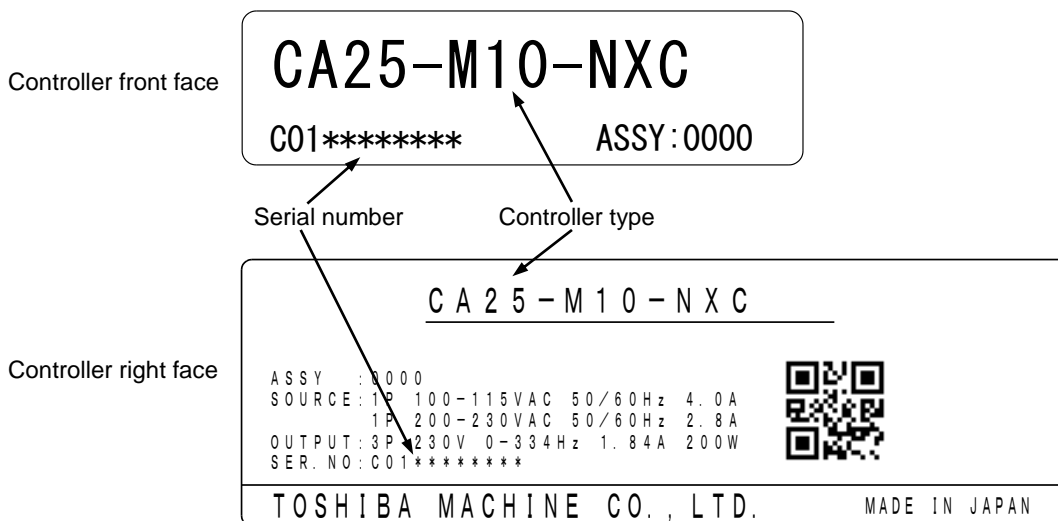


\*1: Equipped at factory shipment. The expansion I/F unit cannot be added or replaced with the other unit by a user.  
A slave unit cannot be equipped with the expansion I/F unit.

\*2: Equipped at factory shipment. The I/O type cannot be changed by a user.

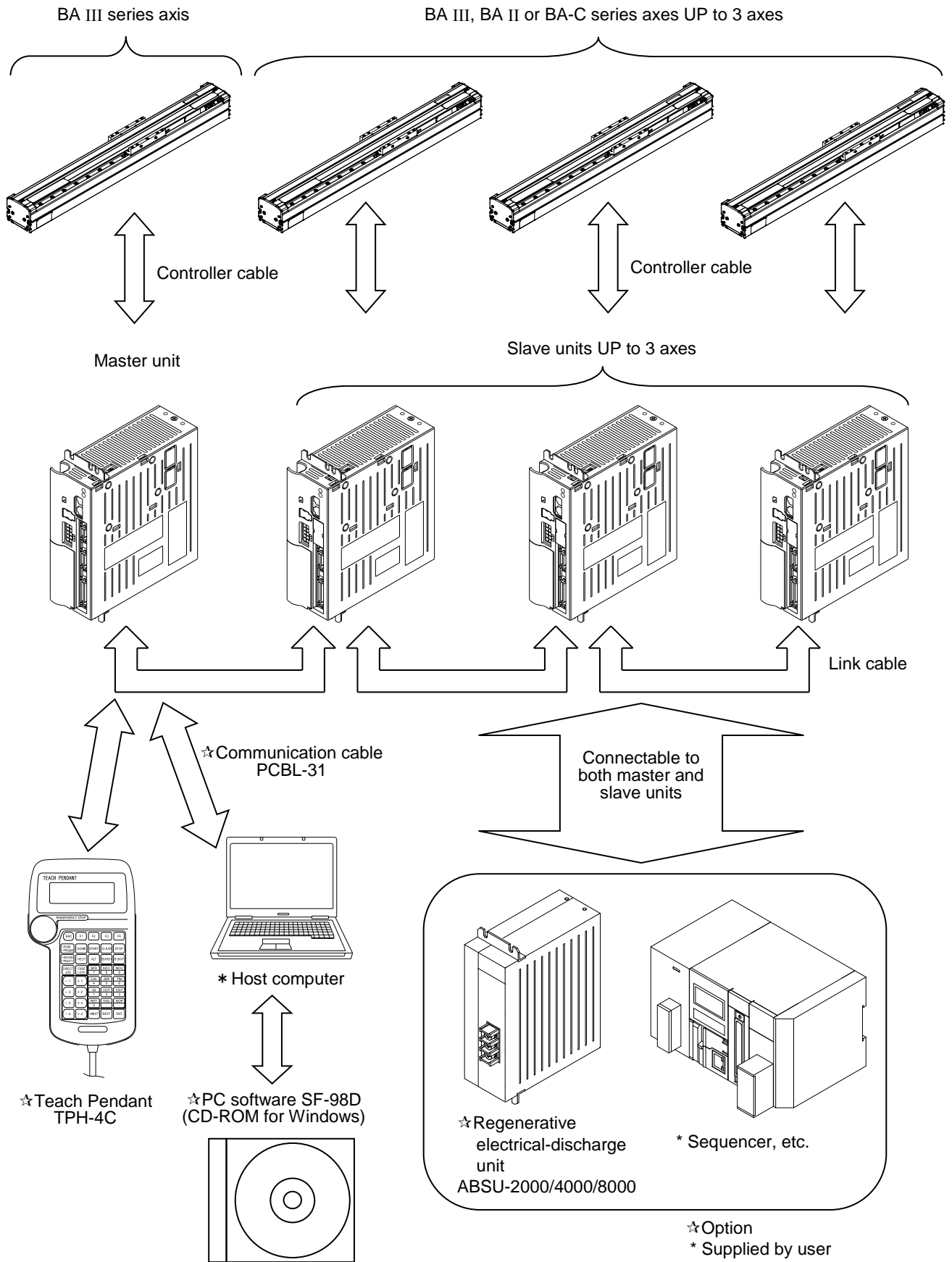


The controller type and serial number can be found on the name plate stuck on the controller.



## ■ 2.3 System components and specifications

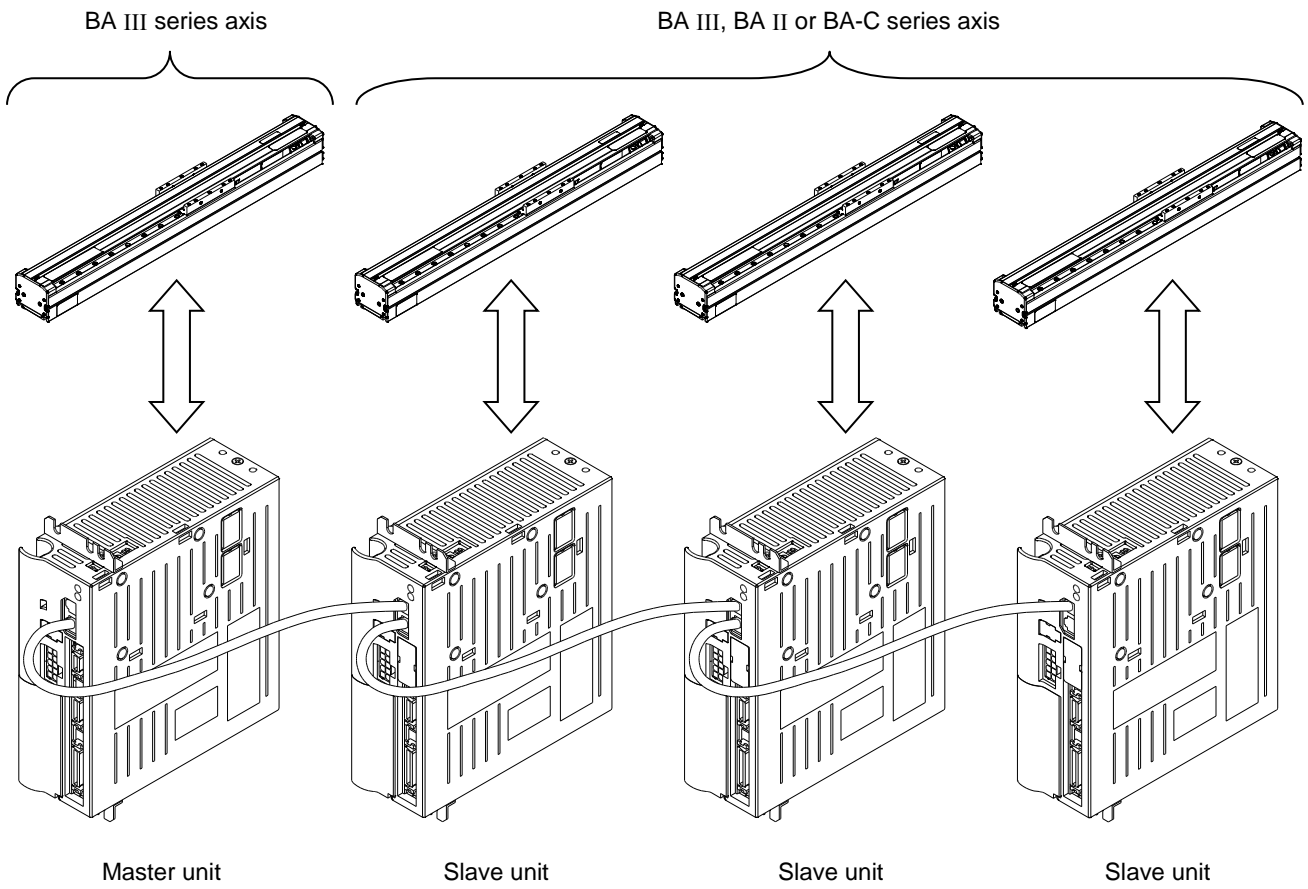
### ■ 2.3.1 System components





## ■ 2.3.2 Controller specifications

The COMPO ARM series CA25-M10 can control one axis, but when a slave unit is connected with a link cable, up to four axes can be controlled. Refer to section ■ 2.3.2-(2) for the slave unit specifications.



Power supply voltage  
CA25-M10/S10 : 100 to 115 VAC  
or 200 to 230 VAC

CA25-M40/S40 : 200 to 230 VAC  
CA25-M80/S80 : 200 to 230 VAC

Outline drawing

## (1) Master unit specifications

Controller type	CA25-M10		CA25-M40 (*1)	CA25-M80 (*2)	
Applicable robot	COMPO ARM BA III series				
Supportable slave unit	CA25-S10, CA20-S10, CA01-S05				
Number of controllable axes	One axis, or two to four axis control with slave unit connection				
Motor capacity (*3)	50 W	100 W	200 W	400 W	750 W
Drive method	AC servomotor				
Control method	PTP, Semi-closed loop control				
Teaching method	Remote teaching, Direct teaching or MDI				
Speed setting	20 steps (variable)				
Acceleration setting	20 steps (variable)				
Operation mode	Sequential, Palletizing, External point designation				
Operation method	Step, Continuous, Single robot movement				
CPU type	32-bit RISC-CPU				
Origin sensor input	Equipped				
Regeneration function	Equipped (ABSU-2000)		Equipped (ABSU-4000)	Equipped (ABSU-8000)	
Dynamic brake function	Unequipped				
Self-diagnostic function	CPU error by WDT, Memory error, Driver error, Power voltage error, Program error, etc.				
Number of program steps	Max. 5000 steps (*5) + 999 coordinate table (total of all tasks)				
Memory method	FRAM				
Number of counters	99				
Number of timers	9				
Error signal	Error display lamp lights (front panel), Teach Pendant				
External input/output	System input	24 V 7 mA 4 points			
	General purpose input	24 V 7 mA 4 points (*4)			
	System output	24 V max. 100 mA 4 points			
	General purpose output	24 V max. 100 mA 4 points (*4)			
Communication function	1 Channel (RS-232C) for Teach Pendant or Personal Computer				
Power supply	100 VAC to 115 VAC, 200 VAC to 230 VAC, ±10% 50/60 HZ (Selection between the 100 V and the 200 V levels is switched by the shorting bar for VOLTAGE SELECT terminal on the terminal block)			200 VAC to 230 VAC ±10% 50/60 HZ	
Power capacity (per axis)	140 VA	210 VA	600 VA	1.2 kVA	1.6 kVA
Operation conditions	Working ambient temperature	0 to 40°C			
	Working ambient humidity	30% to 90%RH (With no dew condensation)			
	Storage ambient temperature	-20 to 70°C			
	Storage ambient humidity	30% to 90%RH (With no dew condensation)			
	Environment	Indoor (not exposed to direct sunlight) 1000 m or less above sea-level No dust, corrosive gas, or flammable gas exists. The environment that the pollution level provided by IEC60664-1 is more than 2.			
	Vibration	9.8 m/s <sup>2</sup> or less			
Dimensions	55 (W) × 160 (H) × 150 (D) (Excluding installation fittings)			85 (W) × 160 (H) × 150 (D) (Excluding installation fittings)	
Mass	0.92 kg			1.58 kg	

**NOTE**

\*1: To use CA25-M40, be sure to use regenerative electrical-discharge unit ABSU-4000.

\*2: To use CA25-M80, be sure to use regenerative electrical-discharge unit ABSU-8000.

\*3: The applicable motor capacity can be found on the controller type on the front face of the controller. (Refer to section ■ 2.2.)

Connection with the motor with different capacity causes the motor to burn out. Do not connect the motor with different capacity.

\*4: General purpose I/O can be used for I/O signals of systems depending on the mode setting.

\*5: Supported only by CA25-M10 version 4.30 or later, and SF-98D version 3.1.7 or later. For other than the above, Max. 2500 steps.

## (2) Slave unit specifications

Controller type	CA25-S10			CA25-S40 (*1)	CA25-S80 (*2)
Applicable robot	COMPO ARM BA III series				
Number of controllable axes	One axis (with connection to master unit)				
Motor capacity (*3)	50 W	100 W	200 W	400 W	750 W
Drive method	AC servomotor				
Origin sensor input	Equipped				
Regeneration function	Equipped (ABSU-2000)			Equipped (ABSU-4000)	Equipped (ABSU-8000)
Dynamic brake function	Unequipped				
Self-diagnostic function	Driver error, Power voltage error, etc.				
Error signal	Error display lamp lights (front panel), Teach Pendant (Connect to master unit)				
External input/output	General purpose input	24 V 7 mA 8 points			
	General purpose output	24 V 100 mA 8 points			
Power supply	100 VAC to 115 VAC, 200 VAC to 230 VAC, ±10% 50/60 HZ (Selection between the 100 V and the 200 V levels is switched by the shorting bar for VOLTAGE SELECT terminal on the terminal block)			200 VAC to 230 VAC ±10% 50/60 HZ	
Power capacity (per axis)	140 VA	210 VA	600 VA	1.2 kVA	1.6 kVA
Operation conditions	Working ambient temperature	0 to 40°C			
	Working ambient humidity	30% to 90%RH (With no dew condensation)			
	Storage ambient temperature	-20 to 70°C			
	Storage ambient humidity	30% to 90%RH (With no dew condensation)			
	Environment	Indoor (not exposed to direct sunlight) 1000 m or less above sea-level No dust, corrosive gas, or flammable gas exists. The environment that the pollution level provided by IEC60664-1 is more than 2.			
	Vibration	9.8 m/s <sup>2</sup> or less			
Dimensions	55 (W) × 160 (H) × 150 (D) (Excluding installation fittings)			85 (W) × 160 (H) × 150 (D) (Excluding installation fittings)	
Mass	0.92 kg			1.58 kg	

### NOTE

\*1: To use CA25-S40, be sure to use regenerative electrical-discharge unit ABSU-4000.

\*2: To use CA25-S80, be sure to use regenerative electrical-discharge unit ABSU-8000.

\*3: The applicable motor capacity can be found on the controller type on the front face of the controller. (Refer to section ■ 2.2.)

Connection with the motor with different capacity causes the motor to burn out. Do not connect the motor with different capacity.

## (3) Various units and options

The following units and options are available for the COMPO ARM.

Part name	Type	Application
Teach Pendant (*1)	TPH-4C	For programming
CC-Link unit (*2)	Refer to section ■ 2.2.	For CC-Link communication (Refer to Chapter 11.)
DeviceNet unit (*2)	Refer to section ■ 2.2.	For DeviceNet communication (Refer to Chapter 12.)
EtherNet/IP (*2)	Refer to section ■ 2.2.	For EtherNet/IP communication (Refer to Chapter 19)
Expansion input/output unit (*2)	Refer to section ■ 2.2.	Expanded input: 24 points, output: 8 points (Refer to section ■ 10.1.2.)
Input/output cable	CA10-IC-A□□	For master unit, slave unit and expansion input/output unit
Link cable	CA10-LC-A□□	Between master unit and each slave
Personal computer software (*3)	SF-98D (CD-ROM)	Program creation and data maintenance (for Windows)
Communication cable	PCBL-31	Connection cable RS-232C between personal computer and controller
Regenerative electrical-discharge unit	ABSU-2000	Electrical-discharge unit for regenerative voltage suppression (for 50 to 200 W)
	ABSU-4000	Electrical-discharge unit for regenerative voltage suppression (for 400 W)
	ABSU-8000	Electrical-discharge unit for regenerative voltage suppression (for 750 W)

### NOTE

\*1: The version 2.28 or later is applicable to CA25 series.

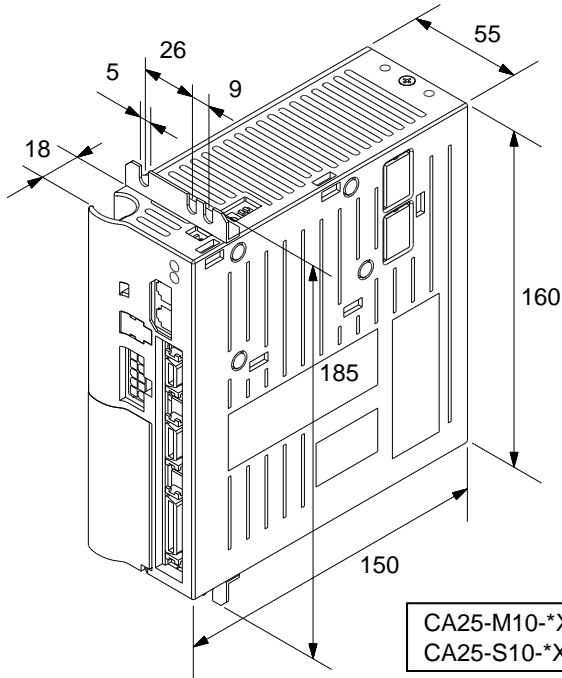
\*2: Equipped at factory shipment. The unit cannot be added or replaced with the other unit by a user.

\*3: The version 3.1.2 or later is applicable to CA25 series.

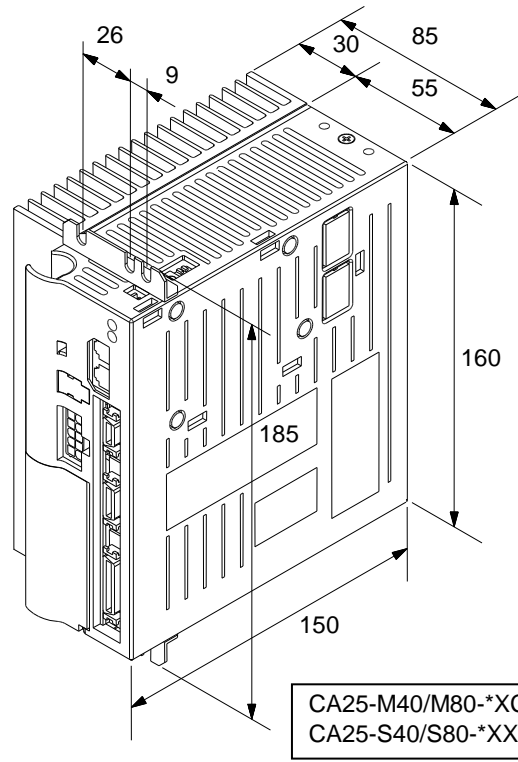
■ 2.4 Explanation of each part

■ 2.4.1 Explanation of controller

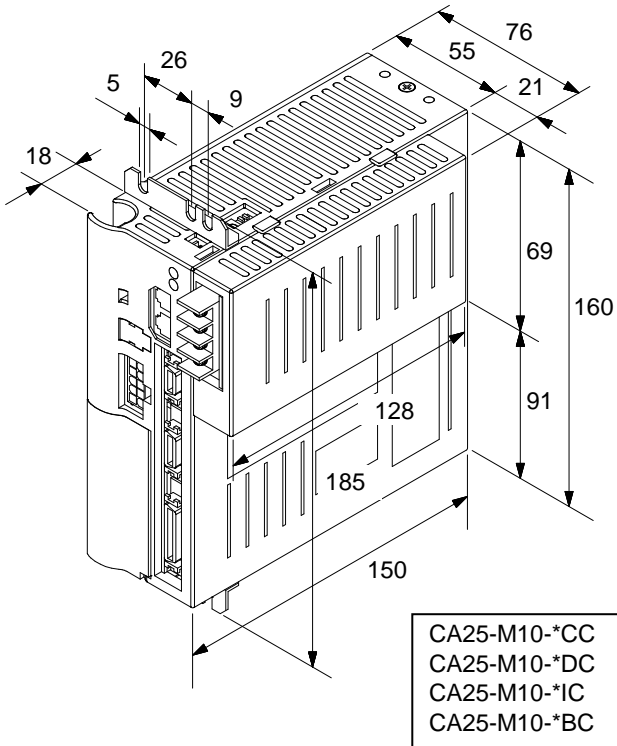
(1) External dimensions



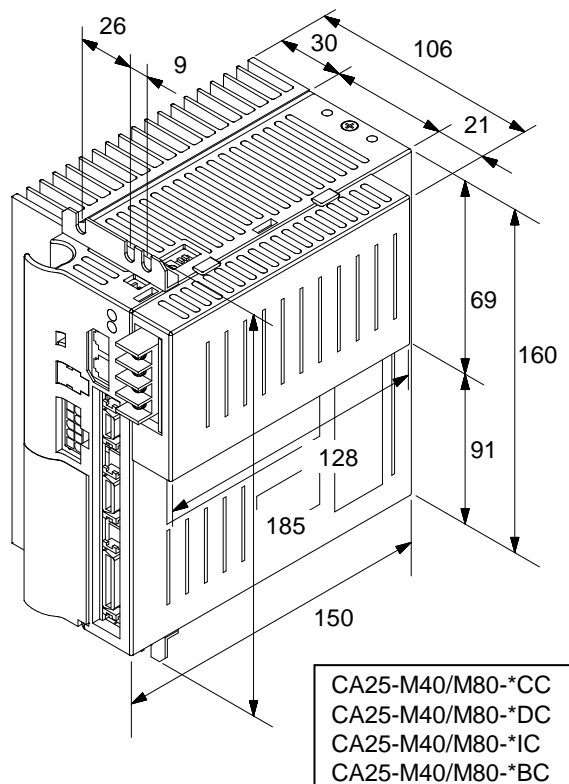
CA25-M10-\*XC  
CA25-S10-\*XX



CA25-M40/M80-\*XC  
CA25-S40/S80-\*XX

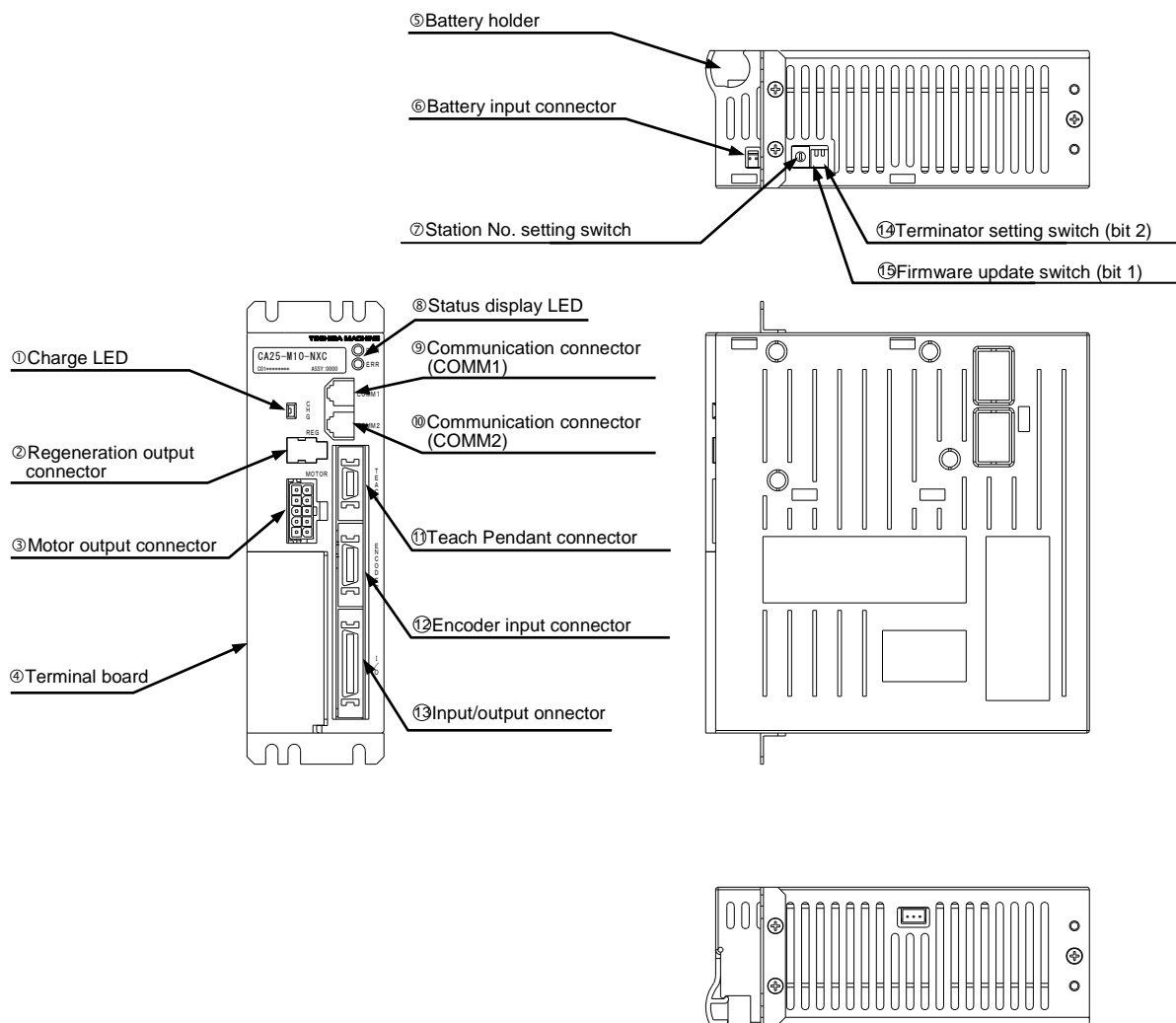


CA25-M10-\*CC  
CA25-M10-\*DC  
CA25-M10-\*IC  
CA25-M10-\*BC



CA25-M40/M80-\*CC  
CA25-M40/M80-\*DC  
CA25-M40/M80-\*IC  
CA25-M40/M80-\*BC

(2) Names and functions of each part



**NOTE** The figure above represents CA25-M10. CA25-S10 is not equipped with ⑪ teach pendant connector, and the blank plate is attached instead.

- ① Charge LED  
This LED displays remaining voltage of the main circuit smoothing capacitor.

**CAUTION** Even after turning OFF the power, do not touch the inside of the controller if the charge LED is lit. Otherwise electric shock caused by remaining voltage in the capacitor may occur.

- ② Regeneration output connector  
This connector is used to connect an optional regenerative discharge unit. The connector is covered by the blank plate. Remove the blank plate when using the connector.
- ③ Motor output connector  
This connector is used to connect the motor cable. (Refer to section ■ 2.5.4.)

**CAUTION** Do not connect or disconnect the motor output connector during servo-lock condition. Connection or disconnection of the motor output connector during servo-lock condition may cause surge voltage and unstable operation.

④ Terminal board

The power input terminal, power voltage changeover terminal, FG (Frame Ground) and LG (Line Ground) terminals are provided on this board. (Refer to section ■ 2.5.2.)

**⚠ CAUTION** Incorrect wiring of the power supply, incorrect connections (mismatch of supplied power voltage and power voltage and power voltage changeover terminal, disconnection of LG and FG, and other disconnections), and incorrect connections of input/output connectors could cause controller faults, malfunctioning, or malfunctioning of the entire system.

⑤ Battery holder

This battery holder stores a lithium battery for backup of the encoder. (Refer to section ■ 2.4.2.)

⑥ Battery input connector

This connector is used to connect the battery harness. (Refer to section ■ 2.4.2.)

⑦ Station No. setting switch

This switch is used to set the station No. of each slave unit when a slave unit is connected and multiple axes are controlled. The master unit is set to 0. (Refer to section ■ 2.5.4-(2).)

⑧ Status LED

This LED displays the status of the controller. The green LED lights when the power is ON, the red LED lights when errors have occurred, and the LED blinks when the other event occurs (Refer to section ■ 18.4).

⑨ Communication connector (COMM1)

This connector is used to connect a link cable from a upper controller. (Refer to section ■ 2.5.4-(1).)

⑩ Communication connector (COMM2)

This connector is used to connect a link cable to a lower controller. (Refer to section ■ 2.5.4-(1).)

⑪ Teach pendant connector (master unit only)

This connector is used to connect a teach pendant or a communication cable to a computer. For a slave unit, the blank plate is equipped instead.

⑫ Encoder input connector

This connector is used to connect an encoder cable. (Refer to section ■ 2.5.4.)

⑬ Input/output connector

An external control unit (sequencer (programmable controller), etc.) is connected to this connector. (Refer to Chapter 10.)

**⚠ CAUTION** Connect or disconnect the motor output connector, the encoder input connector, or the input/output connector only when the controller is turned OFF. Never connect or disconnect the connector when the controller is ON, or failure of the controller may be caused.

⑭ Terminator setting switch (bit 2)

This switch is used to set a terminator for communication when a slave unit is connected. (Refer to section ■ 2.5.4-(4).)

⑮ Firmware update switch (bit 1)

This switch is used to update the controller firmware. Normally this switch should be turned OFF. If this switch is turned ON, the controller cannot start properly (Refer to section ■ 18.4-(4)).

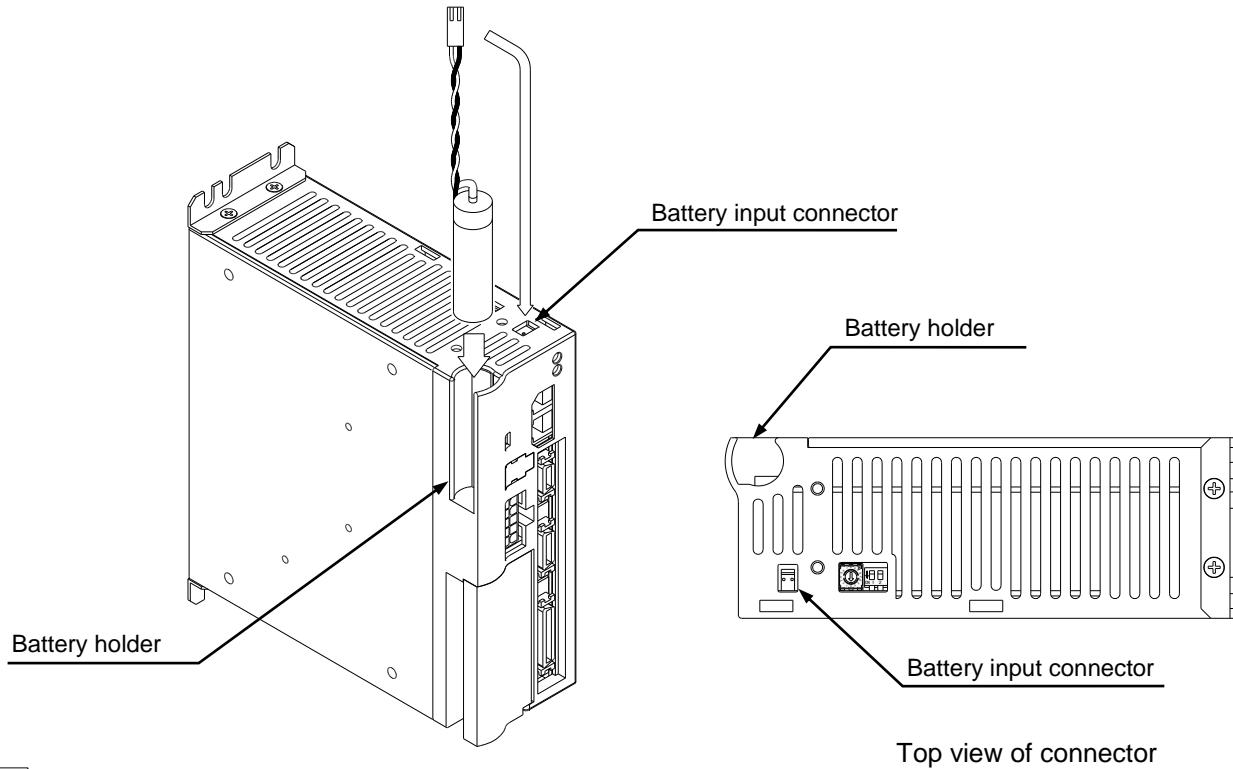
## ■ 2.4.2 Absolute encoder backup

All AC servomotors with BA III axis mount the absolute encoder. The encoder is backed up with a battery, etc. to constantly monitor the motor operation even when the power to the controller is shut off. This enables smooth starting without the need for return to origin when starting the system or recovering from emergency stop.

**NOTE** When the encoder type in the parameter (refer to section ■ 13.4.17) is set to the incremental encoder, the absolute function does not operate even if the backup power is connected.

### ● Installing the lithium battery

One lithium battery for encoder backup comes with each unit of this machine. Put the lithium battery in the battery holder on the top of the controller and connect it to the battery input connector as shown below.



**?** Install the lithium battery on all controllers.

### ● Lithium battery specification

Item		Description	Remarks
Part name		Lithium battery	Thionyl chloride lithium battery
Model		CA25-EB-05	Main unit of battery: ER6C (Manufactured by Hitachi Maxell)
Specification	Nominal voltage and capacity		3.6 V 1800 mAh
	Outside	Main unit of battery	φ14.5 × 45 mm (Excluding protrusion)
		Harness length	50±6 mm (Excluding connector)
	Mass		About 14.5 g
Backup duration time (*1)		About 3 years (*2)	25°C, backup current 65 μA

**NOTE** \*1: The backup duration time is the cumulative time when the power to the control is OFF.  
\*2: The duration time of the battery depends on the temperature, etc. Set the numeric value as a measure of the duration time.

● Battery input connector signal names and pin Nos

No.	Signal name	Meaning
1	GND	Backup power –
2	BV	Backup power +

**NOTE** If the polarity is mistaken, the backup will not be possible and faults could occur.

● Controller side connector type No.

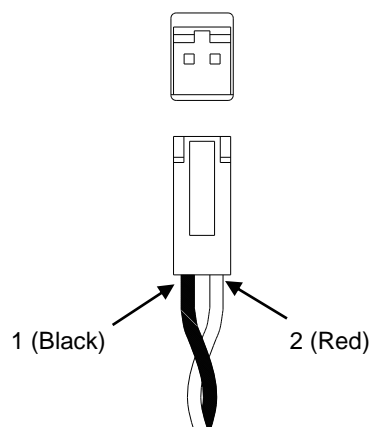
L header IL-2P-S3FP2-1 (JAE)

● Harness side connector type No.

Housing IL-2S-S3L-(N) (JAE)

Socket IL-C2-1-5000 (JAE)

[Applicable wire size: AWG22 to 28 (0.33 to 0.1 mm<sup>2</sup>)]



● Backup specification

Item		Specification	Remarks
Backup voltage		3.6 VDC (Standard)	The state LED flickers in green at 3.1 VDC or less.
Current consumption	When the controller is not energized	65 $\mu$ A (Standard) 85 $\mu$ A (Maximum)	25°C Up to 2 mA instantaneously
	When the controller is energized	3.6 $\mu$ A (Standard)	
Maximum response rotation speed during backup		5000 min <sup>-1</sup>	

● Encoder-related errors

(1) Battery voltage drop alarm

When the backup power becomes 3.1 V or less, the state LED on the controller front face flickers in green as an alarm. If multiple axes are used, only the LED on the controller with the relevant axis flickers in green. Error output will not turn ON. The output to the general-purpose output port can be performed by specifying the battery alarm output bit via mode setting. (Refer to section ■ 13.2.19.)

(2) Encoder backup error (Error codes: ER2C, ER3C, ER4C, or ER5C)

An encoder backup error occurs in the following cases. Reset input or pressing the [CLEAR] key on the Teach Pendant can clear this error.

- If the power is turned ON for the first time after the main unit of axis (motor) is connected to the controller
- If the encoder cable connector is temporarily removed during backup
- If the backup power becomes 2.5 V or less and normal backup cannot be done when the power is not supplied to the controller

(3) Encoder error (Error codes: ER26, ER36, ER46, or ER56)

An encoder error occurs in the following cases. Turn ON the power again. Reset input and pressing the [CLEAR] key on the Teach Pendant cannot clear this error.

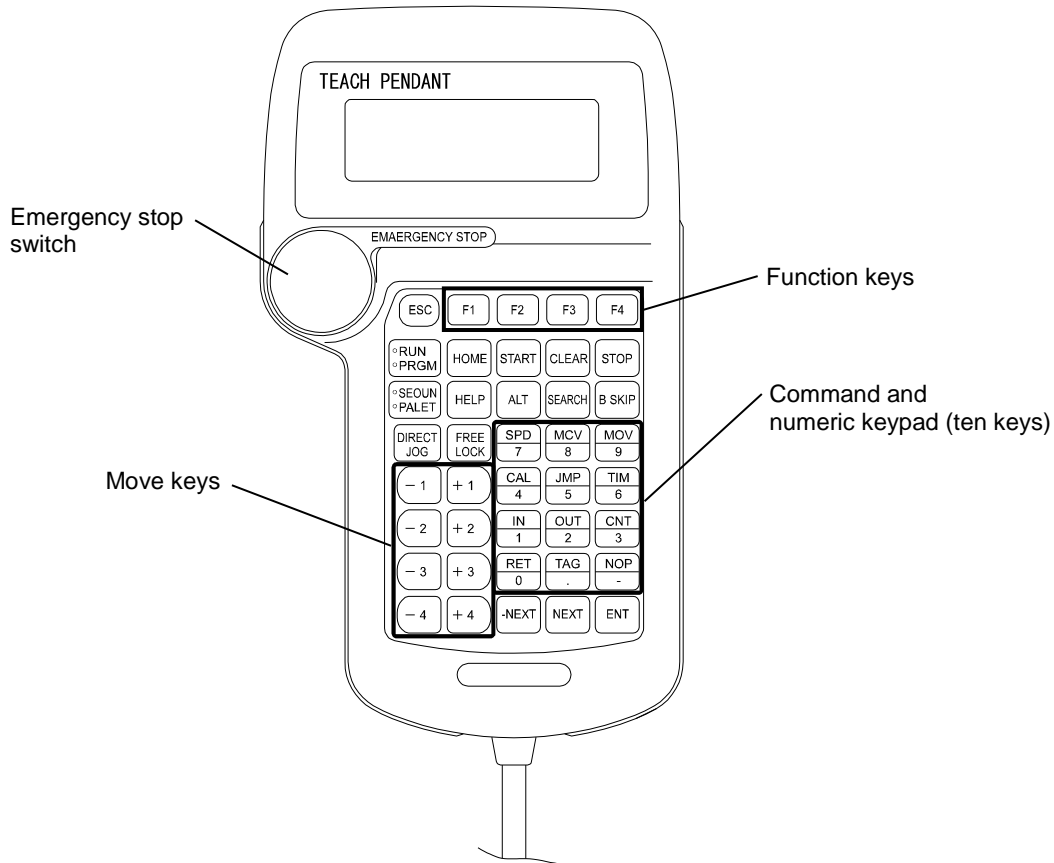
- If normal backup cannot be done because the motor rotation speed exceeds 5000 min<sup>-1</sup>
- If the motor rotation speed exceeds 200 min<sup>-1</sup> during power on
- If the encoder cable connector is removed or the encoder cable is disconnected while the controller is energized
- If a different robot type that uses a different encoder type is set.

If an encoder error and encoder backup error occur, the absolute counter value will be unreliable. Thus, the axis movement will be inhibited unless return to origin is carried out. When these errors occur, axis movement will be inhibited unless return to origin is carried out for all axes besides the axis for which the error occurs.

**?** If an encoder error or encoder backup error and other error (emergency stop, etc.) occur concurrently, the error other than the encoder-related errors may be displayed, depending on the order of occurrence. Thus, it may not be apparent that an encoder-related error has occurred. If the error message "RETURN TO HOME NOT COMPLETED!" appears during axis movement after the error is cleared, an encoder error or encoder backup error may have occurred concurrently.



### ■ 2.4.3 Explanation of Teach Pendant



Model: TPH-4C

Keys of the teach pendant have the following functions respectively.

However, functions may vary depending on the mode or condition. Refer to the section of each mode or condition for the specific function.

- ESC key  
The operator can use this key to exit the function key mode.
- F1 to F4 key  
These keys perform various functions.
- RUN/PRGM key  
This key is used to toggle between RUN and PRGM modes.
- HOME key  
This key executes Return to Origin.
- START key  
The key executes the program.  
The program will be executed from the step currently stopped at.
- CLEAR key  
The key clears the input item, and release alarms.
- STOP key  
Program execution is terminated after the current step is completed.

- **SEQUN/PALET key**  
This switch is used to toggle between the sequential mode and palletizing mode. When the key is pressed, the mode will alternate.
- **HELP key**  
An explanation of the current function is displayed.
- **ALT key**  
This key is used to change and select input data other than numerical values in PRGM or parameter mode.  
This key is also used to change the display task.
- **SEARCH key**  
This key is used to search for step No., tag No., parameter No., table No., palletizing program No., palletizing program screen No., counter No., or error No.  
This key is also used to change the display task.
- **B SKIP key**  
This key is used to reversely shift the cursor.
- **DIRECT/JOG key**  
When this key is pressed in servo-lock condition, JOG mode (manual operation mode) is enabled, and JOG operation of the axis can be executed by using Move keys. When this key is pressed with the cursor positioned in a certain area, remote teaching becomes enabled in a servo-lock condition, or direct teaching becomes enabled in a servo-free condition. (Refer to section ■ 4.7.2.)
- **FREE/LOCK key**  
This key is used to toggle between servo-lock and servo-free conditions.
- **MOVE keys**  
These keys are used to execute JOG operations for each robot axis. An axis moves while its corresponding key is pressed. Each key corresponds to the first axis to fourth axis of the task display. The plus and minus on the keys indicate the direction of movement.
- **Commands and ten keys**  
These keys are used for programming. Main commands and numbers are indicated on the keys. When a key is pressed, the command or number is entered at the position of the cursor.
- **-NEXT key**  
This key is used to display the step and the parameter preceding the one currently on display.  
Holding down this key moves continuously to previous screens.
- **NEXT key**  
This key is used to display the step and the parameter ahead of the one currently on display.  
Holding down this key moves continuously to next screens.
- **ENT key**  
This key is used to write commands and other data into a step in the program.
- **Emergency stop switch**  
Push-lock and turn-reset switch. Pressing this switch causes the robot to enter the emergency stop state. To clear emergency stop, turn the switch clockwise to unlock the switch, and then press the CLEAR key.



In servo-free condition, the robot is separated electrically from the control system, and the axis arm can be moved freely by hand. In the servo-lock condition, the robot axis is connected electrically to the controller, which controls the robot's position. It cannot be easily moved by hand.

**NOTE**

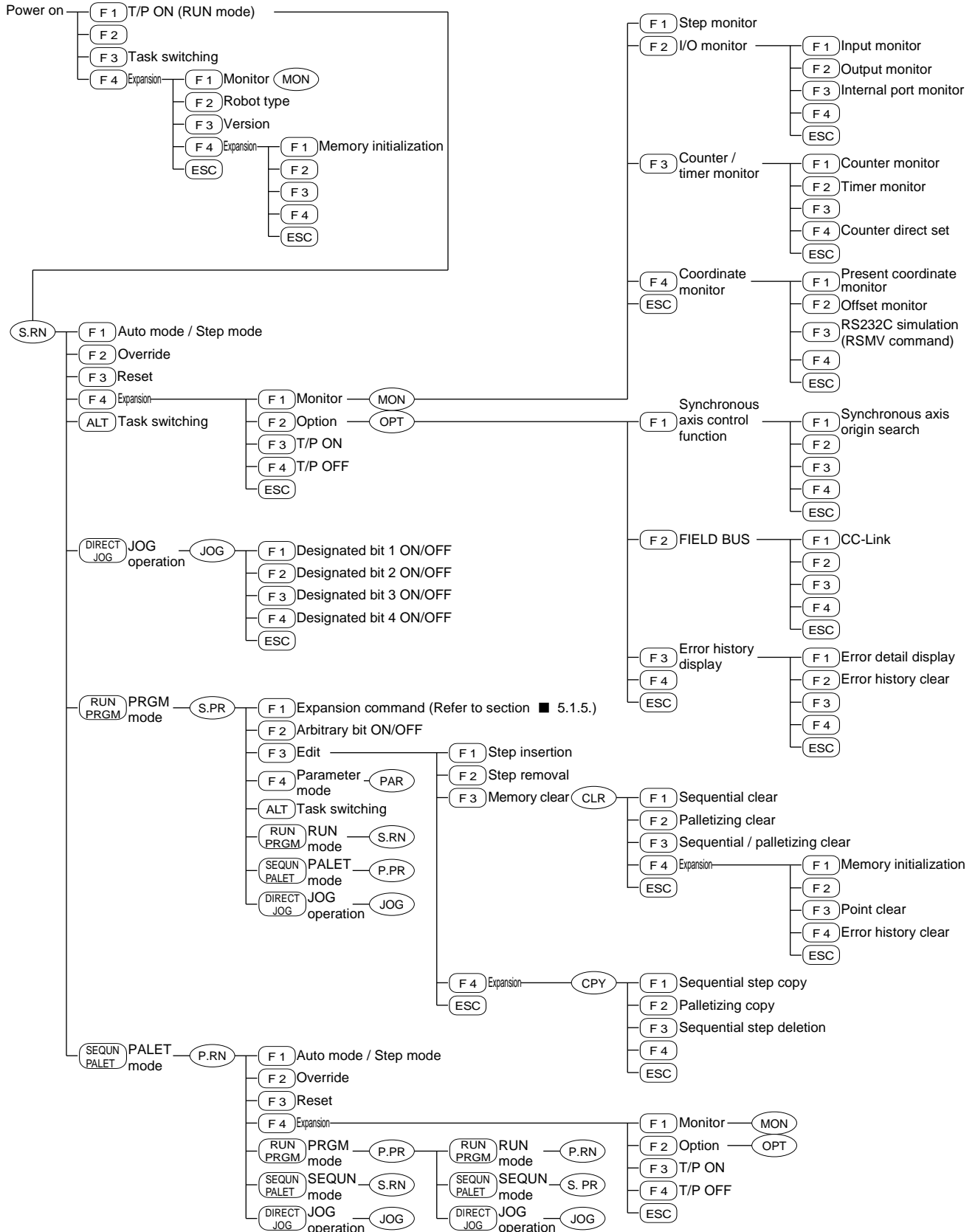
- The teach pendant displays the one to four axes. Display of an unused axis is disabled.
- For turning T/P ON and OFF, refer to section ■ 16.1.

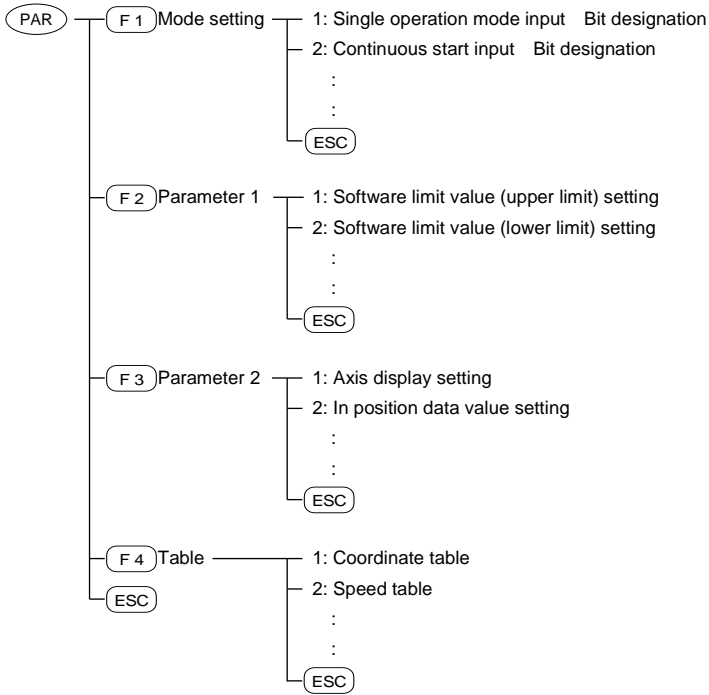
## 2.4.4 Teach pendant key operation system diagram

The teach pendant key operation system diagram is shown below.

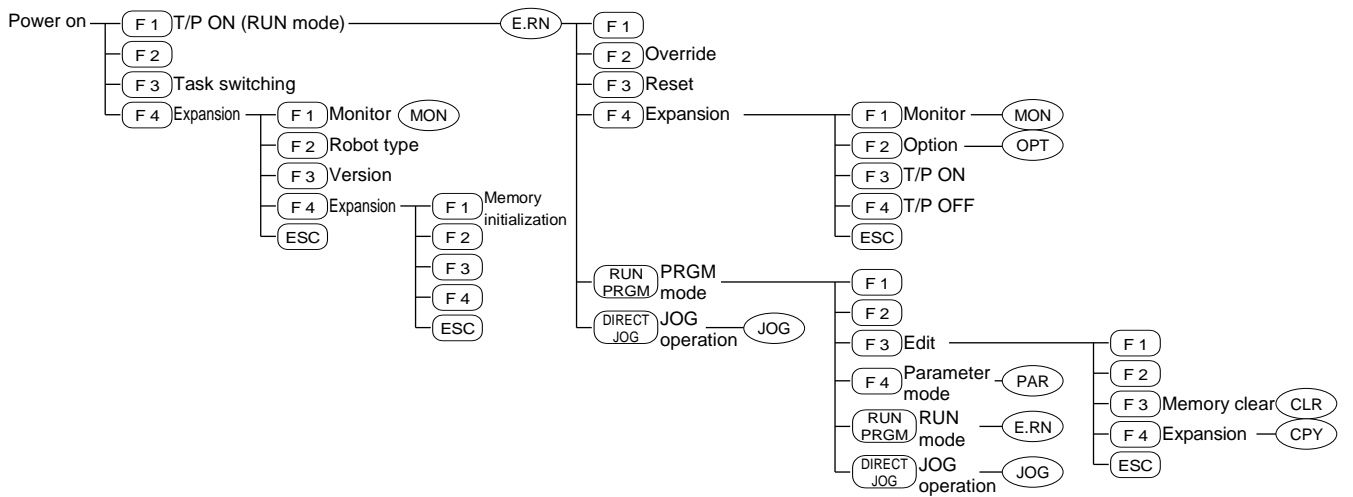
For toggling between sequential /palletizing mode and external point designation mode, refer to section 0.

[Sequential mode / palletizing mode]





[External point designation mode]

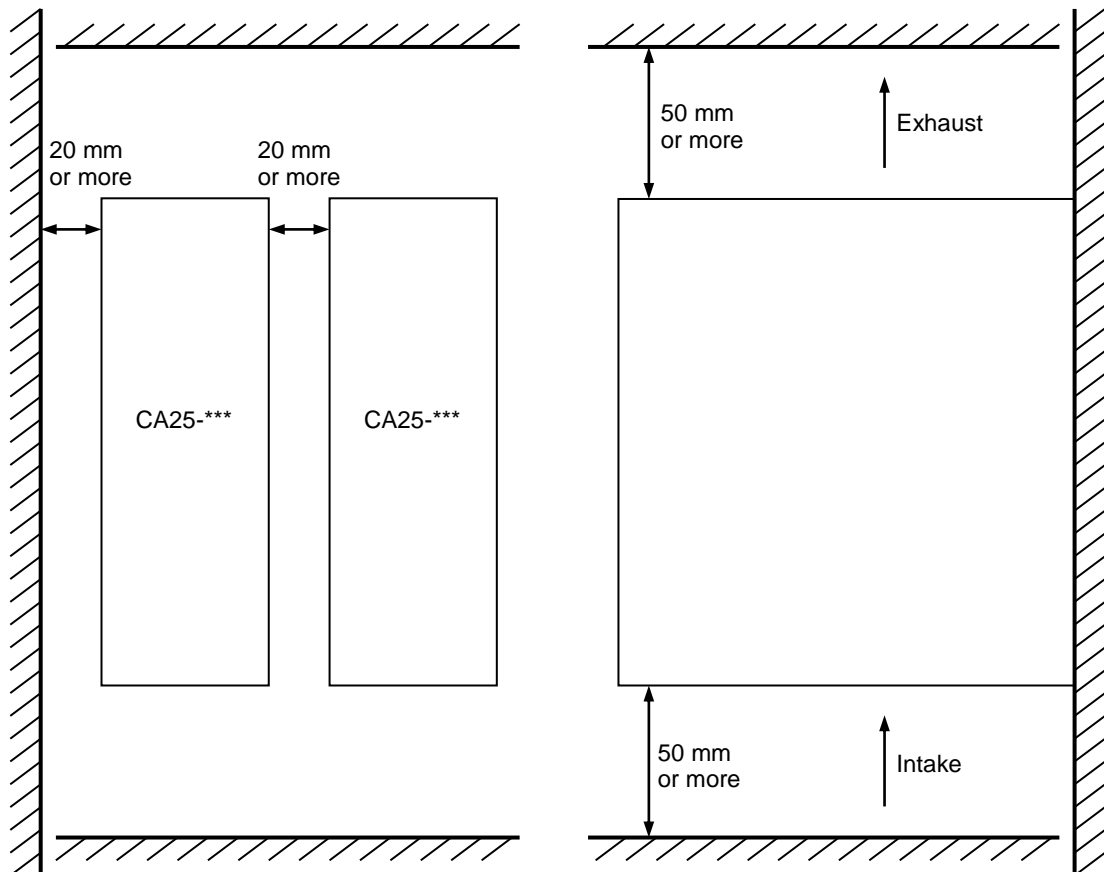


## ■ 2.5 Installation and connection

### ■ 2.5.1 Installing the controller

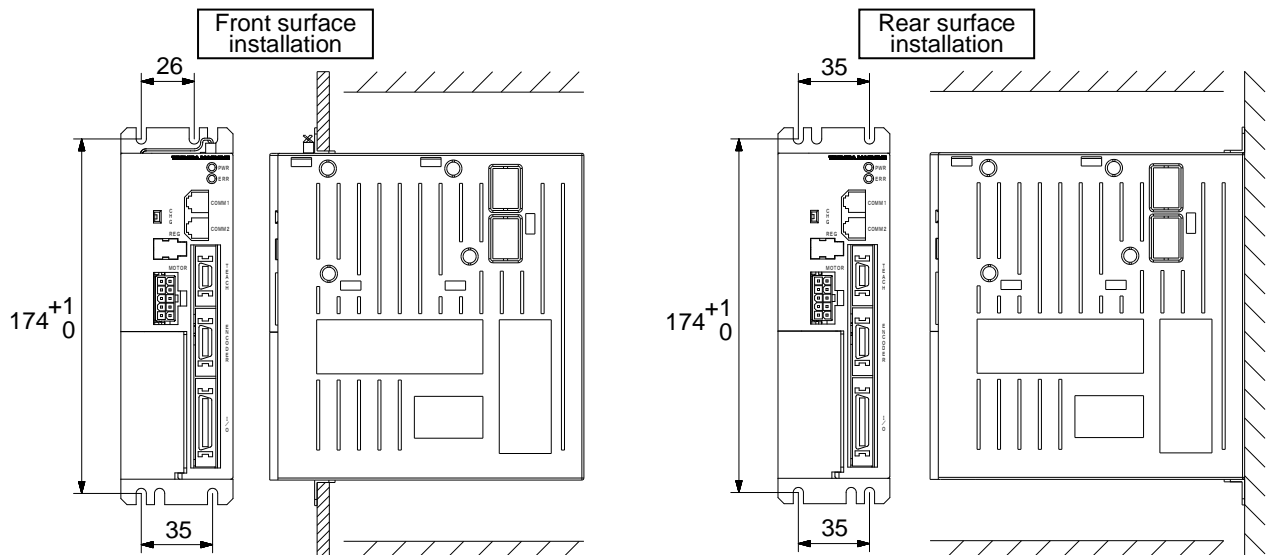
The controller uses a natural cooling method through convection. When installing the controller, place it vertically as shown below, and leave space of 20 mm or more on the left and right sides and 50 mm or more on the top and bottom sides. If the ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

Make sure that foreign matter such as fluids or dust does not enter the controller. This unit does not have a dust proof structure. Avoid use in dusty places.



The controller can be installed on its front surface or rear surface.

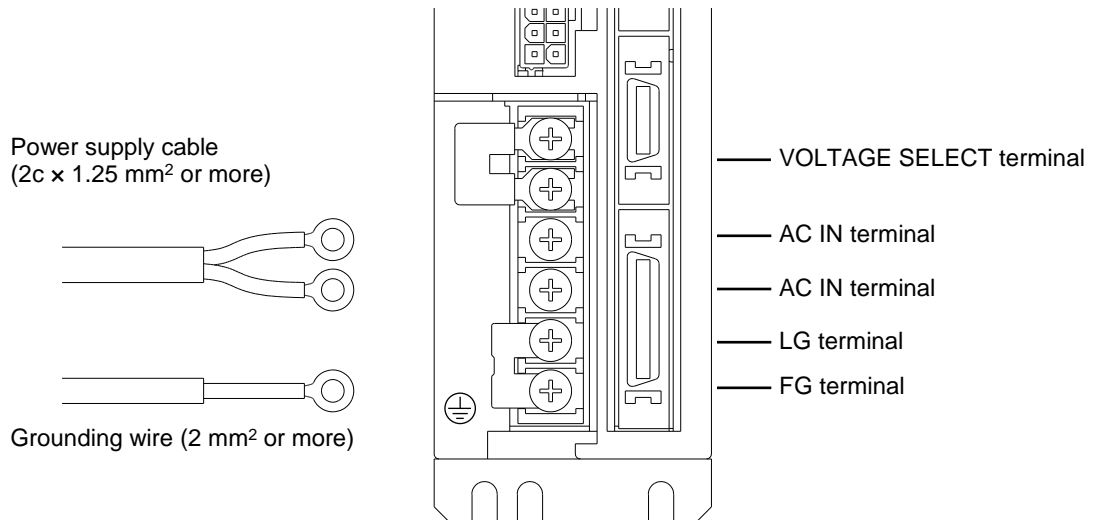
In the case of front surface installation, use the upper mounting holes shown in the figure below to prevent interference with the battery connector.



## ■ 2.5.2 Supply power and grounding

The power voltage supplied to the CA25-M10/S10 can be either 100 VAC system or 200 VAC system by changing the VOLTAGE SELECT terminal's short bar on the terminal board. The power voltage supplied to the CA25-M40/S40 and CA25-M80/S80 can only be 200 VAC system.

CA25-M10/S10	100 VAC system	Single-phase 100 VAC to 115 VAC $\pm 10\%$ 50/60 Hz
	200 VAC system	Single-phase 200 VAC to 230 VAC $\pm 10\%$ 50/60 Hz
CA25-M40/S40 CA25-M80/S80	200 VAC system	Single-phase 200 VAC to 230 VAC $\pm 10\%$ 50/60 Hz



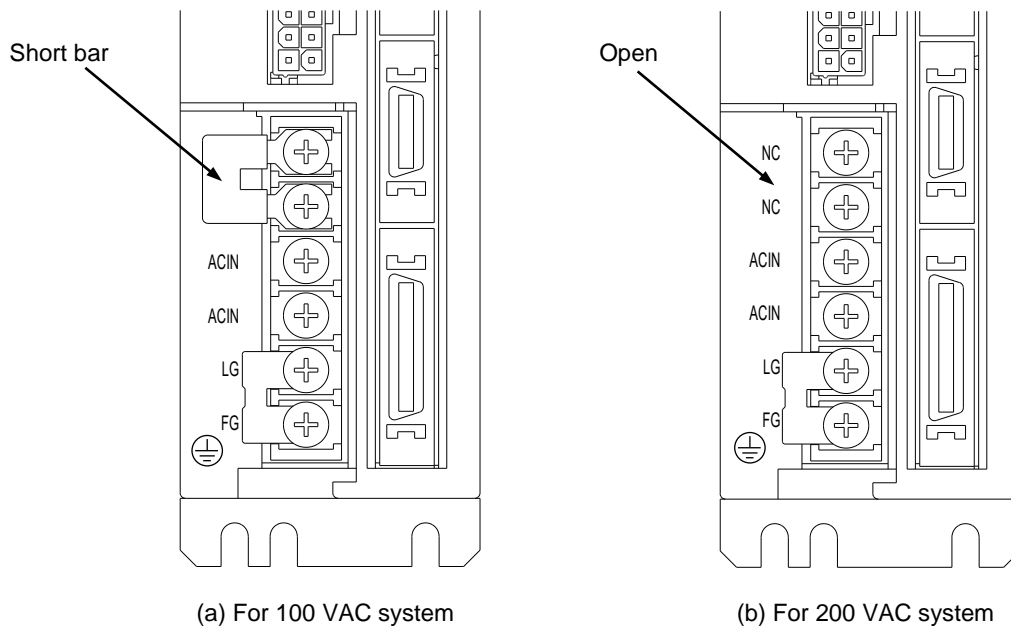
**CAUTION** When the controller is turned OFF once and then turned ON again, wait 10 seconds or more between turning OFF and turning ON. If the controller is turned ON before expiration of 10 seconds from turning OFF, it may not operate properly. However, the controller whose version is 4.41 or more can be turned ON after expiration of 0.5 seconds from turning OFF if the EtherNet/IP unit is not equipped.

### ● Power input terminal (AC IN)

If the voltage fluctuation is particularly large, connect a constant voltage device externally.

To change between the 100 VAC system and 200 VAC system, short circuit the VOLTAGE SELECT terminal with the enclosed short bar to select 100 VAC (figure (a) below), and leave the terminal opened to select the 200 VAC system. (figure (b) below). At factory shipment, the terminal is open as shown in the figure (b) below.

Use the CA25-M40/S40/M80/S80 with the 200 VAC system left open.



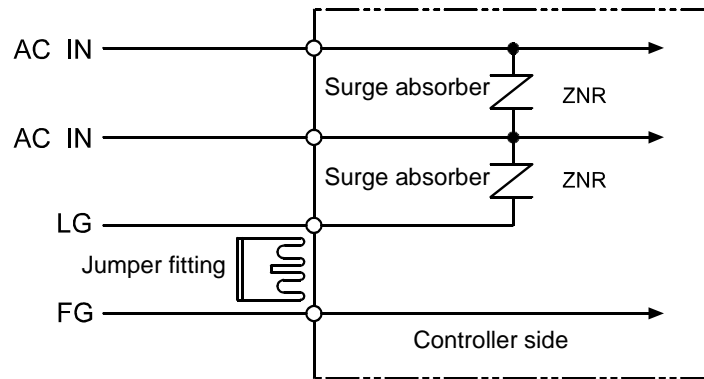
- Frame ground (FG)

This terminal is connected to the cabinet. To prevent electric shocks, carry out Class 3 grounding by connecting the dedicated wire.

**CAUTION** A surge absorbing element is provided between the controller's power line and cabinet. Confirm that the supply power is 290 V or less between the power line and grounding, and then connect. If the power between the power line and grounding is 290 V or more, the absorbing element could be damaged and the controller could be damaged.

- Surge absorber dedicated terminal (LG)

This terminal is provided in addition to the FG terminal to protect the circuit from external lightning surges or noise, etc.



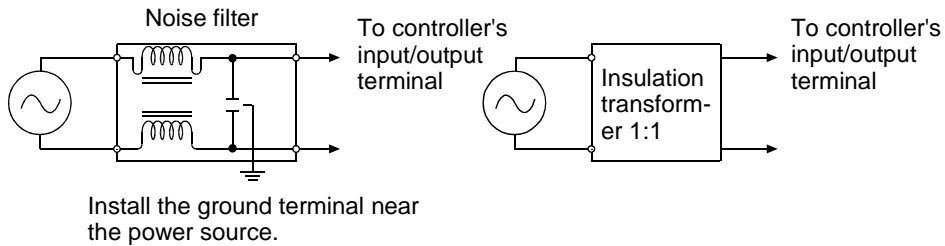
When installing the controller, short circuit the LG and FG terminals with the enclosed jumper fitting so as to protect the circuit from external lightning surges and noise, etc.

**CAUTION** Normally (when shipped from the factory) LG and FG are short circuited with a jumper fitting. When carrying out an insulation resistance test (500 V megger test) or withstand voltage test (1000 VAC), the results may appear faulty due to the current leaked by the surge absorber. In this case, remove the jumper fitting between LG and FG before carrying out the tests.

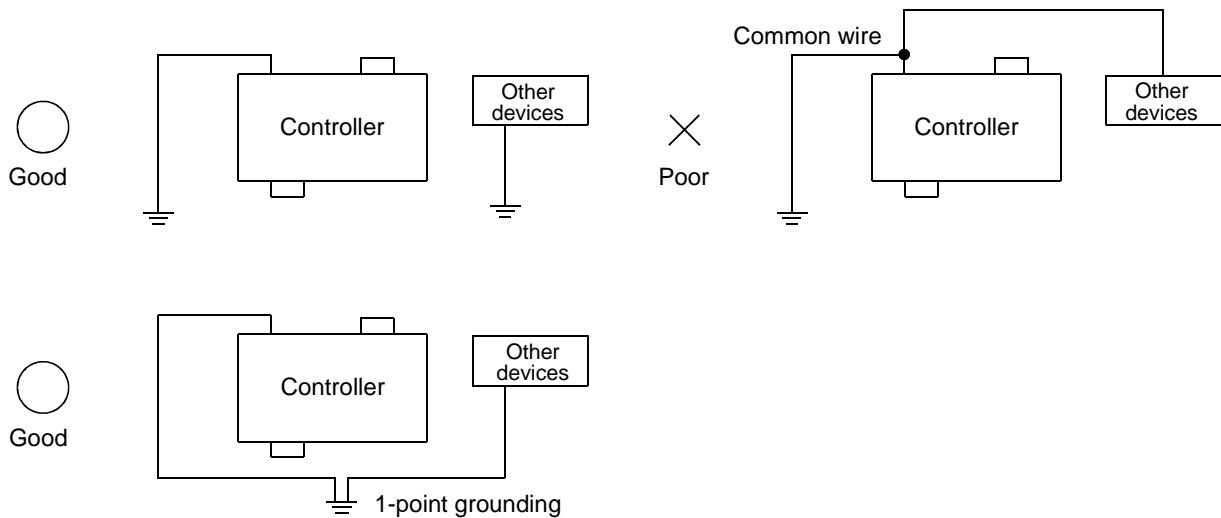
### ■ 2.5.3 Improvement of noise resistance

Using the following measures to further improve the noise resistance is recommended.

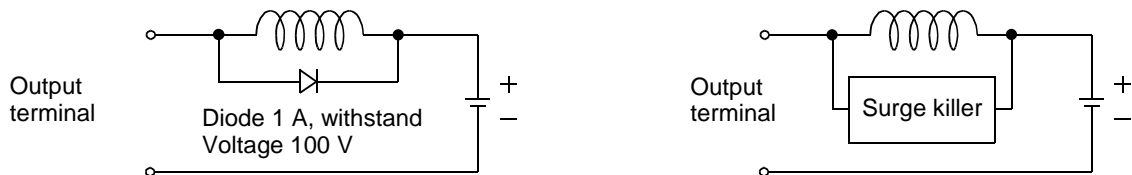
- Insert a power line insulation transformer (1:1) or noise filter.



- Avoid installing the controller near high-voltage devices (induction hardening machines, electric welding machines, etc.).
- Install the controller at a position 200 mm or more away from the power wire.
- When treating the input/output signal and controller cables, if the high voltage wires and power wires are bundled together, malfunctioning could occur due to induction. Thus, separately wire these wires.
- Use Class 3 or higher grounding (grounding resistance 100  $\Omega$  or less) for the controller grounding.
- If the grounding wire is used also for other devices, an adverse effect could occur.



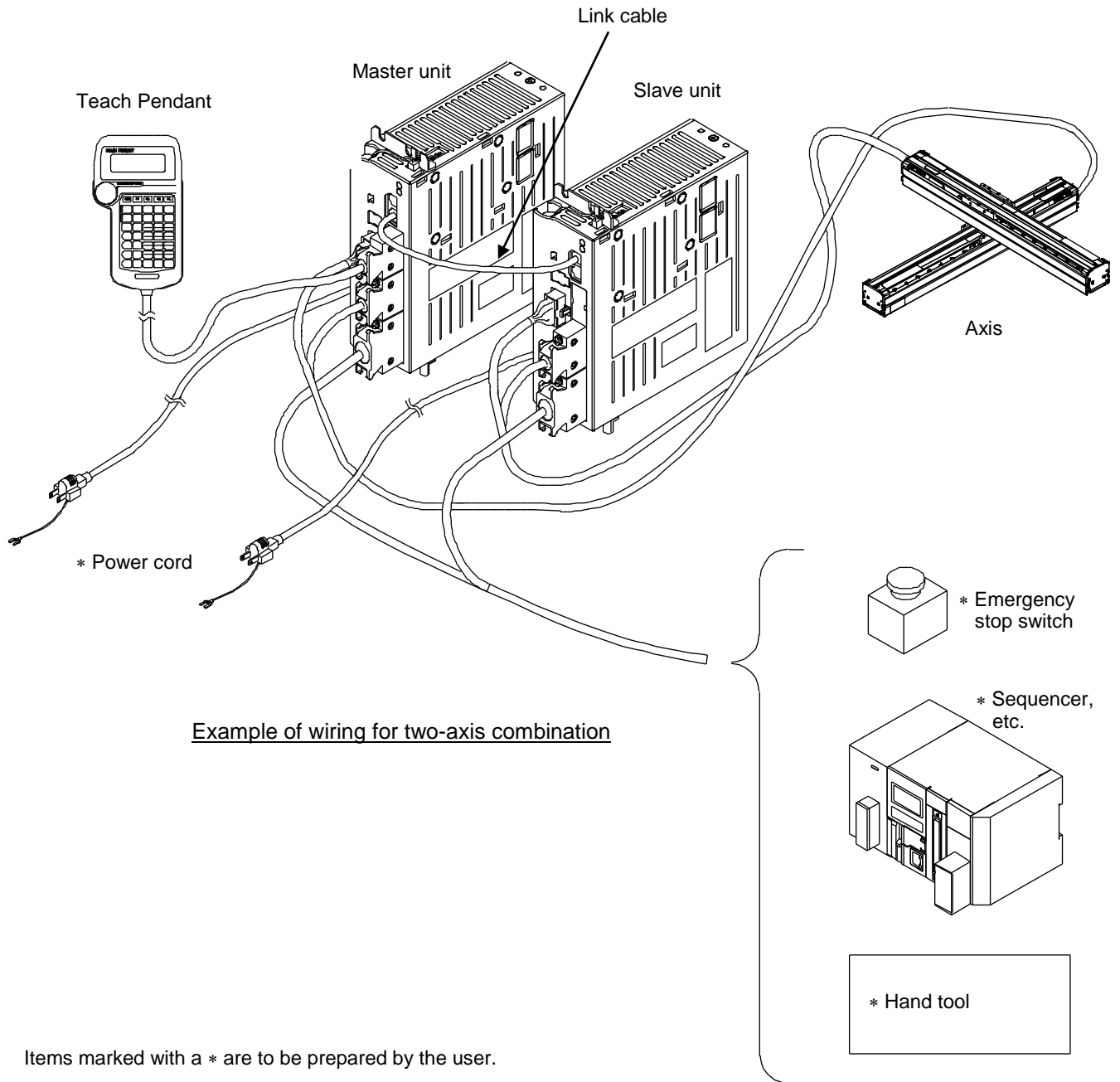
- When connecting induction load to the output, connect a diode or surge killer in parallel.





## ■ 2.5.4 Connecting the axis and controller

Connect the axis and Teach Pendant to the controller as shown below.



Items marked with a \* are to be prepared by the user.

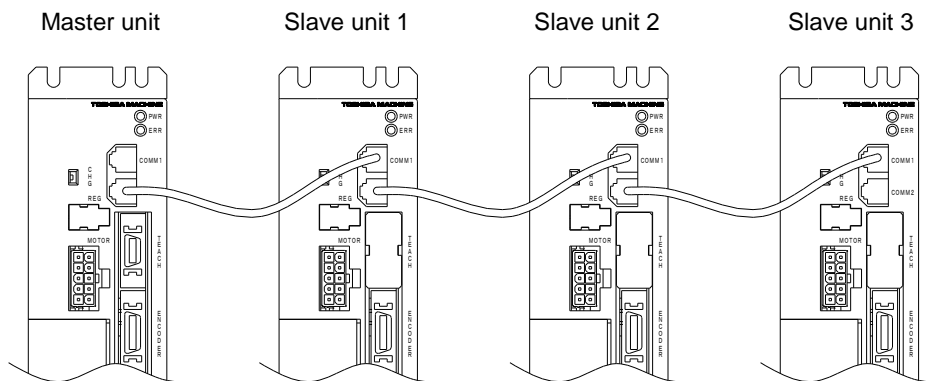
● Control of multiple axes

The master unit can control one axis by itself, but by connecting a slave unit for one to three axes with link cables, up to four axes can be controlled.

CA01-S05 of BA-C series or CA20-S10 of BA II series can be used. For the method to connect with CA01-S05, refer to section ■ 3.10. For method to connect with CA20-S10, refer to the instruction manual of Q3139 or Q3178.

(1) Connecting the controller

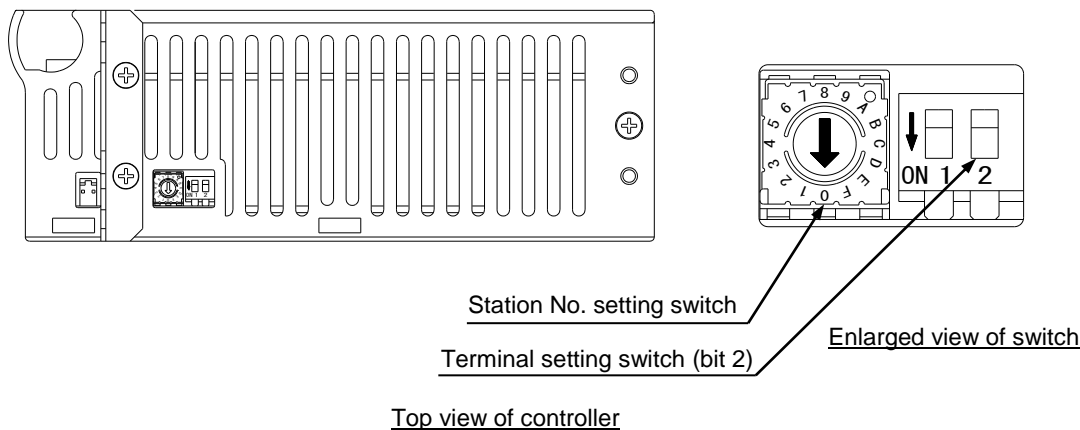
To connect the master unit and slave unit, use the communication connectors (COMM1, COMM2) on the front side, and connect a link cable between COMM2 on the master unit to COMM1 on slave unit 1, and between COMM2 on slave unit 1 to COMM1 on slave unit 2.



(2) Setting station No.

When controlling two or more axes, the station No. must be set with the station No. setting switch on the top of the unit so that the hardware of each unit can recognize the station No. Set the master unit's station No. to "0", and the slave unit station No. to "1" to "3". If other settings are made, or if the same No. is set for multiple slave units, the controller may not start properly (refer to section ■ 18.4-(1)) or a communication error may occur. A master unit is set to "0" and a slave unit is set to "1" at factory shipment.

	Master unit	Slave unit
Setting of station No.	Set to "0"	Set to "1" to "3"



(3) Setting of task and axis combination

This setting is made with task and axis combination setting of the parameter 2. (Refer to section ■ 13.4.19.)

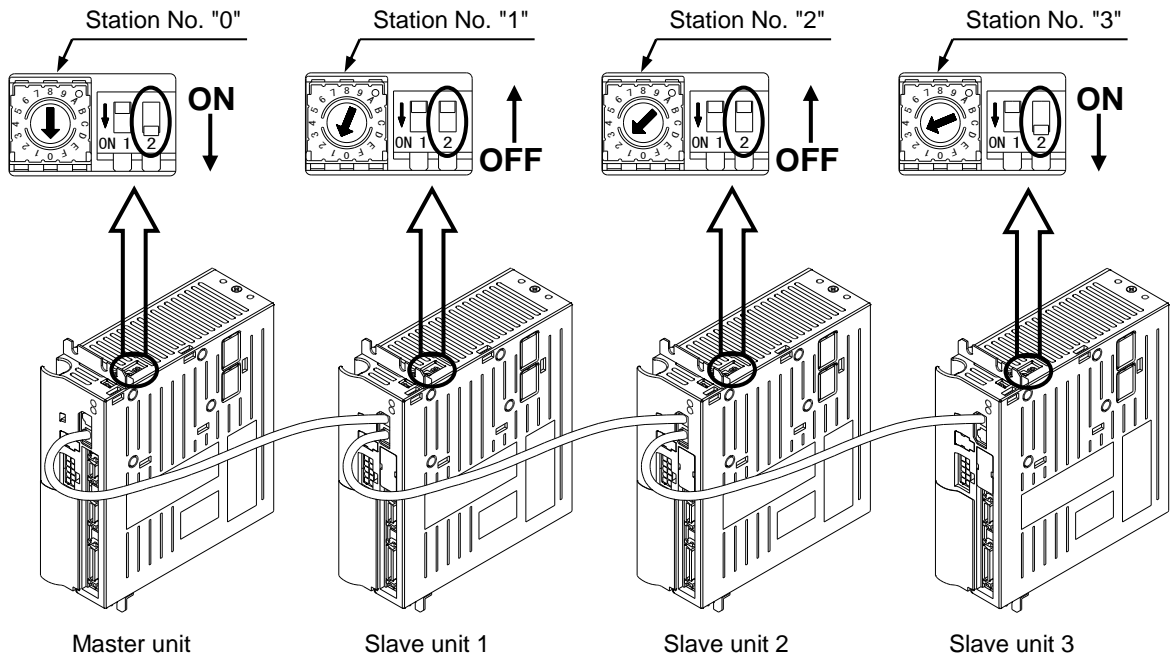
(4) Setting terminator

When multiple units are connected, the end of the communication line must be treated so that the communication will be accurate. This end treatment is possible by setting a terminator and setting the terminator setting switch on the unit to ON. When using three or four axes, turn ON the terminator setting switch (bit 2) on the unit (master unit and slave unit with open COMM2) at the end of the communication line. Leave the switches set to OFF for all other units. When using two axes, turn ON the terminator setting switch (bit 2) on the master unit and slave unit. When using one axis, leave these bits set to OFF. The master unit and the slave unit are preset to "ON" and "OFF" respectively before shipping.

**NOTE**

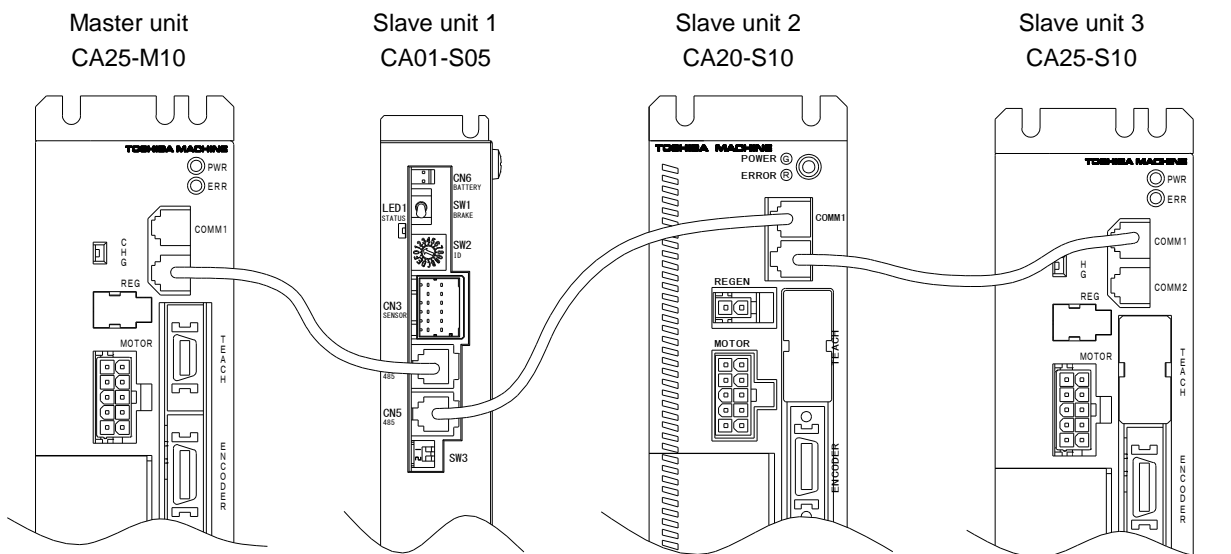
- If the terminator is not set correctly, the controller may not start properly (refer to section ■ 18.4-(1)) or a communication error may occur.
- Do not turn ON the firmware update switch (bit 1), or the controller may not start properly.

[For four-axis combination]



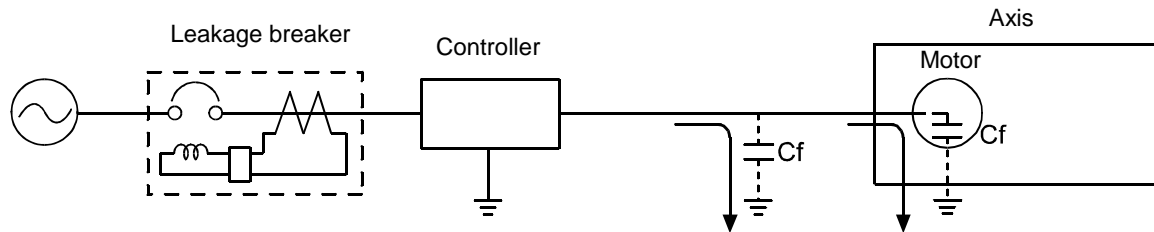
● Mixture connection

Slave units can be used by mixing. The following figure shows a connection example for the case using CA25-M10 for the axis 1, CA01-S05 for the axis 2, CA20-S10 for the axis 3, and CA25-S10 for the axis 4.



## ■ 2.5.5 Effect of leakage current

This controller (master unit, slave unit) controls the motor assembled into the axis with PWM (Pulse Width Modulation). Thus, a high frequency leakage current ( $C_f \cdot dV/dt$ ) that do not affect the human body will flow through the cable from the controller to motor and the motor's floating capacity ( $C_f$ ). General leakage breakers, excluding those for high frequencies, normally detect the leakage current at the same level between the low frequency and high frequency regardless of the frequency zone. Thus, the leakage breaker will function when the leakage current in the high frequency zone exceeds the operating frequency of the leakage breaker.



Measures when leakage breaker functions needlessly by high frequency leakage current

- (1) Use a high frequency and surge corresponding leakage breaker.  
Use a leakage breaker that is less sensitive to the high frequency element leakage breaker contained in the controller's leakage current to prevent needless functioning.
- (2) Decrease the floating capacity between the controller and ground.  
Select as short a controller cable as possible to be used between the controller and axis.

**⚠ WARNING** Always ground the controller with Class 3 or higher grounding (grounding resistance  $100 \Omega$  or less) to prevent electric shock accidents.

**⚠ CAUTION** Needless functioning of the leakage breaker could occur in a separate system that is not directly related to the circuit connected to the controller because of leading in of the leakage current.

## ■ 2.6 Regenerative discharge unit (optional)

The regenerative discharge unit absorbs electrical power energy generated during deceleration of the axis motor using the built-in circuit. This unit prevents overvoltage of the controller when load inertia exceeds the permissible value or too much electrical power is generated.

### ■ 2.6.1 Specifications

Item		Description		
Type		ABSU-2000	ABSU-4000	ABSU-8000
Regeneration activating voltage		420 VDC	390 VDC	421 VDC
Applicable controller		CA10-M10/S10 CA20-M10/S10 CA25-M10/S10	CA10-M40/S40 CA20-M40/S40 CA25-M40/S40	CA25-M80/S80
Cooling		Natural air cooling	Forced air cooling (with cooling fan)	
Cooling fan specifications		–	24 VDC - 0.19 A Brushless DC motor	24 VDC - 0.1 A Brushless DC motor
Protection		Relay activated at discharge resistor temperature of 150°C Output contact: 1b Contact capacity: 125 VAC / 4 A 250 VAC / 4 A		Relay activated at discharge resistor temperature of 150°C Output contact: 1b Contact capacity: 125 VAC / 6 A 250 VAC / 3 A
Operation conditions	Installation place	Indoors		
	Working ambient temperature	0 to 40°C		
	Working ambient humidity	30% to 90%RH With no dew condensation		
	Storage ambient temperature	-20 to 70°C		
	Storage ambient humidity	30% to 90%RH With no dew condensation		
	Environment	Indoor (not exposed to direct sunlight) 1000 m or less above sea-level No dust, corrosive gas, or flammable gas exists. The environment that the pollution level provided by IEC60664-1 is more than 2.		
	Vibration	9.8 m/s <sup>2</sup> or less		
Dimensions		55 (W) × 160 (H) × 122 (D) (not including fixture)	80 (W) × 189 (H) × 122 (D) including cooling fan (not including fixture)	95 (W) × 200 (H) × 169 (D) including cooling fan
Weight		0.78 kg	0.94 kg	2.9 kg

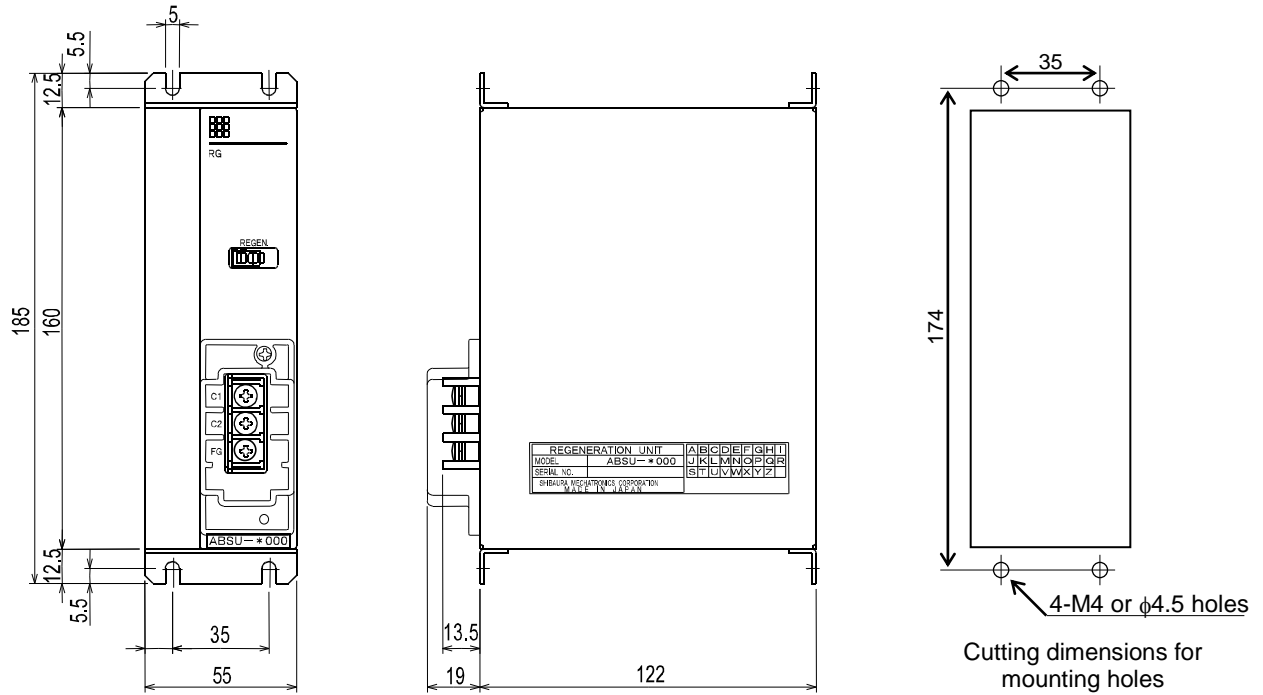
#### NOTE

- If combined with an inapplicable controller, the regenerative discharge unit may malfunction or work improperly.

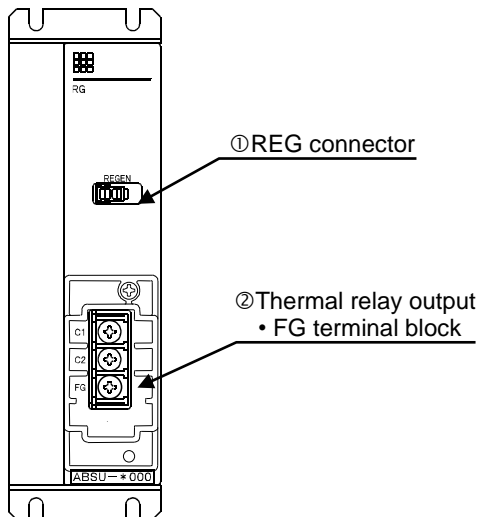
## ■ 2.6.2 Dimensions and name of each part

### (1) ABSU-2000

#### • Dimensions



#### • Name of each part



#### ① REG connector

This connector is used to connect the supplied regeneration harness.

#### ② Thermal relay output and FG terminal block (M4 screw)

##### • C1, C2 terminals:

Outputs the contact of the temperature relay.

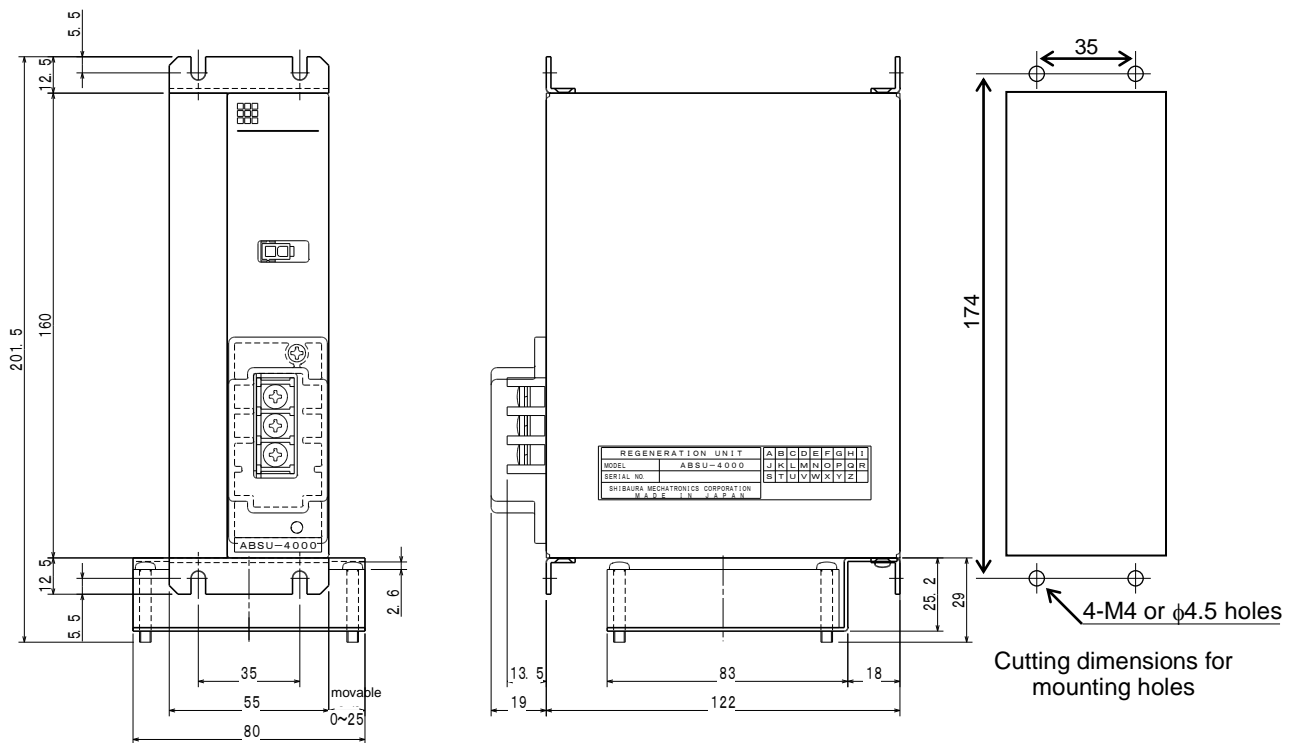
When heat generation of the internal resistor is detected, the circuit opens between the terminals C1 and C2.

##### • FG terminal:

Connect this terminal to the earth.

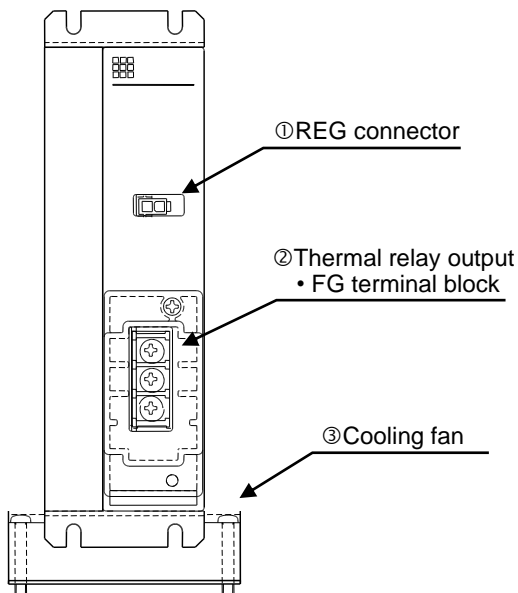
(2) ABSU-4000

• Dimensions



- This figure shows ABSU-4000 with the cooling fan installed on the rear bottom of the unit.
- The cooling fan can be installed in any position within the movable range shown in the above figure.

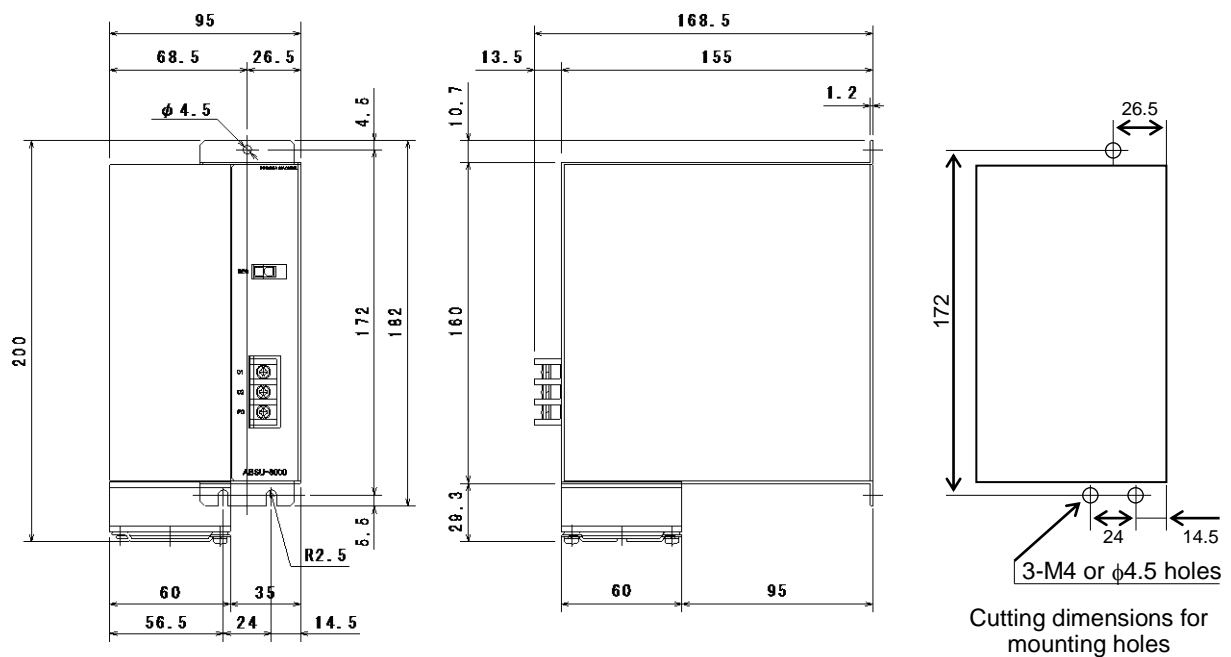
• Name of each part



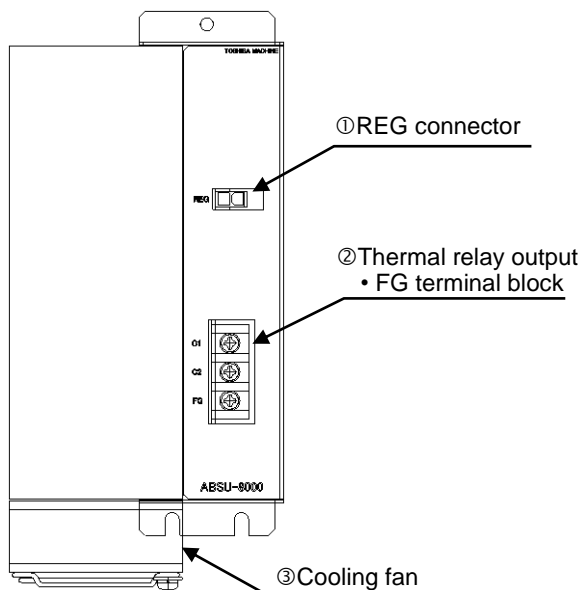
- ① REG connector  
This connector is used to connect the supplied regeneration harness.
- ② Thermal relay output and FG terminal block (M4 screw)
  - C1, C2 terminals:  
Outputs the contact of the temperature relay.  
When heat generation of the internal resistor is detected, the circuit opens between the terminals C1 and C2.
  - FG terminal:  
Connect this terminal to the earth.
- ③ Cooling fan  
The cooling fan is used for cooling of the unit. Be sure to supply external 24 VDC power on the lead and operate the fan.  
Red: +24 V (0.19 A)  
Black: GND

(3) ABSU-8000

• Dimensions



• Name of each part



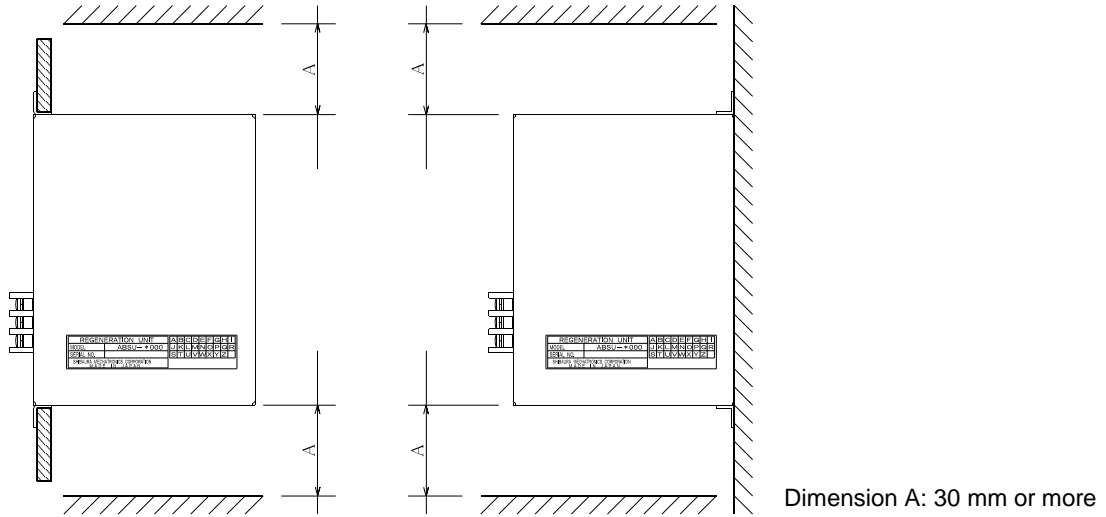
- ① REG connector  
This connector is used to connect the supplied regeneration harness.
- ② Thermal relay output and FG terminal block (M4 screw)
  - C1, C2 terminals:  
Outputs the contact of the temperature relay.  
When heat generation of the internal resistor is detected, the circuit opens between the terminals C1 and C2.
  - FG terminal:  
Connect this terminal to the earth.
- ③ Cooling fan  
The cooling fan is used for cooling of the unit. Be sure to supply external 24 VDC power on the lead and operate the fan.  
Red: +24 V (0.1 A)  
Black: GND



## ■ 2.6.3 Installation

### (1) ABSU-2000

ABSU-2000 uses a natural cooling method through convection. When installing the unit, place it vertically as shown below, and leave space as shown in the following table so as not to block the ventilators on its top and bottom. If ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

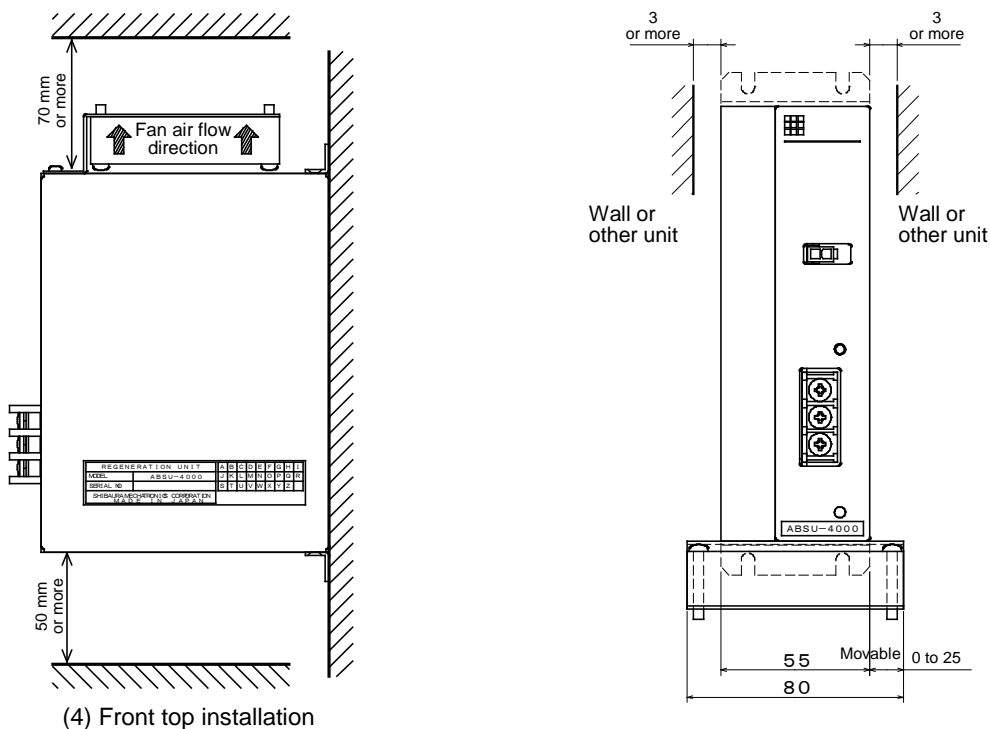
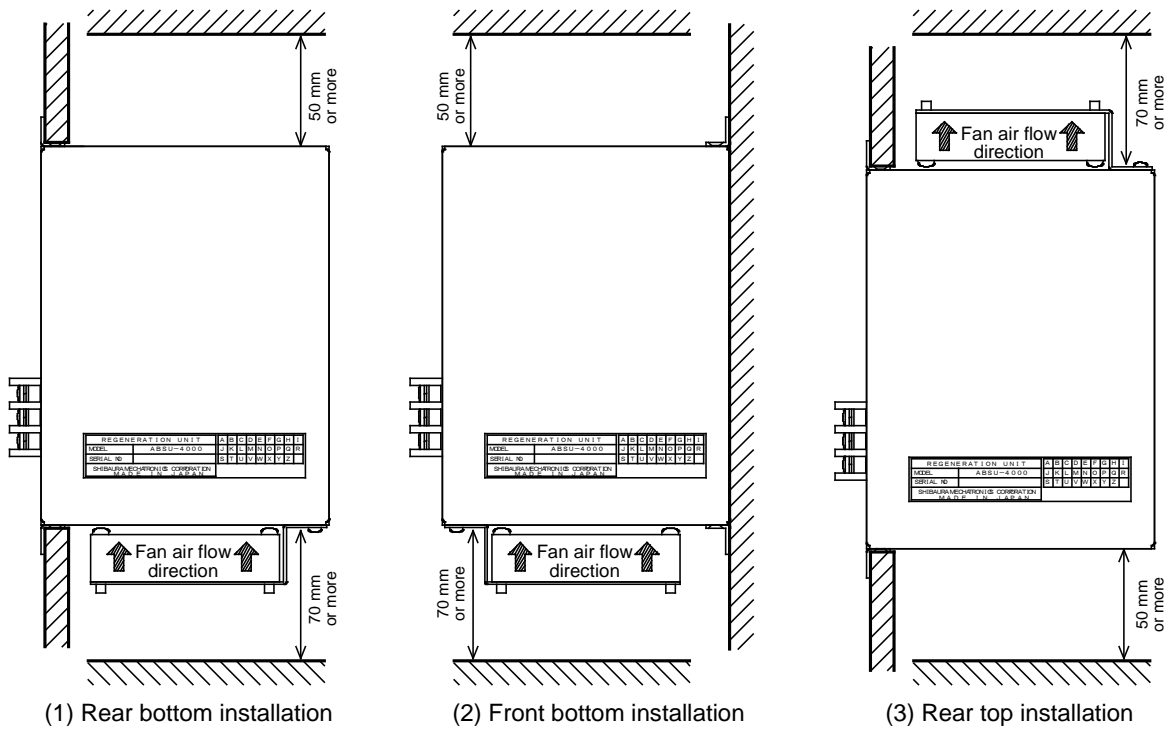


Make sure that foreign matter such as fluids or dust does not enter the regenerative discharge unit through the ventilator.

This unit does not have a dust proof structure. Avoid use in dusty places.

(2) ABSU-4000

ABSU-4000 employs a forced air cooling method with a cooling fan. When installing the unit, place it vertically, and leave space as shown in the following figure so as not to block the ventilators on its top and bottom. If ventilation is insufficient, its performance cannot be used fully, and even a failure may be caused.

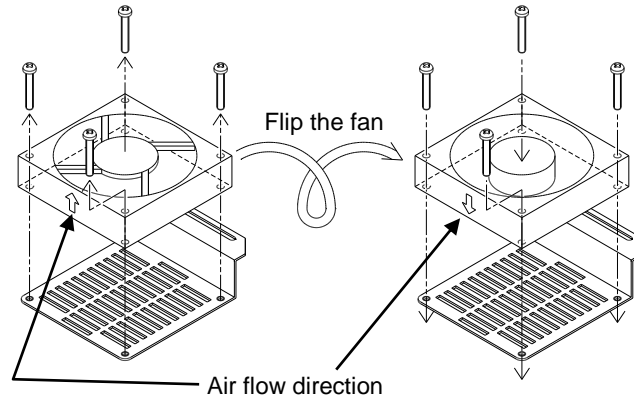


The unit may reach a high temperature during use. Do not allow the unit to be close to the wall or the other unit. Leave space of 3 mm or more on both sides.

The cooling fan can be installed in any position within the movable range shown in the above figure.

Install the fan so that air flows upward regardless of the installation.

At factory shipment, the fan is installed on the bottom of the unit. When the fan is to be installed on the top, remove the screws and flip the fan before installing it.



Take care not to allow foreign matters including liquid and dust to enter through the ventilator into the regenerative discharge unit.

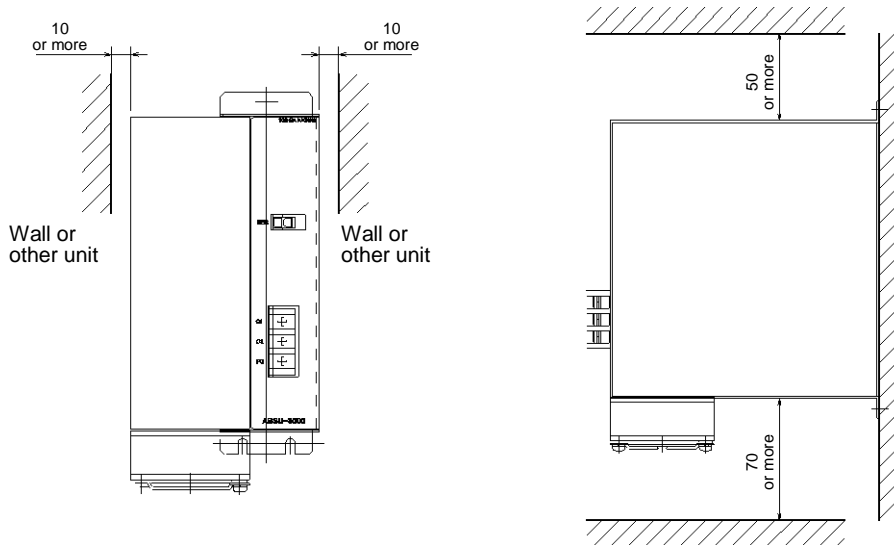
This unit is not dust-proof, and should not be used in dusty environment.

(3) ABSU-8000

ABSU-8000 employs a forced air cooling method with a cooling fan. When installing the unit, place it vertically, and leave space as shown in the following figure so as not to block the ventilators on its top and bottom.

If ventilation is insufficient, its performance cannot be used fully, and even a failure may be caused.

The unit may reach a high temperature during use. Do not allow the unit to be close to the wall or the other unit. Leave space of 10 mm or more on both sides.

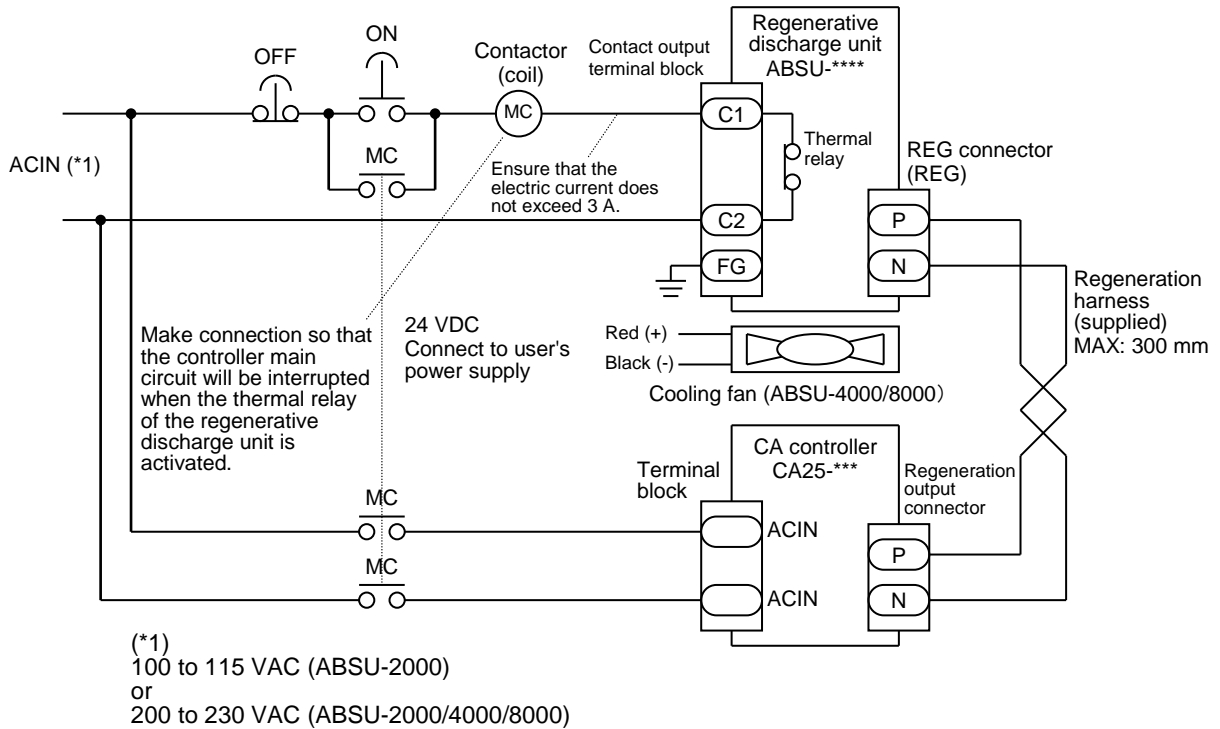


Take care not to allow foreign matters including liquid and dust to enter through the ventilator into the regenerative discharge unit.

This unit is not dust-proof, and should not be used in dusty environment.

## ■ 2.6.4 Example connection

Common for ABSU-2000/4000/8000



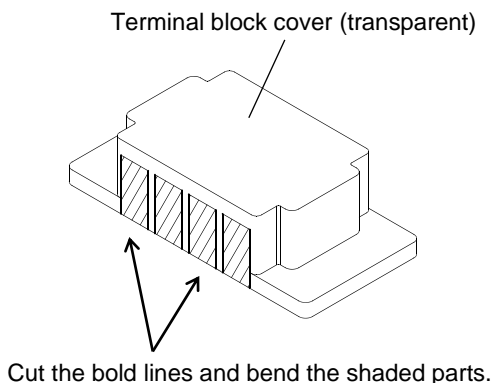
**CAUTION** If AC input is directly connected to C1 and C2 terminals of the regenerative discharge unit, overcurrent can occur and the thermal relay may burn out. Always suppress the current to 3 A or less using a coil of contactor.

## ■ 2.6.5 Precautions for use

- Always use a regenerative discharge unit combined with an applicable controller.
- For ABSU-4000/8000, always operate the cooling fan.
- The discharge resistor of the regenerative discharge unit has the built-in thermal relay that is activated at temperature of 150°C.
- When this relay is activated, the circuit opens between the output terminals C1 and C2 of the regenerative discharge unit.
- Make a sequence program so that the controller always stops when the thermal relay is activated.
- When the thermal relay is activated once, it requires approximately three minutes to reset (return to the normal state).
- After completion of wiring, install the terminal block cover to prevent an accident.

## ■ 2.6.6 How to use the supplied terminal block cover (ABSU-2000/4000)

After completion of wiring of the terminal block, always install the supplied terminal block cover to prevent electrical shock. Before use, process a terminal block cover according to the direction of wiring.



Cut off the shaded areas shown in the figure using a pair of nippers or a cutter in order to allow the wires to pass through the cover. The wiring direction can be set on the opposite side.

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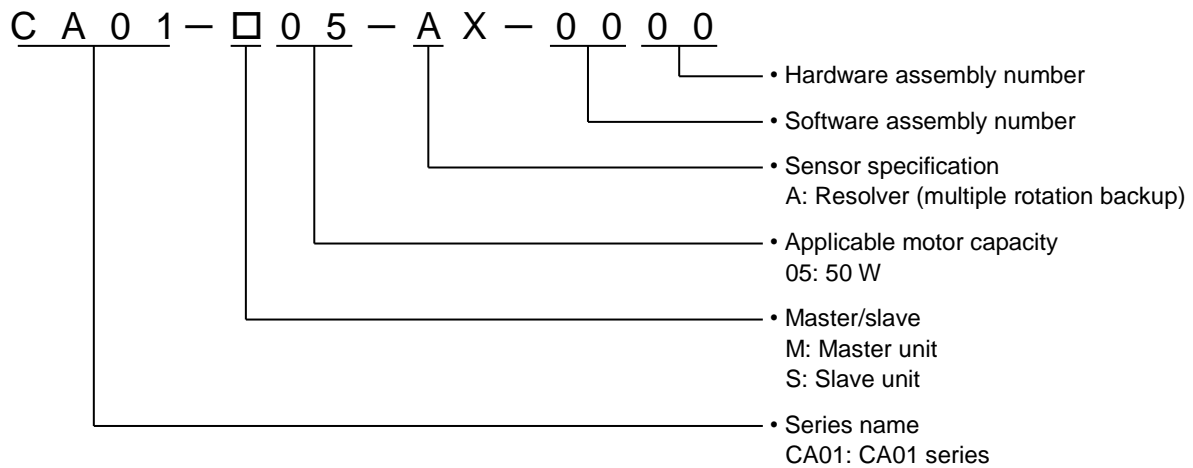
## Chapter 3 BA-C Series

The master unit can be connected with CA01-S05 slave unit of BA-C series. This chapter describes CA01-S05. For the robot type (6-digit number), refer to the instruction manual of the axis unit.

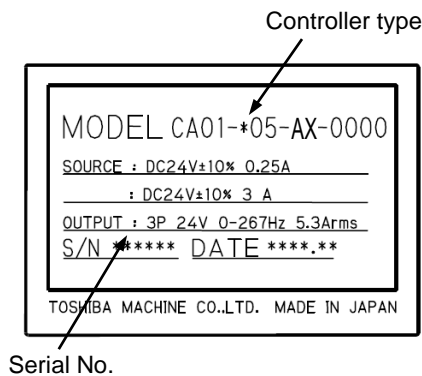
### ■ 3.1 Type

The type of BA-C series is specified as the following.

For descriptions in this manual, however, the sensor specification and the subsequent items are omitted.



The controller type and serial number can be found on the name plate stuck on the right side face of the controller.



## ■ 3.2 Specifications

Controller type	CA01-S05	
Applicable robot	Compo Arm BA-C series	
Number of controllable axes	One axis (with master unit connection)	
Motor capacity	50 W	
Drive method	AC servomotor	
Error signal	Error display lamp lights (front panel) Teach pendant (connected to master unit)	
Origin sensor input	Equipped	
Regeneration function	Equipped (CAR-0500 or CAR-UN50)	
Dynamic brake function	Not equipped	
Mechanical brake operation power	24 VDC 0.4 A or less (for non-excitation operation holding brake) The brake can be released forcibly with brake release switch (SW1).	
Protection function	Software error	Overspeed, Overload, Overflow, etc.
	Warning	Battery low voltage
Status indication	The green LED lights when the power is ON and the red LED lights when an error has occurred.	
External I/O	Not equipped	
Power supply	Control power voltage	24 VDC $\pm$ 10%
	Drive power voltage	24 VDC $\pm$ 10%
Power capacity (per axis)	Control power capacity	0.25 A
	Drive power capacity	Depending on axis type. Rated 3 A (Max. 9 A)
Operation conditions	Working ambient temperature	0 to 40°C
	Working ambient humidity	30 to 90%RH with no dew condensation
	Storage ambient temperature	-20 to 70°C
	Storage ambient humidity	30 to 90%RH with no dew condensation
	Environment	Indoor (not exposed to direct sunlight) 1000 m or less above sea-level No dust, corrosive gas, or flammable gas exists. The environment that the pollution level provided by IEC60664-1 is more than 2.
	Vibration / shock	4.9 m/s <sup>2</sup> or less / 19.6 m/s <sup>2</sup> or less
Dimensions	31(W) × 146(H) × 89(D) (not including screws)	
Weight	Approximately 0.25 kg	

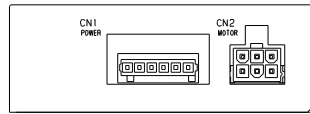
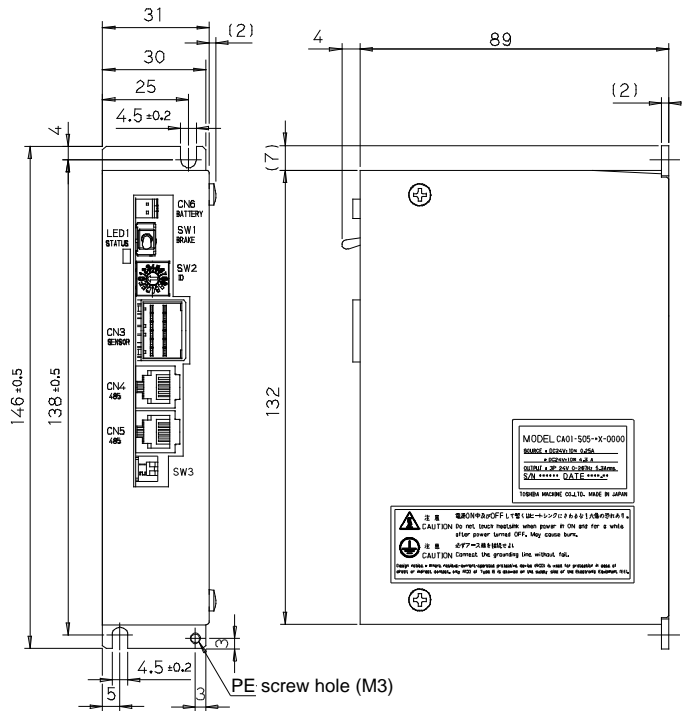
**NOTE** Because the motor sensor resolution of BA-C series is low (2048 pulse/REV), the indicated current position value may be different from the target value ( $\pm$ 0.01 mm) depending on the axis used. This difference is occurred against the absolute position and will not accumulate.

For CA01-S05 slave unit of BA-C series, the following units and options are available.

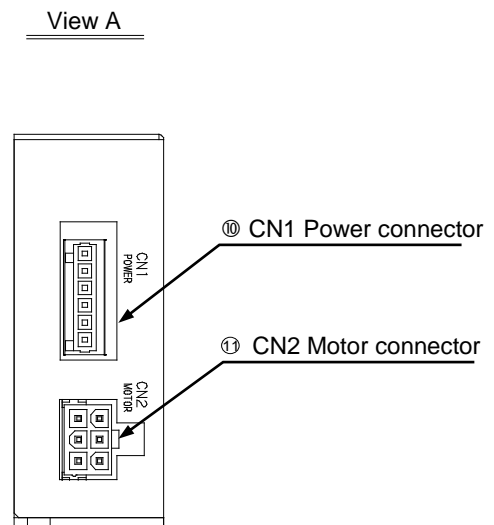
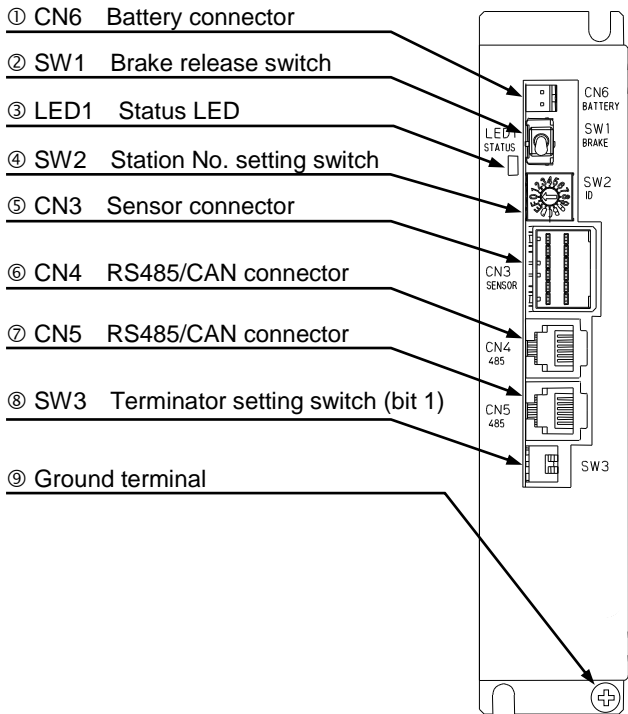
Item name	Type	Purpose
Link cable	CA10-LC-A□□A	For connection between the master unit and slave units
Regenerative discharge resistor	CAR-0500	Discharge resistor for suppression of regenerative voltage
Regenerative discharge unit	CAR-CN50	Discharge unit for suppression of regenerative voltage

### 3.3 Explanation of each part

#### (1) External dimensions



#### (2) Names and functions of each part



↑  
A



① CN6 Battery connector

This connector is used to connect a backup battery for resolver ABS (refer to section ■ 3.4).

② SW1 Brake release switch

This momentary switch is used to release the brake forcibly.

While the lever is being lifted, the brake is released forcibly. When the lever is released, the brake control returns to the normal state.

**CAUTION** When the brake is released forcibly, the workpiece or the hand may drop suddenly and then be damaged or a worker's hand may be caught. Pay enough attention to safety.

③ LED1 Status LED

This LED displays the status of the controller.

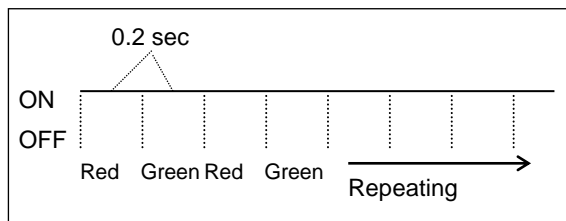
I. Normal mode (SW2 is set to 1 to 4.)

Refer to "①Status LED" in section ■ 2.4.1.

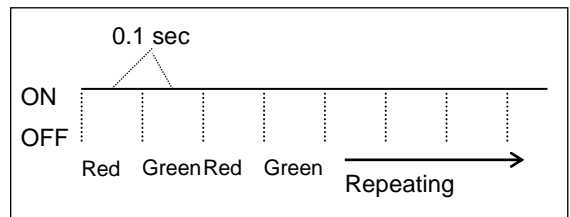
II. Boot mode (SW2 is set to F.)

Color	Status	Blinking pattern
Red + Green blinking	Waiting for boot	①
	Booting	②
Green lighting	Normal termination	—
Red lighting	Abnormal termination	—

● Blinking pattern ①



● Blinking pattern ②



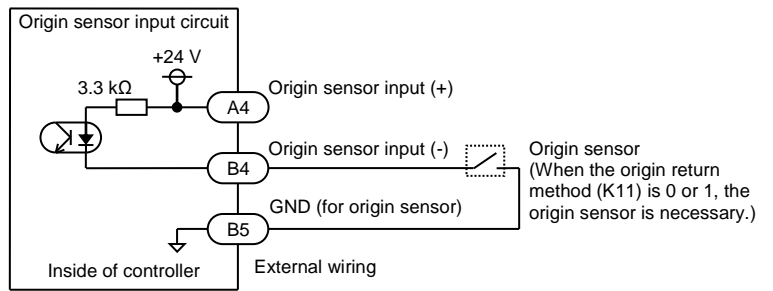
④ SW2 Station No. setting switch

This switch is used to set the station No. of each slave unit when a slave unit is connected and multiple axes are controlled. For updating the firmware, set this switch to "F".

⑤ CN3 Sensor connector

This connector is used to connect the resolver cable.

Pin number	Signal name
A1	S2 (resolver output)
B1	S4 (resolver output)
A2	S1 (resolver output)
B2	S3 (resolver output)
A3	R1 (resolver excitation)
B3	R2 (resolver excitation)
A4	Origin sensor input (+)
B4	Origin sensor input (-)
A5	N.C
B5	GND (for origin sensor)
A6	N.C
B6	GND (shield)

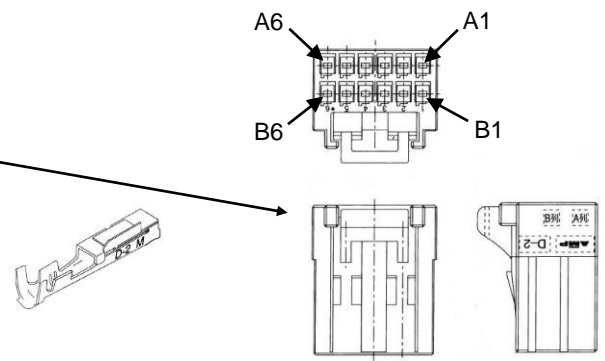


N. C: No Connection

- Part number of cable side connector
 

Receptacle housing	1-1318118-6
Terminal	1318108-1
Manufacturer	tyco Electronics AMP
- Part number of controller side connector
 

Tab header	1376020-1
Manufacturer	tyco Electronics AMP



⑥ CN4 RS485/CAN connector

This connector is used to connect a link cable from an upper controller. For the connecting method, refer to section ■ 3.10.

⑦ CN5 RS485/CAN connector

This connector is used to connect a link cable to a lower controller. For the connecting method, refer to section ■ 3.10.

⑧ SW3 Terminator setting switch

This switch is used to set a terminator for communication. For the setting method, refer to section ■ 3.10.

Bit	Signal name	Remarks
1	Terminator setting	This bit is set to ON for connection of a terminator.
2	N.C	

N. C: No Connection

⑨ Ground wire terminal  
 This terminal is used to connect an earth wire. (Refer to section ■ 3.8.)

⑩ CN1 Power connector  
 This connector is used to input control power and drive power.

Pin number	Signal name	Remarks	Reference section
1	GND (drive power)	This pin is connected with the pin 3 internally.	Section ■ 3.8
2	24 VDC (drive power)		
3	GND (control power)	This pin is connected with the pin 1 internally.	
4	24 VDC (control power)		
5	PA	This pin is used to connect an external regenerative resistor.	Section ■ 3.11
6	JP1	This pin is used to connect an external regenerative resistor.	

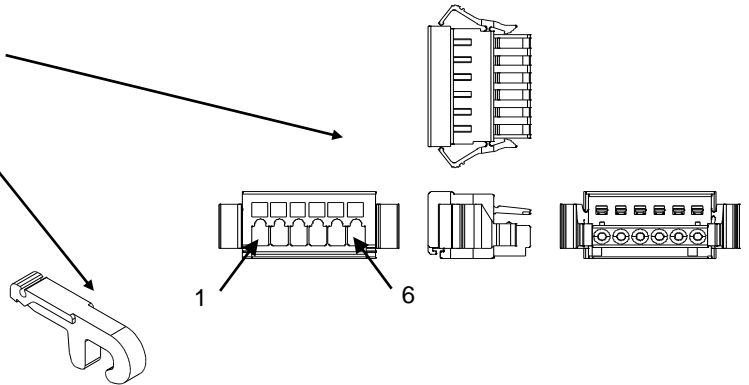
**NOTE** For selection of power, refer to section ■ 3.6.

● Part number of cable side connector

Plug 734-106/037-000  
 Connection lever 734-230  
 Manufacturer WAGO

● Part number of controller side connector

Header 734-166  
 Manufacturer WAGO



⑪ CN2 Motor connector  
 This connector is used to connect the motor cable.

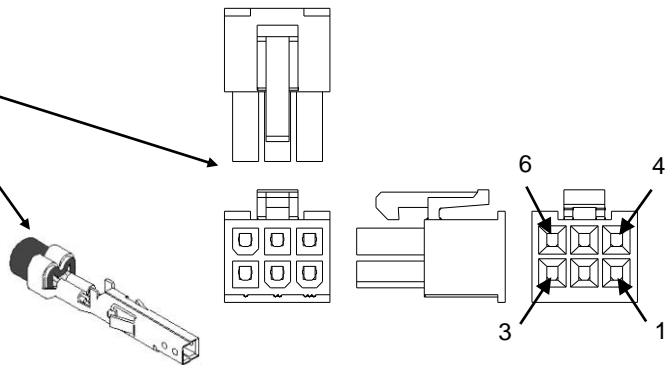
Pin number	Signal name	Remarks
1	U	
2	V	
3	W	
4	F.G	
5	BK+	Brake
6	BK-	Brake

● Part number of cable side connector

Receptacle housing 5557-06R  
 Terminal 5556TL  
 Manufacturer MOLEX

● Part number of controller side connector

Header 5569-06A1  
 Manufacturer MOLEX



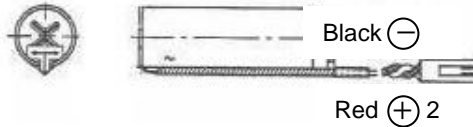
### ■ 3.4 Resolver ABS backup

All AC servomotors of the BA-C axis are equipped with the resolver ABS. By using power from the battery, the motor action is always monitored even when the controller power supply is shut off. This enables smooth start without origin return when starting up of the system or recovery from an emergency stop.

**NOTE** When the encoder type setting parameter is set to "incremental encoder" (refer to section ■ 13.4.17), the absolute function does not work even if the backup power is connected.

- Signal name and pin number of CN6 battery connector

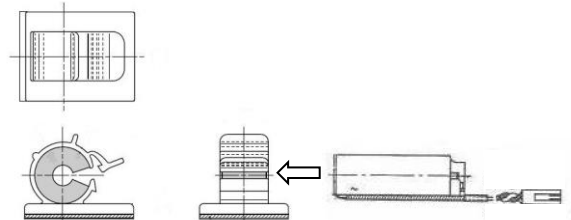
Pin number	Signal name
1	GND (-)
2	VB (+)



**NOTE** If the pins are connected with incorrect polarity, the backup function cannot work and even a failure may be caused.

- Part number of controller side connector
  - Header IL-2P-S3FP2-1
  - Manufacturer JAE

- Battery holder
  - Wire clamp SSP-518
  - Manufacturer Shinagawa Shoko
  - \* Insert the battery into the battery holder as shown in the figure. Then attach the holder on the upper face of the controller etc.



- Specifications of lithium battery

Item		Description	Remarks	
Part name		Lithium battery	Thionyl chloride lithium battery	
Type		ER17500V C	Manufactured by Toshiba	
Specifications	Nominal voltage and capacity	3.6 V 2700 mAh		
	Dimensions	Battery		φ17 × 47 mm (not including protrusions)
		Harness length		50 ± 5 mm (not including connector)
	Weight	Approximately 20 g		
Backup duration (*1)		Approximately one year (*2)	25°C, Backup current 260 μA	

\*1: Depending on accumulation time in which the controller unit is turned OFF.

\*2: Battery duration varies depending on the temperature etc. The value shown should be used as reference only.

- Backup specifications

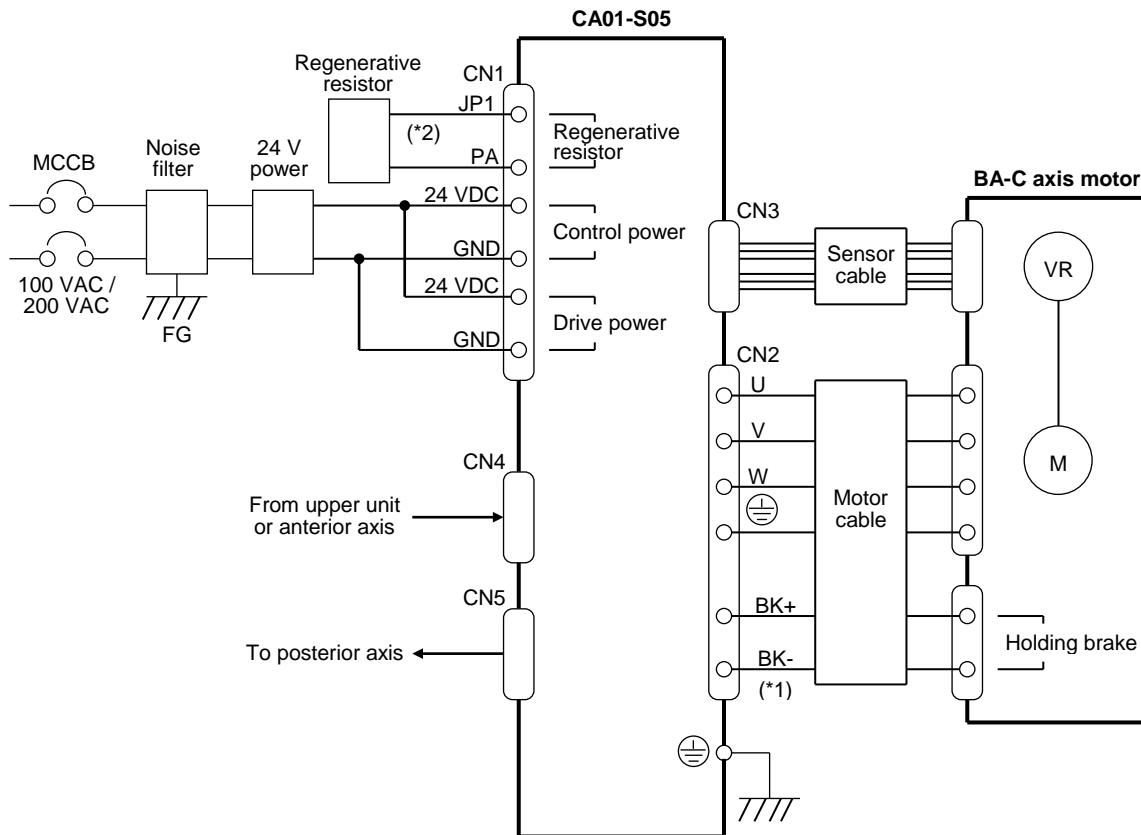
Item		Specification	Remarks
Backup voltage		3.6 VDC (nominal)	If the voltage drops to 3.1 VDC or lower, the status LED blinks in green (warning of voltage drop). (*1) When the voltage drops to 2.5 VDC or lower during backup, the battery error is occurred.
Consumption current	When controller is not energized	260 μA (Max)	25°C Instantaneous maximum current 2 mA
	When controller is energized	1 μA (nominal)	

\*1: Once the status LED blinks in green due to backup voltage drop, the LED continues to blink until shutting off of the power even if the voltage returns to the normal value. In some cases, the status LED does not blink in green even at a voltage drop due to the impedance.

- Encoder error
  - For encoder errors, refer to section ■ 2.4.2.

### ■ 3.5 Wiring

Connect wires to CA01-S05 as shown in the figure below.



\*1: Not required to be connected for use of BA-C axis without holding brake

\*2: Required to be connected when regenerative energy is large. Refer to section ■ 3.11.

### ■ 3.6 Selection of power source

Each power capacity of CA01-S05 is shown in the following table.

Note that insufficient drive power may cause troubles including decrease of power output and torque and then the original performance may not be attained.

Power capacity

Power	Voltage	Power capacity	Remarks
Control power	24 VDC $\pm 10\%$	0.25 A	
Drive power	24 VDC $\pm 10\%$	3 A	Rated value (max. 9 A)

#### ● When connecting multiple controllers

When multiple controllers are connected to one power supply, the power supply is required to have power capacity corresponding to the sum of individual controller power capacities.

When axes do not move simultaneously, however, the power capacity can be reduced depending on their moving patterns.

Example) Two robots are connected to one power source.

- Control power:  $(0.25 \text{ A (control power)} + 0.13 \text{ A (I/O circuit)}) \times 2 = 0.76 \text{ A}$  or higher
- Drive power:  $9 \text{ A} \times 2 = 18 \text{ A}$  or higher (when two robots accelerate or decelerate simultaneously).

#### ● Regenerative action

The motor may generate back electromotive force resulting in increase of drive voltage when decelerating suddenly or being rotated by external torque. To prevent increase of drive voltage, use a regenerative resistor. (Refer to section ■ 3.11.)

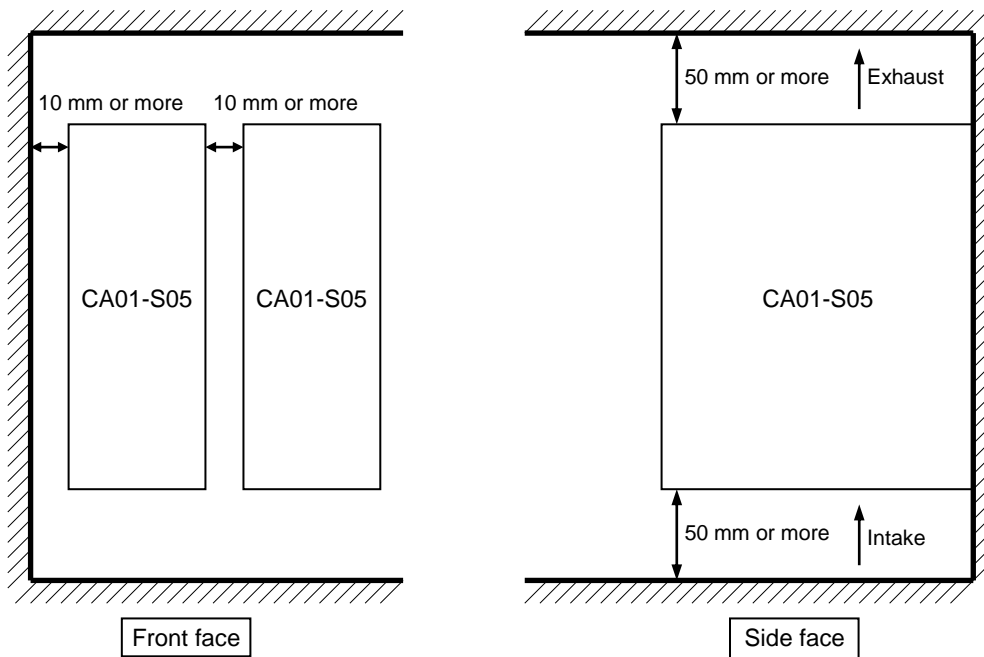
### ■ 3.7 Installation

The controller uses a natural cooling method through convection. When installing the controller, place it vertically as shown below, and leave a space of 10 mm or more on the left and right sides and 50 mm or more on the top and bottom sides. If the ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

Make sure that foreign matter such as fluids or dust does not enter the controller. This unit does not have a dust proof structure. Avoid use in dusty places.

If ambient temperature exceeds +40°C, add a cooling method such as a cooling fan.

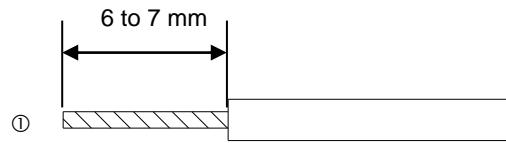
For dimensions of mounting holes, refer to section ■ 3.3-(1).



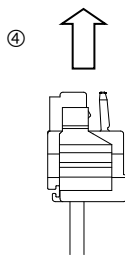
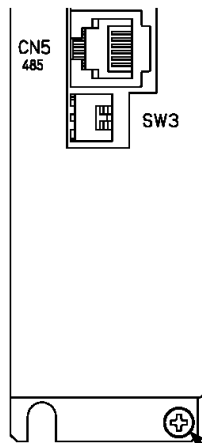
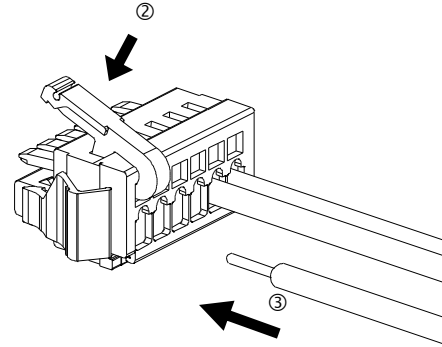
### ■ 3.8 Power supply and ground

Connect power supply to CA01-S05 as shown below.

- ① Strip the wire.  
Wire stripping length: 6 to 7 mm
- ② Attach the wire connection lever supplied with the controller onto the cable side connector and push it in the direction shown by the arrow below to open the connecting hole.
- ③ Insert the stripped conductor of the wire into the hole.  
After insertion, release the wire connection lever.  
\* Insert the wire fully.  
\* Take care not to allow neighboring wires to contact each other resulting in a short circuit.
- ④ Connect the cable side connector to the power connector on the bottom face of CA01-S05.



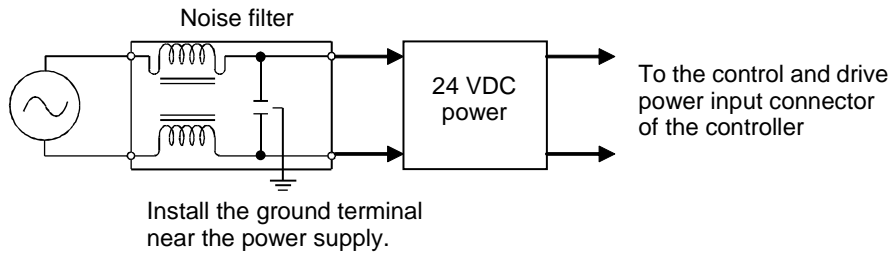
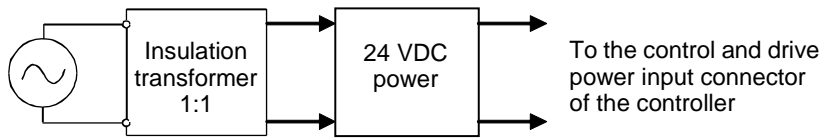
Strip 6 to 7 mm of the wire.



Connect the ground wire.  
At factory shipment, the two washers are attached for prevention of coming off during transportation. Adjust them according to usage conditions.

### ■ 3.9 Improvement of noise resistance

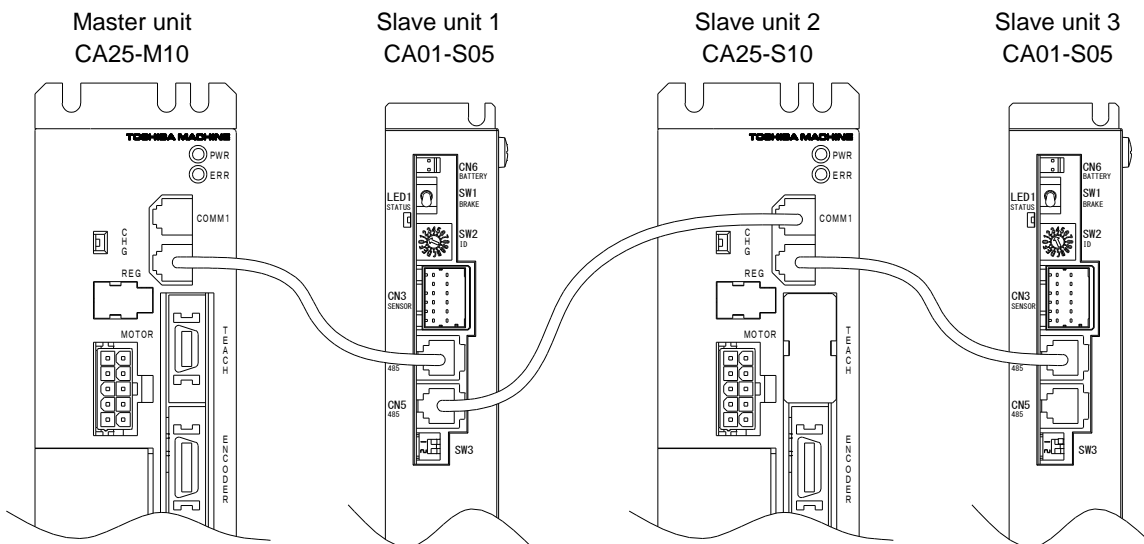
For improvement of noise resistance, refer to section ■ 2.5.3. When a power line insulation transformer (1:1) or noise filter is inserted, however, refer to the following figures.



### ■ 3.10 Connecting the controllers

By connecting multiple CA01-S05 with link cables, the master unit CA25-M10 can control up to four axes. Also a slave unit CA25-S10 and CA01-S05 can be controlled together. For connecting method, refer to section ■ 2.5.4-(1), (2), and (4). However, use COMM1 and COMM2 of the communication connector as CN4 and CN5 respectively. The station No. setting and the terminator setting of the CA01-S05 are set using SW2 and SW3 (bit 1) respectively.

The following figure shows example connection where CA25-M10 is used for the axis 1, CA01-S05 is used for the axes 2 and 4, and CA25-S10 is used for the axis 3.





### ■ 3.11 Regenerative resistor (optional)

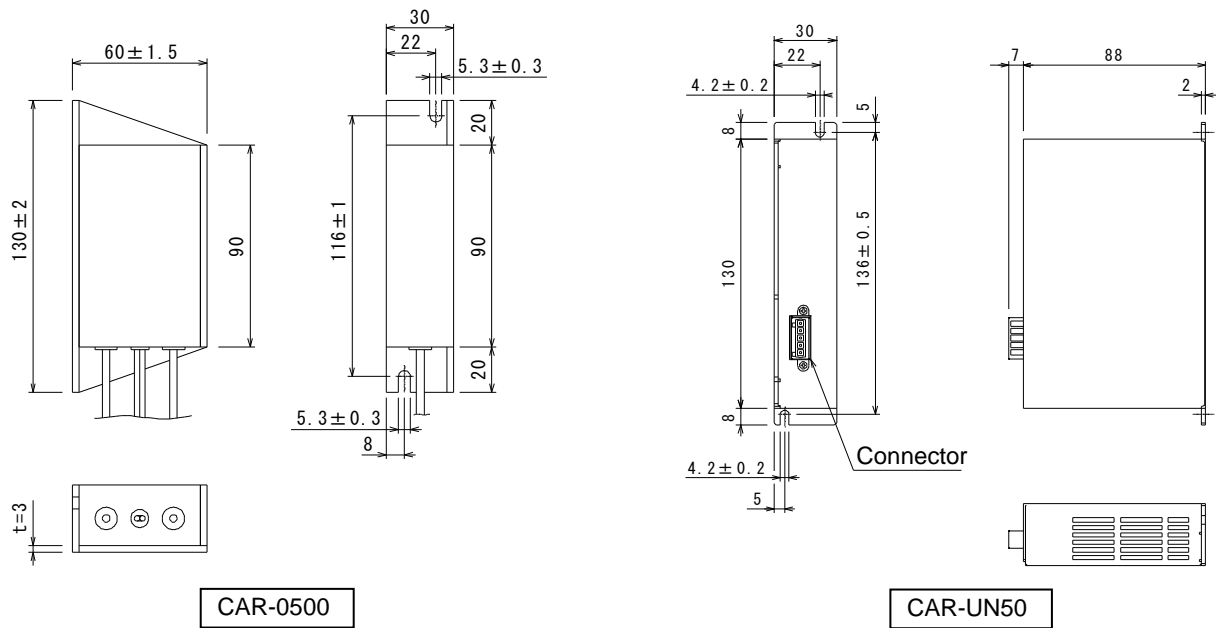
The regenerative resistor absorbs electrical power energy generated during deceleration of the axis motor. The regenerative resistor is used to prevent overvoltage of the controller when a load inertia exceeds the permissible value or a large load on the Z axis is lowered down over a long stroke (too much electrical power is generated). (The regenerative resistor is used to prevent overvoltage of the controller.)

- \* Resistor type CAR-0500 and unit type CAR-UN50 are available.
- \* All discharged energy will be converted into heat.
- \* If the resistor generates abnormal heat, a contact output is outputted (N.C).
- \* The one unit can be used for one axis.

#### ■ 3.11.1 Specifications

Item	Description	
Model number	CAR-0500	CAR-UN50
Type	Resistor	Unit
Regeneration activating voltage	48 VDC (controlled by the controller)	
Cooling	Natural air cooling	
Protection	Thermal relay activated at resistor internal temperature of 135°C Output contact: 1b Maximum switching voltage: 250 VAC/42 VDC Maximum switching current: 0.2 A AC/DC (Minimum switching current: 1 mA AC/DC)	Thermal relay activated at unit surface temperature of 120°C Output contact: 1b Maximum switching voltage: 110 V AC/DC Maximum switching current: 0.3 A AC/DC Maximum switching power: 6 W AC/DC (Minimum switching current: 0.1 mA/1 VDC)
Operation conditions	Working ambient temperature	0 to 40°C
	Working ambient humidity	30 to 90%RH With no dew condensation
	Storage ambient temperature	-20 to 70°C
	Storage ambient humidity	30 to 90%RH With no dew condensation
	Environment	Indoor (not exposed to direct sunlight) 1000 m or less above sea-level No dust, corrosive gas, or flammable gas exists. The environment that the pollution level provided by IEC60664-1 is more than 2.
	Vibration	4.9 m/s <sup>2</sup> or less
External dimensions	30 (W) × 130 (H) × 60 (D)	30 (W) × 146 (H) × 88 (D)
Mass	0.39 kg	0.22 kg

### ■ 3.11.2 Dimensions



### ■ 3.11.3 Installation

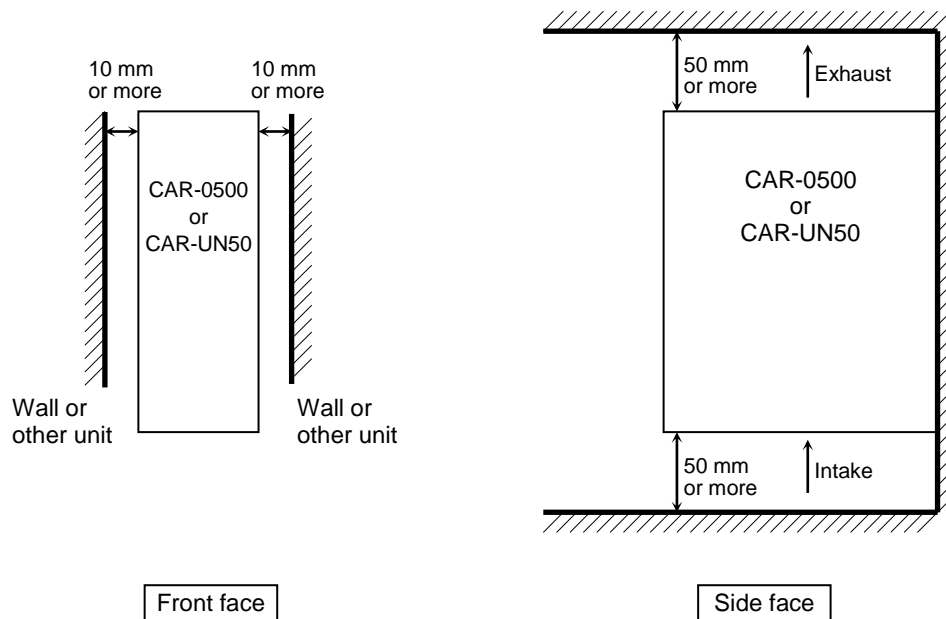
The regenerative resistor uses a natural cooling method through convection. When installing the regenerative resistor, place it vertically as shown below, and leave a space of 10 mm or more on the left and right sides and 50 mm or more on the top and bottom sides.

If the ventilation is insufficient, the sufficient performance will not be achieved, and faults could occur.

Make sure that foreign matter such as fluids or dust does not enter the resistor. This unit does not have a dust proof structure. Avoid use in dusty places.

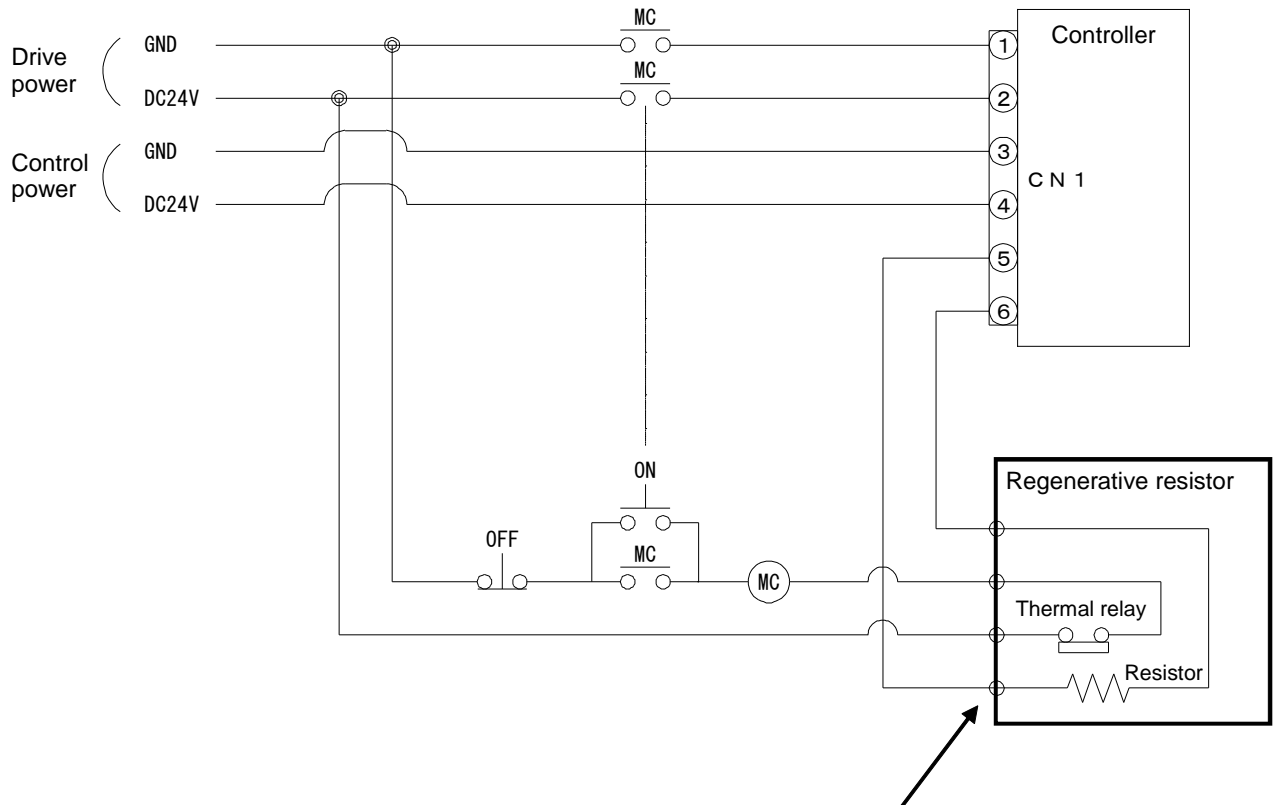
If ambient temperature exceeds  $+40^{\circ}\text{C}$ , add a cooling method such as a cooling fan.

For dimensions of mounting holes, refer to section ■ 3.11.2.



### ■ 3.11.4 Example connection

Connect the controller and the power source to the regenerative resistor as the following figure.



\* The unit type is connected using the connector.

#### ● Precautions for use

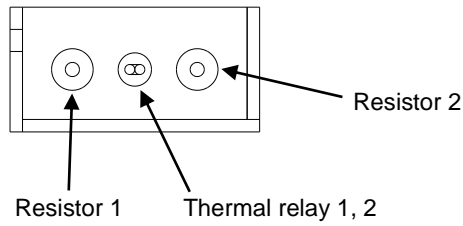
- CAR-0500 and CAR-UN50 have the built-in thermal relay that is activated at temperature of 135°C (CAR-0500) and 120°C (CAR-UN50).
- When this relay is activated, the circuit between outputs of the thermal relay opens.
- Make a sequence program so that the controller power is always turned OFF when the thermal relay is activated.
- When the thermal relay is activated once, it requires approximately three minutes to reset (return to the normal state).

**CAUTION** The regenerative resistor may reach a very high temperature during use. Do not touch the regenerative resistor, or burn injury may be caused. When inspecting the regenerative resistor, wait enough time to allow the regenerative resistor to cool down before starting work.

● Connection terminal

CAR-0500

Bottom view



- \* When the output wire length of the thermal relay is insufficient, use the supplied junction connector.
- \* Prepare the wires by yourself.

● Use of accessory

CAR-0500

Accessory: Two junction connectors

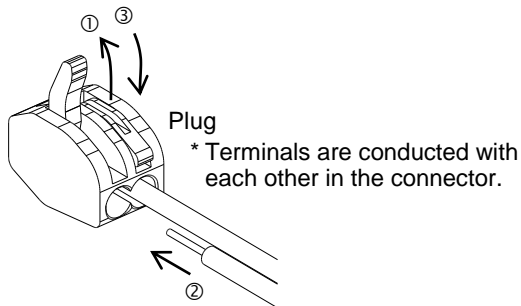
● Connector part number

Plug 222-412  
 Manufacturer WAGO

● Connecting method

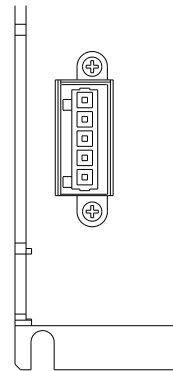
- ① Lift the upper lever to 90° to the connector.
- ② Insert the wire fully.
- ③ Return the upper lever.
- ④ Pull the wire lightly to make sure that it is firmly connected.

\* Wire strip length: approximately 9 mm



CAR-UN50

Frontal view



Pin No.	Name
1	Resistor 1
2	Resistor 2
3	Thermal relay 1
4	Thermal relay 2
5	FG

- \* Prepare the wires by yourself.

CAR-UN50

Accessory: Connector, connection lever

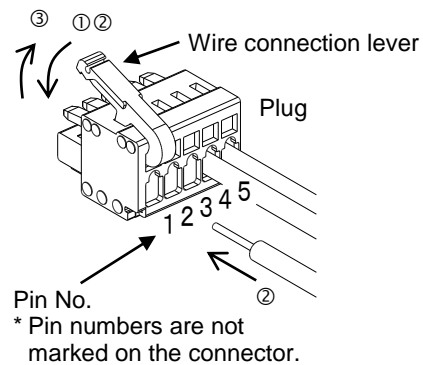
● Connector part number

Plug 734-105  
 Connection lever 734-230  
 Manufacturer WAGO

● Connecting method

- ① Attach the supplied wire connection lever as the following figure.
- ② While pushing the wire connection lever in the direction shown in the figure, insert the wire fully.
- ③ Release the wire connection lever.
- ④ Pull the wire lightly to make sure that it is firmly connected.

\* Wire strip length: approximately 7 mm

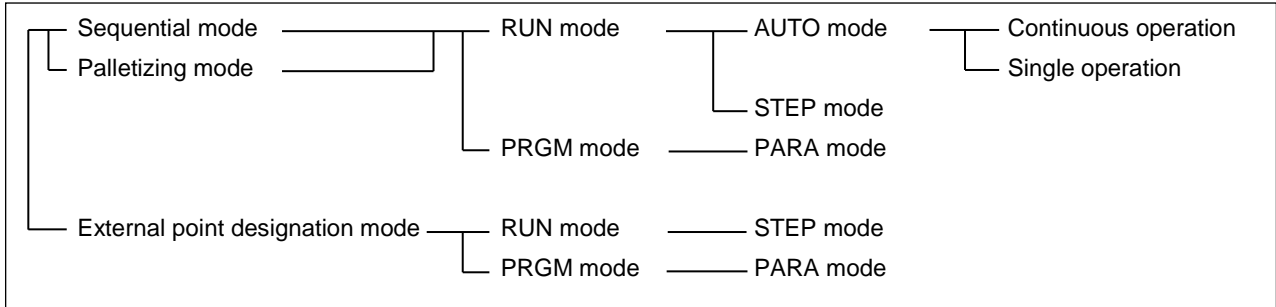


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# Chapter 4 Basic Knowledge

## 4.1 Explanation of operation modes

This robot is provided with the following types of operation modes.



### (1) Sequential mode

The sequential mode is a mode used to execute or program in order of steps. With the sequential mode, the operation program is structured from the beginning, so operations more complex than the palletizing mode are possible.

By using multitasking, up to four sequential programs can be executed simultaneously.

Refer to Chapter 5 for details on the sequential mode, and Chapter 6 for details on multitasking.

### (2) Palletizing mode

The palletizing is a mode exclusive for moving and loading. In this mode, operation is carried out using a mode program and by inputting matrix information that indicates the movement point and loading state, etc.

The following types of modes are prepared in the palletizing mode.

#### ● 1 to M mode

Movement from set position (source side: S) to matrix-type point configured with X, Y, and Z axes (destination side: D)

#### ● M to 1 mode

Movement from matrix-type point configured with X, Y, and Z axes (source side: S) to set position (destination side: D)

#### ● M to M mode

Movement from matrix-type point configured with X, Y, and Z axes (source side: S) to matrix-type point configured with X, Y, and Z axes (destination side: D)

Refer to Chapter 7 for details on the palletizing mode.

### (3) External point designation mode

The external point designation mode does not use the controller's command language. The point table, speed table and acceleration/deceleration table are input beforehand, and by designating these tables with general-purpose inputs, movement takes place.

Refer to Chapter 8 for details on the external point designation mode.

## ■ 4.1.1 Explanation of RUN mode

The RUN mode is a mode that operates the robot. The mode can be divided into the AUTO mode and STEP mode. Both the AUTO and STEP modes can be operated in the sequential and palletizing modes. Only the STEP mode can be operated in the external point designation mode.

### (1) AUTO mode

In this mode, when the start key is pressed, the program displayed on the Teach Pendant will be executed in order of the step numbers.

Normally continuous operation takes place. If the single mode setting is validated, the single operation that stops after a specific command (axis movement related or output related command) is executed in the sequential mode or after movement to the S (source side) or D (destination side) is completed in the palletizing mode can be performed. When a created program is executed for the first time, the program should be verified in the STEP mode before starting continuous operation.

### (2) STEP mode

In this mode, when the start key is pressed, one step of the program will be executed, and the operation will stop. To execute the following program, press the start key again.

When multiple tasks are operated using the multitasking function, one step of the task displayed on the Teach Pendant will be executed and then will stop. The other tasks will stop when the step being executed at the time the displayed tasks have stopped is stopped.

#### NOTE

- When the speed and the acceleration/ deceleration time is not defined before moving an axis, the values in the speed table No. 1 and the acceleration/deceleration table No. 5 will be used.
- When the pass rate is not defined before moving an axis, the pass rate of 100.0% will be used. (Refer to PASS command on page 17-50.)
- Note that the timings of input and output signals of operation in the STEP mode differ from that of operation in the AUTO mode.

## ■ 4.1.2 Explanation of PRGM mode

The PRGM mode is used to program the various operations for sequential and palletizing modes with the Teach Pendant or to set the point tables for the external point designation mode. The program screen differs for each mode, so follow the cursor that appears on the Teach Pendant and input the data. Functions handy during programming such as copy, delete and search are provided. Refer to each chapter for details on the operation methods.

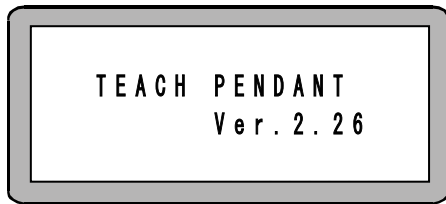
### ● PARA mode

The various parameters related to operation of the robot are set in this mode. The PARA mode is entered from the PRGM mode.

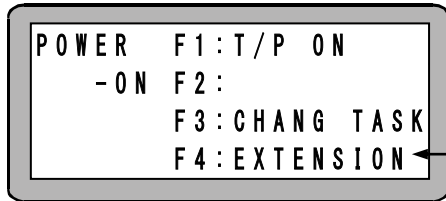
There are two types of parameters, that will not be validated until the power is turned OFF and ON after making a setting, and that will be validated when the PARA mode is quit. Refer to Chapter 13 for details on the operation methods.

## ■ 4.2 Setting the robot type

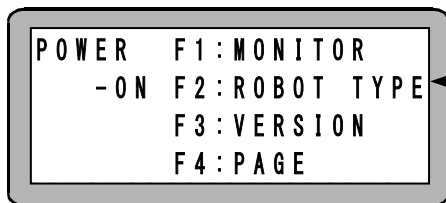
Inputting the Robot Type enables you to automatically set various parameter values according to the axis to be used. The Robot Type is set as the followings.



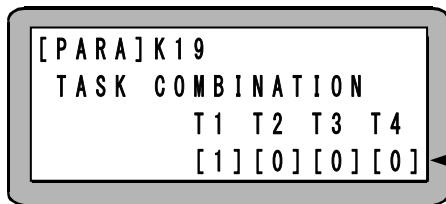
**STEP 1** When the power is turned ON, the first display is shown.



**STEP 2** After the first screen, the display at left is shown. Press the **F4** key.



**STEP 3** Press the **F2** key to select the Robot type. Press the **ESC** key to return to STEP 2.



**STEP 4** Enter the task and axis combination before entering the robot type of each axis.

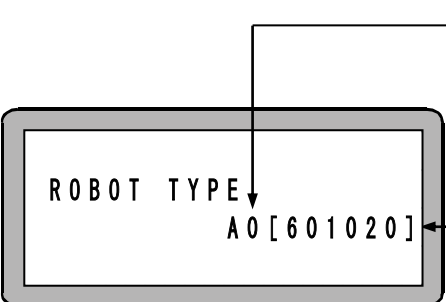
Use the numeric keypad to enter the axis setting used for each task and press the **ENT** key.

Press the **ALT** key or the **NEXT** key to display the next screen.

When the task and axis combination is changed and the **ESC** key is pressed, the setting procedure proceeds to STEP 7.

When the task and axis combination is not changed and the **ESC** key is pressed, the setting procedure returns to STEP 3.

**?** Refer to section ■ 13.4.19 for details.



**STEP 5** Use the **ALT** key or the **NEXT** key to select the station No. (0 to 3).

Press the **ALT** key or the **NEXT** key to return to STEP 4.

**STEP 6** Use the numeric keypad to enter the Robot type and press the **ENT** key.

The robot type will be set.

Press the **ENT** key and then the **ESC** key to display STEP 7.

**?** ●The initial value is "600000". Refer to the Instruction Manual of the axis for details on the robot type (six-digit figure).

●To confirm the robot type, press the **ESC** key at STEP 5 to return to STEP 3.

**NOTE** If a wrong robot type is set, communication with the slave unit may be impossible.

**CAUTION** A robot type includes motor capacity information. If a wrong robot type is set, the specified torque may not be attained or the motor may burn out.



PLEASE POWER OFF !!

**STEP 7** Follow the instructions on the display and turn OFF the controller power.

**NOTE**

- After the Robot type has been entered, turn OFF the controller switch to write the data into the controller.
- If a nonexistent Robot type is entered, robot No. error occurs.
- If the power is turned ON, remaining initial value, robot No. error occurs.
- In the cases of the followings, "PLEASE POWER OFF!!" may be displayed after turning ON the power again. In such a case, turn OFF the power again. When the power is turned ON again, the set parameter 2 will be validated.
  - ① When the power is turned ON for the first time after the axis setting is changed in setting of the combination of the task and the axis (refer to STEP 4) and the power is turned OFF.
  - ② When the link cable is connected and the power is turned ON for the first time after the robot type of the slave unit of the station No. to which the link cable is not connected is changed and the power is turned OFF.
  - ③ When the power is turned ON for the first time after the slave unit is changed following change of the robot type.

### ■ 4.3 Setting the software limit and return to origin

Software limits that restrict the movement range of the axes can be defined to prevent the robot from overrunning. The software limit is set to the positive and negative range of movement of a motor drive shaft. The limits on the movement range can be changed easily by software, unlike the limits using hardware. To set the software limits, use the Teach Pendant and follow the directions below.

POWER F1:T/P ON  
-ON F2:  
F3:CHANG TASK  
F4:EXTENSION

**STEP 1** Turn ON the power. After the first display at left is shown, press the **F1** key. Then, press the **RUN PRGM** key to enter the PRGM mode.

[PRGM]  
0001  
NOP

**STEP 2** Press the **F4** key to enter the PARA mode (refer to section ■ 13.1) and the **F2** key to enter the parameter 1 (refer to section ■ 13.3).

[PARA] P01A0= 0000.00  
UPPER A1= 0000.00  
LIMIT A2= 0000.00  
A3= 0000.00

**STEP 3** The screen as shown at left appears. Set the plus soft limit (refer to section ■ 13.3.1). Then press the **NEXT** key and set the minus soft limit (refer to section ■ 13.3.2). Then press the **ESC** key twice to return to STEP 2. Press the **RUN PRGM** key to enter the RUN mode.

RETURN TO ORIGIN !!

**STEP 4** Press the **HOME** key to execute return to origin. During return to origin, the screen shown here appears. When the return to origin is completed, the screen returns to the original state.

**NOTE**

- The software limits must be within the maximum stroke. After completion of the setting and return to origin, the robot can move within the range from the minus software limit to the plus software limit.
- The software upper limit is the maximum and the software lower limit is the minimum moving distance of the axis.

## ■ 4.4 Servo gain adjustment

There are two kinds of gain in the servo mechanism of this robot: position gain and speed gain. They are set through parameter 1. (Refer to sections ■ 13.3.3 and ■ 13.3.4.)

Generally, a larger servo gain increases the accelerating capacity and enables higher speed response, and a smaller servo gain decreases the accelerating capacity and enables smooth movement. An inappropriate gain setting can cause overshoot or undershoot. It can also result in vibration and noise. Normally, the appropriate servo gain is set automatically when the Robot Type (six-digit figure) is entered. However, when you have to adjust the gain according to actual load conditions, adjust it following the instruction below.

**NOTE** There are 99 gain settings, 0 to 98. Change the gain setting little by little according to the Robot Type's preset value while checking the robot movement.

### ● Position gain

When high speed response is desired, set the value of the servo gain for positioning to a larger value. Note that if it is set too large, hunting (oscillation) can occur during movement or positioning of the robot. If this happens, adjust it to a smaller setting. A smaller value will enable smoother movement of the robot, but the positioning time increases with smaller values.

### ● Speed gain

Set the servo gain for speed at a value one lower than the level at which the motor begins to generate small vibration in servo lock condition (the motor is stopped with the power ON). When the value is set too large, beat noise will be caused by small vibration of the motor. In this case, set it to a smaller value.

When the servo gain for speed is too low, low frequency hunting (oscillation) occurs in the motor. In this case, set the gain to a larger value. When the value is set too small, an overflow error can be generated because of the delayed response to a command of the motor.

## ■ 4.5 Return to origin

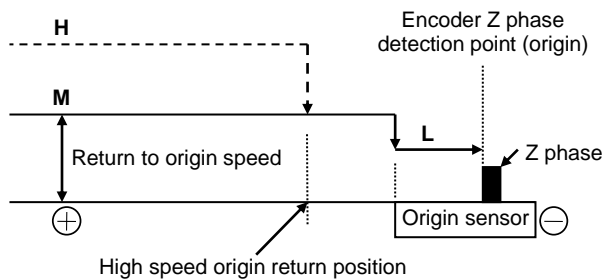
### ■ 4.5.1 Return to origin

There are four kinds of return to origin methods: return to origin methods 0 to 3. In addition, each of the return to origin methods 0 to 2 can be classified into two types: the first return to origin after turning ON the power (starting with return to origin speed M) and the second or later return to origin (starting with return to origin speed H).

Operation of the various return to origin methods are described below.

#### (1) The return to origin setting is "0"

After the origin sensor is turned ON, the encoder Z phase detection is performed at the low speed and the detected point is set as the origin.

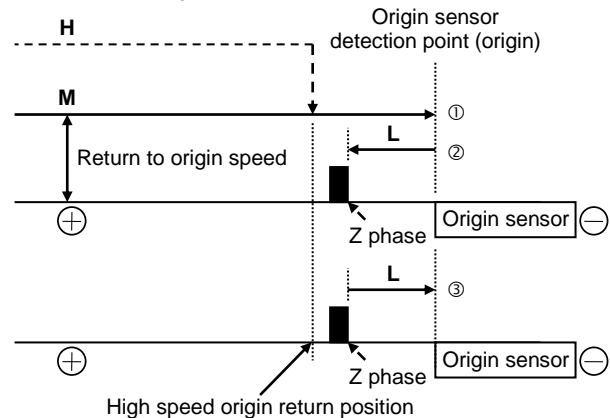


#### NOTE

- If the origin sensor is activated when the first return to origin, the robot moves to outside of the origin sensor activation range and return to origin is performed again.
- When the return to origin speed M (middle speed) is large, the Z phase may be passed over.

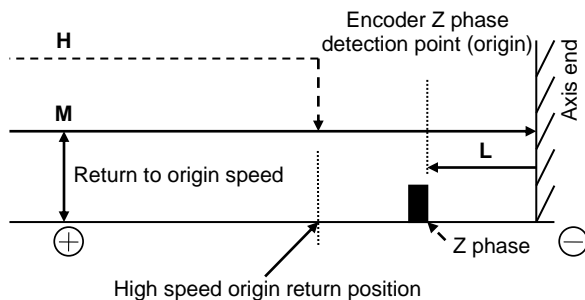
#### (2) The return to origin setting is "1"

After the origin sensor is turned ON, the robot moves forward (+ direction) and stops at the encoder Z phase. Then searching of the origin sensor is performed at the low speed and the point where the sensor is turned ON is set as the origin.



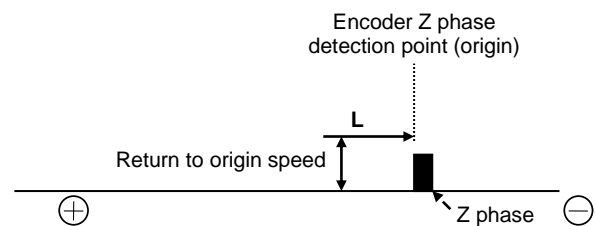
#### (3) The return to origin setting is "2"

After reaching the axis end, the robot moves forward (+ direction) while performing detection of the encoder Z phase and the detected point is set as the origin.



#### (4) The return to origin setting is "3"

The robot moves backward (- direction) from the current position. When the first encoder Z phase is detected, the detected point is set as the origin. Do not use this mode. (For adjustment at manufacturer)



#### NOTE

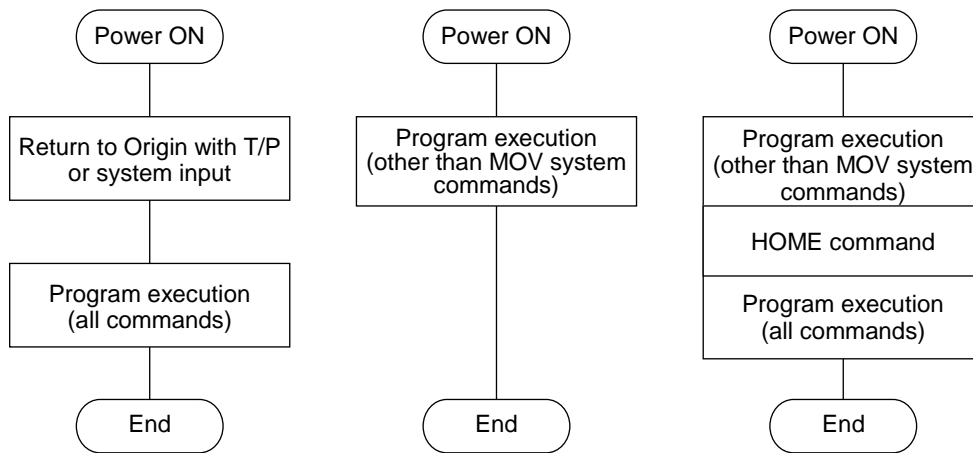
- For setting of the return to origin speed L (low speed), M (medium speed), and H (high speed), refer to sections ■ 13.4.7 to ■ 13.4.10.
- For setting of the return to origin method, refer to section ■ 13.4.11.
- For setting of the high speed origin return position, refer to section ■ 13.4.13.
- For returning to origin in synchronized axes, refer to section ■ 9.5.

## ■ 4.5.2 Return to origin and MOV system commands

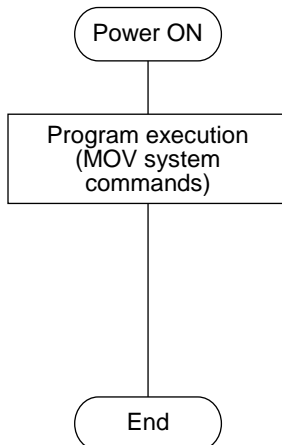
- When the encoder type in the parameter 2 is set to "a" (refer to section ■ 13.4.17), a program including MOV system commands can be executed without return to origin even after turning OFF and ON the power, provided that return to origin has been performed once. However, if an encoder backup error corresponding to the error code of ER2C, ER3C, ER4C, or ER5C occurs upon turning OFF and ON the power, return to origin is required.
- When the encoder type in the parameter 2 is set to "i" (refer to section ■ 13.4.17), return to origin needs to be performed before execution of a program including MOV system commands each time the power is turned OFF and ON. In this case, any encoder backup error corresponding to the error code of ER2C, ER3C, ER4C, or ER5C will not occur.
- Even when return to origin is required, commands other than MOV system commands in a program can be executed before return to origin. Therefore if a program is created so that the HOME command is executed before execution of MOV system commands, return to origin with use of the **HOME** key or a return to origin input before execution of the program becomes unnecessary.

Examples of operation when return to origin is required are shown below.

(1) Program can be executed



(2) Program cannot be executed (error occurs)



## ■ 4.6 Memory initialization

The memory in the controller that stores the programs and parameters can be initialized (cleared).

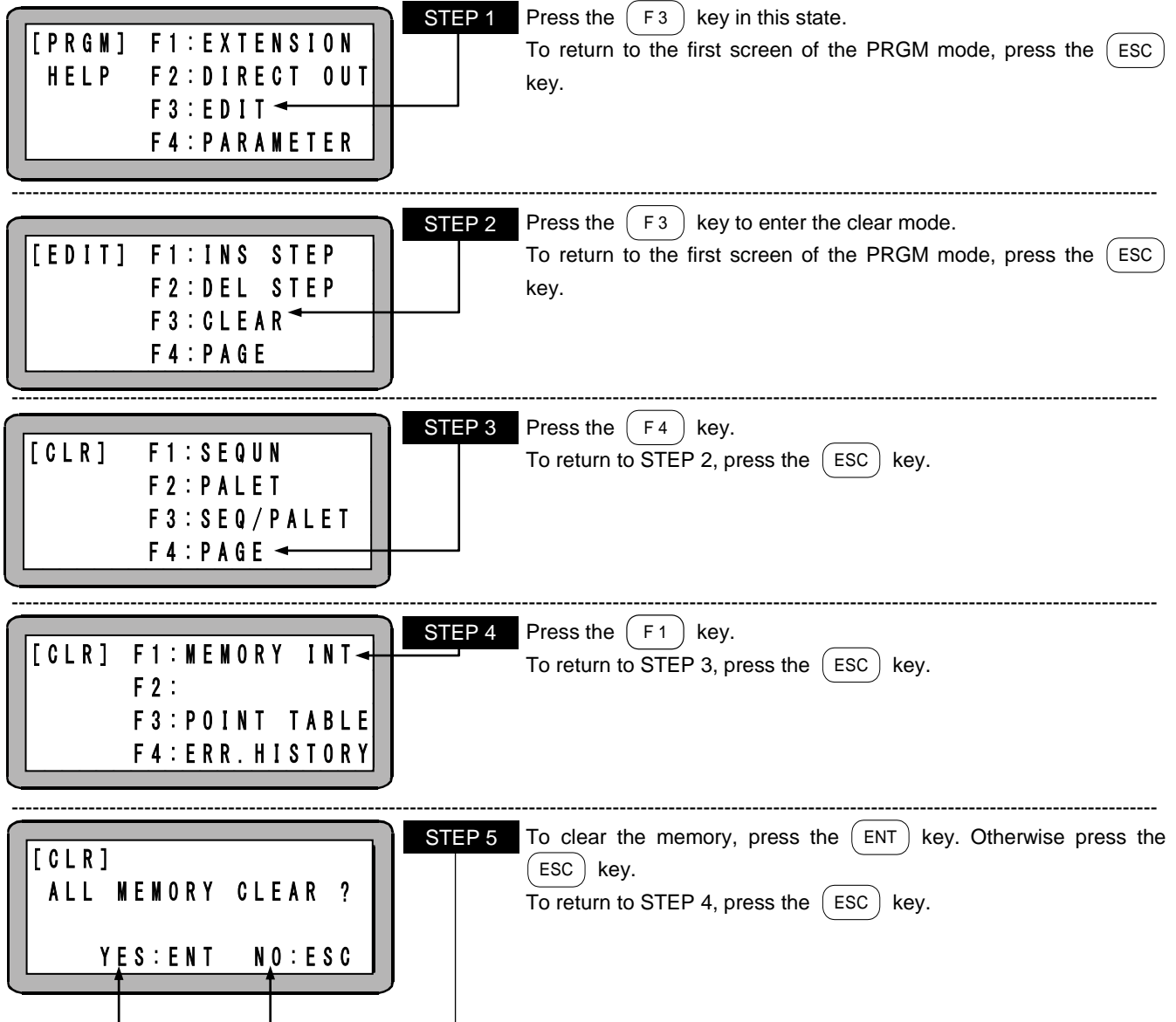
### NOTE

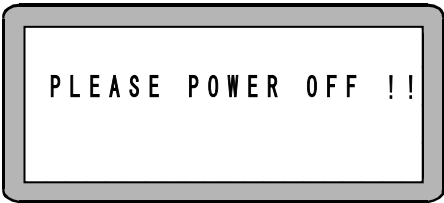
- When the memory is initialized, the various parameters in the memory will be initialized, and the sequential and palletizing mode programs will all be cleared.

The memory can be initialized by a method using operations from the PRGM mode or by a method without turning ON the Teach Pendant (T/P) after turning ON the power.

#### (1) Method to initialize the memory from the PRGM mode

Enter the PRGM mode and press the **HELP** key. The following will display. (Refer to section ■ 5.1.1.)





**STEP 6** Follow the instructions on the screen, and turn the controller power OFF.

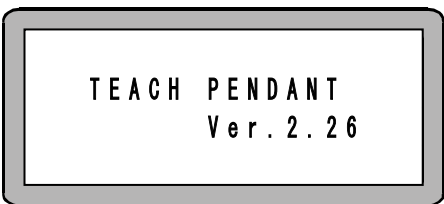
**NOTE**

● After the memory is initialized, the robot type "600000" (single axis specifications) parameter will be set. When using a type other than "600000", set the robot type again. Moreover, the task combination is initialized as follows.

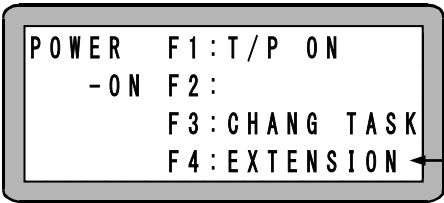
T1	T2	T3	T4
[1]	[0]	[0]	[0]

● Refer to the Instruction Manual of the axis for how to set the robot type.

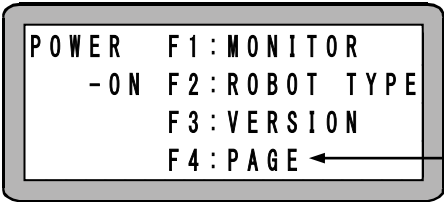
(2) Method to initialize the memory without turning the Teach Pendant ON (T/P ON) after turning the power ON  
The memory can be initialized without turning the T/P ON after the main power is turned ON. Use this method when an error occurs and the memory cannot be initialized from the PRGM mode.



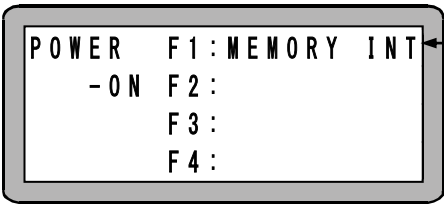
**STEP 1** Turn the power switch ON. The initial screen will display for two seconds.



**STEP 2** After the initial screen ends, the following screen will display. Press the **F4** key.



**STEP 3** Press the **F4** key. To return to STEP 2, press the **ESC** key.



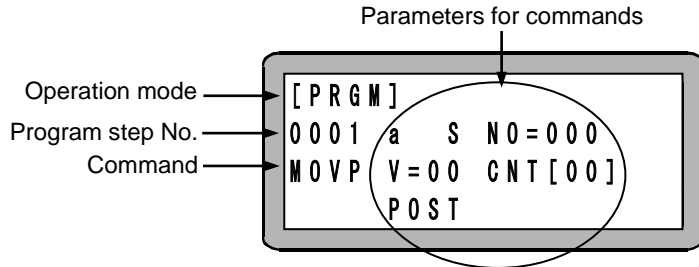
**STEP 4** Press the **F1** key in this state. To return to STEP 3, press the **ESC** key.

The following steps are the same as STEPs 5 and 6 on the previous page.

## ■ 4.7 Programming

### ■ 4.7.1 Basic programming

This section explains basic programming, using examples of a Teach Pendant display. The following illustration shows a display of sequential mode in the PRGM mode.



- Operation mode

The mode selected by the Teach Pendant is displayed. [PRGM] is displayed for the PRGM mode, [AUTO] is displayed for the AUTO mode, and [STEP] is displayed for the STEP mode.

- Program step No.

A maximum of 5000 steps can be written in the sequential mode.

The teach pendant screen (20 characteristics × 4 lines) displays a program step one by one.

To move forward the cursor during writing a program, press the **ENT** key.

To display the next program step, press the **NEXT** key. To display the previous step, press the **-NEXT** key.

**NOTE**

Data displayed on the teach pendant is inputted (transferred to the controller) when the **NEXT** key or the **-NEXT** key is pressed and the screen changes.

Data will not be inputted to the controller by pressing the **ENT** key.

A maximum of 5000 steps is supported only by CA25-M10 version 4.30 or later, and SF-98D version 3.1.7 or later. For other than the above, a maximum of 2500 steps.

- Commands

Various commands are selected by pressing the command key, function key or numeric keypad. The command is then written by pressing the **ENT** key.

- Parameters for commands

When a command is being written, the cursor automatically moves to a field where a parameter should be entered. Write the parameter and press the **ENT** key, then the cursor moves to the next parameter. To correct a parameter, press the **B SKIP** and **ENT** keys to move the cursor to the parameter to be corrected, and then enter the parameter again.

## ■ 4.7.2 Position data input

The following three methods can be used to input the position data for the MOV commands, the coordinate table (used in the sequential mode, external point designation mode), and the palletizing mode.

- (1) Remote teaching  
With this method, the robot is in servo-lock, and the position is taught by moving the robot to the desired position using remote operation (JOG operation).
- (2) Direct teaching  
With this method, the servo lock is released during programming, and the position is taught by the operator directly moving the robot to the desired position.

**NOTE** If the axis is provided with brakes, the brakes will be applied during the servo-free state, so direct teaching is not possible.

- (3) MDI (Manual Data Input)  
Use the Teach Pendant keys to enter the coordinates of the desired location.

This teaching method is described below using the Teach Pendant displays.

In the MOV commands, the coordinate table, and the palletizing mode, the screens for entering the position data will differ. The screens in each mode will be used for explanations, but the operation methods are the same. For the palletizing mode, the M to M screen is used as an example.

### (1) Remote teaching procedures

Remote teaching procedures of the position data are given below.

[MOV commands input screen]

```
[ PRGM ]   X = 0000.00
0001 a S Y = 0000.00
MOV V=00 Z = 0000.00
      POST R = 0000.00
```

Cursor position

#### STEP 1

In the PRGM mode, let the robot be in servo-lock.

Move the cursor to the position shown at left, and press the

**DIRECT  
JOG**

key.

[Coordinate table input screen]

```
[ PARA ]   X = 0000.00
PNT-TBL Y = 0000.00
NO.001 Z = 0000.00
      R = 0000.00
```

Cursor position

[Palletizing mode coordinate input screen]

```
[ PRGM ] 02 SO ORG
01 X = 0000.00
M-M Y = 0000.00
      Z = 0000.00
```

Cursor position

#### NOTE

- When the cursor is not located at the position shown in the above display, remote teaching cannot be executed. When the **DIRECT JOG** key is pressed when the cursor is not located at the position shown in the above display, jog operation to only move the axis will take place. (Refer to section ■ 16.5.)
- If the controller has lost the current position (return to origin is required) and the **DIRECT JOG** key is pressed, an error alarm sounds and remote teaching mode cannot be entered.



[Common screen]

```
[PRGM] X = 0000.00
REMOTE Y = 0000.00
TEACHING Z = 0000.00
SPD:LOW R = 0000.00
```

STEP 2

Remote teaching screen is displayed and JOG operation can be executed in remote teaching mode.

STEP 3

Toggling of JOG speed (HIGH/LOW) can be executed by pressing the **ALT** key.

For example, to move the first axis of the shown task, press the **+1** key.

When the axis reaches the desired position, press the **ENT** key.

To return to the PRGM mode, press the **DIRECT JOG** key.

**NOTE**

- Movement of the axes in JOG operation is done by pressing the **+1** and **-1** keys for the first axis, the **+2** and **-2** keys for the second axis, the **+3** and **-3** keys for the third axis, and the **+4** and **-4** keys for the fourth axis. If a plus key is pressed, the axis will move in the direction opposite the origin while the key is held down, and if a minus key is pressed, the axis will move in the direction of the origin.
- The JOG operation in remote teaching mode can be performed within the software limits. When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in section ■ 3.2.)
- The JOG operation speed can be set with the JOG speed in parameter 1 (refer to sections ■ 13.3.8 to ■ 13.3.11). If TPH-4C version 2.29 or later is used, the screen for setting the JOG operation speed in parameter 1 can be called by pressing the **SEARCH** key.
- Inching movement in JOG operation can be performed by pressing and quickly releasing the movement keys. The distance of an inching movement can be set by JOG increment of parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in JOG speed in parameter 1.
- The screen indicates the current position of the axis. This can be used as the coordinate monitor.

[MOV commands screen]

```
[PRGM] X = 0084.30
0001 a S Y = 0000.00
MOV V=00 Z = 0000.00
POST R = 0000.00
```

STEP 3

The current coordinates are entered. Then the procedure returns to the PRGM mode.

[Coordinate table input screen]

```
[PARA] X = 0084.30
PNT-TBL Y = 0000.00
NO.001 Z = 0000.00
R = 0000.00
```

[Palletizing mode coordinate input screen]

```
[PRGM]02 SO ORG
01 X = 0084.30
M-M Y = 0000.00
Z = 0000.00
```

## (2) Direct Teaching procedures

The method to carry out direct teaching of the position data is described below.

[MOV commands screen]

```
[PRGM] X= 0000.00
0001 a S Y= 0000.00
MOV V=00 Z= 0000.00
FREE POST R= 0000.00
```

Cursor position

[Coordinate table input screen]

```
[PARA] X= 0000.00
PNT-TBL Y= 0000.00
NO.001 Z= 0000.00
FREE R= 0000.00
```

Cursor position


[Palletizing mode coordinate input screen]

```
[PRGM]02 SO ORG
01 X= 0000.00
M-M Y= 0000.00
FREE Z= 0000.00
```


Cursor position

### STEP 1

In the PRGM mode, let the axis be in servo-free condition.

Move the cursor to the point shown at left and press the  key.

### NOTE


- When the cursor is positioned at a point other than the one shown in the display above, Direct Teaching cannot be executed.
- Direct teaching cannot be used with an axis equipped with a brake, because the brake will be activated in servo-free condition.
- If the controller has lost the current position (return to origin is required) and the  key is pressed, an error alarm sounds and direct teaching mode cannot be entered.


[Common screen]

```
[PRGM] X= 0000.00
DIRECT Y= 0000.00
TEACHING Z= 0000.00
FREE R= 0000.00
```

### STEP 2

Direct Teaching screen is displayed and Direct Teaching can be executed.

For example, move the axis manually to a desired position and press the  key.

To return to the PRGM mode, press the  key.

[MOV commands screen]

```
[PRGM] X= 0084.30
0001 a S Y= 0000.00
MOV V=00 Z= 0000.00
FREE POST R= 0000.00
```

**STEP 3**

The current coordinates is entered. Then the procedure returns to the PRGM mode.

[Coordinate table input screen]

```
[PARA] X= 0084.30
PNT-TBL Y= 0000.00
NO.001 Z= 0000.00
FREE R= 0000.00
```

[Palletizing mode coordinate input screen]

```
[PRGM]02 SO ORG
01 X= 0084.30
M-M Y= 0000.00
FREE Z= 0000.00
```

**STEP 4**

Press the **FREE LOCK** key to release the servo-free condition, and the display at left will appear. Then, press **ENT** key and the axis will be servo-locked. When the **ESC** key is pressed, the display returns to STEP 1.

```
SERVO LOCK OK ?
YES:ENT NO:ESC
```

**NOTE**

Direct teaching cannot be used with an axis equipped with a brake, because the brake will be activated in servo-free condition. Use Remote Teaching or MDI for inputting position data of an axis equipped with brakes.

(3) MDI (Manual Data Input) method

The method to teach the position data with MDI is described below.

**STEP 1** Enter the PRGM mode.

Move the cursor to the point shown at the left, enter the set coordinates with the numeric keypad, and press the **ENT** key. For the Y, Z, and R axes, the set coordinates can be entered similarly.

[MOV commands screen]

```
[PRGM] X = 0000.00
0001 a S Y = 0000.00
MOV V=00 Z = 0000.00
POST R = 0000.00
```

Cursor position

[Coordinate table input screen]

```
[PARA] X = 0084.30
PNT-TBL Y = 0000.00
NO.001 Z = 0000.00
R = 0000.00
```

Cursor position

[Palletizing mode coordinate input screen]

```
[PRGM]02 SO ORG
01 X = 0000.00
M-M Y = 0000.00
Z = 0000.00
```

Cursor position

**NOTE** Surely set the coordinate value within the stroke of the axis being used.  
To move the cursor to the next field, press the **ENT** key. To move the cursor back to the previous field, press the **BSKIP** key.

### ■ 4.7.3 MOV system commands and parameters

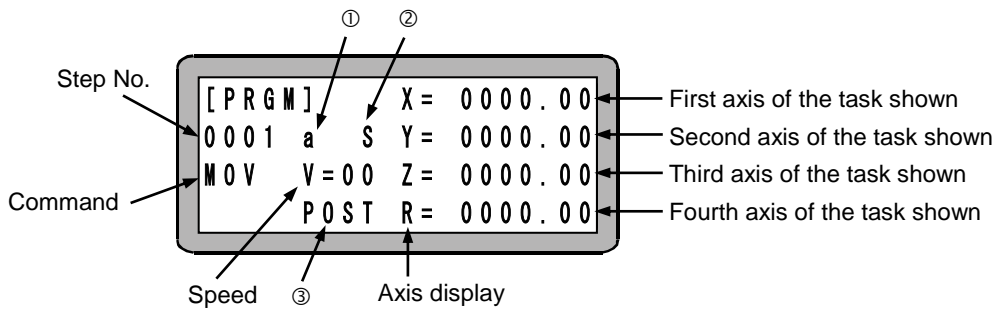
The MOV system commands and their parameters which can be used in the sequential mode are herein described. If any of the MOV system commands is commanded, the relevant axis will be moved as commanded, and there are 9 MOV system commands as follows.

MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, RSMV, and HOME

For the using method of the commands, refer to "Chapter 17 Commands".

● MOV system command word screen

- To input MOV system command, input parameters of ① to ③, speed, and coordinate as shown below. (Parameters to be input vary depending on the command.)
- The four coordinate input fields on the right of the screen correspond to, from the top, the first axis to the fourth axis of the shown task.
- The axes selected in axis display setting in parameter 2 (refer to section ■ 13.4.1) are shown. The unset axes are shown as "?".



- ①: Absolute coordinate position (a) and relative coordinate position (i)
- ②: Axial speed (S) and linear speed (T)
- ③: Position (POST) and pass point (PASS)

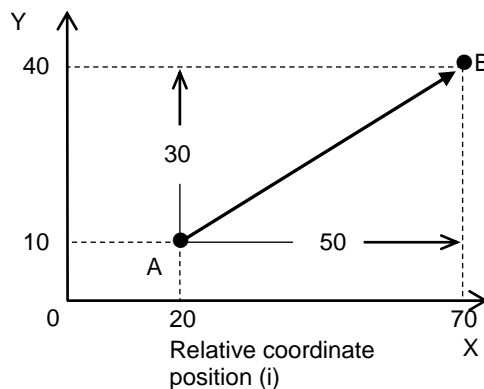
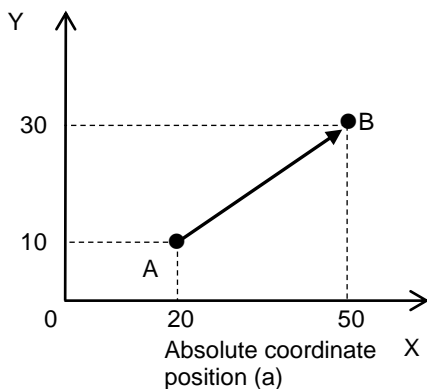


① to ③ and speed in the palletizing mode have the similar functions (refer to section ■ 7.2.2).

The method to use ① through ③ is hereafter described.

① Absolute coordinate position (a) and relative coordinate position (i)

When the absolute coordinate position (a) is selected, the target position becomes the coordinate position according to the origin point (coordinate X=0, Y=0). When the relative coordinate position (i) is selected, the target position becomes the relative movement amount from the axis position at the time of the command execution start. For example, when the current position is Point A (coordinate X=20, Y=10) and the movement amount is X=50, Y=30, the target position of Point B becomes as shown below.



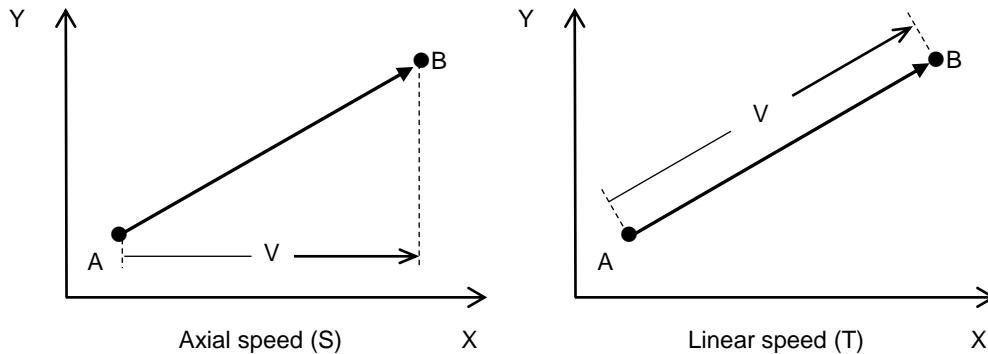
**NOTE**

- When the first axis movement after the axis stops due to an error during the axis movement command and the error is cleared is designated as a relative coordinate position, the movement will be relative from that coordinate position and will not be the commanded start position before the error occurred.
- In the same manner, if the encoder type is set to "a" (K17: section ■ 13.4.17), and the first axis movement after the axis stops due to the power being turned OFF and ON during execution of an axis movement command is designated as a relative position, the movement will be relative from that coordinate position and will not be the commanded start position before the power was turned OFF.

② Axial speed (S) and linear speed (T)

For the movement from Point A to Point B as shown below, the X-axis speed of the longest movement stroke is instructed as the speed  $V$  when the axial speed (S) is selected, and the axis composed speed is instructed as the speed  $V$  when the linear speed (T) is selected.

However, if any axis exceeds the maximum speed set by the parameter, the movement speed of the axis will be at the maximum speed, and the other axes will move at such speeds as all axes simultaneously arrive at the target position.



For operations in which the composed speed of the tool and hand tips affects its quality, such as sealing operation, select the linear speed (T).

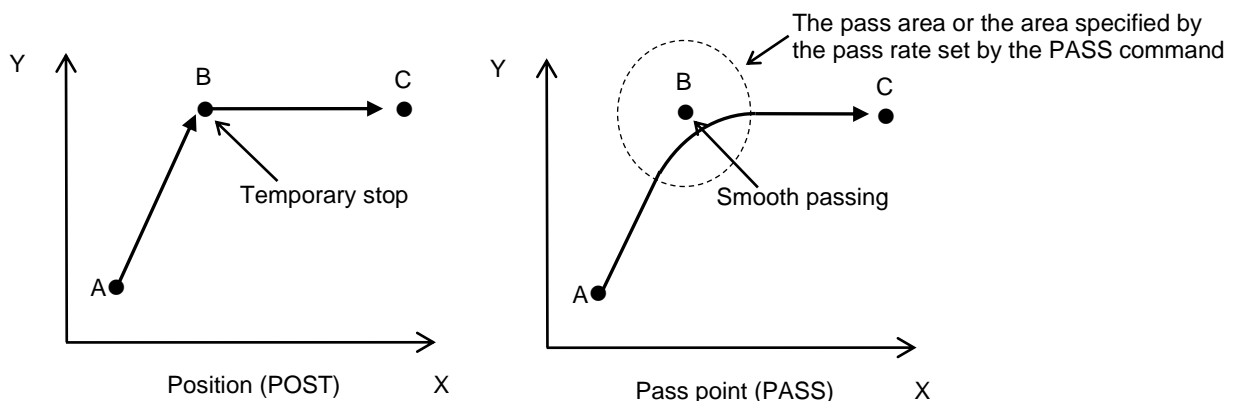
For operations in which the composed speed of the tool and hand tips does not affect its quality, such as conveying of workpieces, select the axial speed (S).

③ Position (POST) and pass point (PASS)

If a position (POST) is selected for movement to a target position on the way when consecutive MOV system commands are executed, control waits at the target position. If a pass point (PASS) is selected, a target position on the way is regarded as a pass point and movement proceeds to the next point smoothly.

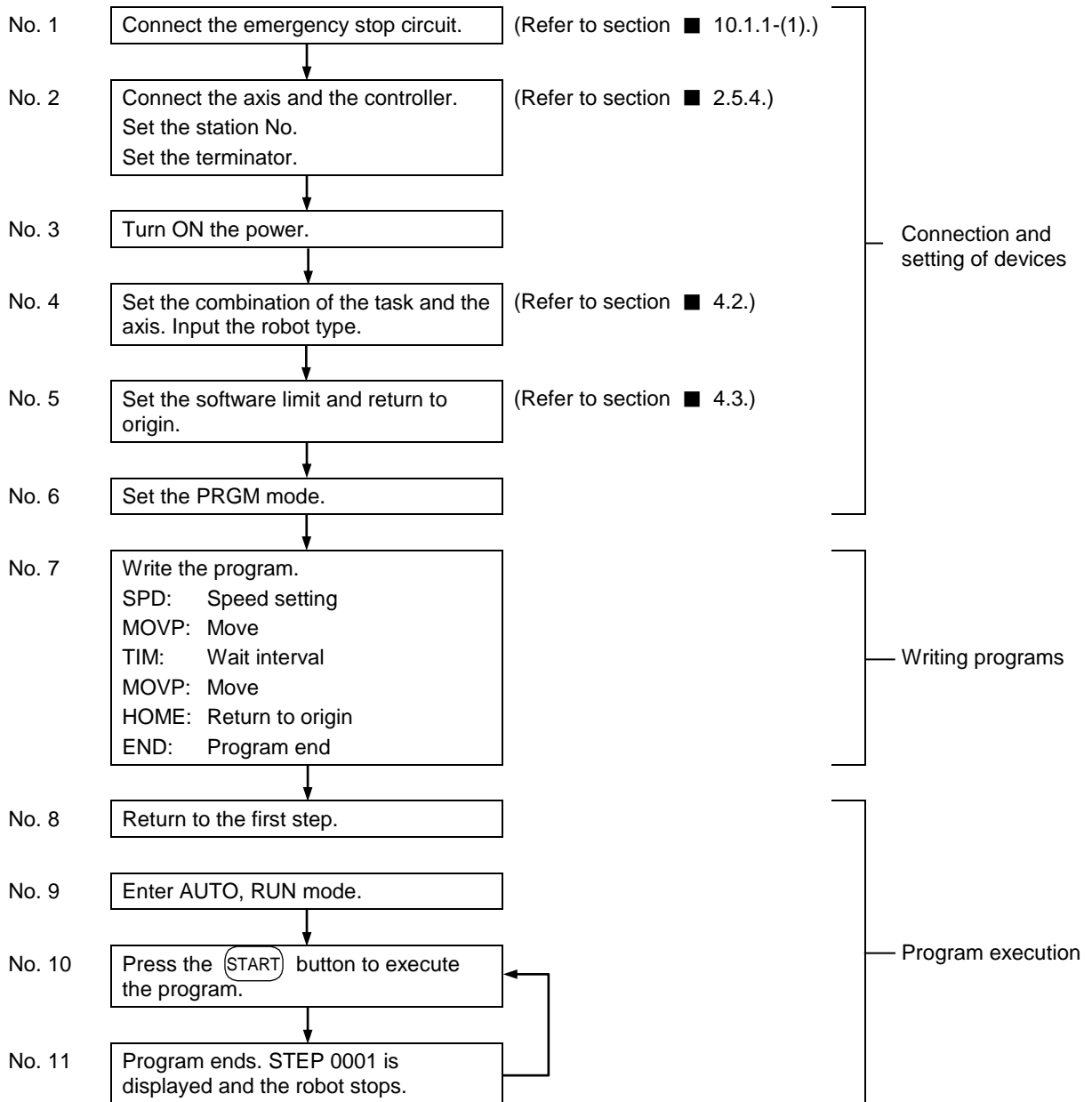
For example, the robot moves from the point A through the point B to the point C as shown in the left figure below when a position (POST) is selected for the point B, and it moves as shown in the right figure below when a pass point (PASS) is selected for the point B.

If a pass point (PASS) is selected for the point B, the move command from the point B to the point C starts at the time point set by the pass area setting in the parameter 1 (refer to section ■ 13.3.5) or the time point set by the PASS command (pass rate setting command), whichever is earlier.



## ■ 4.8 Moving the robot

Now, let's try moving the robot with a simple program following the flow chart below.



Steps after No. 5 in the flow chart ("Set the software limit and return to origin. (Refer to section ■ 4.3.)") are demonstrated below.

Let's try writing a simple program in the sequential mode to move the robot with a single axis.

● Writing a program





```
[AUTO]
0001
NOP
```

**STEP 1** Press the  key to enter the PRGM mode.



```
[PRGM]
0001
NOP
```

**STEP 2** [PRGM] appears on the left top. This is an initial display of the PRGM mode.  
This is stage No. 6 of the flow chart.


```
[PRGM]
0001
SPD V=01
```

**STEP 3** Press the  key to select the speed command, then press the  key. Input the speed No. 1 with the numeric keypad and press the  key. The speed is now defined.  
Press the  key to go to the next step.

```
[PRGM]
0002 a S NO=000
MOV V=00 CNT[00]
POST
```

**STEP 4A** Press the  key twice to select the MOV command and then press the  key.

```
[PRGM]
0002 a S NO=000
MOV V=00 CNT[00]
POST
```

**STEP 4B** The cursor moves to point "a" (absolute coordinate), so just press the  key.



```
[PRGM]
0002 a S NO=001
MOV P V=00 CNT[00]
POST
```

**STEP 4C** The cursor moves to point table No. position, so use the numeric keypad to enter No. =1 and press the **ENT** key.

```
[PARA] X= 0000.00
PNT-TBL ?= 0000.00
NO.001 ?= 0000.00
      ?= 0000.00
```

**STEP 4D** Next, press the **F1** key.  
The coordinate table edit screen appears.

```
[PARA] X= 0300.00
PNT-TBL ?= 0000.00
NO.001 ?= 0000.00
      ?= 0000.00
```

**STEP 4E** Use the numeric keypad to enter coordinate X=300 and press the **ENT** key.

**NOTE** The cursor moves to the next field each time the **ENT** key is pressed.

```
[PRGM]
0002 a S NO=001
MOV P V=00 CNT[00]
POST
```

**STEP 4F** Press the **ESC** key, and then press the **ENT** key twice.  
The cursor moves to speed No. (V=00). Confirm V=00 and press the **ENT** key.

```
[PRGM]
0002 a S NO=001
MOV P V=00 CNT[00]
POST
```

**STEP 4G** The cursor moves to POST, so just press the **ENT** key.  
Programming STEP 4A to STEP 4G sets the MOV P command.  
Press the **NEXT** key to display the next step.

```
[PRGM]
0003
TIM 003.0s
```

**STEP 5** Press the **TIM/6** key to select the TIM command and press the **ENT** key. Enter 3 with the numeric keypad and press the **ENT** key.  
This command executes three-second wait.  
Press the **NEXT** key to display the next step.

```
[PRGM]
0004 a S NO=002
MOV P V=00 CNT[00]
POST
```

**STEP 6** Enter the MOV P command as shown in the left figure in the same manner as STEPs 4A to 4G.  
Here, enter "2" as the coordinate table No. and X=200 as the coordinate data.  
With this command, movement to X=200 is set.  
Press the **NEXT** key to display the next step.

```
[PARA] X= 0200.00
PNT-TBL ?= 0000.00
NO.002 ?= 0000.00
      ?= 0000.00
```

```
[ PRGM ]
0005
HOME ←
```

**STEP 7** Press the **F1**, **IN<sub>1</sub>**, and **MOV<sub>9</sub>** keys to select the HOME command, and then press the **ENT** key. This command executes return to origin. Press the **NEXT** key to display the next step.

```
[ PRGM ]
0006
END ←
```

**STEP 8** Press the **RET<sub>0</sub>** key three times to select the END command, and then press the **ENT** key. This command defines the program end.

```
[ PRGM ]
0001
SPD V=01
```

**STEP 9** Press the **-NEXT** key five times to display the program STEP 0001. This is the stage No. 8 in the flow chart.

• You have now finished writing the program. Next, let's execute the program.

```
[ AUTO ]
0001
SPD V=01
```

**STEP 10** Press the **RUN PRGM** key to enter the AUTO mode. [AUTO] appears on the left top of the screen. Press the **START** key.

```
R U N !!!
```

**STEP 11** The program runs and the execution screen appears.

```
[ AUTO ]
0001
SPD V=01
```

**STEP 12** When the program execution ends, the program step 0001 appears and the robot stops.

This page is blank.

## Chapter 5 Sequential Mode

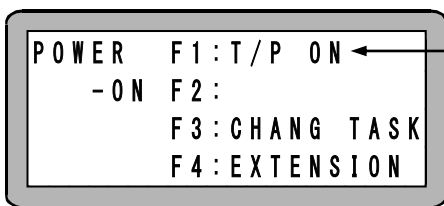
The sequential mode is a mode used to execute or program in order of steps. With the sequential mode, the operation program is structured from the beginning, so operations more complex than the palletizing mode are possible. By using multitasking, up to four sequential programs can be executed simultaneously. (Refer to Chapter 6)

### ■ 5.1 Sequential PRGM mode

The PRGM mode is used for programming, setting parameters, and for controlling direct output.

#### ■ 5.1.1 How to enter and leave PRGM mode

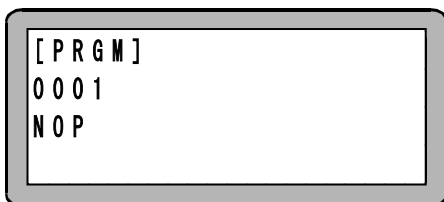
The method for entering and leaving the PRGM mode (sequential mode) will be described in this section.



##### STEP 1

Turn the power ON. When the display shown at left appears after the initial screen, press the **(F1)** key. Then press the **(RUN PRGM)** key to enter PRGM mode.

Refer to section ■ 6.3.2-(3) when the task must be changed with multitasking.

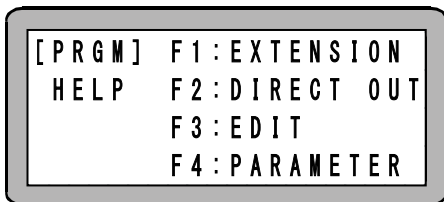


##### STEP 2

The PRGM mode is set. [PRGM] appears on the left top. A program can now be written. Press the **(NEXT)** key or the **(-NEXT)** key until the desired step is displayed. The step No. and the tag No. can be searched (refer to sections ■ 15.1 and ■ 15.2).

To set parameters and edit the program, press the **(HELP)** key to display the screen in STEP 3.

When the **(RUN PRGM)** key is pressed, the program editing will end, and the RUN mode will be entered.



##### STEP 3

To input extension commands, press the **(F1)** key (refer to section ■ 5.1.5).

To manually output a desired bit, press the **(F2)** key (refer to section ■ 16.8.2).

To edit a program, press the **(F3)** key (refer to sections ■ 5.1.2 to ■ 5.1.4).

To set parameters, press the **(F4)** key (refer to Chapter 13).

Press the **(ESC)** key to return to STEP 2.



For details of the commands, refer to Chapter 17.

## ■ 5.1.2 Editing of steps in sequential program

In sequential programming, program steps can be inserted or deleted either individually or as a block.  
Before the following procedures, switch the task to the one whose step is to be edited. (Refer to section ■ 6.3.2-(3))

### (1) Individual step deletion/insertion

First, define the program step No. to be inserted or deleted, and display it on the screen. Insert the new step before the displayed step and move down the remaining program steps in the controller's memory. For a deletion, erase the target step and move up all successive steps in memory. Press **(HELP)** in program mode to show the following display. (Refer to section ■ 5.1.1)

```
[PRGM] F1:EXTENSION
HELP   F2:DIRECT OUT
        F3:EDIT ←
        F4:PARAMETER
```

#### STEP 1

Press the **(F3)** key.

To return to PRGM mode, press the **(ESC)** key.

```
[EDIT] F1:INS STEP
        F2:DEL STEP
        F3:CLEAR
        F4:PAGE
```

#### STEP 2

To insert a step, press the **(F1)** key and go to STEP 3A.

Press the **(F2)** key to delete a step and go to STEP 3B.

To return to PRGM mode, press the **(ESC)** key.

```
[INS]
0005
NOP
```

#### STEP 3A

In inserting a new step, the instruction field will indicate a NOP instruction. When successive insertion is necessary, press the **(F1)** key again.

Press the **(ESC)** key to return to PRGM mode after the insertion.

```
[DEL]
0005
SPD V=01
```

#### STEP 3B

In a deleting operation, the indicated step will be deleted. When successive deletions are necessary, press the **(F2)** key again.

Press the **(ESC)** key to return to PRGM mode after the deletion.

(2) Deleting steps in a block

In sequential programming, a series of steps can be deleted in one time.

To delete a block, set the program mode and press the **HELP** key. The following display will appear. (Refer to section ■ 5.1.1)

```
[PRGM] F1:EXTENSION
        HELP F2:DIRECT OUT
           F3:EDIT ←
           F4:PARAMETER
```

**STEP 1** When this instruction appears, press the **F3** key.  
To return to PRGM mode, press the **ESC** key.

```
[EDIT] F1:INS STEP
        F2:DEL STEP
           F3:CLEAR
           F4:PAGE ←
```

**STEP 2** Press the **F4** key.  
To return to PRGM mode, press the **ESC** key.

```
[EDIT] F1:STEP COPY
        F2:PALET COPY
           F3:STEP DEL ←
           F4:
```

**STEP 3** Press the **F3** key.  
To return to STEP 2, press the **ESC** key.

```
[STEP-
 DEL] DELETE
      [0001]-[0001]
```

**STEP 4** Use the numeric keypad to enter the Nos. of the first and last steps to be deleted.  
Press the **ENT** key. NOP are indicated for all steps deleted, and the program returns to STEP 3.  
Pressing the **ESC** key returns the display to STEP 3.

**NOTE** When steps are deleted in a block, no steps are moved up.

### ■ 5.1.3 Copy editing of sequential programs

A series of steps can be copied in a block from one program and entered into another.

Set the PRGM mode and press the (HELP) key. The following display will appear. (Refer to section ■ 5.1.1)

```
[PRGM] F1:EXTENSION
HELP F2:DIRECT OUT
F3:EDIT ←
F4:PARAMETER
```

**STEP 1** When this instruction appears, press the (F3) key.  
Press the (ESC) key to return to the initial screen of the PRGM mode.

```
[EDIT] F1:INS STEP
F2:DEL STEP
F3:CLEAR
F4:PAGE ←
```

**STEP 2** Press the (F4) key.  
Press the (ESC) key to return to the initial screen of the PRGM mode.

```
[EDIT] F1:STEP COPY ←
F2:PALET COPY
F3:STEP DEL
F4:
```

**STEP 3** Press the (F1) key.  
Press the (ESC) key to return the display to STEP 2.

```
[STEP- FROM[01]
COPY][0001]-[0001] ←
TO
[01][0001]
```

**STEP 4** Use the numeric keypad to enter the task No. (01 to 04) of the copy origin program.

**STEP 5** Use the numeric keypad to enter the first and last steps of the copy origin.

**STEP 6** Use the numeric keypad to enter the task No. (01 to 04) of the copy destination program.

**STEP 7** Next use the numeric keypad to enter the copy destination step and then press the (ENT) key.  
Copy will be executed, and the program will return to STEP 3.  
Press the (ESC) key to return the display to STEP 3.

**NOTE**

- When program steps in which tag commands are written are copied, the tag No. in the destination step will be 000.
- The copy destination program will be overwritten with the copy origin program.

## ■ 5.1.4 Clearing of sequential programs

All of the sequential programs in the controller memory can be cleared (all steps can be returned to NOP).

For multitasking, the program of the currently displayed task will be cleared. Switch the task to the one whose program is to be cleared. (Refer to section ■ 6.3.2-(3))

Sequential and palletizing programs can be cleared in one time. Because a sequential program that can be used from a palletizing program is the main task (task No. 1), this operation is performed only from the condition where the task No. 1 is displayed.

Enter the PRGM mode and press the **(HELP)** key. The following screen will display (Refer to section ■ 5.1.1)

```
[PRGM] F1:EXTENSION
        F2:DIRECT OUT
        F3:EDIT ←
        F4:PARAMETER
```

### STEP 1

Press the **(F3)** key in this state.

To return to PRGM mode, press the **(ESC)** key.

```
[EDIT] F1:INS STEP
        F2:DEL STEP
        F3:CLEAR ←
        F4:PAGE
```

### STEP 2

When the **(F3)** key is pressed, the clear mode will be entered.

To return to PRGM mode, press the **(ESC)** key.

```
[CLR]  F1:SEQUN
        F2:PALET
        F3:SEQ/PALET
        F4:PAGE
```

### STEP 3

To clear the sequential program alone, press the **(F1)** key and return to STEP 4A.

To clear the sequential and palletizing programs in one time, press the **(F3)** key to proceed to STEP 4B.

Press the **(ESC)** key to return to STEP 2.

### NOTE

**(F3)** If the [F3] key is pressed and this procedure is performed not in the task No. 1, an error sound beeps and the key operation will be ignored.

```
[CLR]
ALL SEQ. PROGRAM
          CLEAR ?
YES:ENT NO:ESC
```

### STEP 4A

To clear the program, press the **(ENT)** key. To not clear the program, press the **(ESC)** key.

When the program is cleared, the sequential program in the current task will be all initialized.

```
[CLR]
ALL PROGRAM(S/P)
          CLEAR ?
YES:ENT NO:ESC
```

### STEP 4B

To clear the program, press the **(ENT)** key. To not clear the program, press the **(ESC)** key.

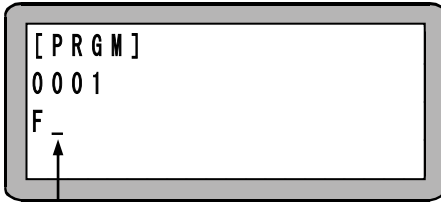
When the program is cleared, the sequential program (task No. 1) that can be used for palletizing and the palletizing program will be all initialized.



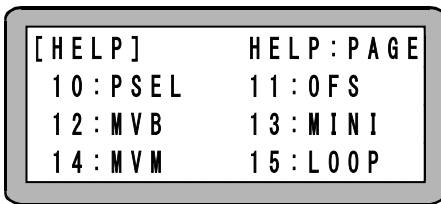
## ■ 5.1.5 HELP function in entering an extension commands

When the **(F1)** key and the numeric keypad are used to enter selected extension commands, pressing the **(HELP)** key displays the input number of each command.

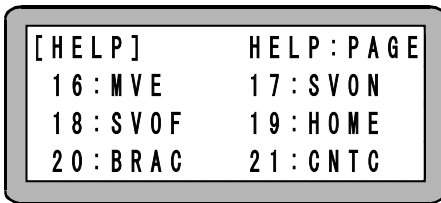
Press the **(F1)** key in PRGM mode. The following display appears:



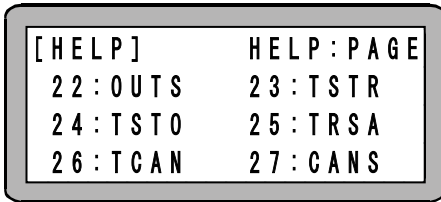
**STEP 1** Press the **(HELP)** key when this display is shown.  
To return to PRGM mode, press the **(ESC)** key.



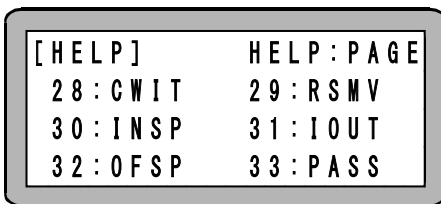
**STEP 2** Confirm the input number of the command to be entered and enter the number with the numeric keypad.  
When the command to be entered is not shown, press the **(NEXT)** key to display the next screen or press the **(-NEXT)** key to display the screen of STEP 5.  
To return to STEP 1, press the **(ESC)** key.



**STEP 3** Confirm the input number of the command to be entered and enter the number with the numeric keypad.  
When the command to be entered is not shown, press the **(NEXT)** key to display the next screen or press the **(-NEXT)** key to display the previous screen.  
To return to STEP 1, press the **(ESC)** key.



**STEP 4** Confirm the input number of the command to be entered and enter the number with the numeric keypad.  
When the command to be entered is not shown, press the **(NEXT)** key to display the next screen or press the **(-NEXT)** key to display the previous screen.  
To return to STEP 1, press the **(ESC)** key.



**STEP 5** Confirm the input number of the command to be entered and enter the number with the numeric keypad.  
When the command to be entered is not shown, press the **(NEXT)** key to display the STEP 2 screen or press the **(-NEXT)** key to display the previous screen.  
To return to STEP 1, press the **(ESC)** key.



For details of the commands, refer to Chapter 17.

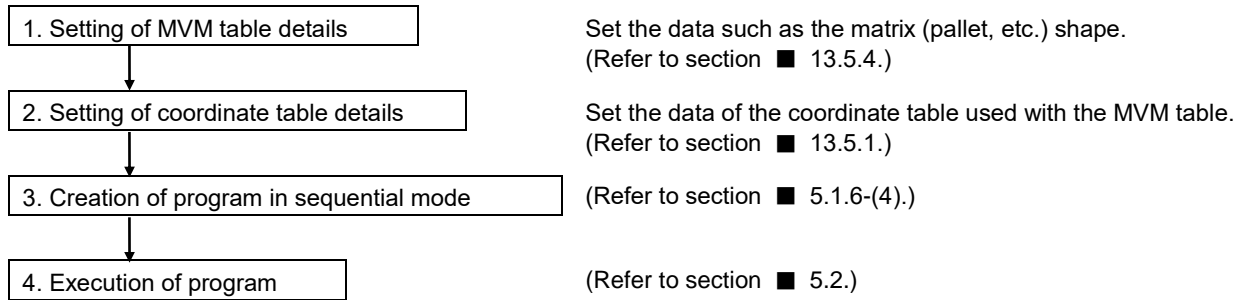
## ■ 5.1.6 Palletizing work with MVM commands

In the palletizing mode described in Chapter 7, palletizing operation can be carried out by just setting various data. However, if a mode is used for the palletizing operation, there will be some restrictions to the degree of operation freedom. The degree of operation freedom and complex palletizing operations can be used by creating a program using MVM commands. (Sequential movement operation such as 1 to M, M to 1, M to M and on matrix.)

[Example]

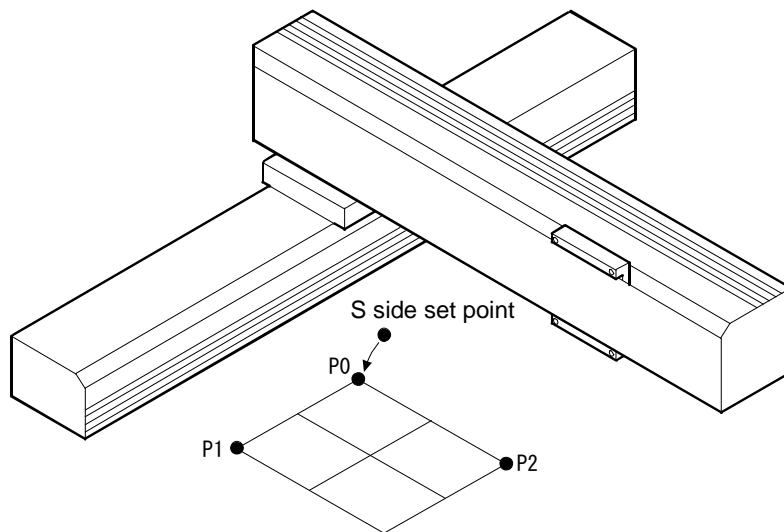
- Correspondence of pallet on which work are arranged in a zigzag pattern.
- Transferring of works on pallet according to passing and failing state, etc.

### ■ Procedure for carrying out palletizing work with MVM commands

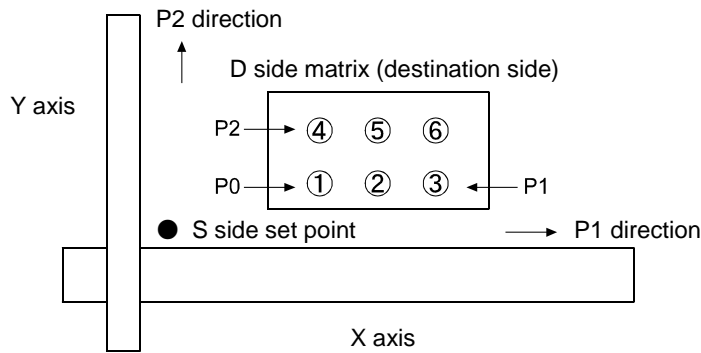


Next, combination of two axes is described for example.  
The basic principle is common for combination of three or more axes.

### Combination of two axes



? S side: Source  
 D side: Destination



(1) Explanation of MVM table

The MVM table is used to set the matrix (pallet, etc.) shape, etc.

For the matrix shape as shown above, the parameters are set in the MVM table as shown below.

Point	Coordinate table No.	Direction	No. of matrixes	Applicable counter No.
P0	① Point coordinate table No. (*1)	P1	3 (*2)	1 (*3)
P1	③ Point coordinate table No. (*1)	P2	2 (*2)	2 (*3)
P2	④ Point coordinate table No. (*1)	P3	—	—
P3	—			

One group (GRP)

The set of table data as shown above is called one group (GRP).

A total of 32 groups (GRP = No. 1 to 32) can be set.

\*1: Explanation of coordinate table No.

- The P0, P1 and P2 coordinates set the points of each matrix end.
- The coordinates are set indirectly using the coordinate table No. so the actual coordinate data must be set in the coordinate table.
- Asterisks (\*\*\*\*\*) cannot be used for the coordinate table. If used, a parameter error (ERA8) occurs when an MVM command is executed.
- "0 to 999" can be set for the coordinate table No.
- If the matrix only has one row, set P0 and P1 to the normal values, and set P2 to "0".
- P0 does not always have to be set to the point closest to the origin. The operation order can be changed by changing the P0, P1 and P2 coordinate settings.

\*2: Explanation of No. of matrixes

- Set the No. of matrixes in the P1 direction and in the P2 direction.
- "0 to 9999" can be set for the No. of matrixes.
- If the matrix only has one row, set P1 to the normal value, and set P2 to "0".

\*3: Explanation of applicable counter

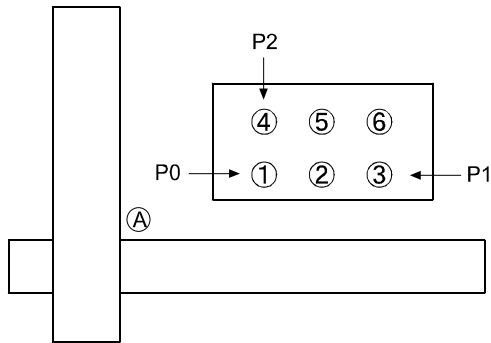
- The applicable counter is used to control the matrix movement (MVM command).
- "0 to 99" can be set for the applicable counter.
- If the matrix only has one row, set P1 to the normal value, and set P2 to "0".

(2) Relation of P0, P1, P2 coordinate setting and operation pattern

Even if the same program is executed, the operation pattern can be changed by changing the coordinate settings of P0, P1 and P2 set in the MVM table.

The following is an operation example of when the 1 to M program given on the next page is executed.

[Operation example]

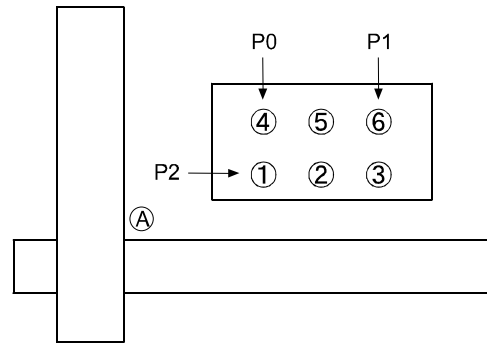


- Set the ① coordinates in P0.
- Set the ③ coordinates in P1.
- Set the ④ coordinates in P2.

[Operation pattern]

To execute the 1 to M program.

① → ② → ③  
 → ④ → ⑤ → ⑥



- Set the ④ coordinates in P0.
- Set the ⑥ coordinates in P1.
- Set the ① coordinates in P2.

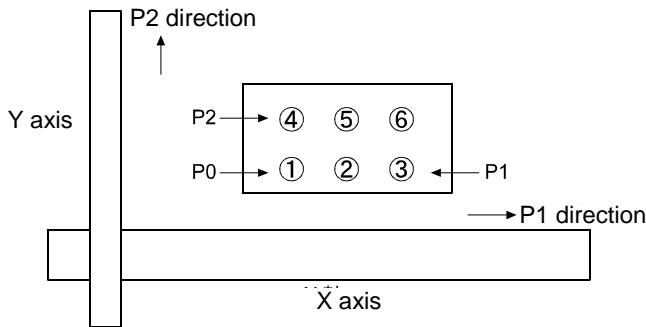
[Operation pattern]

To execute the 1 to M program.

④ → ⑤ → ⑥  
 → ① → ② → ③

(3) Relation of counter details and movement position

The MVM command is a command that looks at only the P1 and P2 direction counter details and moves the unit. The relation of the counter details and movement point is shown below.



Details of MVM table

P0: ① point coordinates

P1: ③ point coordinates

P2: ④ point coordinates

No. in P1 direction: 3

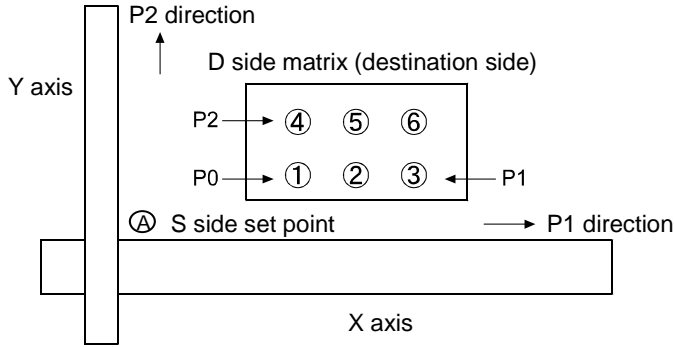
No. in P2 direction: 2

P1 direction counter: No. 1

P2 direction counter: No. 2

Details of P1 direction counter	Details of P2 direction counter	Movement destination point when MVM command is executed with the counter details given on the left.
1	1	①
2	1	②
3	1	③
1	2	④
2	2	⑤
3	2	⑥

(4) Example of palletizing work program using MVM commands

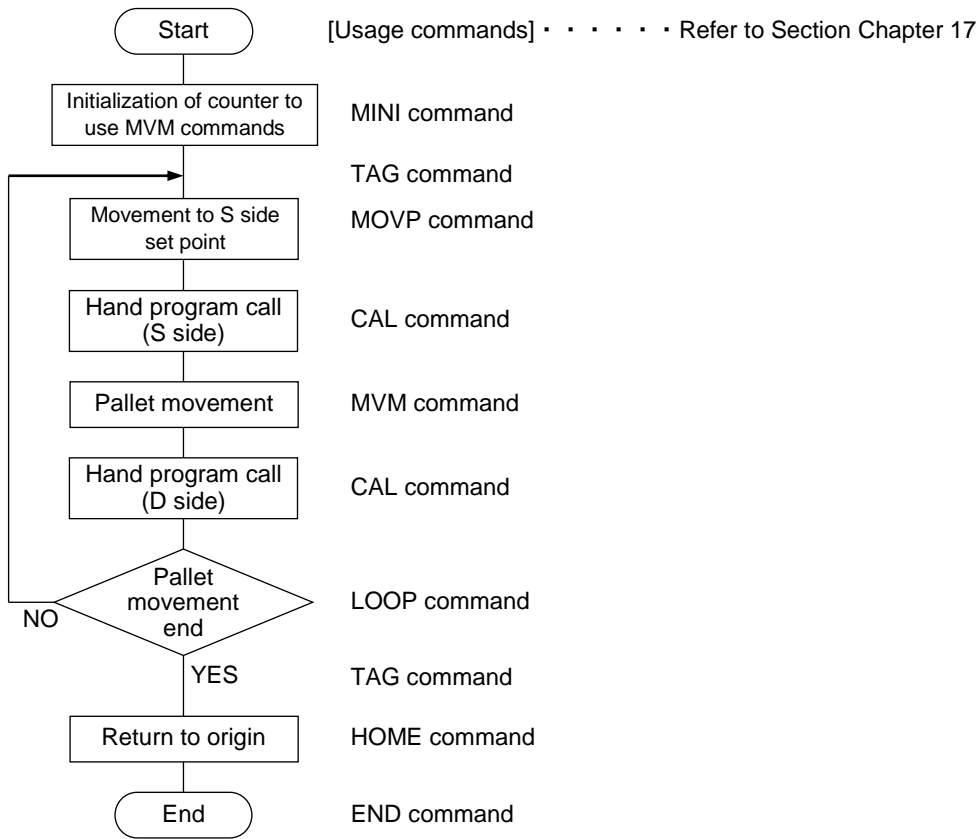


Details of MVM table  
 P0: ① point coordinates  
 P1: ③ point coordinates  
 P2: ④ point coordinates  
 No. in P1 direction: 3  
 No. in P2 direction: 2  
 P1 direction counter: No. 1  
 P2 direction counter: No. 2

[Operation pattern 1 to M]

Ⓐ → ① → Ⓐ → ② → Ⓐ → ③ → Ⓐ → ④ → Ⓐ → ⑤ → Ⓐ → ⑥ → Origin

The flow of the 1 to M program example as shown above is given below.



[Explanation of changing counter details]

The counter details when the MINI command is executed are initialized to "1". When the MVM command is executed, ① will be moved to.

The LOOP command will increment the counter No. 1 details by one during the movement from point ① to ③.

When moving from ③ to ④ the counter No. 1 details are initialized to "1", and the details of counter No. 2 are incremented by "1".

(Counter No. 2 details: 1 to 2.)

When moving from ④ to ⑥ the counter No. 1 details are incremented by "1".

The program example given on the previous page will be explained with the Teach Pendant screens.

● Writing of program

Enter the sequential PRGM mode. (Refer to section ■ 5.1.1)

For this example, commands will be written from step 0001 as shown below.

Refer to Chapter 17 on how to input the commands.

```
[PRGM]
0001
MINI GRP=01
```

**STEP 1** Set the value of the counter to be used for the preset MVM table (group No. 1) to "1".

```
[PRGM]
0002
TAG 100
```

**STEP 2** Assign a tag No. to be used for the loop command (ELSE).

```
[PRGM]
0003 a S NO=001
MOV P V=00 CNT[00]
POST
```

**STEP 3** Move to the S side set point with the MOV P command.

```
[PRGM]
0004
CAL 200
```

**STEP 4** Call the tag No. of the hand program on the S side set point side. The hand program is a subroutine program that carries out handling work. It is necessary to create a hand program separately from TAG200.

```
[PRGM]
0005 S GRP=01
MVM V=00
POST DIST
```

**STEP 5** Write the MVM command. With this command, the destination point on the D side (destination) will be moved to.  
\* To move to the approach point, replace "DIST" with "APPR".

```
[PRGM]
0006
CAL 300
```

**STEP 6** Call the tag No. of the D side hand program, and carry out the handling work.  
It is necessary to create a hand program separately from TAG300.

```
[PRGM]
0007      IF LOOP END
LOOP GRP=01 THEN 400
                ELSE 100
```

**STEP 7** The MVM table (GRP No. 01) counter will be incremented by 1. When the counter used for each axis reaches the No. set at the MVM tables, tag No. 400 will be jumped to. If the number is not reached, the program will jump to tag No. 100, and will realize the loading by carrying out STEP 2 to 6 following the counted counter.



If the details of the designated counter reaches the set No. and the MVM loop is ended (LOOP END), the program will jump to the THEN tag. If not ended (ELSE), the program will jump to the ELSE tag. It is configured of the jump commands with IF~THEN ••• ELSE conditions attached.

```
[PRGM]
0008
TAG 400
```

**STEP 8** Assign a tag No. to be used for the loop command (THEN).

```
[PRGM]
0009
HOME
```

**STEP 9** Carry out return to origin.

```
[PRGM]
0010
END
```

**STEP 10** End the program.

## ■ 5.1.7 Torque limit move

Torque limit move is the move suitable for pushing a work. 1 axis which is specified arbitrarily for each task can move with torque limit move, which is different from the maximum torque limit function in section ■ 11.5 and section ■ 16.11. The torque limit value and the specification of move conditions are set by TLMV command beforehand and actual move is executed by MOV command or MOVP command.

**NOTE** Torque limit move is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, SF-98D version 3.1.6 or later.

- The conditions set by TLMV command are available for only next MOV command or MOVP command. If torque limit move is executed next time, TLMV command needs to be executed again.
- When torque limit move, the process does not go ahead to next command though the robot reaches target position, which is different from normal move. In order to go ahead to next command, set the end condition by TLMV command or stop the program with stop input and then restart with start input.
- The end condition of torque limit move is the logical sum of the following 3 items. Refer to the explanation of TLMV command (refer to page 17-63) for the setting method.

① In case of setting torque limit end (TE) to ON

When the state output torque is reaching torque limit value (refer to section ■ 13.5.5) continues for more than torque limit judgement time (TM) (Condition ①)

② In case of setting lock end (LE) to ON

When the lock is detected (Condition of lock detection is motor stop and meeting condition ①)

③ In case of arrival end (AE) to ON

When the robot reaches target position

- 3 signals of ①task load output (Refer to section ■ 10.2.23), ②task limit output (Refer to section ■ 10.2.24) and ③task lock output (Refer to section ■ 10.2.25) can be used. These signals are available only when torque limit move.

```
[ PRGM ] X TT=8
0001   TM=000.0
TLMV   TE=OFF LE=OFF
        AE=OFF DD=ON
```

TLMV command setting screen

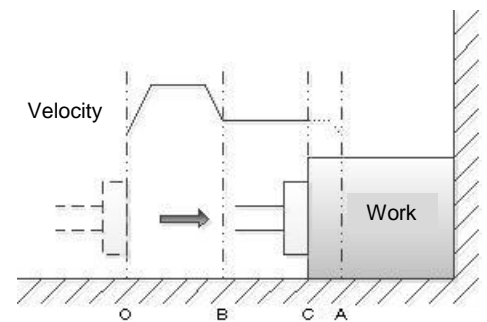
I In case of stopping torque limit move with stop input. (Set TE to OFF, LE to OFF and AE to OFF by TLMV command)

This is the way torque limit move is stopped by an upper controller. Torque limit move is stopped with stop input.

An upper controller can judge whether torque limit move can be stopped, monitoring the status output from this controller. A higher decision in the flexibility can be made because the information of an upper controller can be used to judge the end. Judge the existence of a work with states of positioning complete output, task limit output and task lock output. It is also possible to judge the existence of a work with the area output as needed.

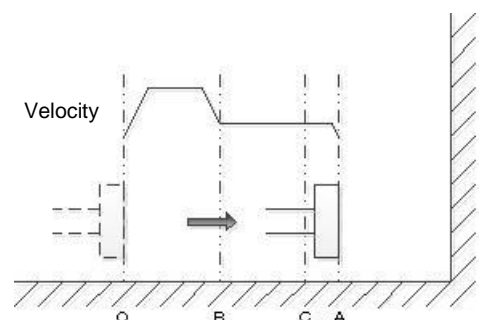
The example of the move with a work

1. Normal move from O point to B point is executed.
2. Torque limit move from B point to A point is executed, slowing down without stopping at B point.
3. The robot slows down and stops with stop input before pushing. Then normal move to O point is executed with start input.
4. The robot becomes to be pushing a work at C point. If bits of task limit output and task lock output are specified, each output turns ON after torque limit judgement time (TM) passes.
5. When stop input is turned ON, running output turns OFF.
6. Normal move to O point is executed with start input. Torque limit continues to remove a shock to a work until when the actual torque of next move become to be lower than torque limit value.



The example of the move without a work

- (1. to 3. are common.)
7. The robot arrives at A point. Positioning complete output turns ON. Torque limit is kept.
  8. When stop input is turned ON, running output turns OFF. Then torque limit is freed.
  9. Normal move to O point is executed with start input.





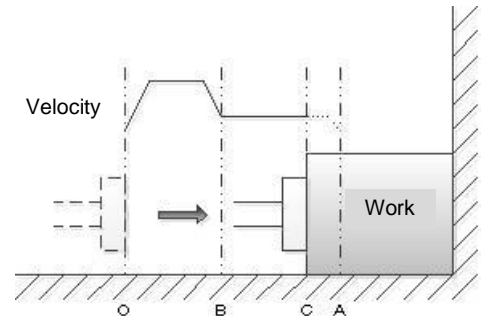
II In case of stopping torque limit move automatically. (Set TE to ON and AE to ON by TLMV command)

This is the way torque limit move is stopped automatically by this controller. An upper controller can detect the end of torque limit move when running output turns OFF.

Judge the existence of a work with states of positioning complete output, task limit output and task lock output. It is also possible to judge the existence of a work with the area output as needed.

The example of the move with a work

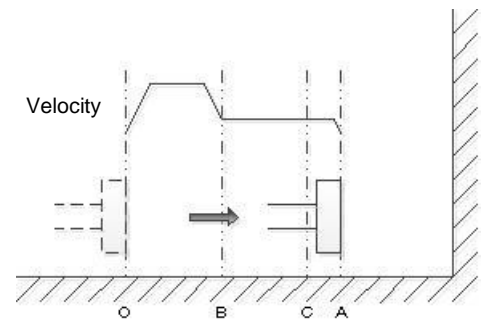
1. Normal move from O point to B point is executed.
2. Torque limit move from B point to A point is executed, slowing down without stopping at B point.
3. The robot slows down and stops with stop input before pushing. Then normal move to O point is executed with start input.
4. The robot becomes to be pushing a work at C point. If bits of task limit output and task lock output are specified, each output turns ON after torque limit judgement time (TM) passes.
5. When pushing a work continues until torque limit judgement time (TM) passes, running output turns OFF.
6. Normal move to O point is executed automatically. Torque limit continues to remove a shock to a work until when the actual torque of next move become to be lower than torque limit value. An upper controller can detect the existence of a work with states of positioning complete output, task limit output and task lock output.



The example of the move without a work

(1. to 3. are common.)

7. The robot arrives at A point. Positioning complete output turns ON.
8. Torque limit is kept and normal move to O point is executed automatically. An upper controller can detect the absence of a work with states of positioning complete output, task limit output and task lock output.



Commands will be written as shown below to move as the above example. For the way of inputting each command, refer to Chapter 17.

Enter the sequential PRGM mode. (Refer to section ■ 5.1.1)

```
[PRGM]
0001
SPD V=05
```

**STEP 1** Set the speed of normal move.

```
[PRGM]
0002 a S NO=001
MOV P V=00 CNT[00]
PASS
```

**STEP 2** Normal move to B point is executed. Select PASS not to stop at B point once. Enter the coordinate of B point in the point table No.001 beforehand.

```
[PRGM] X TT=08
0003 TM=000.0
TLMV TE=OFF LE=OFF
AE=OFF DD=ON
```

**STEP 3** Make next MOV command or MOV P command torque limit move. Set the axis to move with torque limit move, torque limit table No. (TT), torque limit judgement time (TM), ON/OFF of torque limit end (TE), ON/OFF of lock end (LE), ON/OFF of overflow detection (DD).

```
[PRGM]
0004 a S NO=002
MOV P V=01 CNT[00]
POST
```

**STEP 4** Torque limit move to A point is executed. This move is torque limit move because TLMV command is executed in STEP 3. Specify the value in V to change the speed. Enter the coordinate of B point in the point table No.002 beforehand.

```
[PRGM]
0005 a S NO=003
MOV P V=00 CNT[00]
POST
```

**STEP 5** Normal move to O point is executed. Enter the coordinate of O point in the point table No.003 beforehand.

```
[PRGM]
0006
END
```

**STEP 6** End the program.

## ■ 5.2 Sequential RUN mode

Sequential RUN mode can be operated with the following methods.

- AUTO mode (continuous operation, single operation)
- STEP mode

### ■ 5.2.1 AUTO mode of sequential mode

In the AUTO mode, a sequential program will be executed continuously in order of the step numbers. (Refer to section ■ 4.1.1-(1))

When a created program is executed for the first time, the program should be verified in the STEP mode before starting continuous operation. (Refer to section ■ 5.2.2)

#### (1) Continuous operation

Continuous operation means operation that is executed in order automatically and continuously.

#### Operation using Teach Pendant

Procedures using teach pendant are shown below.

```
POWER F1:T/P ON ←
-ON F2:
      F3:CHANG TASK
      F4:EXTENSION
```

**STEP 1** Turn ON the power switch. After the initial screen displays, the screen at left will display, so press the (F1) key.

```
[AUTO]
0001
NOP
```

**STEP 2** In this state, the AUTO mode of the RUN mode of the sequential mode is entered.  
Press the (HOME) key to carry out return to origin. (There are cases where Return to Origin does not need to be carried out. (Refer to section ■ 4.5.2)  
Press the (NEXT) key or the (-NEXT) key to display the first step of the program to be executed.

```
[AUTO]
0005 a S NO=002
MOV P V=00 CNT[00]
      POST
```

**STEP 3** After displaying the step to be executed, press the (START) key.

```
R U N !!!
```

**STEP 4** When the program is being executed, the screen at left will display. If the (STOP) key is pressed, the program will stop after completing the step currently being executed. To restart the program, press the (START) key again.

**CAUTION** If the EMERGENCY STOP button is pressed, the robot will stop generating reduction torque. The stopping distance will differ according to the load size, speed and inertia.

```
[AUTO]
0001
NOP
```

**STEP 5** When the program END command is completed, program step No. 0001 will display, and the operation will stop.

### Operation with external signals

Use the following procedure to carry out operation with the external signals.

[Operation procedures]

1. Carry out return to origin with the system input return to origin. (There are cases where Return to Origin does not need to be carried out. Refer to section ■ 4.5.2)
2. Input the start signal to execute the program from step 0001. If there are multiple tasks in the multitasking, the execution will start with step 0001 of the main task (task 1).
3. If the stop signal is input during operation, the program will stop after ending the program step currently being executed.
4. To restart from the step where the program was stopped, input the start signal.
5. To start from step 1, input the reset signal and then input the start signal. If continuous start input is ON, the reset input will be ignored. Refer to section ■ 10.2.6 for details.

### NOTE

When the T/P is ON, a start signal of the system input is invalid. For the method to disconnect the teach pendant, refer to section ■ 16.1.

### (2) Single operation

During single operation, the program will stop once after the axis movement or output related operation is executed. This is used to verify a program. To start or restart the program, input the start signal or press the **(START)** key.

An example of single operation is given below.

1. Set the single operation mode input bit setting in the mode. (Refer to section ■ 13.2.1)
2. Turn the single operation input signal ON.
3. The following operations are basically the same as continuous operation. (Refer to section ■ 5.2.1-(1))
  - The program can be started by the teach pendant or an external signal.
  - Even if the single operation input signal is turned OFF during single operation, it will be ignored, and single operation will continue.
  - Even if the single operation input signal is turned ON during continuous operation, it will be ignored, and continuous operation will continue.
  - The following commands can be used for stopping after execution.  
MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, RSMV, HOME,  
OUT, OUTP, OUTC, IOUT

## ■ 5.2.2 STEP mode of sequential mode

The STEP mode is used to execute the sequential program one step at a time. (Refer to section ■ 4.1.1-(2))

If a program is started by a start signal input in the sequential mode, however, the AUTO mode will be set, rather than the STEP mode.

When multiple tasks are operated using the multitasking function, one step of the task displayed on the Teach Pendant will be executed and then will stop. The other tasks will stop when the step being executed is stopped at the time the displayed tasks have stopped.

Use this mode to confirm the program operation, etc., before executing the program in the AUTO mode.

```
POWER F1:T/P ON ←
-ON F2:
F3:CHANG TASK
F4:EXTENSION
```

**STEP 1** Turn ON the power switch. After the initial screen displays, the following screen will display, so press the **F1** key.

```
[AUTO]
0001
NOP
```

**STEP 2** In this state, the AUTO mode of the RUN mode of the sequential mode is entered.

Press the **HOME** key to carry out return to origin. (There are cases where Return to Origin does not need to be carried out. Refer to section ■ 4.5.2)

Press the **HELP** key.

```
[RUN] F1:AUTO/STEP ←
HELP F2:OVERRIDE
F3:RESET
F4:PAGE
```

**STEP 3** When this screen displays, press the **F1** key.

```
[STEP]
0005 a S NO=002
MOV P V=00 CNT[00]
POST
```

**STEP 4** The STEP mode will be entered. [STEP] appears on the left top.

Press the **NEXT** key or the **-NEXT** key to display the first step of the program to be executed.

After displaying the step to be executed, press the **START** key.

```
R U N !!!
```

**STEP 5** When the program is being executed, the screen at left will display.

```
[STEP]
0006 a S NO=003
MOV P V=00 CNT[00]
POST
```

**STEP 6** The next step will display and the robot will stop. The displayed step

will be executed when the **START** key is pressed. By repeating the STEPs 4, 5, and 6, the program can be executed one step at a time.

The search function can be used in this mode. This is handy for confirming the jump conditions, etc., in the program by using the tag No. search. Refer to Chapter 15 for details on the search function.

**NOTE** The timing of the input signal and output signal during operation with the STEP mode will be differ compared to operation during the AUTO mode.

### ■ 5.2.3 Changing of speed during operation (override)

By using the override function, the axis moving speed can be changed. This allows the program to be confirmed safely.

**STEP 1** Enter the RUN mode and press the **HELP** key. This screen will display, so press the **F2** key.

**STEP 2** The override setting screen appears. Use the numeric keypad to enter the override value. When the **ENT** key is pressed, the speed will change to the set value. Press the **ESC** key to return to the RUN mode. To return to the RUN mode without changing the value, press the **ESC** key. (Initial value: 100, override value: 1 to 100)

#### **NOTE**

- The override setting is valid only while the program is stopped.
- The override setting value is held even while the power is being shut off.
- The override is effective also for the speed in JOG operation and high speed return to origin.
- The override is applied to speed restricted by the maximum speed data setting in the parameter 2 (refer to section ■ 13.4.6).

### ■ 5.3 Method to continuous start after turning power OFF in sequential mode

With this robot, even if the power is turned OFF, the program can be restarted from the step where the program was stopped when the power was turned OFF. However, this is only limited to when the program was stopped with the Teach Pendant or by inputting stop with the system before the power was turned OFF.

Refer to section ■ 10.2.6 for details on the data, etc., that is held until the program is restarted.

This function can also be used to restart operation that has been stopped with emergency stop input.

Use the following procedure to restart the operation.

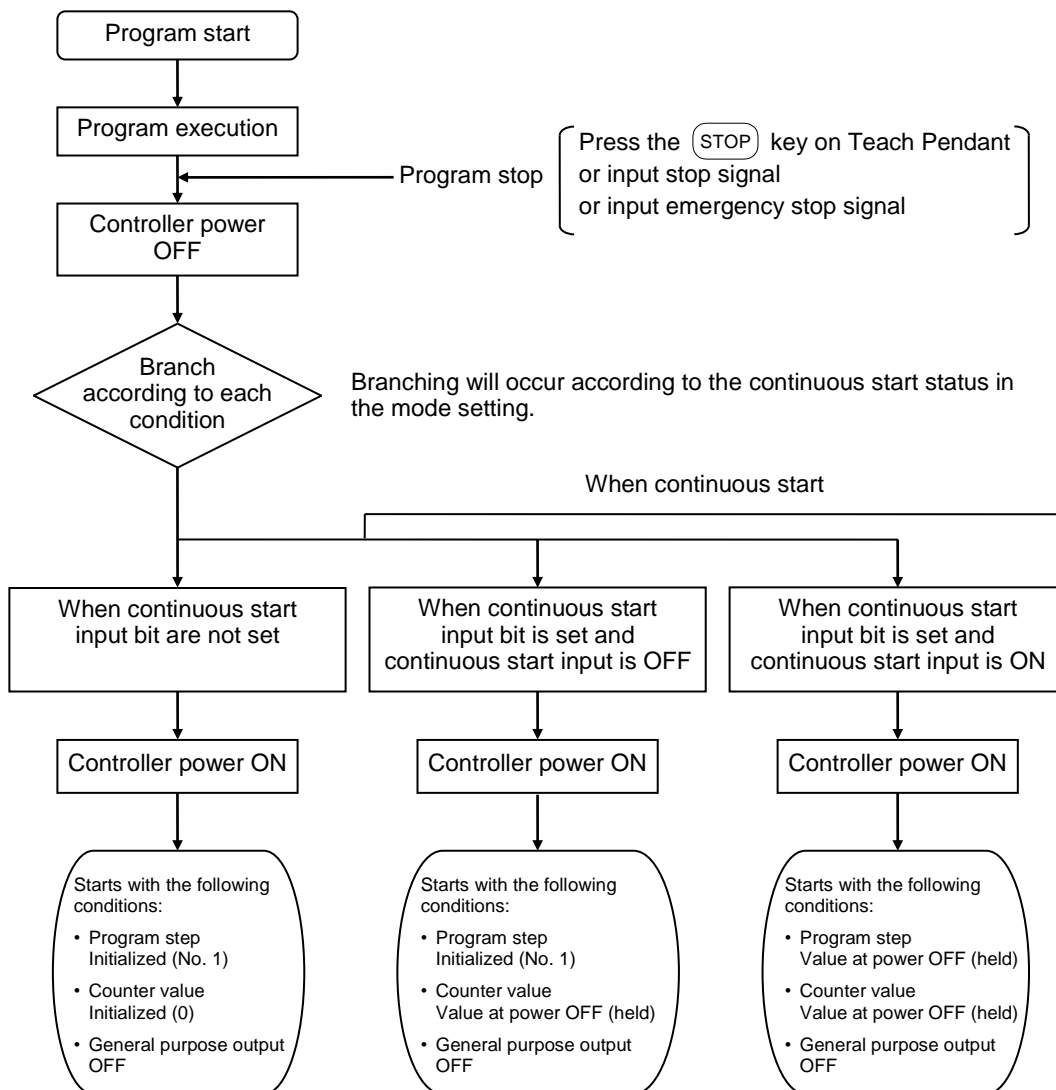
- (1) Designate the continuous start input bit in the mode setting. (Refer to section ■ 13.2.2)
- (2) When the power is turned OFF and then ON again in the state with continuous start ON, the operation can be restarted.

**NOTE**

- Continuous start is not possible if the power is turned OFF or an error occurs and the program stops while a program is being executed. A continuous start impossible error (ER60) occurs..
- During normal operation, the continuous start input functions as a general-purpose input.

<Example>

[Starting of sequential program]



## Chapter 6 Multi-task

### ■ 6.1 Multitasking

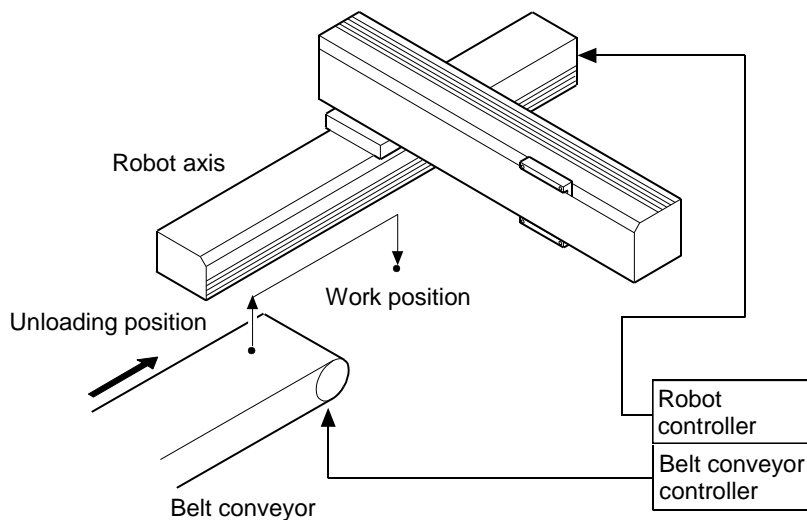
Multitasking refers to executing multiple tasks simultaneously. The multitasking referred to with this controller refers to executing multiple programs simultaneously. This multiple execution of programs is asynchronous operation in which the programs do not interfere with each other.

However, the start of the command execution can be synchronized using commands dedicated for multitasking, and using counters and timers I/O common between the tasks.

### ■ 6.2 Merits of multitasking

The explanation will follow the case of creating a system that unloads the part from the conveyor and places it on the work table.

When the axis is moving to move the part to the work table, the conveyor must be operated to supply the next part to the unloading position.



- When multitasking is not used

In addition to the robot, a programmable logic controller (PLC) for controlling the conveyor will be required.

Due to this, the system will become complicated as wiring for interlocks, etc., will be required. This will in turn lead to a larger and more expensive system.

If the conveyor is controlled with the robot I/O instead of using a PLC, the conveyor cannot be used while the axis is moving, and thus the tact time will increase.

- When multitasking is used

The I/O such as the conveyor control and the axis movement can be controlled simultaneously, so a system can be structured without using a PLC, etc. Thus, the wiring is simplified and the system is less expensive. Control can be carried out just with the controller program, so the system development and maintenance are simplified.



## ■ 6.3 Multitasking usage methods

Each task program is the same as the conventional sequential program. The multitasking settings and the programming methods will be described below.

**NOTE** A maximum of 5000 steps in total for all tasks is supported only by CA25-M10 version 4.30 or later, and SF-98D version 3.1.7 or later. For other than the above, a maximum of 2500 steps in total for all tasks.

### ■ 6.3.1 Multitasking specifications

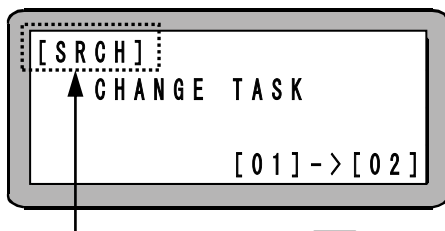
Mode	Only sequential mode
Max. No. of tasks	4
Max. No. of axes	4
Max. No. of program steps	5000 (total for all tasks)

### ■ 6.3.2 Multitasking functions and settings

Multitasking can be set or toggled using the following procedures.

- (1) Setting the task and axis combination  
Up to four tasks (task No. 1 to 4) can be used, and up to four axes can be set per task. When axes are distributed for multiple tasks, up to four tasks in total can be set. For tasks with no axis designation, a command other than the axis related command (movement command etc.) can be executed.  
Refer to section ■ 13.4.19 for the setting methods.
- (2) Setting the task step number  
The No. of program steps is up to 5000 in total for all tasks.  
Refer to section ■ 13.4.22 for the setting methods.
- (3) Changing the task  
To change the task targeted for display or editing, use the **ALT** key or the **SEARCH** key.

[Operation while the RUN mode or PRGM mode sequential program step is displayed]

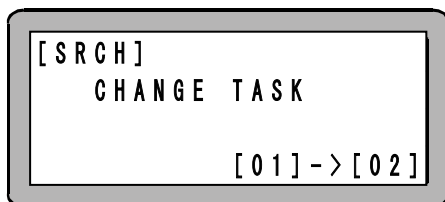


Appears only when the **SEARCH** key is pressed.

Press the **ALT** key or press three times the **SEARCH** key, and then the change task screen as shown in the figure appears.

Using the numeric keypad enter the task No. (01 to 04). The displayed task will change when the **ENT** key is pressed. To return to the previous screen without changing the value, press the **ESC** key.

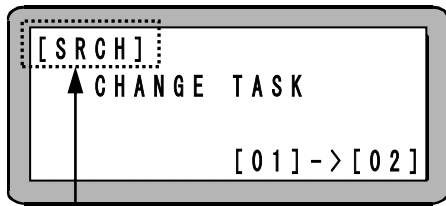
[Operation with the coordinate table edit screen]



Press the **SEARCH** key twice, and then the change task screen as shown in the figure appears.

Using the numeric keypad enter the task No. (01 to 04). The displayed task will change when the **ENT** key is pressed. To return to the previous screen without changing the value, press the **ESC** key.

[Operation with the program step No. monitor or the coordinate monitor]



Appears only when the **SEARCH** key is pressed.

Press the **ALT** key or press the **SEARCH** key, and then the change task screen as shown in the figure appears.

Using the numeric keypad enter the task No. (01 to 04). The displayed task will change when the **ENT** key is pressed. To return to the previous screen without changing the value, press the **ESC** key.

**NOTE** It is impossible to change to a task in which the step number is 0 (the error tone PPPP is generated if changed).

(4) Positioning complete output

The system output positioning completed output (pin No. 13) will turn ON when the positioning of all tasks are completed.

The output that turns ON when a specific task completes positioning can be designated with a port and bit described in section 0 bit designation in the setting of task positioning complete output.

(5) Return to Origin complete output

The system output Return to Origin completed output (pin No. 14) will turn ON when all tasks have returned to the origin.

The output that turns ON when a specific task completes the return to origin can be designated with the port and bit described in section ■ 13.2.15 bit designation in the setting of task return to origin complete output.

### ■ 6.3.3 Starting and stopping tasks

Task 1 of the four tasks is the main task.

(1) Starting the tasks (TSTR command)

If start is applied by the Teach Pendant or system input, task 1 (main task) will start. The other tasks will start with the TSTR command.

(2) Stopping the task (TSTO command)

If stop is applied by the Teach Pendant or system input, all task will stop when the command being executed at that point is completed. The step No. will remain that at the stopped time, and will be used for executed when start is applied again.

The other task can be stopped with the TSTO command. To stop the task itself, use the STOP command.

(3) Restarting the task (TRSA command)

The task that has been started and then stopped by a STOP or TSTO command will be restarted.

(4) Ending a task (TCAN command)

If stop is applied by the system output, all task will stop when the command being executed at that point is completed. The step No. will remain that at the stopped time, but if reset is applied from the system input, step No. will change to 1 and be the same as the end state.

The task will stop and end, and step No. will return to 1 when the END command is executed. However, if the main task executes the END command, all task will end when the command being executed at that time. Thus, all tasks will be canceled. To avoid this, use a counter or an internal port to apply a timing between the tasks (refer to section ■ 6.3.5), and create a program so that the main task does not execute the END command until the other tasks end. The tasks other than the main task can be ended with the TCAN command. To end the task itself, use an END command.

## ■ 6.3.4 Multitasking operation

The method for creating and running a program using multitasking will be explained in this section.

```
[PARA]K19
TASK COMBINATION
      T1 T2 T3 T4
      [2][2][0][0]
```

**STEP 1** Set the number of axes to be controlled by each task through setting the task and axis combination in the PARA mode. (Refer to section ■ 13.4.19)

In the example on the left, the stations No. 0 and No. 1 axes are controlled by task No. 1, and the stations No. 2 and No. 3 axes are controlled by task No. 2.

```
[PARA]K22 T1=1000
TASK      T2=0500
STEP NUM. T3=0000
          T4=0000
```

**STEP 2** Set the No. of steps in each task with the task step number setting in the PARA mode. (Refer to section ■ 13.4.22)

In the example on the left, 1000 step are assigned to the task No. 1 and 500 steps are assigned to the task No. 2.

When the setting finishes, turn OFF and ON the controller power.

- NOTE**
- The total number of steps for all tasks must be 5000 or less.
  - Changing to a task with zero steps is not allowed.

```
CHANGE TASK
          [01]->[01]
```

**STEP 3** Next, enter the program in task No. 1.

Enter the sequential PRGM mode, and press the **ALT** key. The display shown on the left will appear.

Use the numeric keypad to enter the task No. 01, and then press the **ENT** key. The display task will change.

(For a method to change the task, refer to section ■ 6.3.2-(3))

```
[PRGM]
0001
TSTR 02
```

**STEP 4** Enter the TSTR command for starting task No. 2.

When start the program, the main task (task No. 1) will start.

Task No. 2 will start with the TSTR command at the beginning of task No. 1.

Enter the task No. 1 program in sequential order for the steps that follow.

```
CHANGE TASK
          [01]->[02]
```

**STEP 5** Next, enter the program in task No. 2.

Enter the sequential PRGM mode, and press the **ALT** key. The display shown on the left will appear.

Use the numeric keypad to enter the task No. 2, and then press the **ENT** key. The display task will change.

Sequentially enter the task No. 2 program in the following steps.

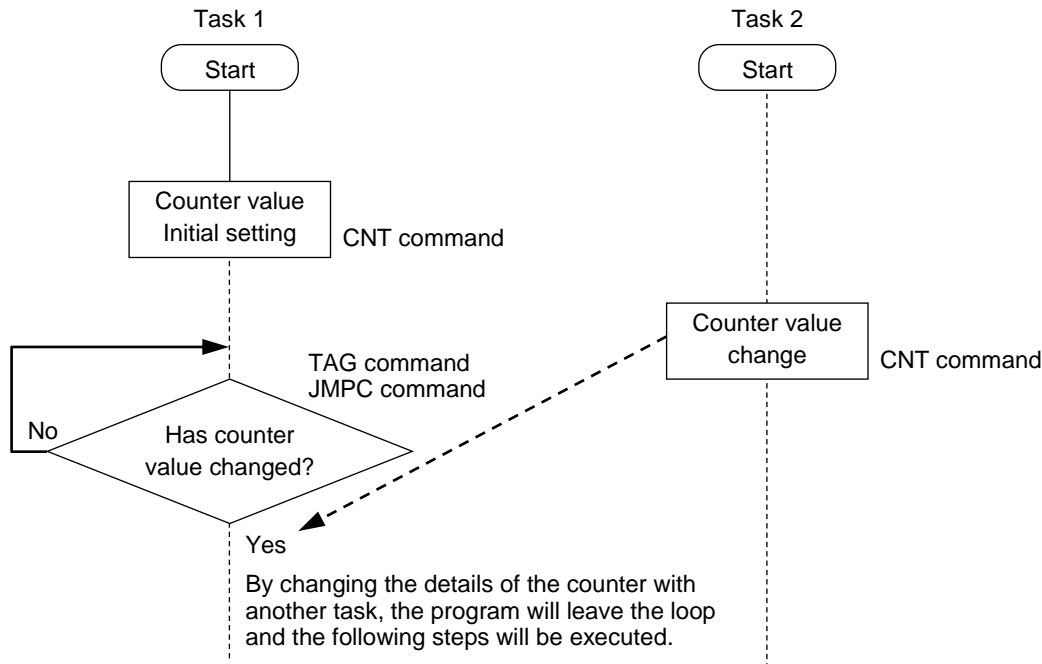
```
R U N !!!
```

**STEP 6** When completed entering the program, return the No. of steps of each task to 1. Enter the RUN mode and press the **START** key. The program will start from the head of task No. 1.

Use the operation described in STEP 3 to change the task display.

### ■ 6.3.5 Applying timing between tasks

A timing is applied to multiple tasks that run in association by using a counter or internal port input/output command (INSP, IOUT) as shown below.



### ■ 6.4 Details on multitasking

Information important for efficiently using the multitask function is described below.

#### ■ 6.4.1 Task status

With the multitasking, multiple task can be executed simultaneously by executing other task during the task's open time. The following three task states exist.

- (1) Resting state  
State in which nothing is occurring. (No tasks have been started.)
- (2) Execution state  
State in which task is being executed.
- (3) Stopped state  
State in which the task is stopping.

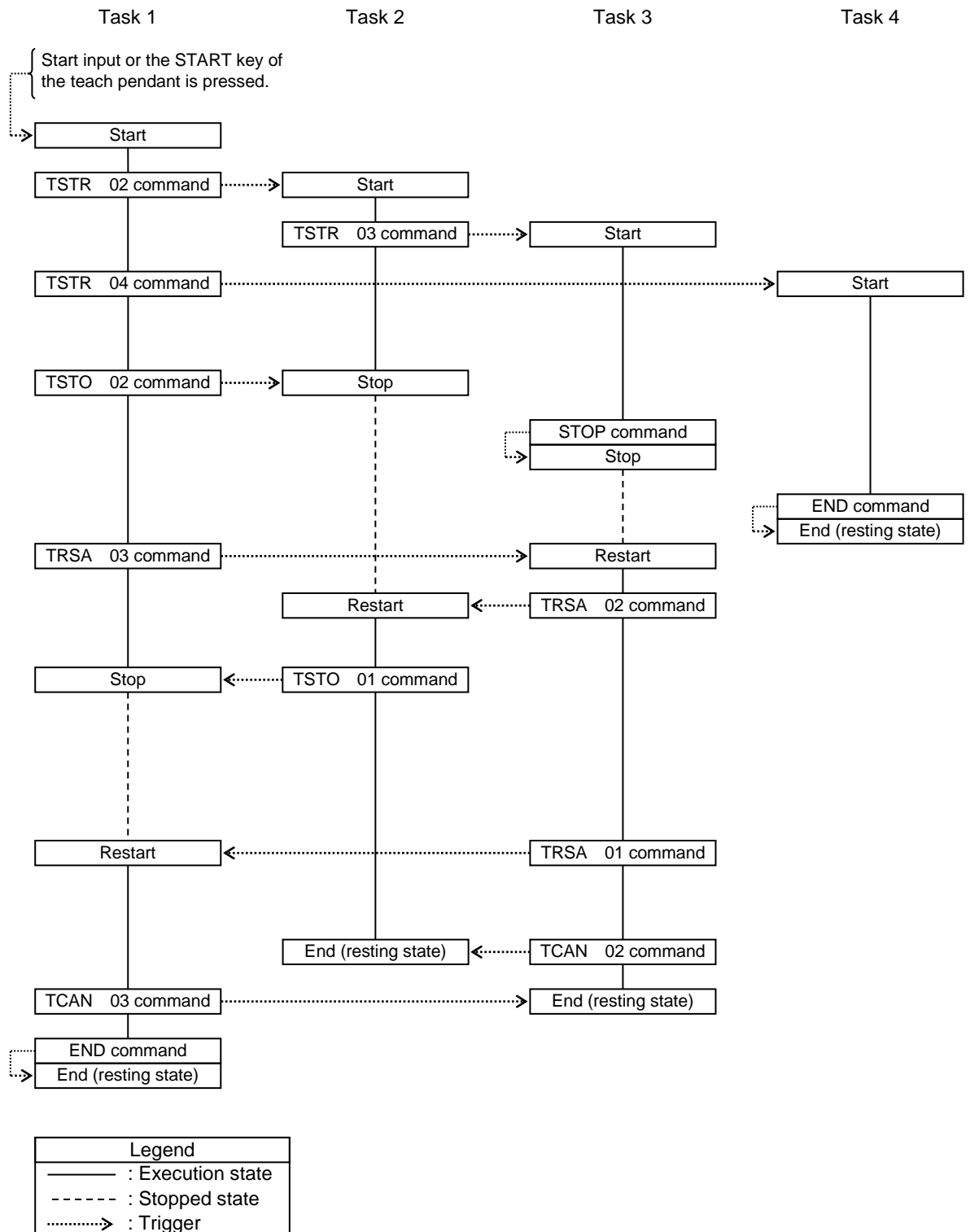
#### ■ 6.4.2 Transition of states

- (1) Starting the task  
The main task (task 1) will start when start is input from the system, or when started with the Teach Pendant. The task stopped from the execution state will be started with the task start command (TSTR).
- (2) Ending the task  
When the task being executed executes the END command, that task will end. The step No., for the ended task will change to 1, and the task will enter the resting state. If the END command is executed with the main task, all tasks will enter the resting state when the commands for all tasks are completed.  
If the task being executed executes the TCAN command, the task will enter the resting state when the task command designated with that command is completed. The main task cannot be ended with the TCAN command.
- (3) Restarting the task  
The task that has been started and then stopped by STOP or TSTO command will be restarted.

### 6.4.3 Transfer of data between tasks

The same counters and timers are used for all tasks, so a value can be set with one task and referred to by another task, or the data or status can be transferred by using condition judgment commands such as JMPC, CALC, JMPT or CALT.

### 6.4.4 Example for transition of states



## Chapter 7 Palletizing Mode

The palletizing is a mode exclusive for moving and loading. This program can be executed just by setting the parameters. The following types of modes are prepared in the palletizing mode.

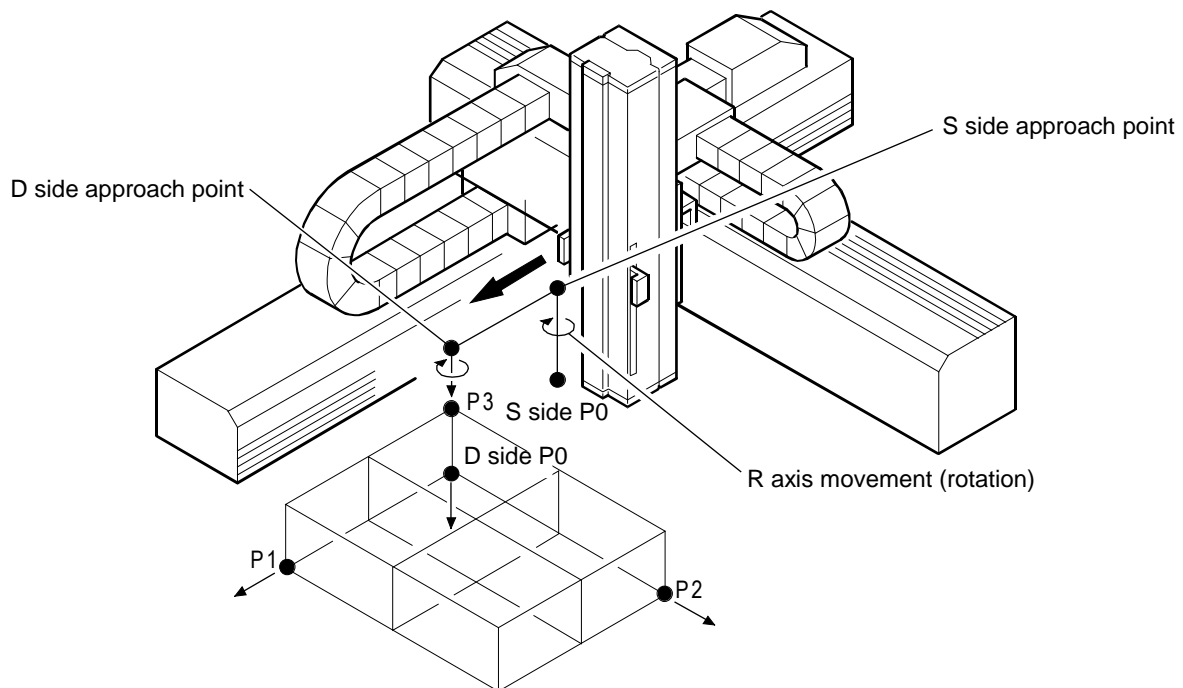
- 1 to M mode: Movement from set position (P0) to matrix-type point on X, Y and Z axes direction
- M to 1 mode: Movement from matrix-type point in X, Y and Z axes direction to set position (P0)
- M to M mode: Movement from matrix-type point in X, Y and Z axes direction to matrix-type point in X, Y and Z axes direction

The matrix work origin P0 does not always need to be near the origin. Palletizing operation is carried out in the order of the P1 direction, P2 direction, and P3 direction. However, because the matrix type points P0 to P3 can be set in any position, the order of palletizing operation can be changed.

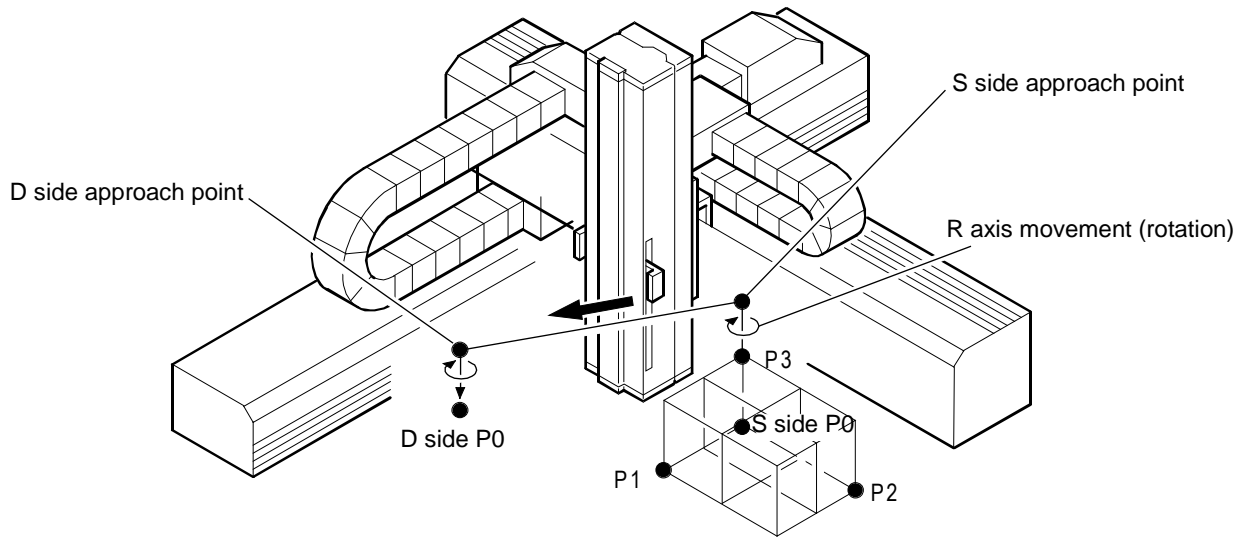
This machine's palletizing mode has the following procedures.

- Up to 16 programs can be set. When a program is started using the start key of the teach pendant, set the program to be executed in advance (refer to section ■ 15.3). When a program is started using a start input, set the bit designation of the program selection input (refer to section ■ 13.2.5).
- Input of positional data of a program can be performed by remote teaching, direct teaching, and MDI (manual data input).
- An approach point (a point right above the matrix type point through which the robot moves to a point) can be set.
- By writing in the tag No. of the start program and end program, a sequential program can be executed before and after the palletizing operation.
- Based on the coordinate data P0 to P3, the oblique state can be corrected. The matrix (pallet etc.) does not always need to be parallel to each axis, but take care not to allow each point coordinate of the matrix to exceed the software limit value.

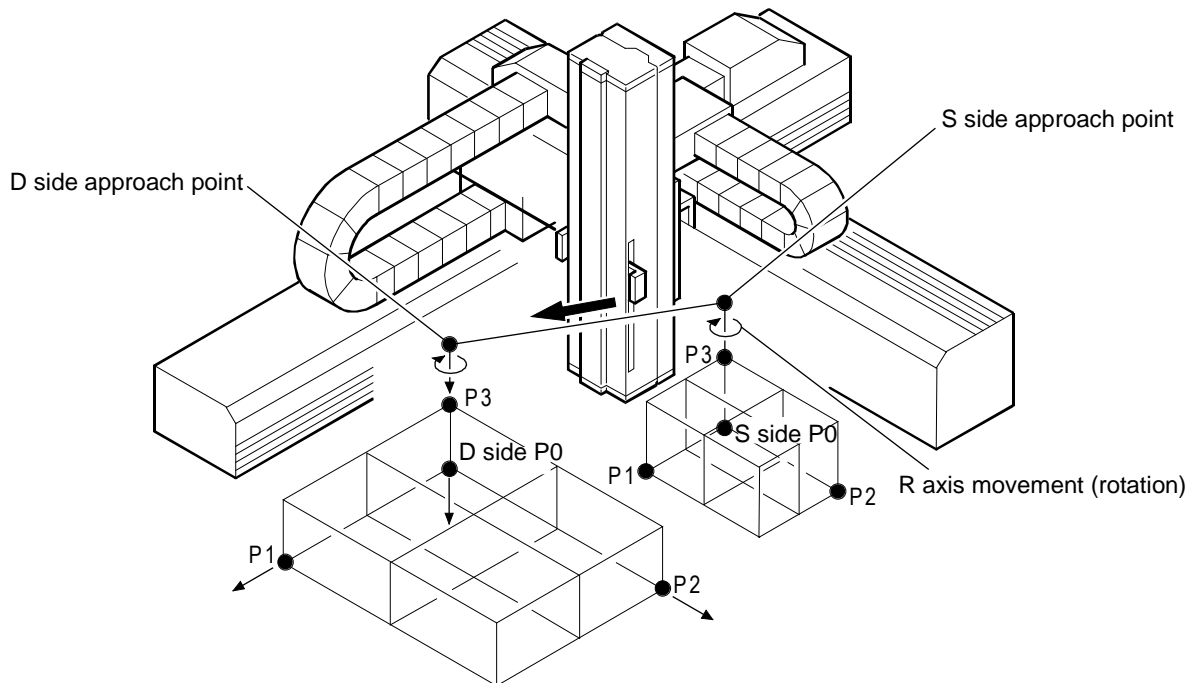
This controller can execute multiple sequential programs using multitasking, but the sequential program that can be executed in the palletizing mode is the task No. 1 only.



- 1 to M mode



● M to 1 mode



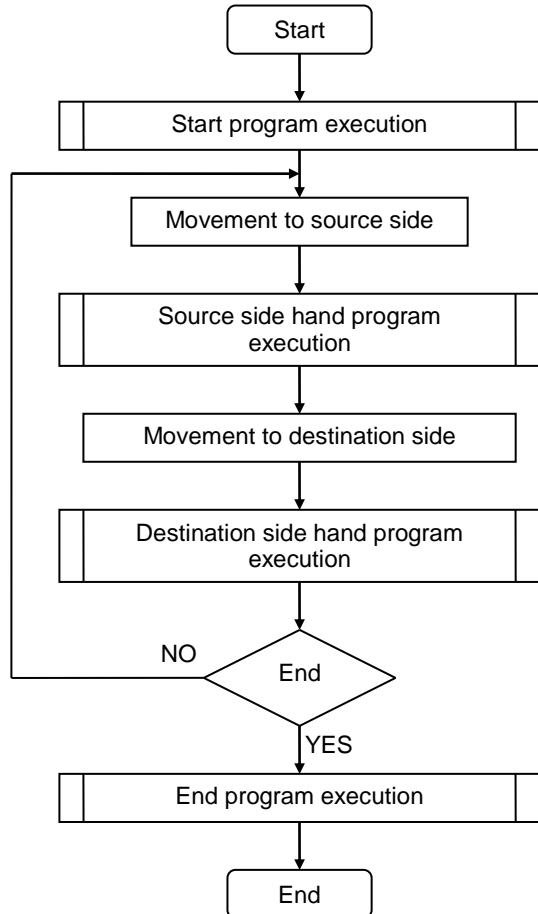
● M to M mode

## ■ 7.1 Basic flow chart of palletizing mode

For the execution order of the palletizing mode, refer to the flow chart below. After a program starts, the start program tag No. will be referred, the procedure will jump to the step of the tag No. in the sequential program, and the sub routine will be executed. If the start program tag No. is 000, the start program will not be executed and will be passed.

Next, the palletizing is performed. The robot will move to each point through the approach point, the hand program No. will be referred, and the sub routine will be executed similarly to the start program.

After ending the palletizing operation, the end program tag No. is referred to, and the subroutine is executed and stopping in the same manner as the start program.



### [Start program]

The tag No. of the sequential program to be executed before palletizing operation is indicated.

### [Hand program]

- The hand program operates the chuck, etc., that is installed.
- Programs are made for both the source side (S side) and destination side (D side).

### [End program]

The tag No. of the sequential program to be executed after palletizing operation is indicated.

### NOTE

- The above three types of programs are written as subroutines in the appropriate steps of the sequential program.
- The tag No. must be set at the first step of this subroutine, and "RET" written at the end.
- This subroutine tag No. is written in the palletizing program.



## 7.2 PRGM mode in palletizing mode

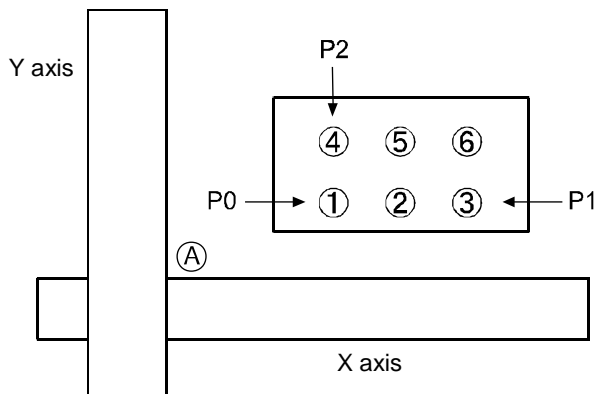
The PRGM mode is a mode where programming is performed. The PRGM (program) screen in the palletizing mode is configured of 16 screens shown in the following table. The screens are common in all modes, but the screens that do not need to be set (the positions indicated with an X in the following table) for the 1 to M mode or M to 1 mode will not display.

Screen No.	Details	M to M	1 to M	M to 1
01	Start program tag No.	○	○	○
02	S side matrix P0 coordinates	○	○	○
03	S side matrix P1 coordinates	○	×	○
04	S side matrix P2 coordinates	○	×	○
05	S side matrix P3 coordinates	○	×	○
06	No. of S side matrixes	○	×	○
07	Movement speed toward S side	○	○	○
08	S side hand program tag No.	○	○	○
09	D side matrix P0 coordinates	○	○	○
10	D side matrix P1 coordinates	○	○	×
11	D side matrix P2 coordinates	○	○	×
12	D side matrix P3 coordinates	○	○	×
13	No. of D side matrixes	○	○	×
14	Movement speed toward D side	○	○	○
15	S side hand program tag No.	○	○	○
16	End program tag No.	○	○	○

### Operation example: 1 to M

The place of 2-axis combination is shown below for example.

- Set the coordinates ① in the D side P0 coordinates
- Set the coordinates ③ in the D side P1 coordinates
- Set the coordinates ④ in the D side P2 coordinates

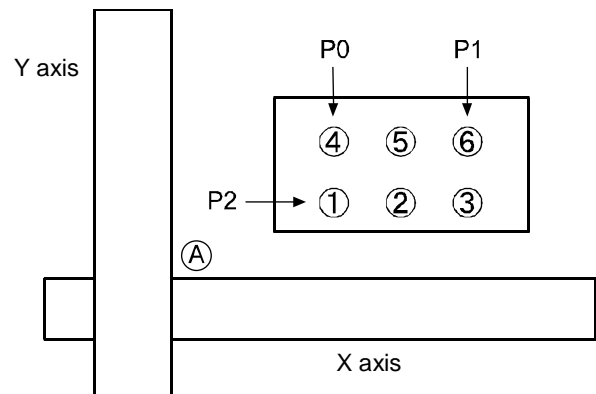


#### [Operation pattern]

To execute the 1 to M program.

- ① → ② → ③
- ④ → ⑤ → ⑥

- Set the coordinates ④ in the D side P0 coordinates
- Set the coordinates ⑥ in the D side P1 coordinates
- Set the coordinates ① in the D side P2 coordinates



#### [Operation pattern]

To execute the 1 to M program.

- ④ → ⑤ → ⑥
- ① → ② → ③

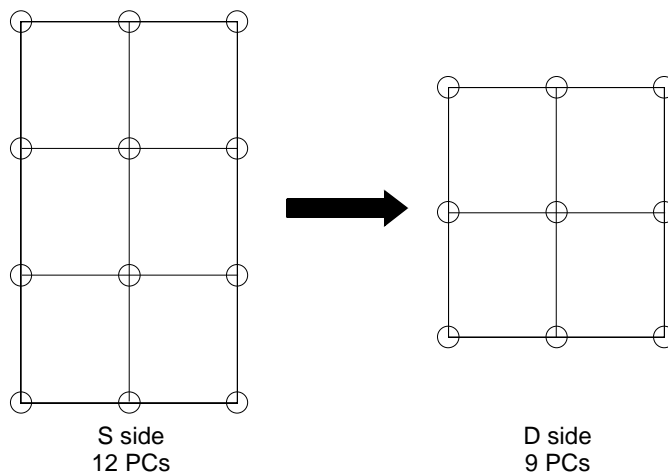
- In the palletizing program, counter Nos. 91 to 96 are used as the palletizing counter.

		Applicable counter
S side	Count in P0 to P1 direction	No. 91
	Count in P0 to P2 direction	No. 92
	Count in P0 to P3 direction	No. 93
D side	Count in P0 to P1 direction	No. 94
	Count in P0 to P2 direction	No. 95
	Count in P0 to P3 direction	No. 96

**NOTE**

- Counter Nos. 91 to 96 are counters exclusive for palletizing. Do not use these in programs other than the palletizing program.
  - Refer to the relation of the counter details and movement position given in section ■ 5.1.6-(3) for details on the counter and movement position.
  - The counter details are automatically processed (counted up, initialized) after the destination side hand program is executed.
- Remote teaching or direct teaching can be used for the S side and D side coordinate data P0 to P3. However, direct teaching cannot be used for axes provided with brakes. (Refer to section ■ 4.7.2)
  - If the No. of S sides and D sides differs in the M to M mode, the palletizing operation will be continuously repeated until the work at the final point of the S side reaches the final point on the D side. (If the pallet is full, the first point of the pallet will be returned to.)

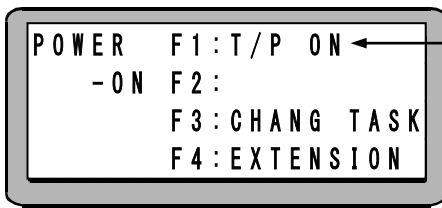
[Example]



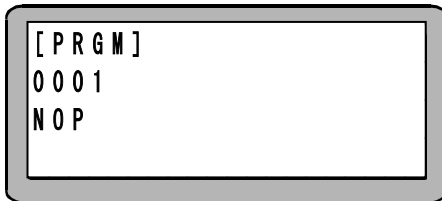
In the above example, after 36 works (min. nominal multiple of 12 and 9) are palletized, the program will end. (The palletizing operation is repeated three times on the S side pallet and four times on the D side pallet.)

## ■ 7.2.1 How to enter and leave the PRGM mode

The method for entering and leaving the PRGM mode in the palletizing mode will be described in this section.

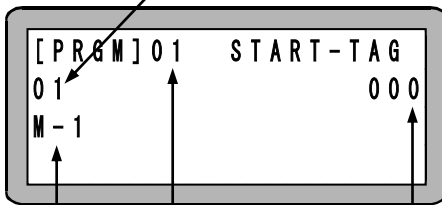


**STEP 1** Turn the power ON. When the display shown at the left appears after the initial screen, press the **F 1** key.  
Then press the **RUN PRGM** key.



**STEP 2** The PRGM mode is set. [PRGM] appears at the top left.  
Press the **SEQUN PALET** key and enter the palletizing mode.

Palletizing program No.



**STEP 3** The initial screen of the palletizing mode will display.  
Press the **NEXT** key to display the next screen.  
Press the **SEQUN PALET** key to leave the palletizing mode and return to the sequential mode.

M to 1 mode    Screen No.    Start tag No.




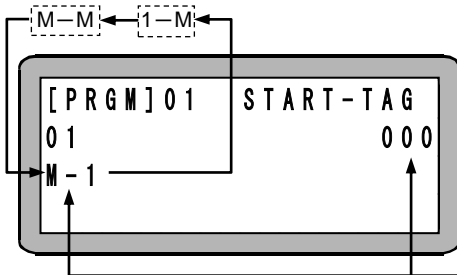
For details of program No. change, refer to section ■ 15.3.





To change the program screen No., press the **NEXT** and **-NEXT** keys or use the search function. (Refer to section ■ 15.4)


## 7.2.2 Editing palletizing mode program

The programming screen using the M to M mode is shown below.

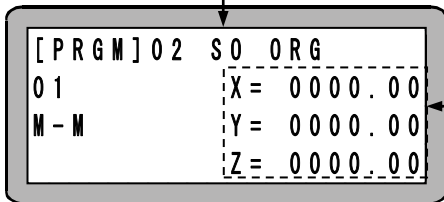
Enter the PRGM (program) mode and press the  key. (Refer to section 7.2.1)






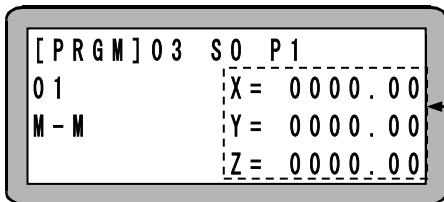
- STEP 1** When the  key is pressed, the mode will alternate, so select the required mode and press the  key.  
Next, use the numeric keypad to enter the tag No. and press the  key.  
Press the  key to display the next screen.




 If the start program is not used, set the start tag No. to 0.

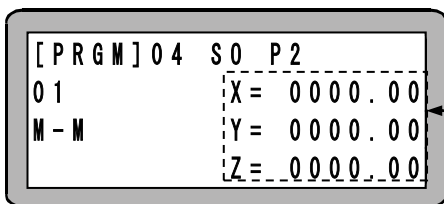
These characters represents source side (feed side).







- STEP 2** Use the numeric keypad to enter the S side P0 coordinates (absolute coordinates) and press the  key.  
Press the  key to display the next screen and the  key to display the previous screen.

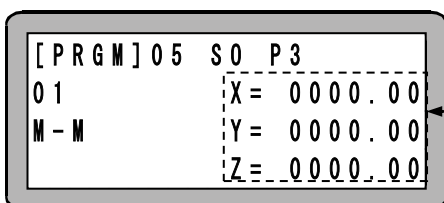





- STEP 3** Use the numeric keypad to enter the S side P1 coordinates (absolute coordinates) and press the  key.  
Press the  key to display the next screen and the  key to display the previous screen.




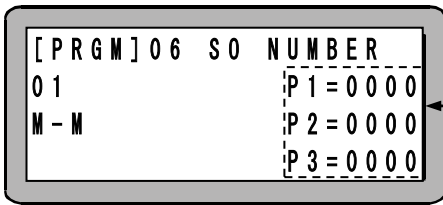
- STEP 4** Use the numeric keypad to enter the S side P2 coordinates (absolute coordinates) and press the  key.  
Press the  key to display the next screen and the  key to display the previous screen.

 If the S side matrix is one row, set "0" for the X, Y coordinates.



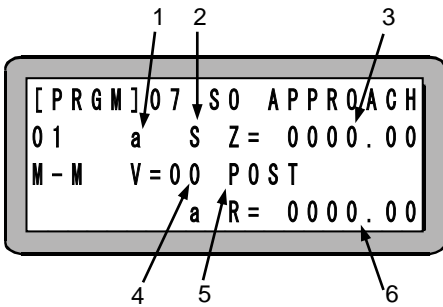
- STEP 5** Use the numeric keypad to enter the S side P3 coordinates (absolute coordinates) and press the  key.  
Press the  key to display the next screen and the  key to display the previous screen.

 If the S side matrix is a plane (one stage), set the X, Y, and Z coordinates to zero.



**STEP 6** Use the numeric keypad to enter the No. of pieces on the S side and then press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

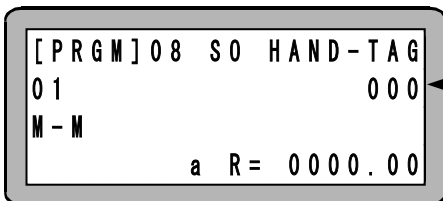
- ?** ● If the S side matrix is one row, set "0" for P2.
- If the S side matrix is a plane (one stage), set "0" P3 for.



**STEP 7**

1. For the Z axis, press the **ALT** key to select "a" (absolute coordinates) or "i" (relative coordinates), and press the **ENT** key.
2. Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.
3. Enter the approach point of the Z axis, and press the **ENT** key.
4. Enter the speed No., and press the **ENT** key.
5. Press the **ALT** key, select POST (position) or PASS (pass point), and press the **ENT** key.
6. Enter the approach point of the R axis, and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

- NOTE**
- For the R axis, "i" (relative coordinate) cannot be selected.
  - The S side approach point is always set just above the S side matrix type point.
  - If the approach point of the Z axis is not entered (Z=0000.00), the approach point will be invalid.
  - For "a" (absolute coordinate), "i" (relative coordinate), "S" (axial speed), "T" (linear speed), POST, and PASS of the parameter, refer to "MOV system commands and parameter" (section ■ 4.7.3).



**STEP 8** Enter the tag No. of the S side hand program with the numeric keypad, and press the **ENT** key.  
Next, enter the R axis coordinate and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

- ?** If the S side hand program is not used, set the hand tag No. to zero.

These characters represents destination side (receive side)

[PRGM]09	DI	ORG
01	X=	0000.00
M-M	Y=	0000.00
	Z=	0000.00

**STEP 9**

Enter the D side P0 coordinate (absolute coordinate) with the numeric keypad, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

[PRGM]10	DI	P1
01	X=	0000.00
M-M	Y=	0000.00
	Z=	0000.00

**STEP 10**

Enter the D side P1 coordinate (absolute coordinate) with the numeric keypad, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

[PRGM]11	DI	P2
01	X=	0000.00
M-M	Y=	0000.00
	Z=	0000.00

**STEP 11**

Enter the D side P2 coordinate (absolute coordinate) with the numeric keypad, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.



If the D side matrix is one row, set the X, Y, and Z coordinates to zero.

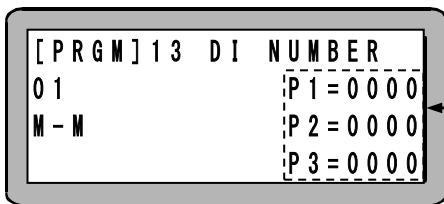
[PRGM]12	DI	P3
01	X=	0000.00
M-M	Y=	0000.00
	Z=	0000.00

**STEP 12**

Enter the D side P3 coordinate (absolute coordinate) with the numeric keypad, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.



If the D side matrix is a plane (one stage), set the X, Y, and Z coordinates to zero.

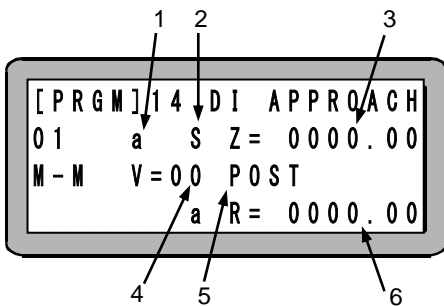


**STEP 13**

Enter the number of the D side, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.



- If the D side matrix is one row, set the P2 to zero.
- If the D side matrix is a plane (one stage), set the P3 to zero.

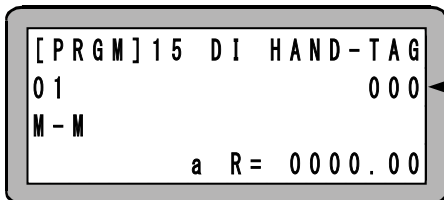


**STEP 14**

1. For the Z axis, press the **ALT** key to select "a" (absolute coordinates) or "i" (relative coordinates), and press the **ENT** key.
2. Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.
3. Enter the approach point of the Z axis, and press the **ENT** key.
4. Enter the speed No., and press the **ENT** key.
5. Press the **ALT** key, select POST (position) or PASS (pass point), and press the **ENT** key.
6. Enter the approach point of the R axis, and press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

**NOTE**

- For the R axis, "i" (relative coordinate) cannot be selected.
- The D side approach point is always set just above the D side matrix type point.
- If the approach point of the Z axis is not entered (Z=0000.00), the approach point will be invalid.
- For "a" (absolute coordinate), "i" (relative coordinate), "S" (axial speed), "T" (linear speed), POST, and PASS of the parameter, refer to "MOV system commands and parameter" (section ■ 4.7.3).

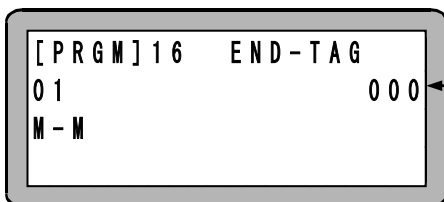


**STEP 15**

Enter the D side hand program tag No. with the numeric keypad, and then press the **ENT** key. Next, enter the R axis coordinate, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.



If the D side hand program is not used, set the hand tag No. to zero.



**STEP 16**

Enter the end program tag No. with the numeric keypad, and then press the **ENT** key. Press the **-NEXT** key to display the previous screen.



If the end program is not used, set the end tag No. to zero.

### ■ 7.2.3 Copy editing of palletizing mode

A random program in the palletizing mode can be copied to another palletizing program.

Enter the PRGM mode of sequential mode and press the (HELP) key. The following screen will display. (Refer to section ■ 5.1.1)

```
[PRGM] F1:EXTENSION
HELP F2:DIRECT OUT
F3:EDIT ←
F4:PARAMETER
```

**STEP 1** From this state, press the (F3) key.  
Press the (ESC) key to return to PRGM mode.

```
[EDIT] F1:INS STEP
F2:DEL STEP
F3:CLEAR
F4:PAGE ←
```

**STEP 2** In this state, press the (F4) key.  
Press the (ESC) key to return to PRGM mode.

```
[EDIT] F1:STEP COPY
F2:PALET COPY ←
F3:STEP DEL
F4:
```

**STEP 3** Press the (F2) key.  
Press the (ESC) key to return to STEP 2.

```
[PALE-
COPY] FROM [01] ←
T O [01] ←
```

**STEP 4** Use the numeric keypad to enter the copy origin palletizing program No. and press the (ENT) key.

**STEP 5** Then use the numeric keypad to enter the copy destination palletizing program No. and press the (ENT) key.  
Press the (ENT) key for the copy destination and the program will be copied, and STEP 3 will be returned to.  
Press the (ESC) key to return to step 3.



## ■ 7.2.4 Clearing of palletizing mode programs

Set the PRGM mode of the sequential mode of the task No. 1 (refer to section ■ 5.1.1), and press the **HELP** key. The following screen will display.

```
[PRGM] F1:EXTENSION
HELP  F2:DIRECT OUT
      F3:EDIT ←
      F4:PARAMETER
```

**STEP 1** From this state, press the **F3** key.  
Press the **ESC** key to return to PRGM mode.

```
[EDIT] F1:INS STEP
      F2:DEL STEP
      F3:CLEAR ←
      F4:PAGE
```

**STEP 2** In this state, press the **F3** key to enter the clear mode.  
Press the **ESC** key to return to PRGM mode.

```
[CLR]  F1:SEQUN
      F2:PALET
      F3:SEQ/PALET
      F4:PAGE
```

**STEP 3** To clear only palletizing program press the **F2** key to return to STEP 4A.  
To clear the sequential program and the palletizing program in one time, press the **F3** key to go to STEP 4B.  
Press the **ESC** key to go to STEP 2.

**NOTE** If this operation is performed in other than the task No. 1, the error beeps and the operation becomes invalid.

```
[CLR]
ALL PALET. PROGRAM
      CLEAR ?
YES:ENT NO:ESC
```

**STEP 4** To clear the program, press the **ENT** key. To not clear the program, press the **ESC** key.  
If the program is cleared, all palletizing programs will be initialized.

```
[CLR]
ALL PROGRAM(S/P)
      CLEAR ?
YES:ENT NO:ESC
```

**STEP 5** To clear the program, press the **ENT** key. To not clear the program, press the **ESC** key.  
When the program is cleared, the sequential program (task No. 1) that can be used for palletizing and the palletizing program are initialized entirely.

## ■ 7.3 RUN mode of palletizing mode

RUN mode of palletizing mode can be operated with the following methods.

- AUTO mode (Continuous operation or single operation)
- STEP mode

### ■ 7.3.1 AUTO mode of palletizing mode

In the AUTO mode, the program is executed continuously in order. (Refer to section ■ 4.1.1-(1))

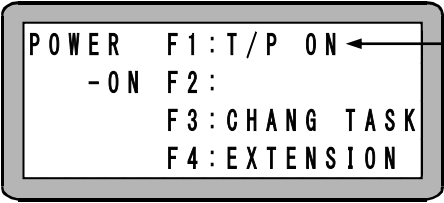
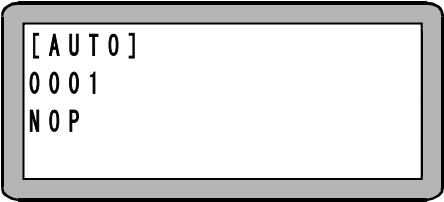
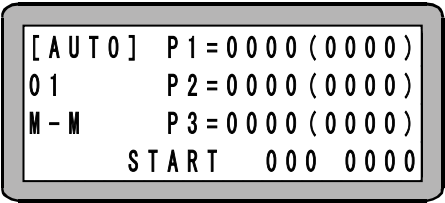
When running the program for the first time after creating it, verify the operation of the program using the STEP mode before starting continuous operation. (Refer to section ■ 7.3.2)

#### (1) Continuous operation

Continuous operation will automatically execute the program in sequence.

#### Operation using Teach Pendant

The operation procedures using the Teach Pendant are shown below.

	<b>STEP 1</b> Turn ON the power switch. After the initial screen displays, the following screen will display, so press the <b>F1</b> key and the <b>HOME</b> key to carry out return to origin. (In some cases, return to origin is unnecessary (refer to section ■ 4.5.2))
	<b>STEP 2</b> Press the <b>SEQUN PALET</b> key in this state. The palletizing mode will be entered.
	<b>STEP 3</b> Press the <b>SEARCH</b> key and then use the numeric keypad to enter the program No. to be executed. Then press the <b>ENT</b> key to display the corresponding program.

- The number being executed will display.
- The set number will display.

**STEP 4** The program execution will start when the **START** key is pressed.

```
[ AUTO ] P 1 = 0 0 0 0 ( 0 0 0 0 )
0 1      P 2 = 0 0 0 0 ( 0 0 0 0 )
M - M    P 3 = 0 0 0 0 ( 0 0 0 0 )
          S T A R T   0 0 0   0 0 0 0
```

- The step No. (sequential program) being executed will display. (0000 will display if no program is being executed.)
- The tag No. being executed (sequential program) will display. (000 will display if no program is being executed.)
- The execution program mode (M-1, 1-M, M-M) will display.
- Display of execution state. This will change according to the process.
- The program No. will display. (1 to 16)

START (Start program)

SOURCE (Source side)

DESTI. (Destination side)

END (End program)

**STEP 5** When the end program execution has completed, the display will change from END to START, and the initial state will be returned to.

```
[ AUTO ] P 1 = 0 0 0 0 ( 0 0 0 0 )
0 1      P 2 = 0 0 0 0 ( 0 0 0 0 )
M - M    P 3 = 0 0 0 0 ( 0 0 0 0 )
          S T A R T   0 0 0   0 0 0 0
```

#### Operation with external signals

Use the following procedure to carry out operation with the external signals.

1. Set the palletizing input signal with the mode setting. (Refer to section ■ 13.2.6)
2. Turn the palletizing input signal ON.
3. Turn the controller power ON.
4. If READY output is set with the mode setting, check the ON state and then input the next input signal. (Refer to section ■ 13.2.13)  
If the READY signal is not set with the mode setting, the next input signal will be input approximately five seconds after the power is turned ON.
5. Turn the return to origin signal ON and return to the home. (In some cases, return to origin is unnecessary (refer to section ■ 4.5.2)
6. Confirm that the return to origin signal is ON and then input the next signal.
7. Turn the start signal ON and start the program.  
The palletizing input signal state will be checked when the start signal is input. If the signal is ON, the palletizing mode program will be started.

#### NOTE

- When the T/P is ON, a start signal of the system input is invalid. For the method to disconnect the teach pendant, refer to section ■ 16.1.
- The palletizing mode can be entered only from the sequential mode. Thus, the mode setting must be set to "Invalid" as shown in section 0. If a state other than "Invalid" is selected, the palletizing input signal will be ignored.



- If a stop signal is input during operation, the program will stop after ending the operation currently being executed.
- To restart the program after stopping with a stop signal or STOP command, input the start signal again. To start the program from the start again, input the reset signal and then input the start signal.  
Note that the restart mode setting and restart signal input state are related. (Refer to sections ■ 10.2.6 and ■ 13.2.2)
- Refer to section ■ 7.4 for how to restart operation after turning the power OFF.

(2) Single operation

During single operation, the program will stop once after the axis movement or output related operation is executed. This is used to verify a program. To start or restart the program, input the start signal or press the **(START)** key.

An example of single operation is given below.

1. Designate the single operation mode input bit in the mode setting. (Refer to section ■ 13.2.1)
2. Turn the single operation input signal ON.
3. The following operations are basically the same as continuous operation. (Refer to section ■ 7.3.1-(1))



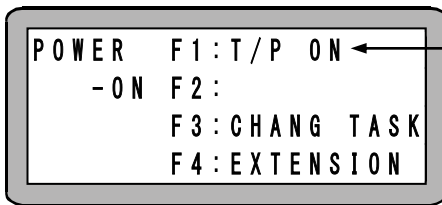
- Operation with either the Teach Pendant or external signal is possible.
- Even if the single operation input signal is turned OFF during single operation, it will be ignored, and single operation will continue.
- Even if the single operation input signal is turned ON during continuous operation, it will be ignored, and continuous operation will continue.
- The palletizing input signal must be ON when the start signal is input.
- The following commands can be used for stopping after execution.  
MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, RSMV, HOME,  
OUT, OUTP, OUTC, IOUT

### ■ 7.3.2 STEP mode of palletizing mode

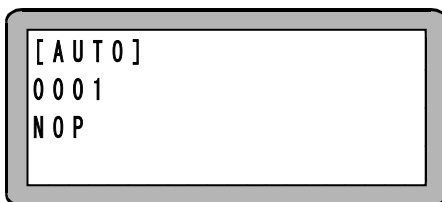
The STEP mode is used to execute the palletizing program one step at a time using the teach pendant.

If a program is started by a start signal input in the palletizing mode, however, the AUTO mode will be set, rather than the STEP mode. Before execution in the AUTO mode, check the program running in this mode.

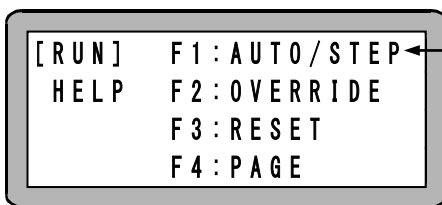
The operation procedures of the step mode are given below.



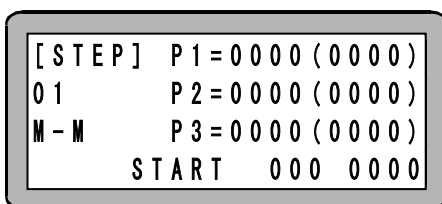
**STEP 1** Turn ON the power switch. After the initial screen displays, the following screen will display, so press the **(F1)** key.



**STEP 2** The AUTO mode of the RUN mode of the sequential mode is set. Press the **(HOME)** key to carry out return to origin. (In some cases, return to origin is unnecessary (refer to section ■ 4.5.2.) Press the **(HELP)** key.



**STEP 3** When this screen displays, press the **(F1)** key. The STEP mode will be entered. Press the the **(SEQUEN PALET)** key.



**STEP 4** The STEP mode is set. [STEP] appears at the left top. Press the **(SEARCH)** key and then use the numeric keypad to enter the program No. to be executed. Then press the **(ENT)** key to display the corresponding program.

```
[STEP] P1=0001(0003)
01     P2=0001(0003)
M-M    P3=0001(0002)
        START 000 0000
```

**STEP 5** Press the **START** key to start the program.

```
[STEP] P1=0002(0003)
01     P2=0001(0003)
M-M    P3=0001(0002)
        START 000 0000
```

**STEP 6** The next step will display, and the robot will stop.  
Press the **START** key to execute the next step.  
The program will be executed sequentially in step units and will stop.

**NOTE** During the operation with the STEP mode, the input signal and output signal timings will differ compared to operation in the AUTO mode.

### 7.3.3 Changing of speed during operation (override)

By using the override function, the axis moving speed can be changed. This allows the program to be confirmed safely.

```
[RUN]  F1:AUTO/STEP
HELP   F2:OVERRIDE ←
        F3:RESET
        F4:PAGE
```

**STEP 1** Enter the RUN mode and press the **HELP** key. This screen will display, so press the **F2** key.

```
[OVER]
OVERRIDE
        100% ←
```

**STEP 2** The override setting screen appears.  
Use the numeric keypad to enter the override value. When the **ENT** key is pressed, the speed will change to the set speed, and the screen returns to the RUN mode.  
To return to the RUN mode without changing the value, press the **ESC** key.  
(Initial value: 100, override value: 1 to 100)

- NOTE**
- The override setting is valid only while the program is stopped.
  - The override setting value is held even while the power is being shut off.
  - The override is effective also for the speed in JOG operation and high speed return to origin.
  - The override is applied to speed restricted by the maximum speed data setting in the parameter 2 (refer to section ■ 13.4.6).

## 7.4 Method to continuous start after turning power OFF in palletizing mode

In the palletizing mode, even if the power is turned OFF and then turned ON again, the operation can be restarted provided that conditions in the following table are met. However, this is valid only when the operation is stopped by the teach pendant or the stop input of the system input before turning OFF the power.

For details of data held until restart, refer to section 10.2.6.

This function can be used also for recovery from a stop due to emergency stop input.

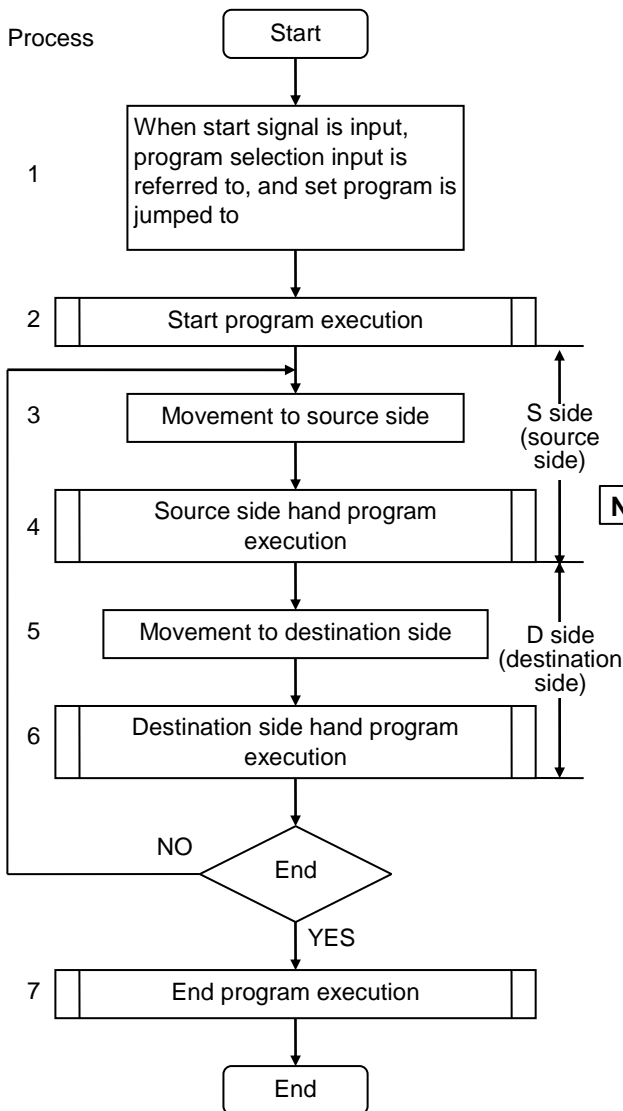
Use the following procedure to restart the operation.

- (1) Designate the continuous start input bit in the mode setting. (Refer to section 13.2.2.)
- (2) After turning the power OFF, turn the continuous start input ON, and turn the power ON. The program will be restarted with the following conditions.

### NOTE

- Continuous start is not possible if the power is turned OFF or an error occurs and the program stops while a program is being executed. A continuous start impossible error (ER60) occurs.
- During normal operation, the continuous start input functions as a general-purpose input.

### Palletizing flow chart



Position where power is turned OFF	Continuous start method
At processes 1 to 2	Starts from process 1 (from beginning)
At processes 3 to 6	Starts from process 3 (continuing of operation)
At process 7	Starts from process 1 (It is interpreted that the process has been completed, so operation will start from process 1.)

### NOTE

- If the operation is stopped between processes 3 and 6, the axis will stop at the S side or D side. However, if it is stopped at the D side (process 5 or 6), start again after returning one work to the S side pallet. When stopped at the S side (process 3 or 4), confirm that the work is at the S side pallet, and then start.
- Continuous start is possible only when the power is turned OFF while the program execution is stopped (stopped in normal state). If the power is turned OFF during execution of a program (during operation), continuous start will not be possible. A continuous start impossible error will occur.
- The program execution stop state represents the condition where the running output of the system output is OFF. The following cases correspond to this condition.
  - 1) When the operation is stopped by the stop key or the stop input.
  - 2) When the operation is stopped by the emergency stop button or the emergency stop input.
  - 3) When the operation is stopped by execution of the STOP command.

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## Chapter 8 External Point Designation Mode

### 8.1 Explanation of external point designation mode

The external point designation mode does not use the controller's command language and instead, the positioning movement takes place according to the signals input from the input ports. When the output setting (refer to section ■ 13.2.20 mode parameter M20) is "valid", the moved coordinate table number will be outputted after the movement has finished.

The usable table and coordinate system differs depending on whether the expansion I/F unit (\*1) exists or not, the type of the expansion I/F unit, and whether the slave unit exists or not as shown in the table below.

When expansion I/F unit (\*1) is not used

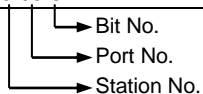
	Number of tables	Input port		Output port (*4)	
		Assigned port	Table No.	Assigned port	Table No.
Coordinate table	Up to 256 tables (Up to 8 bits) (*2)	M05: Up to 8 bits from the bit designated by program selection input (*3)	Table 8.1-A, B, C	General purpose port having the same number as the input port (*3)	Table 8.5-A, B, C
Speed table	1 table (Fixed table No. 1)	None	-	None	-
Acceleration/ deceleration table	1 table (Fixed table No.5)	None	-	None	-
Coordinate system	Fixed absolute coordinates	None	-	None	-

When expansion I/F unit (\*1) is used [1] (equipped with CC-Link unit, DeviceNet unit, EtherNet/IP)

	Number of tables	Input port		Output port (*4)	
		Assigned port	Table No.	Assigned port	Table No.
Coordinate table	999 tables (10 bits)	Station No. 0 General-purpose input port 0-01-1 to 0-01-8, 0-02-1, 0-02-2	Table 8.1-D	Station No. 0 General-purpose output port 0-01-1 to 0-01-8, 0-02-1, 0-02-2	Table 8.5-D
Speed table	20 tables (*5) (5 bits)	Station No. 0 General-purpose input port 0-04-1 to 0-04-5	Table 8.2	None	-
Acceleration/ deceleration table	20 tables (5 bits)	Station No. 0 General-purpose input port 0-03-1 to 0-03-5	Table 8.3	None	-
Coordinate system	Absolute coordinates / Relative coordinates (1 bit)	Station No. 0 General-purpose input port 0-03-6	Table 8.4	None	-

When expansion I/F unit (\*1) is used [2] (equipped with expansion input/output unit)

	Number of tables	Input port		Output port (*4)	
		Assigned port	Table No.	Assigned port	Table No.
Coordinate table	999 tables (10 bits)	Station No. 0 General-purpose input port 0-01-1 to 0-01-4, 0-02-1 to 0-02-6	Table 8.1-E	Station No. 0 General-purpose output port 0-01-1 to 0-01-4, 0-02-1 to 0-02-6	Table 8.5-E
Speed table	20 tables (*5) (5 bits)	Station No. 0 General-purpose input port 0-04-1 to 0-04-5	Table 8.2	None	-
Acceleration/ deceleration table	20 tables (5 bits)	Station No. 0 General-purpose input port 0-03-1 to 0-03-5	Table 8.3	None	-
Coordinate system	Absolute coordinates / Relative coordinates (1 bit)	Station No. 0 General-purpose input port 0-03-6	Table 8.4	None	-

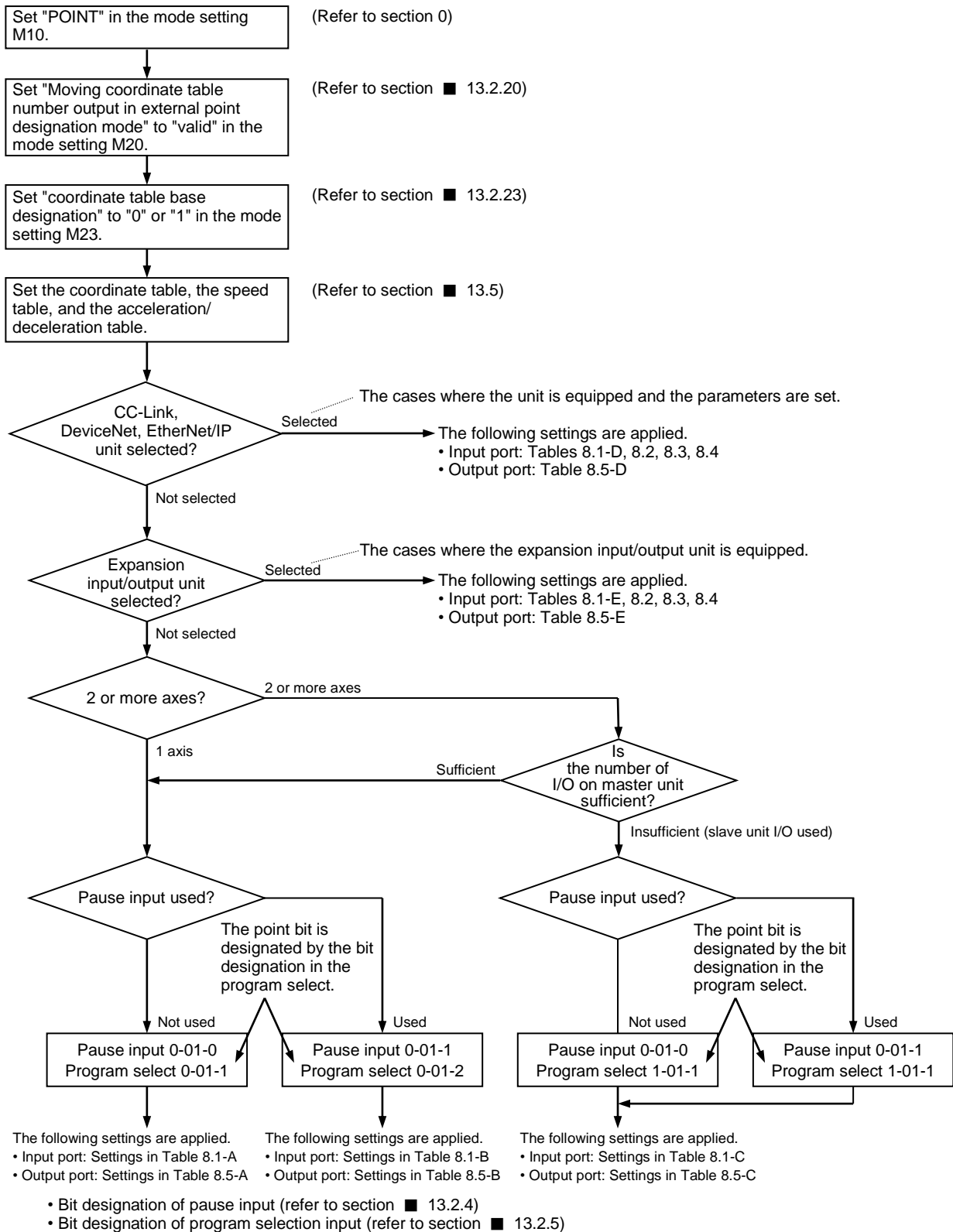

  
 Bit No.
   
 Port No.
   
 Station No.



- \*1: Expansion I/F unit:
  - ① CC-Link unit   ② DeviceNet unit   ③ EtherNet/IP unit   ④ Expansion input/output unit
- \*2: 16 tables (4 bits) when the general-purpose input port on the master unit is used. 8 tables (3 bits) when the pause input is used. 256 tables (8 bits) when the general-purpose input port on the slave unit is used.
- \*3: The number of the selection bits vary depending on the bit position assigned. The consecutive bits in the designated port are valid.
- \*4: The output port works when the output setting (section ■ 13.2.20 mode parameter M20) is "valid". The moved coordinate table number will be outputted after the movement has finished. During movement, 1 is outputted for all. If the destination point is not reached because of emergency stop or if pausing is canceled by the reset input, 1 remains for all.
- \*5: Supported only by CA25-M10 version 4.15 or later, TPH-4C version 2.32 or later, and SF-98D version 3.1.5 or later. For other than the above, 10 tables (4 bits).

## 8.1.1 Setting of external point designation mode

The procedure for making settings to operate with this mode, and the relation of the input ports is shown below.



## 8.1.2 Assignment of input port

Table 8.1-A Method to designate coordinate table

Coordinate table to be designated		General-purpose input port No.			
		0-01-4	0-01-3	0-01-2	0-01-1
Base 0	Base 1	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0
002	001	0	0	0	1
003	002	0	0	1	0
:	:	:	:	:	:
008	007	0	1	1	1
:	:	:	:	:	:
016	015	1	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 0-01-1

Table 8.1-B Method to designate coordinate table

Coordinate table to be designated		General-purpose input port No.		
		0-01-4	0-01-3	0-01-2
Base 0	Base 1	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0
002	001	0	0	1
003	002	0	1	0
:	:	:	:	:
008	007	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 0-01-2

Table 8.1-C Method to designate coordinate table

Coordinate table to be designated		General-purpose input port No.							
		1-01-8	1-01-7	1-01-6	1-01-5	1-01-4	1-01-3	1-01-2	1-01-1
Base 0	Base 1	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:
256	255	1	1	1	1	1	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 1-01-1

Table 8.1-D Method to designate coordinate table

Coordinate table to be designated		General-purpose input port No.									
		0-02-2	0-02-1	0-01-8	0-01-7	0-01-6	0-01-5	0-01-4	0-01-3	0-01-2	0-01-1
Base 0	Base 1	2 <sup>9</sup>	2 <sup>8</sup>	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
256	255	0	0	1	1	1	1	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
999	998	1	1	1	1	1	0	0	1	1	0
-	999	1	1	1	1	1	0	0	1	1	1

1:ON  
0:OFF

• Bit patterns other than the above lead to the table No. error.

Table 8.1-E Method to designate coordinate table

Coordinate table to be designated		General-purpose input port No.									
		0-02-6	0-02-5	0-02-4	0-02-3	0-02-2	0-02-1	0-01-4	0-01-3	0-01-2	0-01-1
Base 0	Base 1	2 <sup>9</sup>	2 <sup>8</sup>	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
256	255	0	0	1	1	1	1	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
999	998	1	1	1	1	1	0	0	1	1	0
-	999	1	1	1	1	1	0	0	1	1	1

1:ON  
0:OFF

• Bit patterns other than the above lead to the table No. error.



• For the method to setting the coordinate table, refer to section 13.5.1.

• The relation of the coordinate table No. and the input port is as follows.

When the input port values are arranged in the order of 2<sup>9</sup>, 2<sup>8</sup>, ... 2<sup>1</sup>, 2<sup>0</sup> and interpreted as binaries, the obtained value is the table No. for the cases where the base 1 is set, and the value obtained by adding 1 to that value is the table No. for the cases where the base 0 is set. For the method to designate the coordinate table base, refer to section 13.2.23.

<Example> Base 0, Table No. 16  $16 = (2^3 \times 1 + 2^2 \times 1 + 2^1 \times 1 + 2^0 \times 1) + 1 = (8 + 4 + 2 + 1) + 1$

Table 8.2 Method to designate speed table

Speed table to be designated	General-purpose input port No.				
	0-04-5	0-04-4	0-04-3	0-04-2	0-04-1
	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
01	0	0	0	0	1
02	0	0	0	1	0
03	0	0	0	1	1
04	0	0	1	0	0
05	0	0	1	0	1
06	0	0	1	1	0
07	0	0	1	1	1
08	0	1	0	0	0
09	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0

1:ON  
0:OFF

\*: For bit patterns other than the above, the table No. 01 will be selected.



● For the method to set the speed table, refer to section ■ 13.5.2.

Table 8.3 Method to designate acceleration/deceleration table

Acceleration/ deceleration table to be designated	General-purpose input port No.				
	0-03-5	0-03-4	0-03-3	0-03-2	0-03-1
	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
01	0	0	0	0	1
02	0	0	0	1	0
03	0	0	0	1	1
04	0	0	1	0	0
05	0	0	1	0	1
06	0	0	1	1	0
07	0	0	1	1	1
08	0	1	0	0	0
09	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0

1:ON  
0:OFF

\*: For bit patterns other than the above, the table No. 05 will be selected.



● For the method to set the acceleration/deceleration table, refer to section ■ 13.5.3.

Table 8.4 Method to designate coordinate system

Coordinate system to be designated	General-purpose input port No.
	0-03-6
Absolute coordinate system	0
Relative coordinate system	1

1:ON  
0:OFF

### ■ 8.1.3 Assignment of output port

Table 8.5-A Relation between coordinate table and output port

Coordinate table after move		General-purpose output port No.			
		0-01-4	0-01-3	0-01-2	0-01-1
Base 0	Base 1	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0
002	001	0	0	0	1
003	002	0	0	1	0
:	:	:	:	:	:
008	007	0	1	1	1
:	:	:	:	:	:
016	015	1	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 0-01-1

Table 8.5-B Relation between coordinate table and output port

Coordinate table after move		General-purpose output port No.		
		0-01-4	0-01-3	0-01-2
Base 0	Base 1	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0
002	001	0	0	1
003	002	0	1	0
:	:	:	:	:
008	007	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 0-01-2

Table 8.5-C Relation between coordinate table and output port

Coordinate table after move		General-purpose output port No.							
		1-01-8	1-01-7	1-01-6	1-01-5	1-01-4	1-01-3	1-01-2	1-01-1
Base 0	Base 1	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:
256	255	1	1	1	1	1	1	1	1

1:ON  
0:OFF

\*: For the cases where program selection is designated to 1-01-1

Table 8.5-D Relation between coordinate table and output port

Coordinate table after move		General-purpose output port No.									
		0-02-2	0-02-1	0-01-8	0-01-7	0-01-6	0-01-5	0-01-4	0-01-3	0-01-2	0-01-1
Base 0	Base 1	2 <sup>9</sup>	2 <sup>8</sup>	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
256	255	0	0	1	1	1	1	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
999	998	1	1	1	1	1	0	0	1	1	0
-	999	1	1	1	1	1	0	0	1	1	1

1:ON  
0:OFF

Table 8.5-E Relation between coordinate table and output port

Coordinate table after move		General-purpose output port No.									
Base 0	Base 1	0-02-6	0-02-5	0-02-4	0-02-3	0-02-2	0-02-1	0-01-4	0-01-3	0-01-2	0-01-1
		2 <sup>9</sup>	2 <sup>8</sup>	2 <sup>7</sup>	2 <sup>6</sup>	2 <sup>5</sup>	2 <sup>4</sup>	2 <sup>3</sup>	2 <sup>2</sup>	2 <sup>1</sup>	2 <sup>0</sup>
001	-	0	0	0	0	0	0	0	0	0	0
002	001	0	0	0	0	0	0	0	0	0	1
003	002	0	0	0	0	0	0	0	0	1	0
:	:	:	:	:	:	:	:	:	:	:	:
008	007	0	0	0	0	0	0	0	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
016	015	0	0	0	0	0	0	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
256	255	0	0	1	1	1	1	1	1	1	1
:	:	:	:	:	:	:	:	:	:	:	:
999	998	1	1	1	1	1	0	0	1	1	0
-	999	1	1	1	1	1	0	0	1	1	1

1:ON  
0:OFF



- This works when "M20: moving coordinate table number output in external point designation mode" of the mode setting is "valid". (Refer to section ■ 13.2.20)
- When the movement finishes, the moved coordinate table No. is outputted. The relation of the coordinate table No. and the output port is as follows.  
When the output port values are arranged in the order of 2<sup>9</sup>, 2<sup>8</sup>, ... 2<sup>1</sup>, 2<sup>0</sup> and interpreted as binaries, the obtained value is the table No. for the cases where the base 1 is set, and the value obtained by adding 1 to that value is the table No. for the cases where the base 0 is set. For the method to designate the coordinate table base, refer to section ■ 13.2.23.
- During movement, 1 is outputted for all.
- If the destination point is not reached because of emergency stop or if pausing is canceled by the reset input, 1 remains for all.
- This works also when operation with the teach pendant (refer to section ■ 8.2.2).
- If the following parameters are assigned to general-purpose output port shown in the table 8.5-A to 8.5-E overlappingly, the functions assigned by the parameters override. Do not assign overlappingly.
  - M07: Bit designation of pausing output (Refer to section 0)
  - M08: Bit designation of input wait output (Refer to section ■ 13.2.8)
  - M13: Bit designation of READY output (Refer to section ■ 13.2.13)
  - M14: Bit designation of task positioning complete output (Refer to section 0)
  - M15: Bit designation of task return to origin complete output (Refer to section ■ 13.2.15)
  - M19: Bit designation of battery alarm output (Refer to section ■ 13.2.19)
  - P13: Bit designation of area output (A0) (Refer to section ■ 13.3.13)
  - P14: Bit designation of area output (A1) (Refer to section ■ 13.3.14)
  - P15: Bit designation of area output (A2) (Refer to section ■ 13.3.15)
  - P16: Bit designation of area output (A3) (Refer to section ■ 13.3.16)

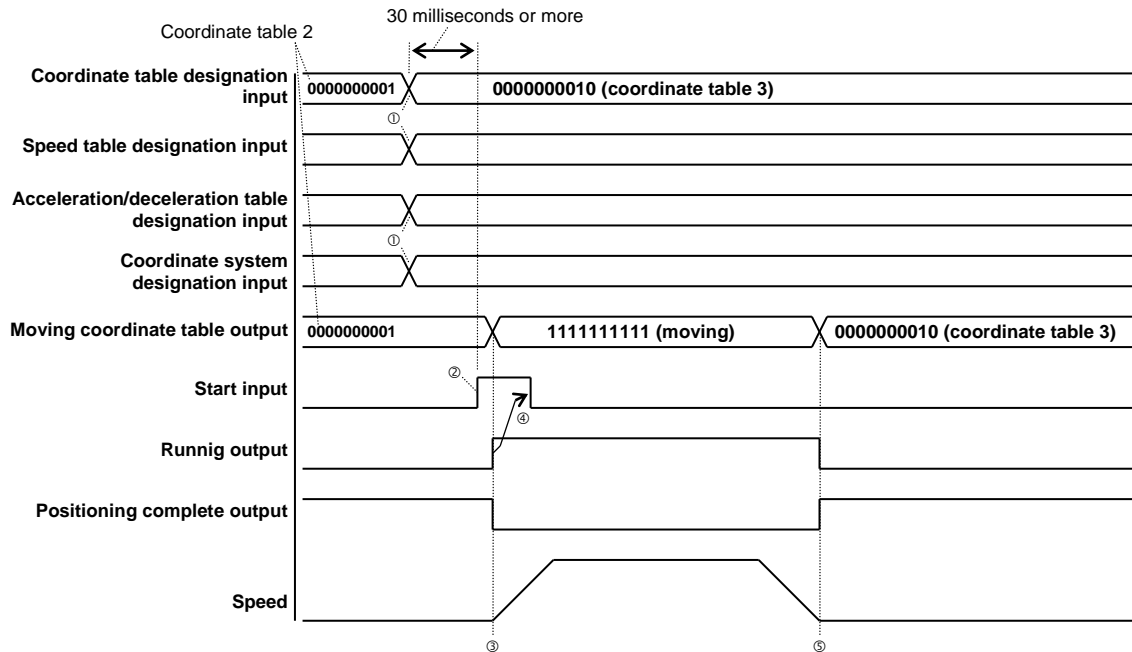
## ■ 8.2 Operation method of external point designation mode

In the external point designation mode, operation can be carried out with system inputs and general-purpose inputs or with the Teach Pendant.

Before start of operation, the coordinate table, the speed table, and the acceleration/deceleration table are required to be set. (Refer to section ■ 13.5)

### ■ 8.2.1 Operation with system input and general-purpose input

Example: moving to the coordinate table 3 from stopping at the coordinate table 2

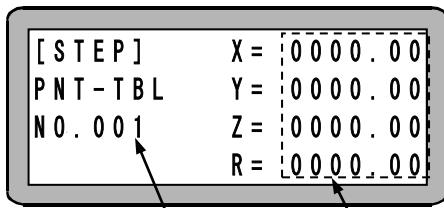


- ① Designate the coordinate table, the speed table, the acceleration/deceleration table, and the coordinate system with the general-purpose port.
- ② After 30 milliseconds or more have passed from the step ①, turn ON the start input.  
If the start input is turned ON before 30 milliseconds have passed, movement to an unintended point may occur.
- ③ When the start input is received, the movement starts.  
At the same time, all the moving coordinate table output turns ON (=111111111), the running output turns ON, and the positioning complete output turns OFF.  
If the time from the start input is received to the movement starts is delayed, refer to section ■ 10.2.2.
- ④ Return the start input to OFF after the running output is turned ON or after 30 milliseconds or more have passed from turning ON of the start input.
- ⑤ When the movement finishes, the running output turns OFF and the positioning complete output turns ON. At the same time, the moving coordinate table output outputs the value of the coordinate table 3 (=000000010).  
If the destination point is not reached because of errors or if pausing is canceled by the reset input, the moving coordinate table output remains ON for all (=111111111).

## ■ 8.2.2 Operation with Teach Pendant

This section describes operating procedures with the Teach Pendant in the external point designation mode.

When the Teach Pendant is turned ON in the external point designation mode, the following screen will display.



### STEP 1

Display the coordinate table to be moved using the **NEXT** key, the **-NEXT** key, or the **SEARCH** key. Press the **START** key.

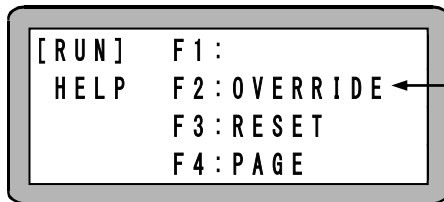
### NOTE

The following restrictions will apply when executing operation with the Teach Pendant.

Speed designation:	Fixed to table No. 1
Acceleration/deceleration designation:	Fixed to table No. 5
Coordinate system designation:	Fixed to absolute coordinates

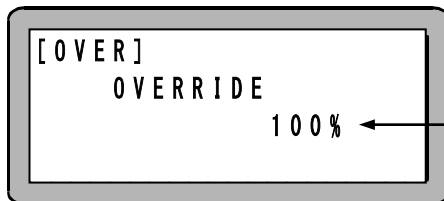
## ■ 8.3 Changing of speed during operation (Override)

By using the override function, the axis moving speed can be changed. This allows the program to be confirmed safely.



### STEP 1

Enter the RUN mode and press the **HELP** key. This screen will display, so press the **F2** key.



### STEP 2

The override setting screen appears. Use the numeric keypad to enter the override value. When the **ENT** key is pressed, the speed will change to the set speed, and the screen returns to the RUN mode. To return to the RUN mode without changing the value, press the **ESC** key. (Initial value: 100, setting range: 1 to 100)

### NOTE

- The override setting is valid only while the program is stopped.
- The override setting value is held even while the power is being shut off.
- The override is effective also for the speed in JOG operation and high speed return to origin.
- The override is applied to speed restricted by the maximum speed data setting in the parameter 2 (refer to section ■ 13.4.6).



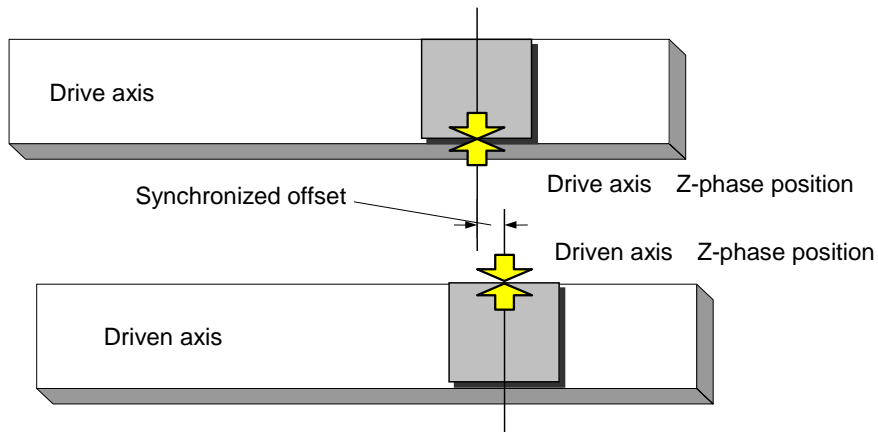
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## Chapter 9 Synchronous Axis Control Function

### ■ 9.1 What is the Synchronized Axes Control Function ?

This function enables two axes installed in parallel to be operated in synchronization. This function is supported only by CA25-M10 version 4.46 or later and TPH-4C version 2.41 or later.

The axis performing the main operation is called the "drive axis", and the axis performing the following-up operation is called the "driven axis".



The main functions of the synchronized axes control function are described below.

(1) Synchronized control

The two axes (drive axis and driven axis) designated by the parameters are operated in synchronization.

(2) Synchronized axes origin search function

The synchronized offset (installation error amount) of the drive axis and driven axis that occurs during installation is measured automatically moving with synchronized control.

(3) Synchronized axes return to origin function

The drive axis and driven axis return to origin with the synchronized offset.

### ■ 9.2 Conditions and Limitations

#### ■ 9.2.1 Controller

The available slave units are CA25-S10, CA20-S10.

#### ■ 9.2.2 Axis type

- The same "Axis type" and "Axis length" for the drive axis and driven axis can be used.
- Axes where the return to origin method is "1" (mainly belt driven-type axes) and axes where the return to origin method is "2" (mainly 50 W motor axes) cannot be used.

**NOTE** If the drive axis and driven axis are not connected, the drive axis or driven axis can suddenly operate as soon as a servo lock is applied from a servo free state, and a collision can result.

## ■ 9.2.3 Programming

- MVM, MINI and LOOP commands cannot be used.  
→ The error message "ER62: Not Executable" occurs when the command is executed.
- MVC and MVCP commands cannot be used.  
→ The error message "ER62: Not Executable" occurs when the command is executed.
- Palletizing operation cannot be used.  
→ The error message "ER62: Not Executable" occurs before axis movement.

## ■ 9.3 Preparation

### ■ 9.3.1 Installation

#### (1) Preliminary installation

Perform a preliminary installation of the drive axis and driven axis. When installing, leave the oval bolts for holding the axes in a temporarily tightened state.

#### (2) Origin positioning

Return the driven axis and drive axis separately to the origin, and specify the origin position.

**NOTE** At this point, leave the K26: synchronized axes setting parameter unset (=0, 0, 0, 0).

#### (3) Axis position adjustment

Adjust the drive axis and driven axis to be parallel and to fit the origin position.

#### (4) Synchronized axes connection

Connect the drive axis and driven axis.

**NOTE** If the drive axis and driven axis are not connected, the drive axis or driven axis can suddenly operate as soon as a servo lock is applied from a servo free state, and a collision can result.

#### (5) Parallelism confirmation

Move the synchronized axes (drive axis and driven axis) by hand to check that the axis moves smoothly. If it does not move smoothly, readjust the parallelism of the synchronized axes.

#### (6) Full installation

Fully tighten the oval bolts for holding the axes.

## ■ 9.3.2 Adjustment

### (1) Parameter setting

Set the parameters that will be used in the synchronized axes control function. (For details on the parameter setting procedure, refer to Chapter 13 Parameter Setting.)

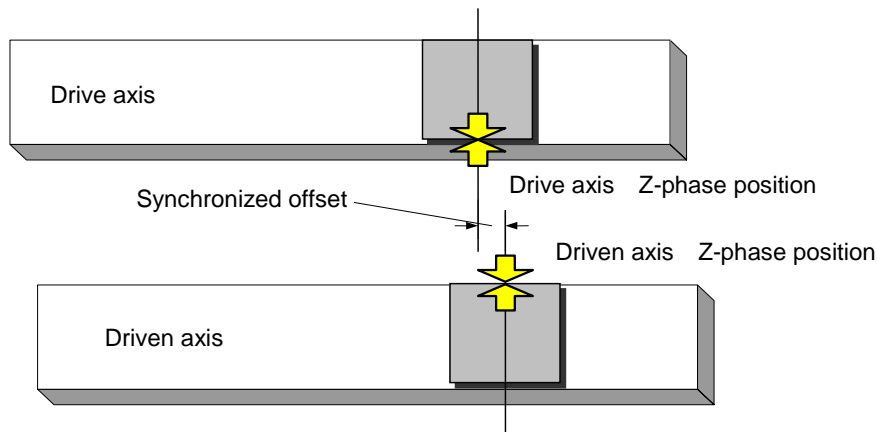
●K26: Synchronized axes setting (Refer to section ■ 13.4.26)

This sets the target axes for synchronized axes control.

●P17: Synchronized offset (Refer to section ■ 13.3.17)

This specifies the installation error amount of the drive axis and driven axis.

This parameter is set automatically when the synchronized axes origin search is executed. Although fine adjustment of this parameter is also possible manually, be sure to perform the synchronized axes origin search before performing adjustment.



●P18: Synchronized error allowable value (Refer to section ■ 13.3.18)

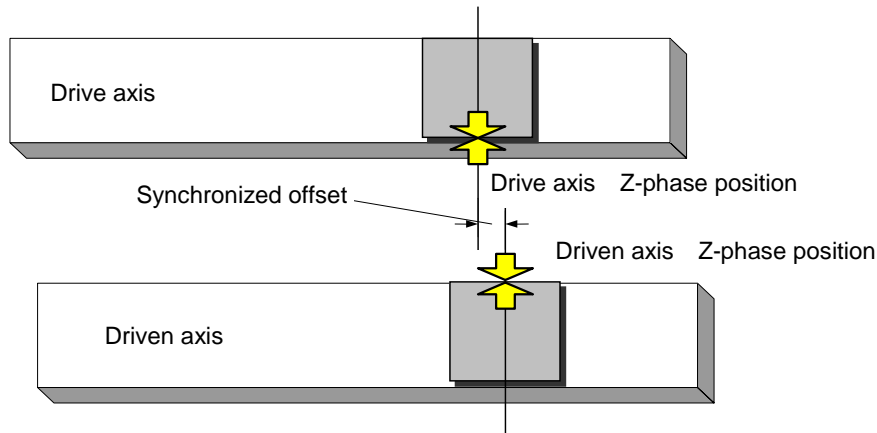
The upper limit of the position error for the drive axis and driven axis that occurs during synchronized operation is specified.

### (2) Operation check

Use the jog operation to check that the synchronized axes are operating smoothly.

## ■ 9.4 Synchronized Axes Origin Search Function

The synchronized axes origin search function measures the synchronized offset (positional error) that occurs when installing the synchronized axes (drive axis and driven axis).



- NOTE**
- Before performing the synchronized axes origin search, be sure to perform the operation in ■ 9.3 Preparation. Failure to perform the proper preparation can cause the robot to collide with the mechanical stopper.
  - The synchronized axes origin search does not need to be performed each time. Execute it only when re-measuring the synchronized offset.
  - Be sure to always perform the return to origin operation after executing the synchronized axes origin search. (If a program is run without performing the return to origin, the error message "ER61: Return to Origin Incomplete" occurs.)
  - If the synchronized offset amount that was measured by the synchronized axes origin search exceeds one-quarter turn of the motor (for instance, exceeds 5 mm for a lead of 20 mm), the error message "ER67: Synchronized Axes Origin Search Error" occurs.

### ■ 9.4.1 Operating procedure

The screen below is displayed in RUN mode.

```
[RUN] F1: MONITOR
      F2: OPTION ←
      F3: T/P ON
      F4: T/P OFF
```

**STEP 1** Press the **F4** key in the main screen of RUN mode to display the screen shown on the left.  
Press the **F2** key

---

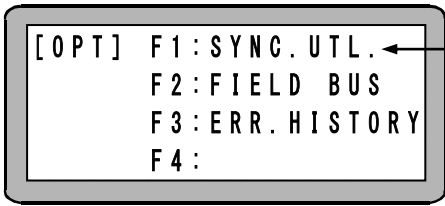
```
[OPT] F1: SYNC. UTL. ←
      F2: FIELD BUS
      F3: ERR. HISTORY
      F4:
```

**STEP 2** "Option Function Selection screen" is displayed.  
Press the **F1** key.

---

```
[SYNC F1: SRCH. ORG. ←
-UTL] F2:
      F3:
      F4:
```

**STEP 3** "Synchronized Axes Control Function Utility screen" is displayed.  
Press the **F1** key.



**STEP 4**

"Synchronized Axes Origin Search screen " is displayed.

When each key is pressed, the synchronized axes origin search operation of the axes below is started.

- F 1 A1\_SRCH: the first axis (drive) and second axis (driven)
- F 2 A1\_SRCH: the first axis (drive) and second axis (driven)
- F 3 A1\_SRCH: the first axis (drive) and second axis (driven)
- F 4 \*\*\*\*\*: Disabled  
("\*\*\*\*\*" is displayed for the driven axis.)

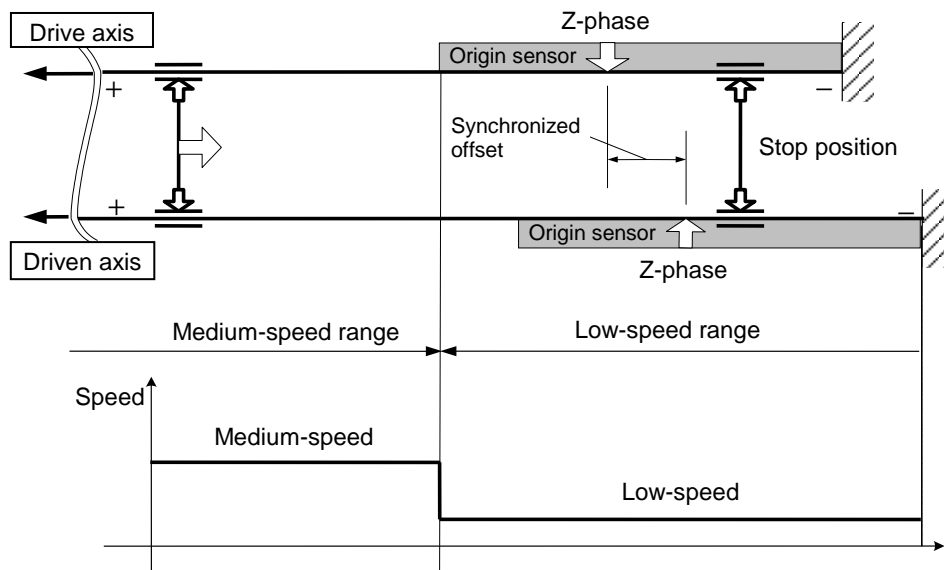


**STEP 5**

During the synchronized axes origin search, the message shown on the left is displayed on the screen. After completion of the synchronized axes origin search, the screen returns to the Synchronized Axes Origin Search screen.

**9.4.2 Synchronized axes origin search sequence**

The synchronized axes search origin as below.



Medium-speed range: The origin sensors for both the drive and driven axes are set to OFF.  
Low-speed range: The origin sensors for the drive or driven axes are set to ON.

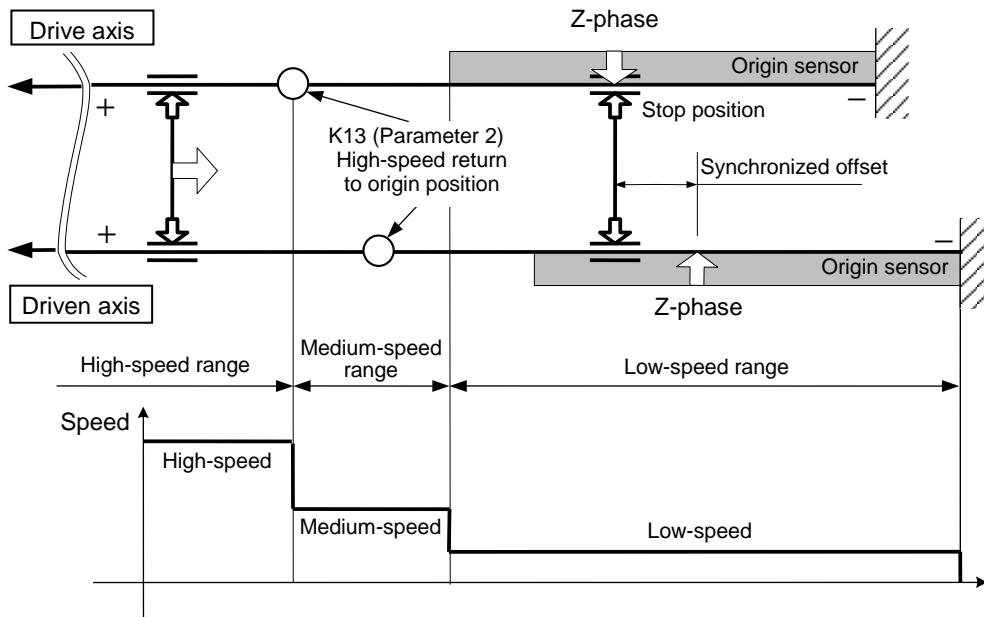
- (1) Origin search start (The axes move with synchronized control.)
  1. The case of being at Medium-speed range  
The axes move to "Negative direction" at "Medium-speed" until entering the Low-speed range and move to "Negative direction" at "Low-speed".
  2. The case of being at Low-speed range (The axes move with synchronized control.)  
The axes move to "Positive direction" at "Low-speed" until entering the Medium-speed range and move to "Negative direction" at "Low-speed".
- (2) Origin search end  
The axes stops after detection of the "Z-phase" for both the drive axis and driven axis.

## ■ 9.5 Synchronized axes return to origin sequence

The synchronized axes return to origin as below.

### NOTE

- Be aware that the return to origin operation sequence for axes that were set as synchronized axes is different from the normal axis operation sequence.
- If the return to origin operation is performed without performing the synchronized axes origin search, the error message "ER64: Synchronized Axes Origin Search Incomplete Error" occurs. In installation and adjustment work, be sure to always perform the synchronized axes origin search before performing the return to origin operation.



High-speed range: The axes are at + side of the high-speed return to origin position of the drive axis.

Medium-speed range: The axes are at - side of the high-speed return to origin position of the drive axis and the origin sensors for both the drive and driven axes are set to OFF.

Low-speed range: The origin sensors for the drive or driven axes are set to ON.

(1) Return to origin start (The axes move with synchronized control.)

1. The case of being at High-speed range or Medium-speed range

The axes move to "Negative direction" at "Medium-speed" until entering the Low-speed range and move to "Negative direction" at "Low-speed". However, If Return to origin complete output is ON and The axes are at High-speed range, The axes move to " Negative direction" at "High-speed" until entering the Medium-speed range

2. The case of being at Low-speed range

The axes move to "Positive direction" at "Low-speed" until entering the Medium-speed range and move to "Negative direction" at "Low-speed".

(2) Return to origin end

The axes move to the "Z-phase" position of the driven axis after detection of the "Z-phase" for both the drive axis and driven axis. And the drive axis moves to the "Z-phase" position, the driven axis moves to the synchronized offset position from the "Z-phase" position of the drive axis with same speed, without synchronized control. Then the axes stop.

# Chapter 10 Connection with External Devices

## 10.1 Input/output signal

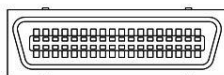
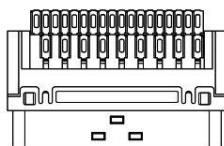
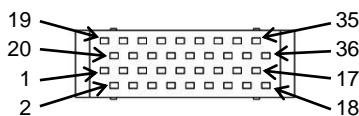
The input/output connector is configured of the system input/output, general-purpose input/output and emergency stop input/output. The system input/output and general-purpose input/output are basically connected to the programmable controller, etc., and is used to control the robot from an external source.

### 10.1.1 Master unit input/output connector signal names and pin numbers

Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	-	+COM1	+COM1	-COM5
2	OUT	OUT1	General-purpose output port 1-1	←
3	OUT	OUT2	General-purpose output port 1-2	←
4	OUT	OUT3	General-purpose output port 1-3	←
5	OUT	OUT4	General-purpose output port 1-4	←
6	-	-COM1	-COM1 (*1)	+COM5 (*1)
7	OUT	EMONO	Emergency stop output (NO)	←
8	OUT	EMOCOM	Emergency stop output (COM)	←
9	OUT	EMONC	Emergency stop output (NC)	←
10	-	N.C	N.C	←
11	OUT	OUT5	Running	←
12	OUT	OUT6	Error	←
13	OUT	OUT7	Positioning complete	←
14	OUT	OUT8	Return to origin complete	←
15	-	N.C	N.C	←
16	-	N.C	N.C	←
17	-	-COM2	-COM2 (*1)	+COM6 (*1)
18	-	N.C	N.C	←
19	-	COM3	COM3 (*2)	←
20	IN	IN1	General-purpose input port 1-1	←
21	IN	IN2	General-purpose input port 1-2	←
22	IN	IN3	General-purpose input port 1-3	←
23	IN	IN4	General-purpose input port 1-4	←
24	-	N.C	N.C	←
25	IN	EMIN+	Emergency stop input (+)	←
26	IN	EMIN-	Emergency stop input (-)	←
27	-	COM4	COM4 (*2)	←
28	IN	IN5	Return to origin	←
29	IN	IN6	Start	←
30	IN	IN7	Stop	←
31	IN	IN8	Reset	←
32	-	N.C	N.C	←
33	-	N.C	N.C	←
34	-	N.C	N.C	←
35	-	N.C	N.C	←
36	-	N.C	N.C	←

N.C: No Connection

- NOTE** \*1: Pin Nos. 6 and 17 are connected internally.  
 \*2: Pin Nos. 19 and 27 are not connected internally.



Use the enclosed connector.

- Cable side connector type
  - Plug 54306-3619 (MOLEX)
  - Shell kit 54331-0361 (MOLEX)
- Panel side connector type
  - Receptacle 52986-3621 (MOLEX)

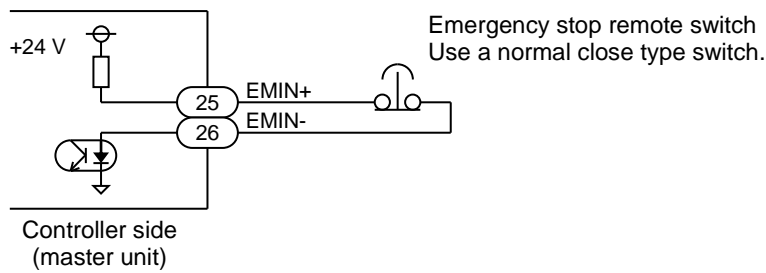
Applicable wire size: AWG24 (0.22 mm<sup>2</sup>)



(1) Emergency stop input/output (master unit input/output connector)

Before use, connect an emergency stop circuit to the input/output connector of the master unit. If the emergency stop circuit is not connected, the controller becomes the emergency stop state.

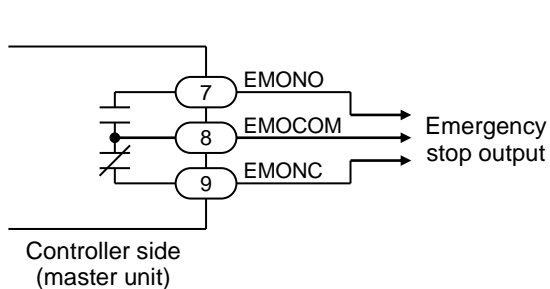
● Emergency stop input



**CAUTION** If the emergency stop signal is input (the emergency stop circuit is open), general-purpose output remains unchanged by default. Note that the stop distance of the robot varies depending on the load, speed, inertia, etc.

● Emergency stop output

This machine is equipped with the output terminal that informs external devices of the emergency stop state of the controller when an emergency stop occurs. The emergency stop output can be used for external indication, an interlock with other devices, or the like.



Output type: relay contact output  
(corresponding to OMRON G6E-134P)

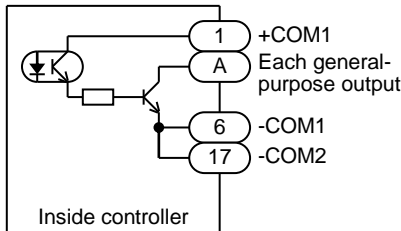
	EMONO	EMONC
Emergency stop	Close	Open
Normal state	Open	Close

**NOTE** Use the emergency stop output within the voltage range from 5 to 30 V and the current range from 10 to 300 mA.

(2) General-purpose input/output (master unit input/output connector)

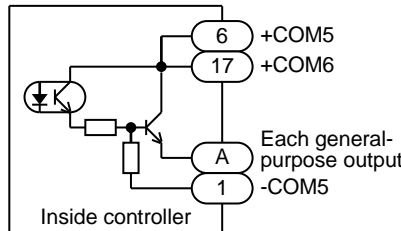
Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	-	+COM1	+COM1	-COM5
2	OUT	OUT1	General-purpose output port 1-1	←
3	OUT	OUT2	General-purpose output port 1-2	←
4	OUT	OUT3	General-purpose output port 1-3	←
5	OUT	OUT4	General-purpose output port 1-4	←
6	-	-COM1	-COM1	+COM5
17	-	-COM2	-COM2	+COM6
19	-	COM3	COM3	←
20	IN	IN1	General-purpose input port 1-1	←
21	IN	IN2	General-purpose input port 1-2	←
22	IN	IN3	General-purpose input port 1-3	←
23	IN	IN4	General-purpose input port 1-4	←

General-purpose output circuit (NPN output)



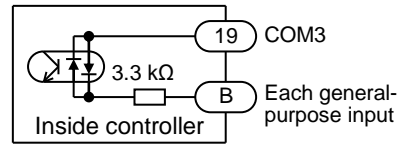
- 1) A: OUT1 - OUT4
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocoupler insulation
- 5) Open collector output

General-purpose output circuit (PNP output)



- 1) A: OUT1 - OUT4
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocoupler insulation
- 5) Emitter follower output

General-purpose input circuit (common for NPN/PNP)



- 1) B: IN1 - IN4
- 2) Voltage: 24 VDC
- 3) Current: 7 mA
- 4) Photocoupler insulation

**NOTE**

- There are two types of output circuits: NPN output specification and PNP output specification. The controller type is different between the two. (Refer to section ■ 2.2)
- The input circuit type is common for NPN input specification and PNP input specification.
- This machine does not have an input/output power output (24 VDC). Supply it from an external source.
- The general-purpose input/output can be used for various functions input/output signals by setting the mode. (Refer to section ■ 13.2)
- The controller recognizes the changes of the signals 10 msec later because the general-purpose input is filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

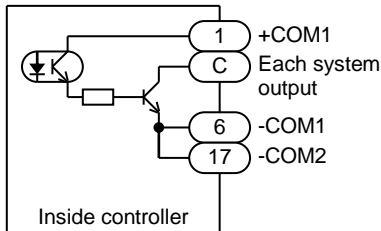
**CAUTION**

Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken. Especially, take care because the COM voltage polarity of pins 1, 6, and 17 differs by the type of output circuits (NPN output, PNP output).

(3) System input/output (master unit input/output connector)

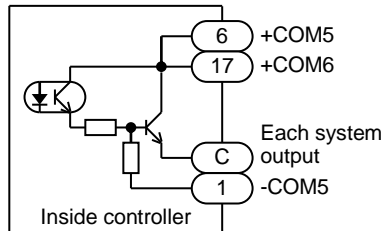
Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	-	+COM1	+COM1	-COM5
6	-	-COM1	-COM1	+COM5
11	OUT	OUT5	Running	←
12	OUT	OUT6	Error	←
13	OUT	OUT7	Positioning complete	←
14	OUT	OUT8	Return to origin complete	←
17	-	-COM2	-COM2	+COM6
27	-	COM4	COM4	←
28	IN	IN5	Return to origin	←
29	IN	IN6	Start	←
30	IN	IN7	Stop	←
31	IN	IN8	Reset	←

System output circuit (NPN output)



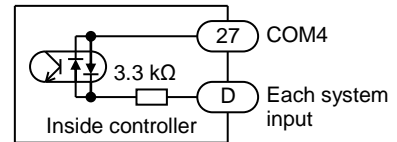
- 1) C: OUT5 - OUT8
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocopler insulation
- 5) Open collector output

System output circuit (PNP output)



- 1) C: OUT5 - OUT8
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocopler insulation
- 5) Emitter follower output

System input circuit (common for NPN/PNP)



- 1) D: IN5 - IN8
- 2) Voltage: 24 VDC
- 3) Current: 7 mA
- 4) Photocopler insulation

**NOTE**

- There are two types of output circuits: NPN output specification and PNP output specification. The controller type is different between the two. (Refer to section ■ 2.2)
- The input circuit type is common for NPN input specification and PNP input specification.
- This machine does not have an input/output power output (24 VDC). Supply it from an external source.
- The controller recognizes the changes of the signals 10 msec later because the system input is filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

**CAUTION**

Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken. Especially, take care because the COM voltage polarity of pins 1, 6, and 17 differs by the type of output circuits (NPN output, PNP output).

## ■ 10.1.2 Signal name and pin No. of connector on extension input/output unit

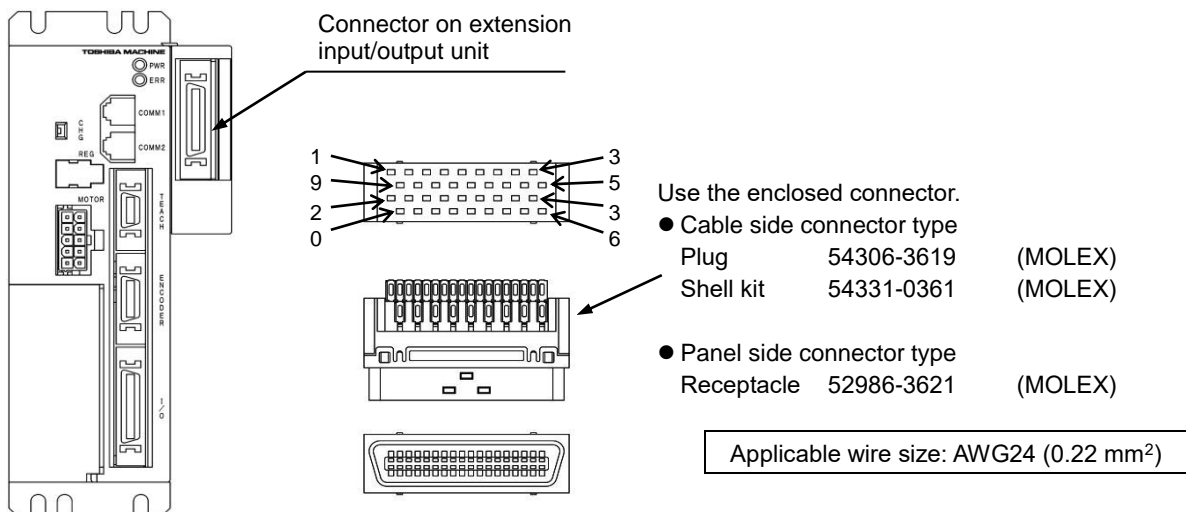
The extension input/output unit is a circuit board that adds 24 inputs and 8 outputs to the master unit. The extension input/output unit is used when the number of inputs/outputs of the connector on the controller is insufficient. The polarity of both the input circuit and the output circuit of this circuit board is bidirectional.

Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	IN	IN9	General-purpose input port 2-1	←
2	IN	IN10	General-purpose input port 2-2	←
3	IN	IN11	General-purpose input port 2-3	←
4	IN	IN12	General-purpose input port 2-4	←
5	IN	IN13	General-purpose input port 2-5	←
6	IN	IN14	General-purpose input port 2-6	←
7	IN	IN15	General-purpose input port 2-7	←
8	IN	IN16	General-purpose input port 2-8	←
9	IN	IN17	General-purpose input port 3-1	←
10	-	COM7	COM7 (*1)	←
11	IN	IN18	General-purpose input port 3-2	←
12	IN	IN19	General-purpose input port 3-3	←
13	-	COM8	COM8 (*2)	←
14	IN	IN20	General-purpose input port 3-4	←
15	IN	IN21	General-purpose input port 3-5	←
16	IN	IN22	General-purpose input port 3-6	←
17	IN	IN23	General-purpose input port 3-7	←
18	IN	IN24	General-purpose input port 3-8	←
19	IN	IN25	General-purpose input port 4-1	←
20	IN	IN26	General-purpose input port 4-2	←
21	IN	IN27	General-purpose input port 4-3	←
22	IN	IN28	General-purpose input port 4-4	←
23	IN	IN29	General-purpose input port 4-5	←
24	IN	IN30	General-purpose input port 4-6	←
25	IN	IN31	General-purpose input port 4-7	←
26	IN	IN32	General-purpose input port 4-8	←
27	OUT	OUT9	General-purpose output port 2-1	←
28	OUT	OUT10	General-purpose output port 2-2	←
29	-	COM9	COM9 (*2)	←
30	OUT	OUT11	General-purpose output port 2-3	←
31	OUT	OUT12	General-purpose output port 2-4	←
32	OUT	OUT13	General-purpose output port 2-5	←
33	OUT	OUT14	General-purpose output port 2-6	←
34	OUT	OUT15	General-purpose output port 2-7	←
35	OUT	OUT16	General-purpose output port 2-8	←
36	-	N.C	N.C	←

N.C: No Connection

### NOTE

- \*1: Pin No. 10 and Pin Nos. 13/29 are not connected internally.
- \*2: Pin Nos. 13 and 29 are connected internally.



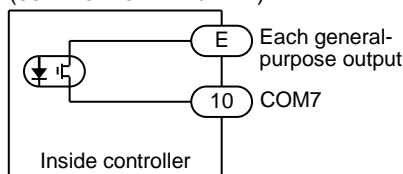
### CAUTION

The number of pins on the connector of the extension input/output unit is same as that of the input/output connector of the master unit and the slave unit, but the internal circuit differs. If the connector is connected wrongly, the internal circuit may be broken. Perform connection of a connector while checking the connector to be connected to.

(1) General-purpose input/output (extension input/output unit connector)

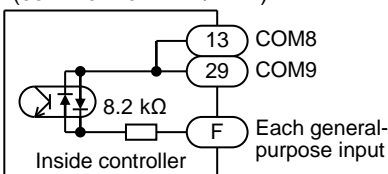
Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	IN	IN9	General-purpose input port 2-1	←
2	IN	IN10	General-purpose input port 2-2	←
3	IN	IN11	General-purpose input port 2-3	←
4	IN	IN12	General-purpose input port 2-4	←
5	IN	IN13	General-purpose input port 2-5	←
6	IN	IN14	General-purpose input port 2-6	←
7	IN	IN15	General-purpose input port 2-7	←
8	IN	IN16	General-purpose input port 2-8	←
9	IN	IN17	General-purpose input port 3-1	←
10	-	COM7	COM7	←
11	IN	IN18	General-purpose input port 3-2	←
12	IN	IN19	General-purpose input port 3-3	←
13	-	COM8	COM8	←
14	IN	IN20	General-purpose input port 3-4	←
15	IN	IN21	General-purpose input port 3-5	←
16	IN	IN22	General-purpose input port 3-6	←
17	IN	IN23	General-purpose input port 3-7	←
18	IN	IN24	General-purpose input port 3-8	←
19	IN	IN25	General-purpose input port 4-1	←
20	IN	IN26	General-purpose input port 4-2	←
21	IN	IN27	General-purpose input port 4-3	←
22	IN	IN28	General-purpose input port 4-4	←
23	IN	IN29	General-purpose input port 4-5	←
24	IN	IN30	General-purpose input port 4-6	←
25	IN	IN31	General-purpose input port 4-7	←
26	IN	IN32	General-purpose input port 4-8	←
27	OUT	OUT9	General-purpose output port 2-1	←
28	OUT	OUT10	General-purpose output port 2-2	←
29	-	COM9	COM9	←
30	OUT	OUT11	General-purpose output port 2-3	←
31	OUT	OUT12	General-purpose output port 2-4	←
32	OUT	OUT13	General-purpose output port 2-5	←
33	OUT	OUT14	General-purpose output port 2-6	←
34	OUT	OUT15	General-purpose output port 2-7	←
35	OUT	OUT16	General-purpose output port 2-8	←

General-purpose output circuit (common for NPN/PNP)



- 1) E: OUT9 - OUT16
- 2) Voltage: 24 VDC
- 3) Current: 50 mA (MAX)
- 4) Photocoupler insulation
- 5) Photo MOS relay output

General-purpose input circuit (common for NPN/PNP)



- 1) F: IN9 - IN32
- 2) Voltage: 24 VDC
- 3) Current: 3 mA
- 4) Photocoupler insulation

**NOTE**

- The output circuit of the extension input/output unit is the photo MOS relay output. This is common for NPN input specification and PNP input specification.
- The input circuit type of the extension input/output unit is common for NPN input specification and PNP input specification.
- This machine does not have an input/output power output (24 VDC). Supply it from an external source.
- The general-purpose input/output can be used for various functions input/output signals by setting the mode. (Refer to section ■ 13.2)
- The controller recognizes the changes of the signals 10 msec later because the general-purpose input is filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

**CAUTION**

Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

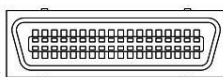
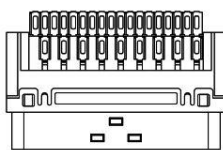
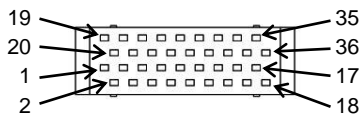
### ■ 10.1.3 Slave unit input/output connector signal names and pin numbers

Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	-	+COM1	+COM1	-COM5
2	OUT	OUT1	General-purpose output port 1-1	←
3	OUT	OUT2	General-purpose output port 1-2	←
4	OUT	OUT3	General-purpose output port 1-3	←
5	OUT	OUT4	General-purpose output port 1-4	←
6	-	-COM1	-COM1 (*1)	+COM5 (*1)
7	-	N.C	N.C	←
8	-	N.C	N.C	←
9	-	N.C	N.C	←
10	-	N.C	N.C	←
11	OUT	OUT5	General-purpose output port 1-5	←
12	OUT	OUT6	General-purpose output port 1-6	←
13	OUT	OUT7	General-purpose output port 1-7	←
14	OUT	OUT8	General-purpose output port 1-8	←
15	-	N.C	N.C	←
16	-	N.C	N.C	←
17	-	-COM2	-COM2 (*1)	+COM6 (*1)
18	-	N.C	N.C	←
19	-	COM3	COM3 (*2)	←
20	IN	IN1	General-purpose input port 1-1	←
21	IN	IN2	General-purpose input port 1-2	←
22	IN	IN3	General-purpose input port 1-3	←
23	IN	IN4	General-purpose input port 1-4	←
24	-	N.C	N.C	←
25	-	N.C	N.C	←
26	-	N.C	N.C	←
27	-	COM4	COM4 (*2)	←
28	IN	IN5	General-purpose input port 1-5	←
29	IN	IN6	General-purpose input port 1-6	←
30	IN	IN7	General-purpose input port 1-7	←
31	IN	IN8	General-purpose input port 1-8	←
32	-	N.C	N.C	←
33	-	N.C	N.C	←
34	-	N.C	N.C	←
35	-	N.C	N.C	←
36	-	N.C	N.C	←

N.C: No Connection

**NOTE**

- \*1: Pin Nos. 6 and 17 are connected internally.
- \*2: Pin Nos. 19 and 27 are not connected internally.



Use the enclosed connector.

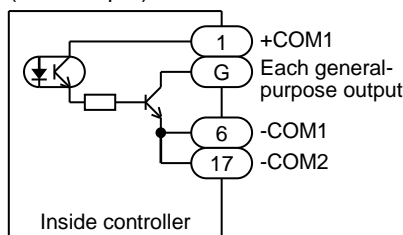
- Cable side connector type
  - Plug 54306-3619 (MOLEX)
  - Shell kit 54331-0361 (MOLEX)
- Panel side connector type
  - Receptacle 52986-3621 (MOLEX)

Applicable wire size: AWG24 (0.22 mm<sup>2</sup>)

(1) General-purpose input/output (slave unit input/output connector)

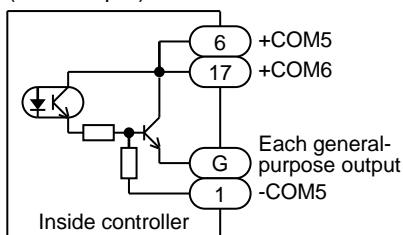
Pin No.	I/O	Signal name	Description	
			NPN input/output specification	PNP input/output specification
1	-	+COM1	+COM1	-COM5
2	OUT	OUT1	General-purpose output port 1-1	←
3	OUT	OUT2	General-purpose output port 1-2	←
4	OUT	OUT3	General-purpose output port 1-3	←
5	OUT	OUT4	General-purpose output port 1-4	←
6	-	-COM1	-COM1	+COM5
11	OUT	OUT5	General-purpose output port 1-5	←
12	OUT	OUT6	General-purpose output port 1-6	←
13	OUT	OUT7	General-purpose output port 1-7	←
14	OUT	OUT8	General-purpose output port 1-8	←
17	-	-COM2	-COM2	+COM6
19	-	COM3	COM3	←
20	IN	IN1	General-purpose input port 1-1	←
21	IN	IN2	General-purpose input port 1-2	←
22	IN	IN3	General-purpose input port 1-3	←
23	IN	IN4	General-purpose input port 1-4	←
27	-	COM4	COM4	←
28	IN	IN5	General-purpose input port 1-5	←
29	IN	IN6	General-purpose input port 1-6	←
30	IN	IN7	General-purpose input port 1-7	←
31	IN	IN8	General-purpose input port 1-8	←

General-purpose output circuit (NPN output)



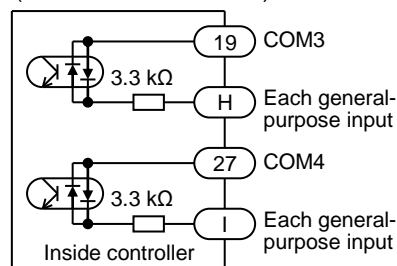
- 1) G: OUT1 - OUT8
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocoupler insulation
- 5) Open collector output

General-purpose output circuit (PNP output)



- 1) G: OUT1 - OUT8
- 2) Voltage: 24 VDC
- 3) Current: 100 mA (MAX)
- 4) Photocoupler insulation
- 5) Emitter follower output

General-purpose input circuit (common for NPN/PNP)



- 1) H: IN1 - IN4 I: IN5 - IN8
- 2) Voltage: 24 VDC
- 3) Current: 7 mA
- 4) Photocoupler insulation
- 5) Pin Nos. 19 and 27 are not connected internally.

**NOTE**

- There are two types of output circuits: NPN output specification and PNP output specification. The controller type is different between the two. (Refer to section ■ 2.2)
- The input circuit type is common for NPN input specification and PNP input specification.
- This machine does not have an input/output power output (24 VDC). Supply it from an external source.
- The general-purpose input/output can be used for various functions input/output signals by setting the mode. (Refer to section ■ 13.2)
- The controller recognizes the changes of the signals 10 msec later because the general-purpose input is filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

**CAUTION**

Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken. Especially, take care because the COM voltage polarity of pins 1, 6, and 17 differs by the type of output circuits (NPN output, PNP output).

## ■ 10.1.4 Inputs and outputs that can be set for general-purpose input/output

Inputs and outputs that can be set for general-purpose input/output are as below. For the method to set each signal, refer to section ■ 13.2. When performing the setting, take care not to allow the bits to overlap.

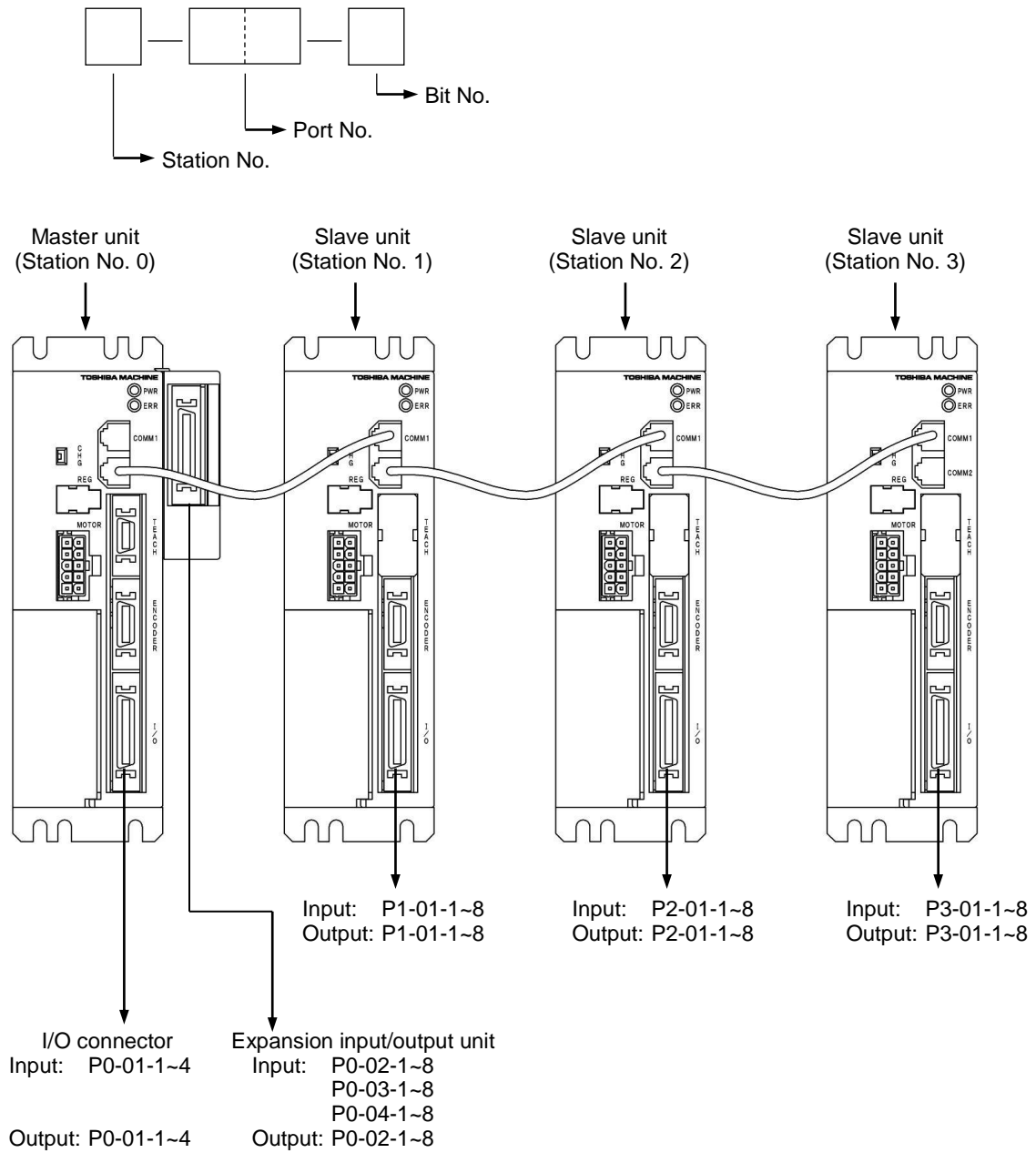
Signal name	Input/output	Details	Reference
Single operation	Input	The single operation mode is entered when a program is started with this input turned ON.	Section 0
Continuous start	Input	The data in the counter etc., is held or cleared according to the status of this input when the power is turned ON or when reset is input.	Section ■ 10.2.6
Escape	Input	If this input turns ON during execution of the MVE command, the movement will decelerate and stop, and the step will be considered as completion.	Section ■ 10.2.7
Pause	Input	ON: The axis will decelerate and stop temporarily. Restart: Start input Cancel: Reset input	Section ■ 10.2.8
Program selection	Input	Designate the PSEL command in the sequential mode, the program No. of the palletizing mode, and the coordinate table No. of the external point designation mode, using a binary number with multiple inputs.	Section ■ 10.2.9
Palletizing	Input	ON: Palletizing mode OFF: Sequential mode	Section ■ 10.2.10
Servo ON	Input	ON: Servo lock enabled OFF: Servo lock disabled	Section ■ 10.2.11
Torque limit	Input	Designates torque limit table No.	Section ■ 10.2.12
Pausing	Output	This turns ON when the pause input is recognized and the axis decelerates and stops. This will turn OFF when pause is canceled.	Section ■ 10.2.17
Input wait output	Output	This turns ON when the program is waiting for an input with IN command.	Section ■ 10.2.18
READY	Output	The operation status of the controller is indicated. Preparing for operation: OFF Operation preparation complete: ON	Section ■ 10.2.19
Task positioning complete	Output	When positioning per task is completed: ON	Section ■ 10.2.20
Task return to origin complete	Output	When return to origin per task is complete: ON	Section ■ 10.2.21
Battery alarm	Output	When the power source for encoder backup voltage drops: ON	Section ■ 10.2.22
Task load	Output	When the state output torque is exceeding load output standard value for more than torque limit judgement time: ON	Section ■ 10.2.23
Task limit	Output	When the state output torque is reaching torque limit value continues for more than torque limit judgement time: ON	Section ■ 10.2.24
Task lock	Output	When the lock is detected: ON	Section ■ 10.2.25
JOG	Input output	JOG operation is executed with multiple inputs/outputs.	Section ■ 10.2.26

**NOTE** Task load output, task limit output and task lock output are supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, and SF-98D version 3.1.6 or later.  
JOG input and JOG output are supported by CA25-M10 version 4.36 or later, TPH-4C version 2.38 or later, and SF-98D version 3.2.2 or later.



## ■ 10.1.5 Names of general-purpose input/output ports and Teach Pendant displays

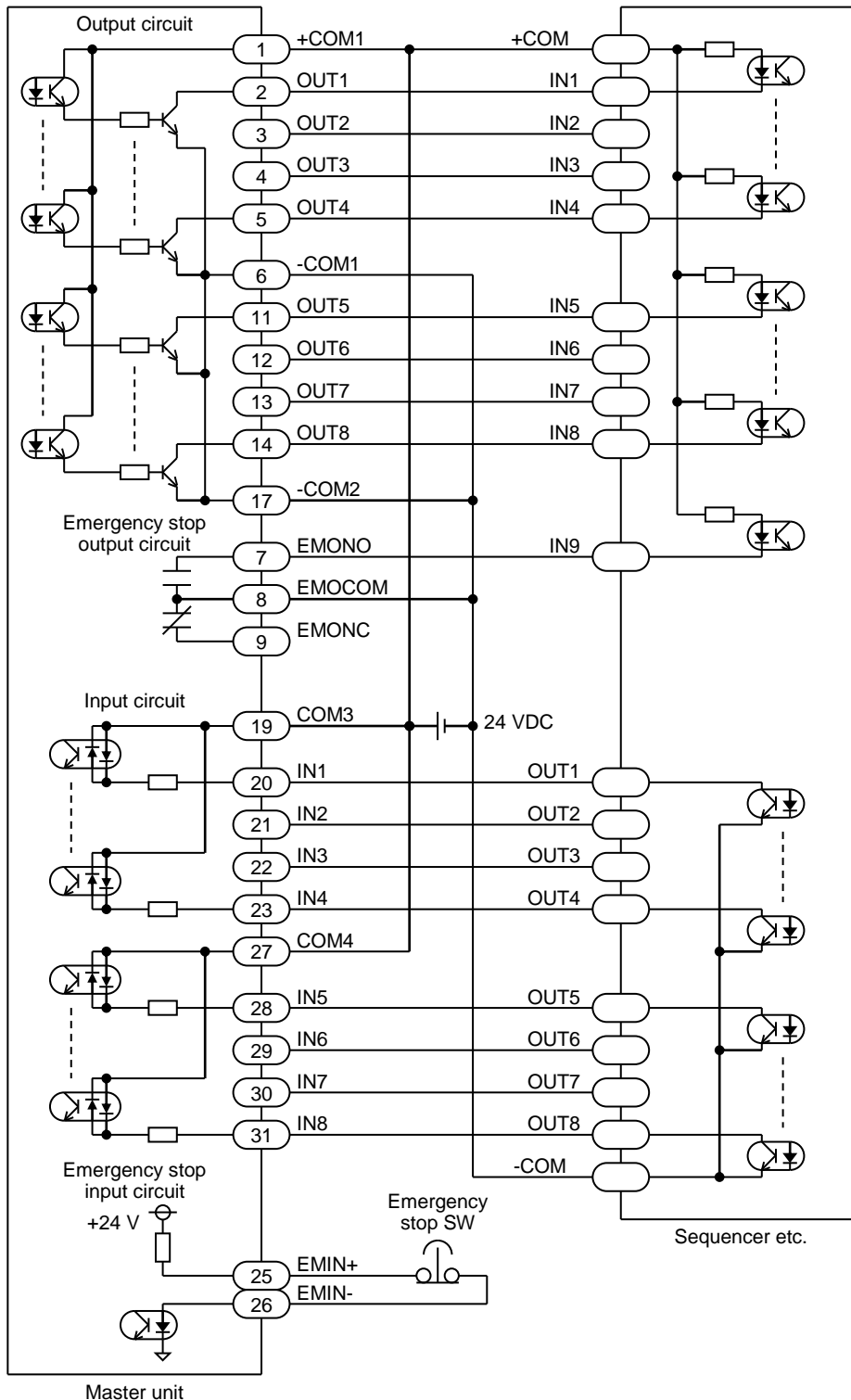
In the controller's system configuration, there are master unit, slave unit and expansion input/output unit input/output ports. The No. of points will change according to the use of options. These input/output ports are displayed on the Teach Pendant as shown below.



## 10.1.6 Example of input/output signal connection

- Example of master unit input/output connector connection

(1) NPN input/output



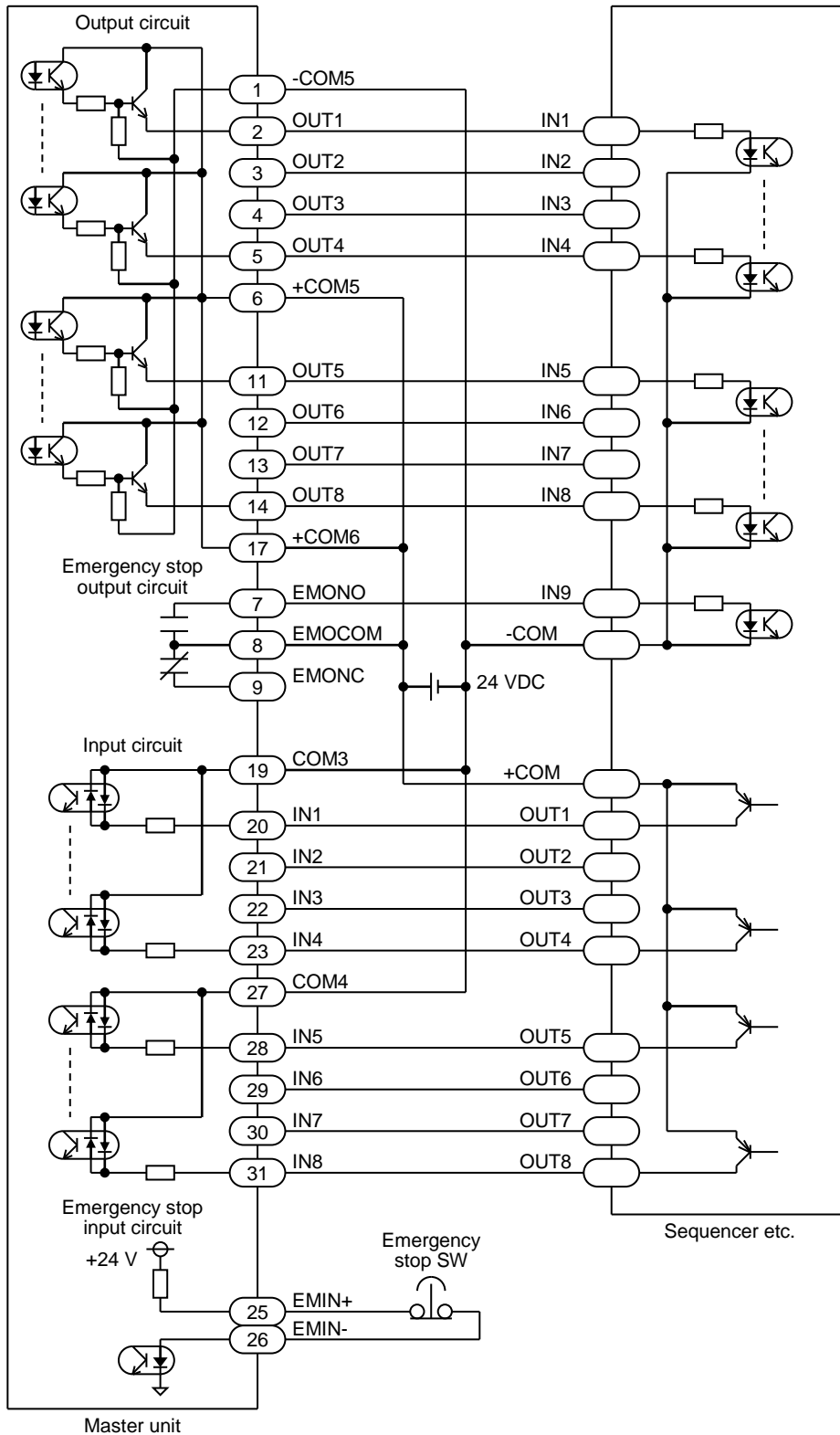
### NOTE

- -COM1 and -COM2 are connected internally.
- COM3 and COM4 are not connected internally.

### CAUTION

Take sufficient care to perform wiring because if the wires are connected incorrectly, the internal circuit may be broken.

(2) PNP input/output

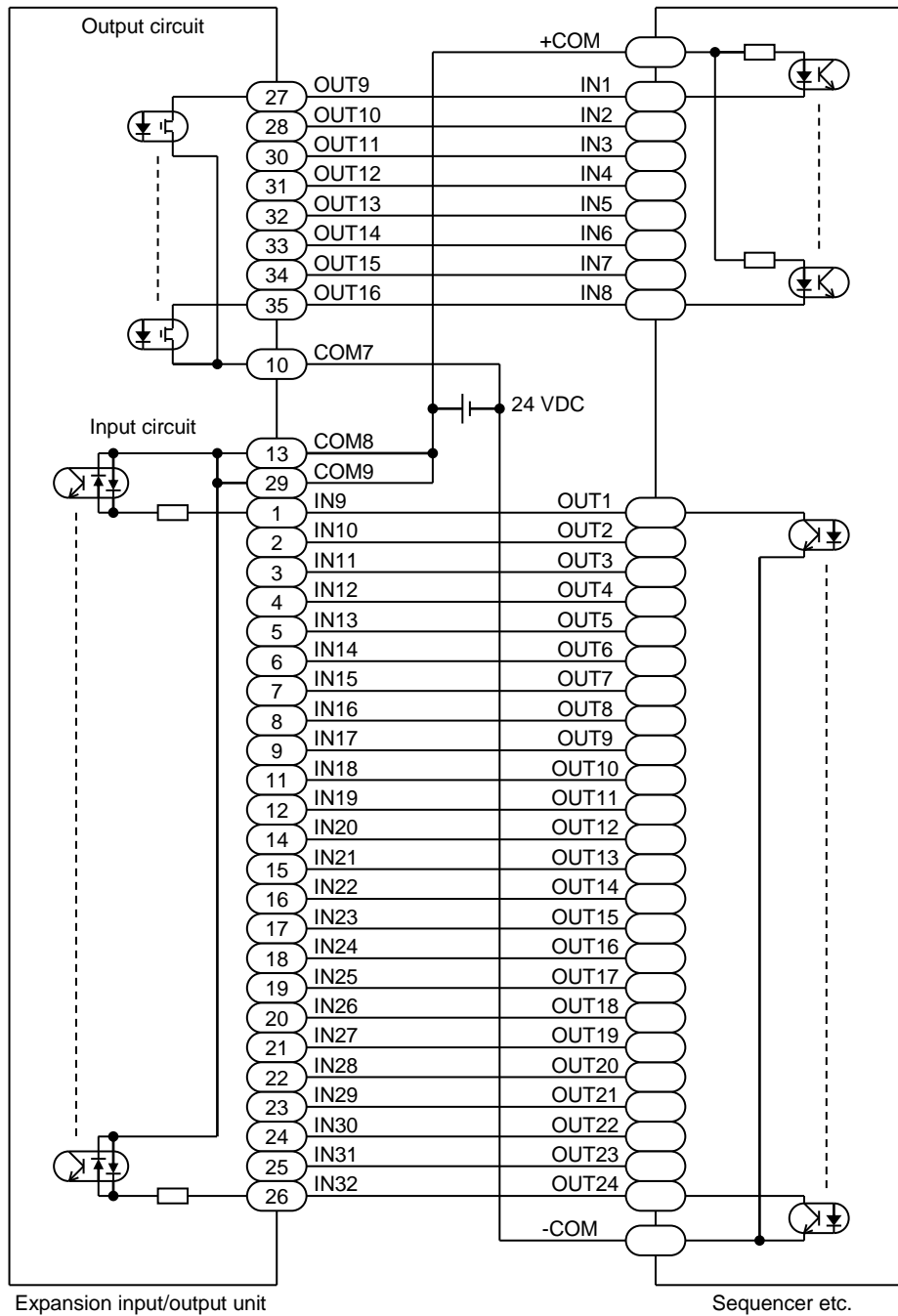


- NOTE**
- +COM5 and +COM6 are connected internally.
  - COM3 and COM4 are not connected internally.

**CAUTION** Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

● Example of extension input/output unit connector connection

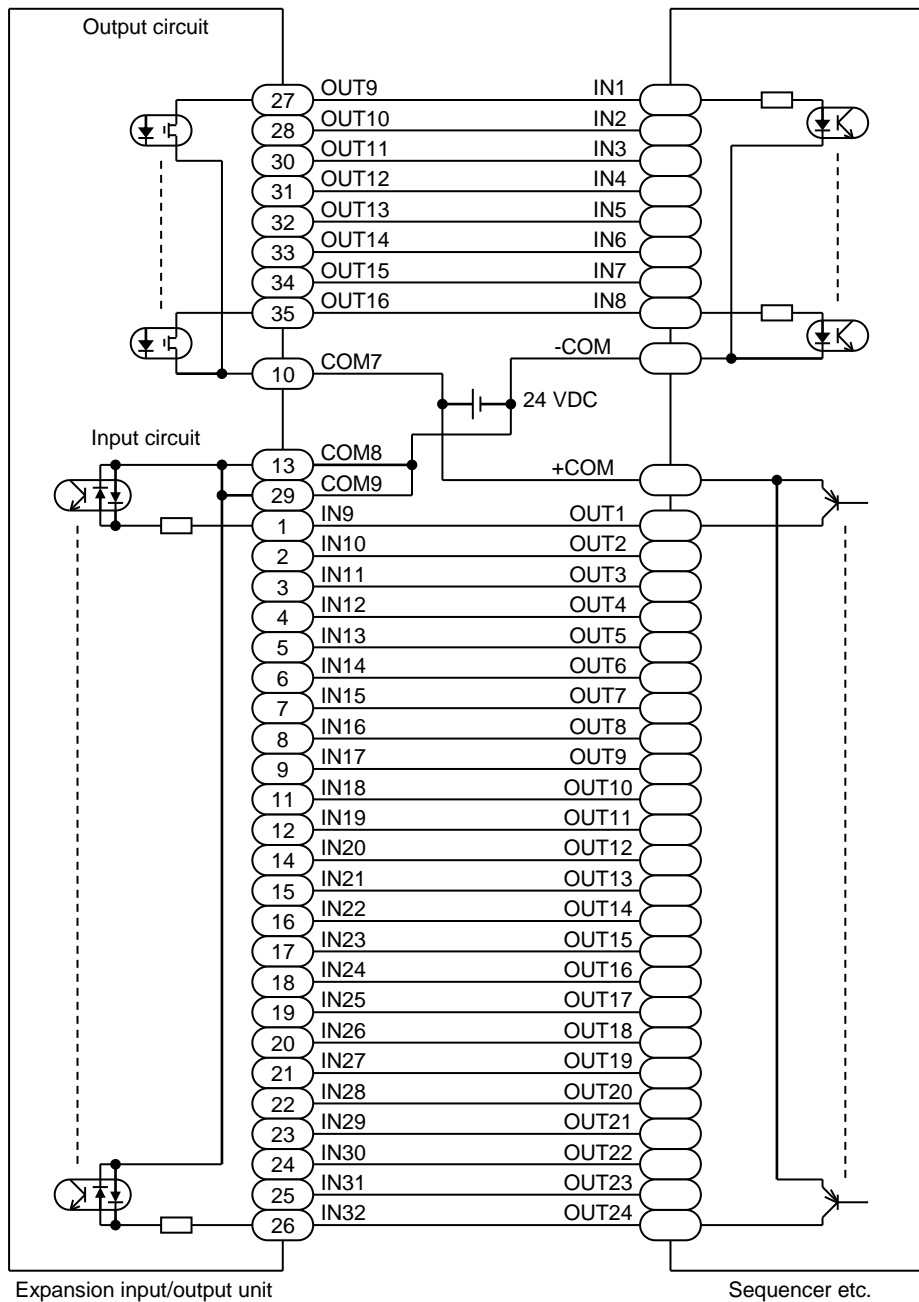
(1) NPN input/output



- NOTE**
- COM7 is not connected with COM8 and COM9.
  - COM8 and COM9 are connected internally.

**CAUTION** Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

(2) PNP input/output

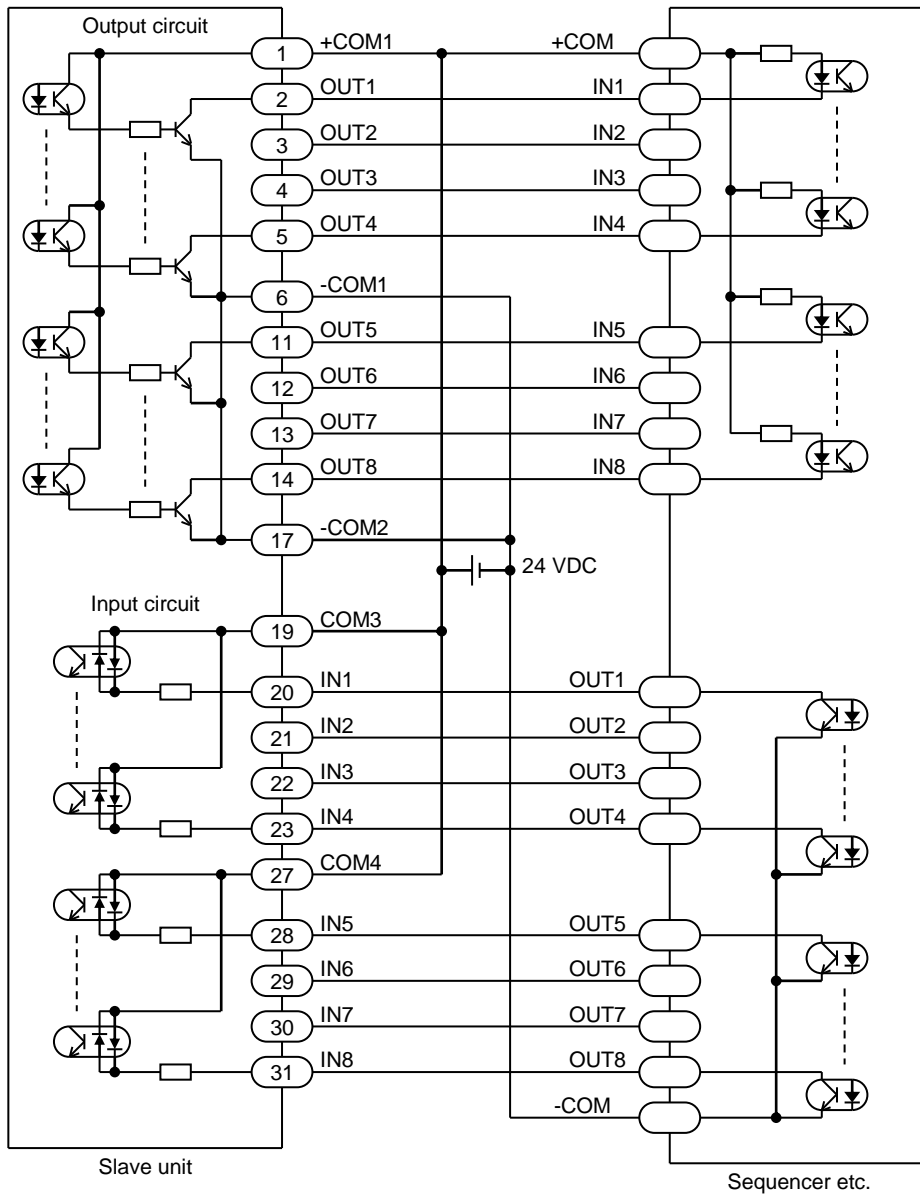


- NOTE**
- COM7 is not connected with COM8 and COM9.
  - COM8 and COM9 are connected internally.

**CAUTION** Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

● Example of slave unit connection

(1) NPN input/output



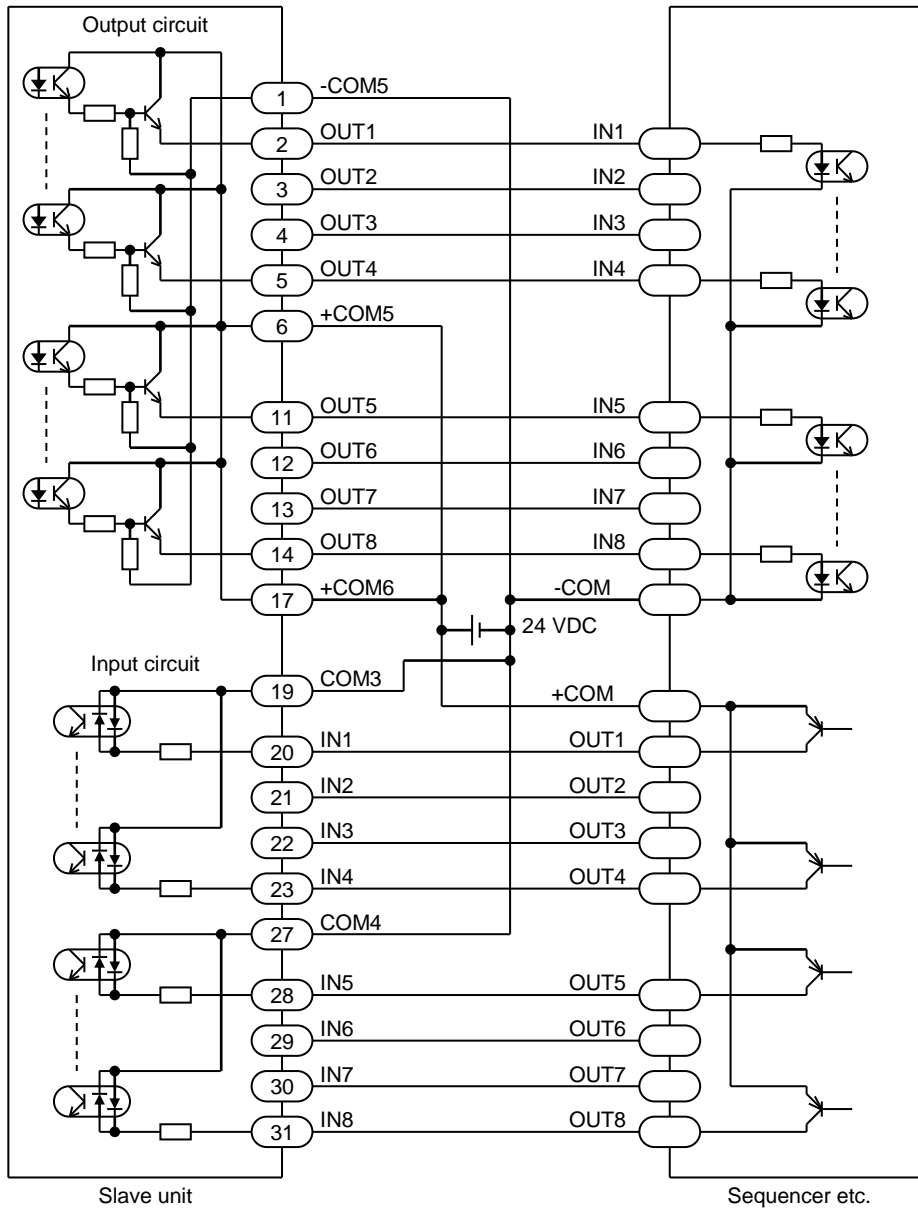
**NOTE**

- -COM1 and -COM2 are connected internally.
- COM3 and COM4 are not connected internally.

**CAUTION**

Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

(2) PNP input/output



- NOTE**
- +COM5 and +COM6 are connected internally.
  - COM3 and COM4 are not connected internally.

**CAUTION** Take sufficient care to perform wiring because If the wires are connected incorrectly, the internal circuit may be broken.

## ■ 10.2 Details of system input/output function

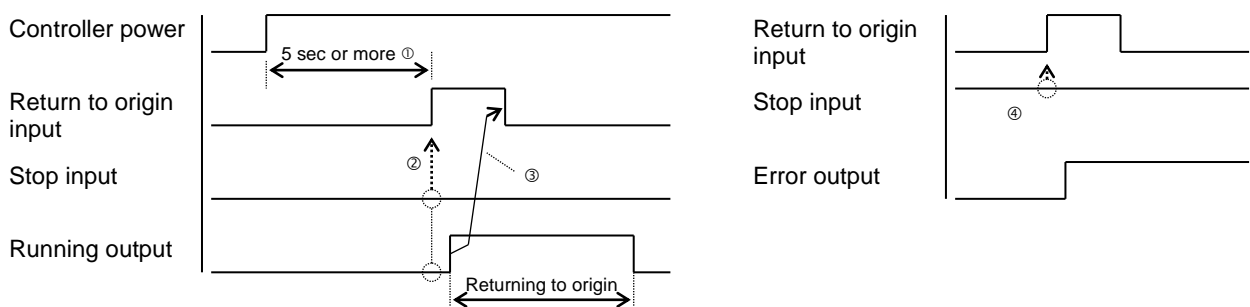
The detail of each system input/output function is explained.



- The controller recognizes the changes of the signals 10 msec later because each input is filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.
- Each logic of system input/output can be selected in "M27 to M34: positive logic/negative logic selection (input 1 to 4, output 1 to 4)" of the mode setting. (Refer to section ■ 13.2.27 to ■ 13.2.34)

### ■ 10.2.1 Return to origin input

- This input starts the return to origin.
- The return to origin input will be invalid with the T/P turned ON, or during execution or parameter transmission/reception of SF-98D.
- This input will be invalid for approx. five seconds after the controller power is turned ON.



- ① Turn the return to origin input ON after 5 seconds or more has passed after the power is turned ON.
- ② Before turning ON the return to origin input, check that the running output and the stop input are turned OFF.
- ③ Return the return to origin input to OFF after the running output is turned ON or when 30 milliseconds or more have passed after the return to origin input is turned ON.
- ④ If the return to origin input is turned ON with the stop input turned ON, an error occurs.

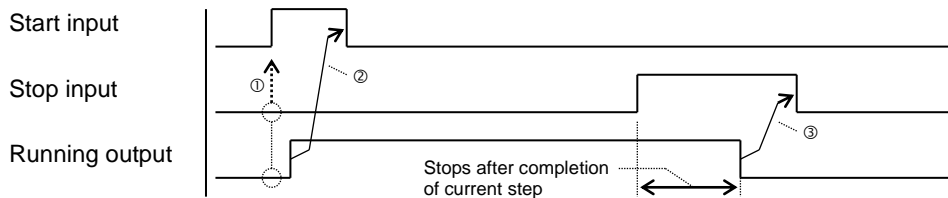
### ■ 10.2.2 Start input

- The start input restarts the operation from the currently stopped step or the pausing state.
- The start input is invalid with the T/P turned ON, or during execution or parameter transmission/reception of SF-98D.
- When there are multiple tasks with the multitasking function, the program will start from the main task step that is currently stopped.
- If the time from the start input is ON to the robot starts is delayed, the 7th digit (start input delay function) of the "special function" (refer to section ■ 13.2.37) in mode setting is set to 1 to 9. The delay time is setting value x 10 ms. (This is supported by CA25-M10 version 4.38 or later, TPH-4C version 2.39 or later, and SF-98D version 3.3.0 or later.)



### ■ 10.2.3 Stop input

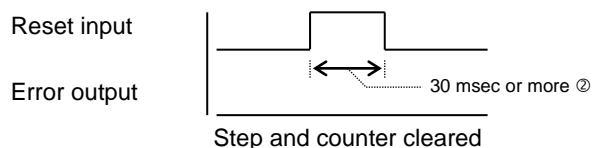
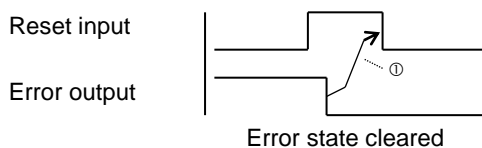
- This input is used to stop the axis after the step currently being executed is ended.
  - When the stop input is inputted during execution of a time waiting related command, the step is considered as completion upon the input.
  - During waiting for conditions with the IN command, the step is not considered as completion. When restarted, the execution will start from the step.
- After this input turns ON, return to origin and start input will be invalid.
- If start of execution or return to origin is performed using the teach pendant with the stop input turned ON, ER62 execution impossible error occurs.



- ① Before turning ON the start input, check that the running output and the stop input are turned OFF.
- ② Return the start input to OFF after the running output is turned ON or when 30 milliseconds or more have passed after the start input is turned ON.
- ③ Return the stop input to OFF after the running output is turned OFF or when 30 milliseconds or more have passed after the stop input is turned ON.

### ■ 10.2.4 Reset input

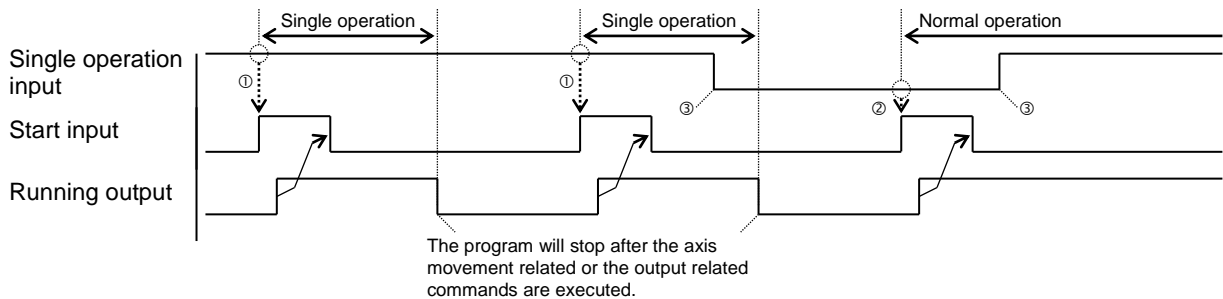
- This input resets the error state when an error has occurred.
- When the reset input is turned ON, in the sequential mode the step No. will be cleared to 0001 and the counter will be cleared to zero, in the multitasking mode and during performing multiple tasks the step No. of all tasks are cleared to 0001 and the counter will be cleared to zero, and in the palletizing mode the step will be returned to the initial state. However, the continuous start bit setting and the continuous start input signal state affect the functions. (Refer to section ■ 10.2.6)
- This input can be accepted only when execution of the program in the controller has been stopped. (When the program is not running.)



- ① Return the reset input to OFF after the error output is turned OFF or when 30 milliseconds or more have passed after the reset input is turned ON.  
Note that the error output will not be turned OFF unless the cause of the Error is removed.
- ② To clear the step and the counter, turn ON for 30 milliseconds or more.

## ■ 10.2.5 Single operation input

- The general-purpose input port designated for single operation input with the mode setting can be used for the Single operation input. (Refer to section ■ 13.2.1)
- This input is also led in as the general-purpose input data.
- This input is used to verify the program. If the single operation input is ON when the program starts, the single operation mode will be entered. Then the program will stop after the axis movement related or the output related commands will be executed.



- ① When the start input is turned ON with the single operation mode input turned ON, the single operation will be executed.
- ② When the start input is turned ON with the single operation mode input turned OFF, the normal operation will be executed.
- ③ The single operation mode input turned ON or OFF during running (program execution) will be ignored.

## ■ 10.2.6 Continuous start input

- The general-purpose input port designated for continuous start input with the mode setting can be used for the continuous start input. (Refer to section ■ 13.2.2)
- This input is also led in as the general-purpose input data.
- When reset is input, whether to hold or clear each data is shown in the following table.

Data	Bit is designated		Bit is not designated
	This input is ON	This input is OFF	
Step No.	Hold	Initialize	Initialize
Counter	Hold	Hold	Clear
General-purpose output	Clear	Clear	*1

\*1 Whether to hold or clear depends on the "general-purpose output clear for emergency stop or reset" (refer to section 0) in mode setting.

- When the power is turned OFF and ON, whether to hold or clear each data is shown in the following table.

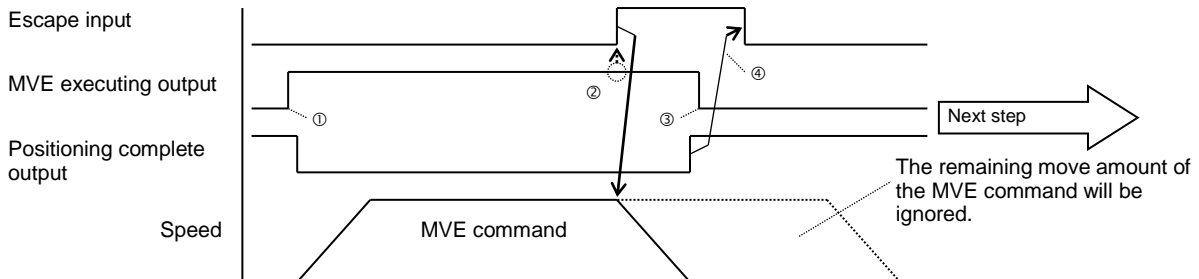
Data	Bit is designated				Bit is not designated
	The power is turned OFF in continuity valid state *2		The power is turned OFF not in continuity valid state *2		
	This input is ON	This input is OFF	This input is ON	This input is OFF	
Step No.	Hold	Initialize	ER60: continuous start impossible error occurs	Initialize	Initialize
Counter	Hold	Hold		*3	Clear
General-purpose output	Clear	Clear		Clear	Clear

\*2 Continuity valid state: program stop state (except for occurring errors other than emergency stop)

\*3 Default setting is "clear". If the setting is changed to "hold", the 8th digit (counter hold function) of the "special function" (refer to section ■ 13.2.37) in mode setting is set to 1. (This is supported by CA25-M10 version 4.37 or later, TPH-4C version 2.39 or later, and SF-98D version 3.3.0 or later.)

## ■ 10.2.7 Escape input

- The general-purpose input port designated as the escape input with the mode setting can be used as the escape input. (Refer to section 0)
- This input is also led in as the general-purpose input data.
- If this input turns ON during execution of the MVE command, the robot will decelerate to a stop, and at the same time it will be interpreted that step has been completed. The next step will be executed.
- The escape input is valid only for the MVE command.



### Example program

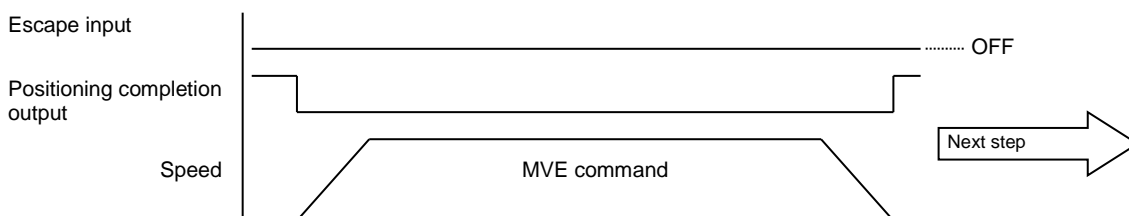
```
[PRGM]
0001  PORT 0-01
OUT   .....1
```

```
[PRGM]
0002  a  S NO=001
MVE  V=00 CNT[00]
      POST
```

```
[PRGM]
0003  PORT 0-01
OUT   .....0
```

- ① To inform the host controller about that the MVE command is being executed, turn ON the MVE executing output before the MVE command. Output this signal as the OUT command using the general-purpose output port. (Refer to the steps 1 and 2 of the example program.)
- ② Before turning ON the escape input, check that the MVE executing output is turned ON.
- ③ When a command that turns OFF the MVE executing output (OUT command) is programmed in the next step of the MVE command, the MVE executing output will be turned OFF after deceleration and stop. (Refer to the step 3 of the example program.)
- ④ Return the escape input to OFF after the positioning complete output is turned ON, or when 30 milliseconds or more have passed after the escape input is turned ON.

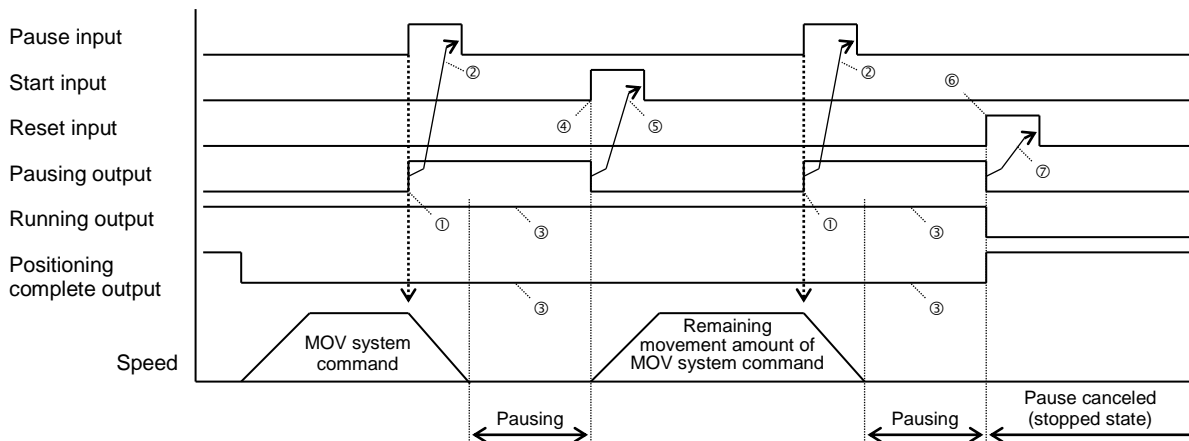
- If the escape input is not turned ON during execution of the MVE command, the next step will be entered after the destination is reached.



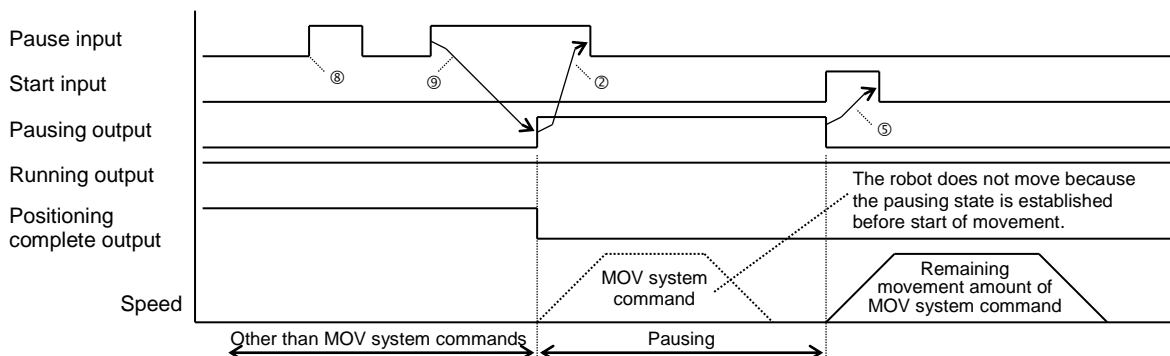
- If the escape input is turned ON after the stop input is turned ON, the robot decelerates to stop and the step ends, and the execution of the program stops.
- The ON edge of the escape input with the MVE command not executed will be stored until the escape input is turned OFF. Therefore if the escape input has been ON before execution of the MVE command, the MVE command will not be executed (considered as completion) and the next step will be entered. At the same time, the stored ON edge of the escape input will be cleared.

## ■ 10.2.8 Pause (temporary stop) input

- The general-purpose input port designated as the pause input with the mode setting can be used as the pause input. (Refer to section ■ 13.2.4)
- This input is also led in as the general-purpose input data.
- If the pause input turns ON during execution of a program, the axis will decelerate and pause. During the temporary stop, the positioning complete output remains OFF. The pause input is invalid during return to origin and except when execution of a program.
- The ON edge of the pause input with a command other than MOV system commands executed will be stored until the pause input is turned OFF. Therefore if the pause input has been ON before execution of the MOV system command, the robot will pause after execution of the MOV system command. At the same time, the stored ON edge of the pause input will be cleared.
- The pause input overrides the stop input. If the pause input is turned ON after the stop input is turned ON, the axis will decelerate and pause. To stop the program, turn ON the reset input or turn ON again the stop input after restart.
- If the reset input is turned ON during pausing, all task programs will stop.



- ① The pausing output turns ON when the deceleration starts.
- ② After the pausing output turns ON, return the pause input to OFF.
- ③ During pausing, the running output and positioning complete output remain unchanged.
- ④ To restart after pausing (resume), use the start input. When the teach pendant is ON, however, the start input is invalid, and therefore use the start key on the teach pendant.
- ⑤ Turn OFF the start input after the pausing output turns OFF or when 30 milliseconds or more have passed after the start input is turned ON.
- ⑥ Also cancel can be done using the reset input. In this case, the programs of all tasks will stop.
- ⑦ Turn OFF the reset input after the pausing output turns OFF or when 30 milliseconds or more have passed after the reset input is turned ON.



- ⑧ The pulse input during execution of a command other than MOV system commands will be ignored.
- ⑨ If the pause input is turned ON during execution of a command other than MOV system commands, the pausing state will be entered just after execution of an MOV system command.

### NOTE

- During pausing, the stop key of the teach pendant and the stop input are invalid.

## ■ 10.2.9 Program selection input

- The general-purpose input port designated as the program selection input with the mode setting can be used as the program selection input  $2^0$  to  $2^3$  or  $2^0$  to  $2^7$ . (Refer to section ■ 13.2.5)
- This input is also led in as the general-purpose input data.
- The program selection input designates  $2^0$  bit. The program selection input consists of the four consecutive bits starting with the designated bit ( $2^0$  to  $2^3$ ) or the eight consecutive bits starting with the designated bit ( $2^0$  to  $2^7$ ).

<Example> When 0-01-1 is set with the four consecutive bits, the input is set as the followings.

Port 0-01-1	→	Program selection input $2^0$	}	The number of selected programs is 16.
Port 0-01-2	→	Program selection input $2^1$		
Port 0-01-3	→	Program selection input $2^2$		
Port 0-01-4	→	Program selection input $2^3$		

### NOTE

The program selection input cannot be set over multiple ports.

<Example> When 0-01-3 is set, the input is set as the followings.

Port 0-01-3	→	Program selection input $2^0$	}	The number of selected programs is 4.
Port 0-01-4	→	Program selection input $2^1$		

- The functions in each mode are as the followings.

#### (1) For sequential mode

The program selection input selects a tag No. of No. 001 to 016 to be jumped when the PSEL command is executed using the four consecutive bits input signal.

Tag No.	General purpose input port No.			
	0-01-4 $2^3$	0-01-3 $2^2$	0-01-2 $2^1$	0-01-1 $2^0$
001	0	0	0	0
002	0	0	0	1
003	0	0	1	0
:	:	:	:	:
008	0	1	1	1
:	:	:	:	:
016	1	1	1	1

1:ON  
0:OFF

\*: Program selection is designated as 0-01-1

[Example] When the input  $2^0$  is ON,  $2^1$  is ON,  $2^2$  is OFF, and  $2^3$  is OFF, and the PSEL command is executed, jump to the step to which the tag No. 004 is inputted will occur.

#### (2) For palletizing mode

The program selection input selects a program No. of No. 01 to 16 to be executed when the start signal is inputted using the four consecutive bits input signal.

Program No.	General purpose input port No.			
	0-01-4 $2^3$	0-01-3 $2^2$	0-01-2 $2^1$	0-01-1 $2^0$
01	0	0	0	0
02	0	0	0	1
03	0	0	1	0
:	:	:	:	:
08	0	1	1	1
:	:	:	:	:
16	1	1	1	1

1:ON  
0:OFF

\*: Program selection is designated as 0-01-1

[Example] When the input  $2^0$  is ON,  $2^1$  is ON,  $2^2$  is ON, and  $2^3$  is OFF, and the start signal is inputted, the program No. 08 will be executed.

#### (3) For external point designation mode

If the I/F unit is not equipped, the program selection input selects a coordinate table No. of No. 001 to 256 to be executed when the start signal is inputted using the eight consecutive bits input signal. For details, refer to Chapter 8.

## ■ 10.2.10 Palletizing input

- The general-purpose input port designated as the palletizing input with the mode setting can be used as the palletizing input. (Refer to section ■ 13.2.6)
- This input is also led in as the general-purpose input data.
- This is the sequential and palletizing mode changeover input. When the start input is turned ON, the controller will judge this signal and change the mode.
  - OFF: Sequential mode
  - ON: Palletizing mode
- The palletizing input is invalid with the T/P turned ON, or during execution of SF-98D.

## ■ 10.2.11 Servo on input

- The general-purpose input port assigned to the servo on input in the mode setting can be used as the servo on input subsequently. (Refer to section ■ 13.2.21)
- This input is also led in as the general-purpose input data.
- With the T/P turned ON, the servo cannot be locked unless the servo on input is turned ON.
- With the T/P turned OFF, the servo is locked when the servo on input is turned ON and the servo lock is released when the servo input is turned OFF.
- With the T/P turned OFF, to lock the servo for recovery from errors, turn OFF the servo on input once, and turn ON again after 30 milliseconds or more have passed.
- If the servo on input is turned ON before 5 seconds have passed from turning ON the power, the servo may not be locked. Turn ON the servo on input after 5 seconds have passed from turning ON the power.

## ■ 10.2.12 Torque limit input

- The general-purpose input port assigned to the torque limit input in the mode setting can be used as the torque limit input subsequently. (Refer to section ■ 13.2.22)
- This input is also led in as the general-purpose input data.
- The torque limit input designates  $2^0$  bit. The torque limit input consists of the three consecutive bits in the same port starting with the designated bit ( $2^0$  to  $2^2$ ). The torque limit input cannot be set over multiple ports.
- The three bits select one table among the 8 torque limit tables (No. 1 to 8) (refer to section ■ 13.5.5).
- For the function details, refer to section ■ 16.11.

## ■ 10.2.13 Running output

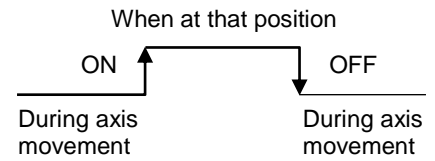
- This signal turns ON when the controller is executing a program or during return to origin or JOG operation. In the external point designation mode, this signal will turn ON during robot operation.
- This signal remains ON even when the operation is paused with the pause input.
- This signal will turn OFF when the program is stopped with the END command or stop input, etc.

## ■ 10.2.14 Error output

- This signal turns ON when an error has occurred in the controller.
- Refer to Chapter 18 for details on the error types and processes.

## ■ 10.2.15 Positioning complete output

- This is the positioning complete signal used in the movement system commands.
- The positioning complete output is turned OFF when return to origin is necessary.  
If the positioning complete output is turned OFF when the operation stops, perform return to origin.
- This signal turns ON when at the position (in-position).
- During stopping due to pause input, the positioning complete output remains OFF.
- This signal will also turn ON when the origin is reached during return to origin.
- When the servo is turned OFF, the positioning complete output is turned OFF.
- When using two to four axes, this signal will turn ON when all axes have completed positioning.
- The output specification varies depending on the encoder type setting (K17: section ■ 13.4.17). (Refer to section ■ 16.10.2)
- To make the output specification same as conventional BA series, set the BA I/O compatibility mode (K23: section ■ 13.4.23) to valid. For operation with the BA I/O compatibility mode validated, refer to section ■ 16.10.



## ■ 10.2.16 Return to origin complete output

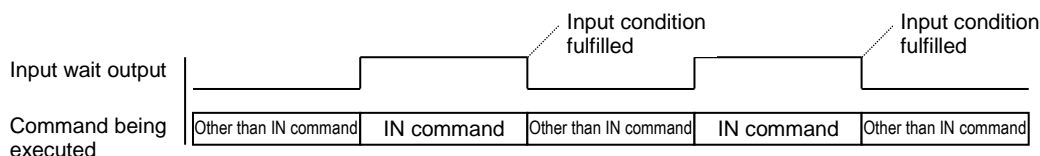
- This is the origin return and HOME command execution completion signal.
- This signal will turn ON when the robot can identify the current position and return to origin is not required for execution of a move command.
- This signal will turn OFF when return to origin is required for execution of a move command due to an encoder-related error, etc.
- When the servo is turned OFF, the positioning complete output is turned OFF.
- When using two to four axes, this signal will turn ON when all axes have returned to origin.
- The output specification varies depending on the encoder type setting (K17: section ■ 13.4.17). (Refer to section ■ 16.10.2)
- To make the output specification same as conventional BA series, set the BA I/O compatibility mode (K23: section ■ 13.4.23) to valid. For operation with the BA I/O compatibility mode validated, refer to section ■ 16.10.

## ■ 10.2.17 Pausing output

- The general-purpose output port assigned as pausing output in the mode setting can be used as the pausing output subsequently. (Refer to section 0)
- The pausing output is turned ON when the robot decelerates and stops after recognizing the pause input. The pausing output will turn OFF when the pause is canceled.
- For the signal timing, refer to section ■ 10.2.8.

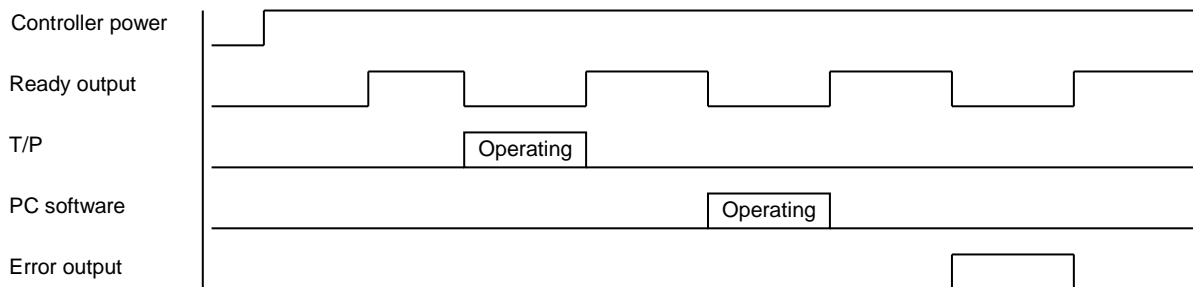
## ■ 10.2.18 Input wait output

- The general-purpose output port designated as input wait output with the mode setting can be used as the input wait output. (Refer to section ■ 13.2.8)
- This output turns ON during IN command execution (general-purpose input wait state).



## ■ 10.2.19 READY output

- The general-purpose output port designated as READY output with the mode setting can be used as the READY output. (Refer to section ■ 13.2.13)
- After the power is turned ON, the ready output is turned ON when the controller consisting of the master unit and slave unit becomes ready for receiving the external start input or return to origin input.
- The ready input is turned OFF under the conditions shown below. When the ready input is turned OFF, the start input or the return to origin input is not accepted.
  - With the T/P turned ON, or during execution or parameter transmission of SF-98D
  - With the error output turned ON



## ■ 10.2.20 Task positioning complete output

- After a general-purpose output port is designated for the task positioning complete output by the mode setting, the port can be used for task positioning complete output. (Refer to section 0)
- This setting can set the positioning complete output separately for each task. (The positioning complete output of the system output is turned ON when all the axes complete positioning.)
- The output conditions are same as the positioning complete output of the system output. (Refer to section ■ 10.2.15)

## ■ 10.2.21 Task return to origin complete output

- After a general-purpose output port is designated for the task return to origin complete output by the mode setting, the port can be used for task return to origin complete output. (Refer to section ■ 13.2.15)
- This setting can set the return to origin complete output separately for each task. (The return to origin complete output of the system output is turned ON when all the axes complete return to origin.)
- The output conditions are same as the return to origin complete output of the system output. (Refer to section ■ 10.2.16)

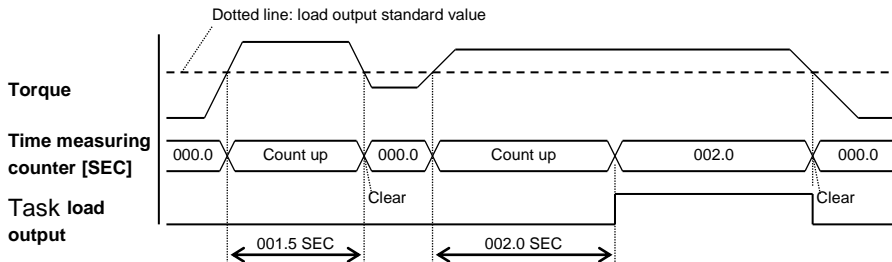
## ■ 10.2.22 Battery alarm output

- After a general-purpose output port is designated for the battery alarm output by the mode setting, the port can be used for battery alarm output. (Refer to section ■ 13.2.19)
- The battery alarm output turns ON when the backup power voltage of any configuring controller drops, and turns OFF when the backup power voltage of all configuring controllers recovers.
- When the encoder type setting (refer to section ■ 13.4.17 the encoder type setting in the parameter 2) is "i", the battery alarm output is invalid.
- Once turned ON because of backup voltage drop of CA01-S05 slave unit, the battery alarm output remains ON until the power is turned OFF even after recovery of the voltage. Because of impedance related factors, the battery alarm output does not turn ON even when voltage drops in some cases.



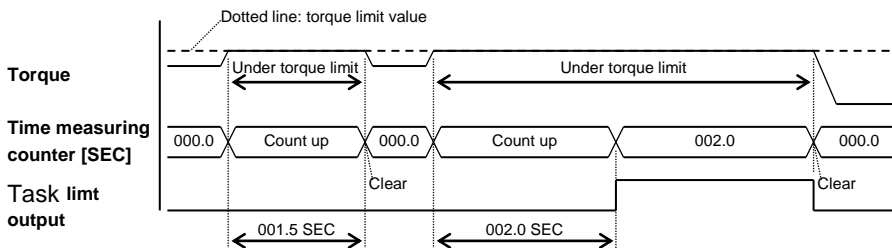
### ■ 10.2.23 Task load output

- After a general-purpose output port is designated for the task load output by the mode setting, the port can be used for task load output. (Refer to section ■ 13.2.24)
- This output is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, SF-98D version 3.1.6 or later.
- This output is available only when torque limit move. (For details of torque limit move, refer to section ■ 5.1.7)
- This output turns ON when the state output torque is exceeding load output standard value (refer to section ■ 13.5.5) continues for more than torque limit judgement time (TM). (refer to page 17-63)
- Though this output turns ON once, this output turns OFF when output torque is not exceeding load output standard value.
- An example is shown as follows. (Torque limit judgement time (TM) is 002.0 [sec].)



### ■ 10.2.24 Task limit output

- After a general-purpose output port is designated for the task limit output by the mode setting, the port can be used for task limit output. (Refer to section ■ 13.2.25)
- This output is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, SF-98D version 3.1.6 or later.
- This output is available only when torque limit move. (For details of torque limit move, refer to section ■ 5.1.7)
- This output turns ON when the state output torque is reaching torque limit value (refer to section ■ 13.5.5) continues for more than torque limit judgement time (TM). (refer to page 17-63) (condition ①)
- Though this output turns ON once, this output turns OFF when output torque is not reaching torque limit value.
- An example is shown as follows. (Torque limit judgement time (TM) is 002.0 [sec])



### ■ 10.2.25 Task lock output

- After a general-purpose output port is designated for the task lock output by the mode setting, the port can be used for task lock output. (Refer to section ■ 13.2.26)
- This output is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, SF-98D version 3.1.6 or later.
- This output is available only when torque limit move. (For details of torque limit move, refer to section ■ 5.1.7)
- This output turns ON when the lock is detected. (Condition of lock detection is motor stop and meeting condition ① of section ■ 10.2.24)
- Though this output turns ON once, this output turns OFF when the lock is not detected.

## ■ 10.2.26 JOG Input, JOG output

- The general-purpose input/output port assigned to the JOG input and JOG output in the mode setting can be used as the JOG input and JOG output subsequently. (Refer to section ■ 13.2.35 and ■ 13.2.36)
- This input/output is supported by CA25-M10 version 4.36 or later, TPH-4C version 2.38 or later, SF-98D version 3.2.2 or later.

(1) List of JOG input/output signals

JOG output		JOG input	
Bit No. (*1) (Offset)	Signal name	Bit No. (*2) (Offset)	Signal name
+0	"Axis 1 JOGGING" output (Station No. 0)	+0	"Request axis 1 JOG" input (Station No. 0)
+1	"Axis 2 JOGGING" output (Station No. 1)	+1	"Request axis 2 JOG" input (Station No. 1)
+2	"Axis 3 JOGGING" output (Station No. 2)	+2	"Request axis 3 JOG" input (Station No. 2)
+3	"Axis 4 JOGGING" output (Station No. 3)	+3	"Request axis 4 JOG" input (Station No. 3)
+4	JOG-ready output	+4	"Request inching" input
Unused	Unused	+5	"Request low-speed JOG" input
Unused	Unused	+6	"Request high-speed JOG" input
Unused	Unused	+7	"Designate JOG direction" input OFF: + direction, ON: - direction

\*1: The bit designated by M36 Bit designation of JOG output (refer to section ■ 13.2.36) is bit No. +0 of JOG output. JOG output consists of the 5 consecutive bits in the same port starting with the designated bit.

\*2: The bit designated by M35 Bit designation of JOG input (refer to section ■ 13.2.35) is bit No. +0 of JOG input. JOG input consists of the 8 consecutive bits in the same port starting with the designated bit.

<Example 1>

When 1-01-3 is designated in M36,  
the bits are set as the followings.

JOG output {  
 Bit No. +0 → Port 1-01-3  
 Bit No. +1 → Port 1-01-4  
 :  
 Bit No. +4 → Port 1-01-7

<Example 2>

When 1-01-1 is designated in M35,  
the bits are set as the followings.

JOG input {  
 Bit No. +0 → Port 1-01-1  
 Bit No. +1 → Port 1-01-2  
 :  
 Bit No. +7 → Port 1-01-8

**NOTE** JOG input and JOG output cannot be set over multiple ports.

<Example 3>

When 1-01-4 is designated in M35,  
the bits are set as the followings. (More than bit No. +5 of JOG input are invalid.)

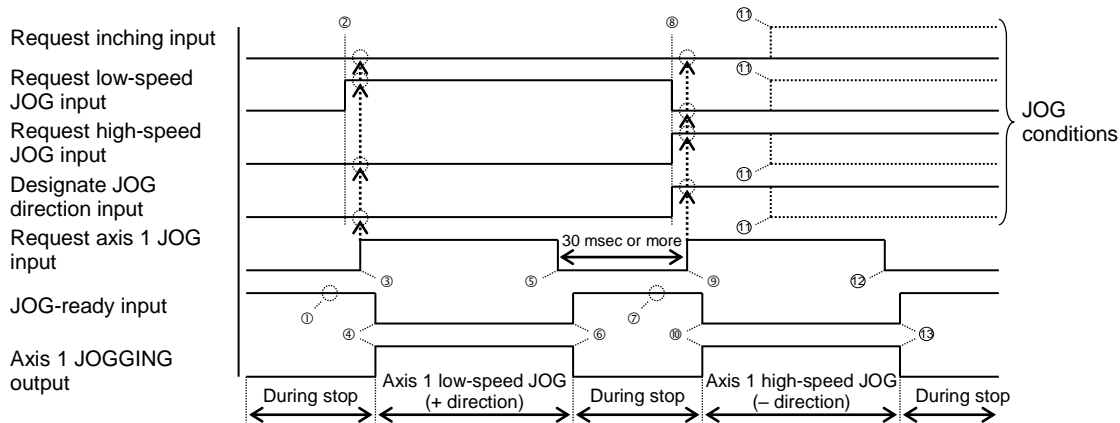
JOG input {  
 Bit No. +0 → Port 1-01-4  
 Bit No. +1 → Port 1-01-5  
 :  
 Bit No. +4 → Port 1-01-8

- When the JOG conditions (inching request, low-speed JOG request, high-speed JOG request) and JOG direction are specified, and the JOG request is ON, the corresponding axis performs the JOG operation. Refer to "(2) Example of axis 1 moving".
- JOGGING by I/O signal is not accepted as long as the JOG ready output signal is OFF. The JOG ready output signal is OFF under the following conditions.
  - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - While the "running" output is ON.
  - While the error output is ON.
- When the multiple bits for the "request inching" input, "request low-speed JOG" input and "request high-speed JOG" input are ON, the motions are executed according to the following order.  
 Inching > Low-speed JOG > High-speed JOG
- It is not possible to simultaneously move two (2) or more axes at JOGGING. Move each axis separately.
- The axis designated by the JOG move request signal corresponds to the station No.

**NOTE**

- The JOG operation can be performed within the software limits when the controller understands the current position of the axis (when return to origin is unnecessary). When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in ■ 3.2)
- The JOG operation can be performed even if the controller has lost the current position (return to origin is required). In this case, the software limit is not applied.
- The JOG operation speed can be set in the JOG speed setting in the parameter 1 (refer to sections ■ 13.3.8 to ■ 13.3.11).
- The distance of an inching movement can be set in the JOG increment of the parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in the JOG speed in the parameter 1.
- Each input signal is ORed with each signal of JOG input by CC-Link, DeviceNet or EtherNet/IP. Each signal of JOG output by CC-Link, DeviceNet or EtherNet/IP is also outputted. (Refer to sections ■ 11.2.4 and ■ 12.2.4)

## (2) Example of axis 1 moving



- ① Make sure that the JOG-READY signal is ON.
- ② Set the JOG conditions. (In the above figure, low-speed JOG and plus "+" direction are specified.)
- ③ Turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ④ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at low speed in the plus "+" direction.
- ⑤ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑥ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at low speed in the plus "+" direction stops.
- ⑦ Make sure that the JOG-READY signal is ON.
- ⑧ Set the JOG conditions. (In the above figure, high-speed JOG and "-" direction are specified.)
- ⑨ 30 msec or more has passed after ⑤, then turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ⑩ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at high speed in the minus "-" direction.
- ⑪ Even if the JOG conditions have been changed during travel, they are neglected.
- ⑫ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑬ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at high speed in the minus "-" direction stops.

## ■ 10.3 RS-232C communication specifications

This machine can communicate data with the host computer (personal computer, etc.) by using the optional communication cable (Type: PCBL-31). Refer to the RS-232C communication specifications for details.

Ask your nearest branch or dealer for the RS-232C communication specifications.

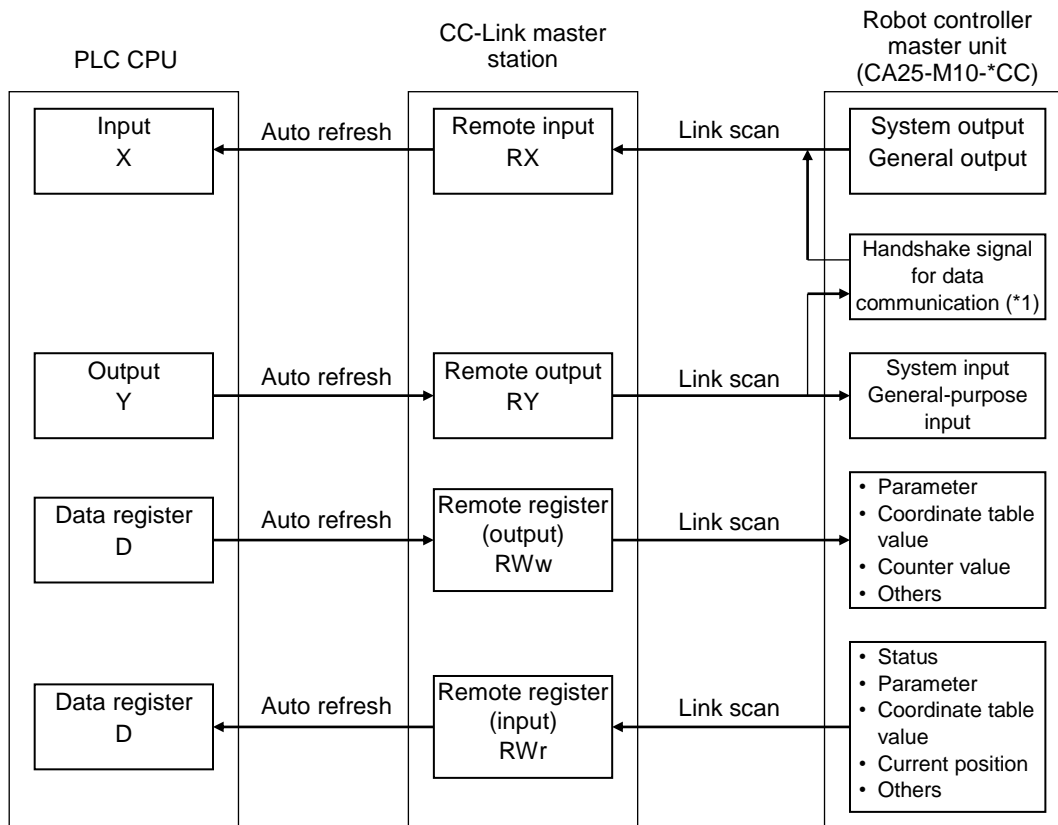
# Chapter 11 CC-Link

## 11.1 CC-Link Function

A controller equipped with CC-Link unit can use CC-Link. This chapter describes the CC-Link interface. CC-Link (Control & Communication Link) is a field network interface that features a minimized wiring design in a low-cost structure and high-speed data communication. The CC-Link interface allows data communication for various input/output, coordinate table, status, JOG operation, etc.

### 11.1.1 Overview

This controller serves as the remote device station (Fixed at four (4) stations) and allows communication of various data. Data communication is performed through remote registers RWw and RWr, and some of remote inputs RX and remote outputs RY are used as handshake signals.



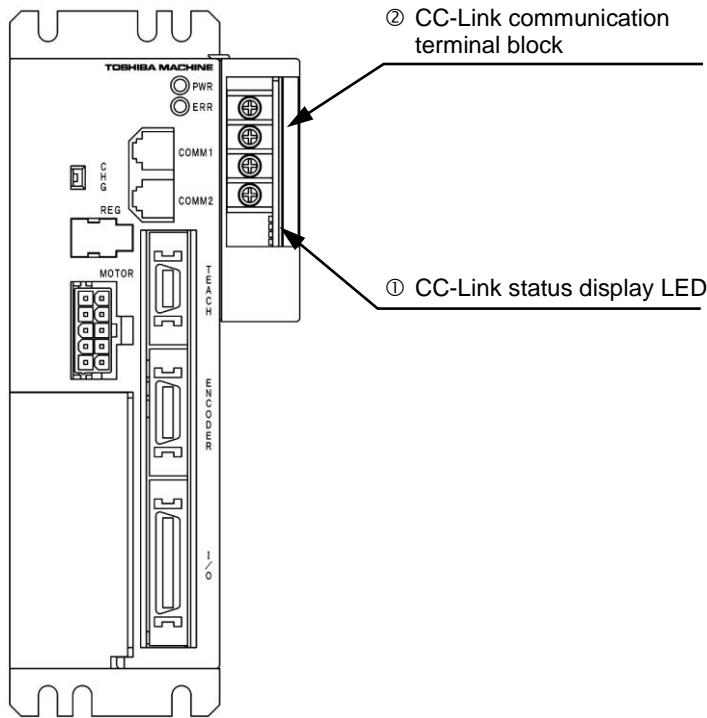
\*1: The data communication handshake signal on the robot controller side is created by the robot controller automatically.

### 11.1.2 CC-Link specifications

Item	Specification
Transmission specifications	CC-Link Ver 1.10
Communication speed	10M/5M/2.5M/625k/156k bps (Set by parameter)
Station type	Remote device station
Number of occupied stations	Fixed at 4 stations (RX, RY: 128 points each, RWw, RWr: 16 points each)
Station number setting	1 – 64 (Set by parameter)
Number of input/output points	System input: 4 points, System output: 4 points
	General-purpose input: 64 points, General-purpose output: 64 points
	JOG input: 8 points, JOG output: 8 points
	Handshake input: 1 point, Handshake output: 2 points
	Data selection input: 4 points, Data selection check output: 4 points
Data communication functions	Coordinate table sending and receiving, current position monitor, error code request, status request, etc.

\*: The input and output are based on the direction viewed from the robot controller.

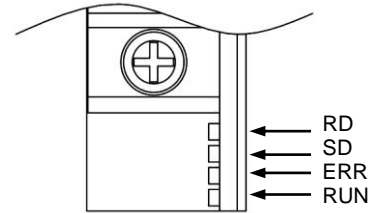
### ■ 11.1.3 Explanation of CC-Link component



① CC-Link status display LED

Name	Color	On/Off	Description
RD	Green	On	When receiving data
		Off	When not receiving data
SD	Green	On	When sending data
		Off	When not sending data
ERR	Red	On	CRC error, error speed, error station number setting
		Off	During normal operation
RUN	Green	On	During normal operation
		Off	During timeout or network stoppage

CC-Link status display LED

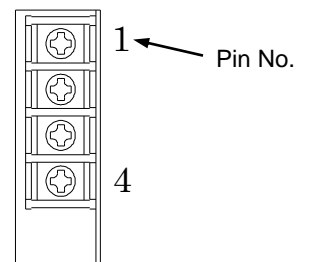


② CC-Link communication terminal block

The exclusive CC-Link cable for data linkage is connected to this terminal block.

Pin No.	Signal name	Wire color
1	Communication line (DA)	Blue
2	Communication line (DB)	White
3	Digital ground (DG)	Yellow
4	Shield (SLD)	Shield

CC-Link communication terminal



## ■ 11.1.4 Connection of exclusive CC-Link cable

The order of cable connection is unrelated to the station number.

Be sure to connect the terminators for the units located at both ends of the CC-Link system. Connect each terminator between DA and DB.

In the CC-Link system, the terminator to be connected differs with the cable to be used.

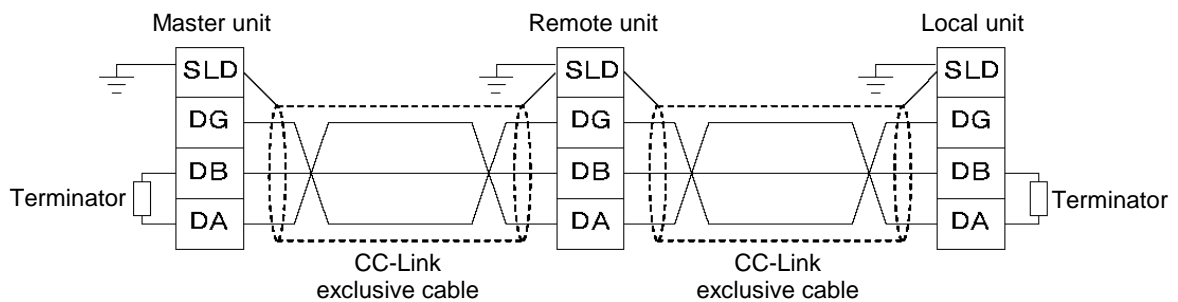
Type of cable	Terminator
CC-Link exclusive cable	110 Ω, 1/2 W (Brown, brown, brown)
CC-Link exclusive cable designed for Ver 1.10	
CC-Link exclusive high-performance cable	130 Ω, 1/2 W (Brown, orange, brown)

No terminator is attached to this controller.

The master unit can be located at other than the both ends.

Star-connection is not possible.

The connecting method is shown below.



For details on the cable connection, see the master station instruction manual and CC-Link cable wiring manual (published by the CC-Link Partner Association).

\* If a communication error caused by noise occurs, review the grounding conditions of the controller.

\* Prepare the CC-Link exclusive cable by yourself.

## ■ 11.1.5 CC-Link settings

### (1) CA25-M10-\*CC settings

The station number and baud rate are specified by CC-Link setting in the mode setting. (Refer to section 0)

### (2) CC-Link master station settings

Make the CC-Link master station settings by following the master station operating manual.

The type of CA25-M10-\*CC is the remote device station, and the number of exclusive stations is four (4).

## ■ 11.2 Connection with External Devices

### ■ 11.2.1 List of master unit (CA25-M10-\*CC) I/O signals

Signal direction: CC-Link master station ← CA25-M10-*CC		Signal direction: CC-Link master station → CA25-M10-*CC (*1)	
Device No. (Input)	Signal name	Device No. (Output)	Signal name (*5)
RXn0	Running output	RYn0	Return to origin input
RXn1	Error output	RYn1	Start input
RXn2	Positioning complete output	RYn2	Stop input
RXn3	Return to origin complete output	RYn3	Reset input
RXn4~RXn7	Use prohibited	RYn4~RYn7	Use prohibited
RXn8~RXnF	General output port 1-1 ~ 8	RYn8~RYnF	General input port 1-1 ~ 8
RX(n+1)0~RX(n+1)7	General output port 2-1 ~ 8	RY(n+1)0~RY(n+1)7	General input port 2-1 ~ 8
RX(n+1)8~RX(n+1)F	General output port 3-1 ~ 8	RY(n+1)8~RY(n+1)F	General input port 3-1 ~ 8
RX(n+2)0~RX(n+2)7	General output port 4-1 ~ 8	RY(n+2)0~RY(n+2)7	General input port 4-1 ~ 8
RX(n+2)8~RX(n+2)F	General output port 5-1 ~ 8	RY(n+2)8~RY(n+2)F	General input port 5-1 ~ 8
RX(n+3)0~RX(n+3)7	General output port 6-1 ~ 8	RY(n+3)0~RY(n+3)7	General input port 6-1 ~ 8
RX(n+3)8~RX(n+3)F	General output port 7-1 ~ 8	RY(n+3)8~RY(n+3)F	General input port 7-1 ~ 8
RX(n+4)0~RX(n+4)7	General output port 8-1 ~ 8	RY(n+4)0~RY(n+4)7	General input port 8-1 ~ 8
RX(n+4)8~RX(n+4)F	JOG output (*2)	RY(n+4)8~RY(n+4)F	JOG input (*2)
RX(n+5)0~RX(n+5)7	Reserved (*3)	RY(n+5)0~RY(n+5)7	Reserved (*3)
RX(n+5)8~RX(n+5)F		RY(n+5)8~RY(n+5)F	
RX(n+6)0~RX(n+6)7		RY(n+6)0~RY(n+6)7	
RX(n+6)8	Command processing finish (*4)	RY(n+6)8	Request for command processing (*4)
RX(n+6)9	Command error (*4)	RY(n+6)9	Use prohibited
RX(n+6)A~RX(n+6)B	Use prohibited	RY(n+6)A~RY(n+6)B	Use prohibited
RX(n+6)C~RX(n+6)F	Data selection check output	RY(n+6)C~RY(n+6)F	Data selection input
RX(n+7)0~RX(n+7)7	Use prohibited	RY(n+7)0~RY(n+7)7	Use prohibited
RX(n+7)8~RX(n+7)F	Use prohibited	RY(n+7)8~RY(n+7)F	Use prohibited



n: Address assigned to CA25-M10-\*CC by station number setting. n = (Station number - 1) × 2

\*1: When the CC-Link communication is interrupted, the stop input is set to 1 and the others are cleared to zero. For the T/P operation, however, also the stop input is cleared to zero.

\*2: Refer to sections ■ 11.2.2 and ■ 11.2.4.

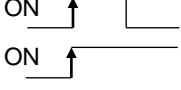
\*3: Area reserved for future extension of function.

\*4: Handshake signal for data transmission.

\*5: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

## ■ 11.2.2 System I/O

### (1) System input (CC-Link master station → CA25-M10-\*CC)

Signal name	Remote output	Normal mode	External point designation mode	Remarks
Return to origin	RYn0	ON: Start of return to origin operation.	Return to origin	Detection of leading edge 
Start	RYn1	ON: Restart from currently stopped step or from pausing.	ON: Starts moving based on currently specified table information.	
Stop	RYn2	ON: Stops after current step has been executed.	Invalid	When this input is ON, return to origin and start input are invalid.
Reset	RYn3	ON: Cancels an error status. (Valid while program execution is stopped.)	ON: Cancels an error status.	
JOG input	RY(n+4)8 ~ RY(n+4)F	A selected axis is moved by JOGGING after the motion mode (JOG, low-speed or high-speed) and travel direction are specified.		Refer to section ■ 11.2.4.



The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

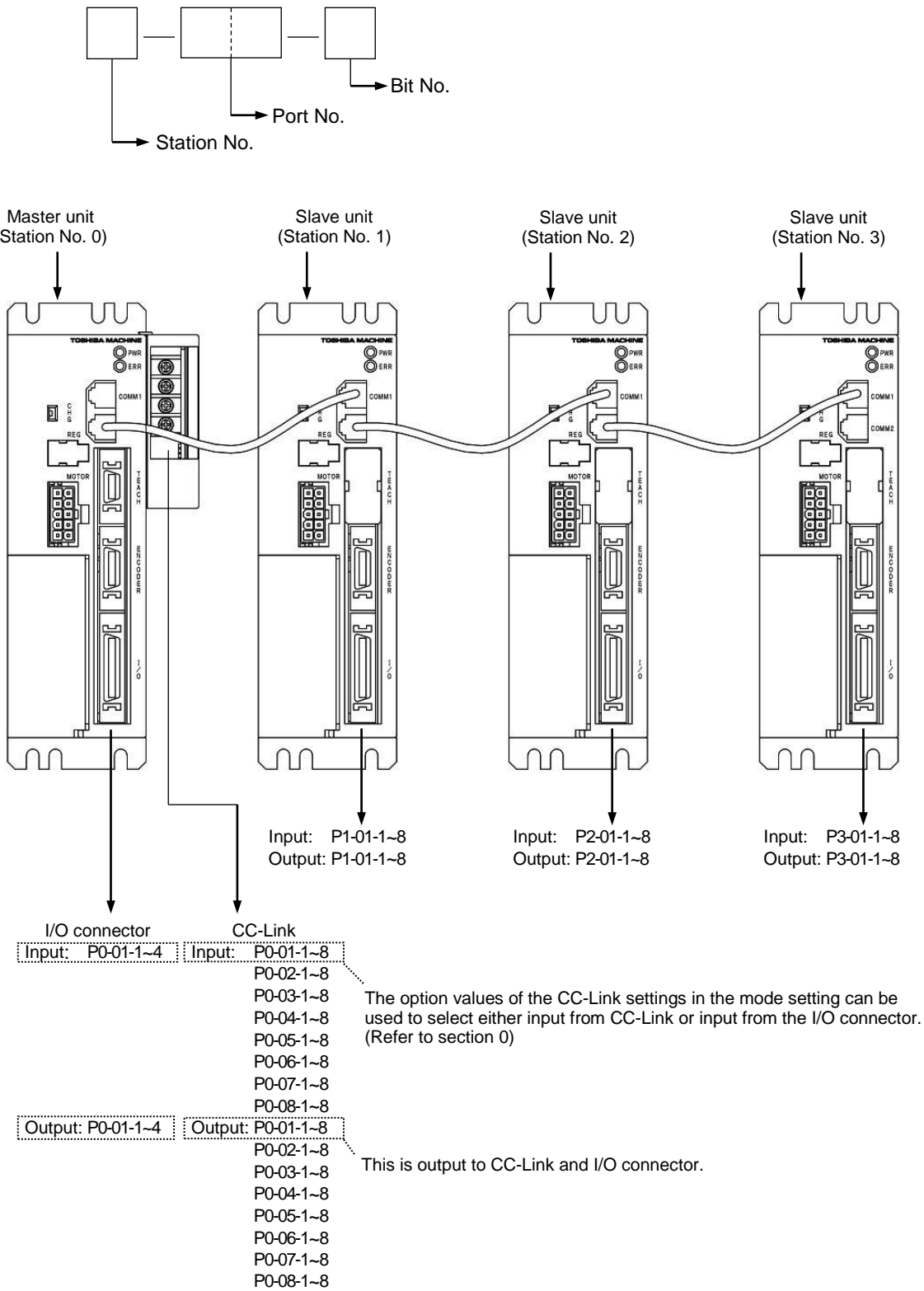
### (2) System output (CA25-M10-\*CC → CC-Link master station)

Signal name	Remote input	Normal mode	External point designation mode	Reference
Running	RXn0	ON during controller operation and during return to origin.	ON during robot operation.	Section ■ 10.2.13
Error	RXn1	ON at error generation.	Same as left	Section ■ 10.2.14
Positioning complete	RXn2	ON when the robot has been located at a predetermined position. OFF while the robot is moving. (Remains OFF when it is paused.)	Same as left	Section ■ 10.2.15
Return to origin complete	RXn3	ON when return to origin is completed.	Same as left	Section ■ 10.2.16
JOG output	RX(n+4)8 ~ RX(n+4)F	Acceptance or rejection of JOG, active status, etc. are displayed.		Section ■ 11.2.4



### 11.2.3 Name of general-purpose I/O port and teach pendant display

In the controller's system configuration, there are master unit, slave unit and CC-Link unit input/output ports. These input/output ports are displayed on the Teach Pendant as shown below.



● For the correspondence between the port numbers and remote input (RX)/output (RY), refer to section 11.2.1.

## ■ 11.2.4 JOG input/output

### (1) List of JOG input/output signals

Signal direction: CC-Link master station ← CA25-M10-*CC		Signal direction: CC-Link master station → CA25-M10-*CC	
Input Device No.	Signal name	Output Device No.	Signal name (*1)
RX(n+4)8	"Axis 1 JOGGING" output (Station No. 0)	RY(n+4)8	"Request axis 1 JOG" input (Station No. 0)
RX(n+4)9	"Axis 2 JOGGING" output (Station No. 1)	RY(n+4)9	"Request axis 2 JOG" input (Station No. 1)
RX(n+4)A	"Axis 3 JOGGING" output (Station No. 2)	RY(n+4)A	"Request axis 3 JOG" input (Station No. 2)
RX(n+4)B	"Axis 4 JOGGING" output (Station No. 3)	RY(n+4)B	"Request axis 4 JOG" input (Station No. 3)
RX(n+4)C	JOG-ready output	RY(n+4)C	"Request inching" input
RX(n+4)D	Unused	RY(n+4)D	"Request low-speed JOG" input
RX(n+4)E	Unused	RY(n+4)E	"Request high-speed JOG" input
RX(n+4)F	Unused	RY(n+4)F	"Designate JOG direction" input OFF: + direction, ON: - direction



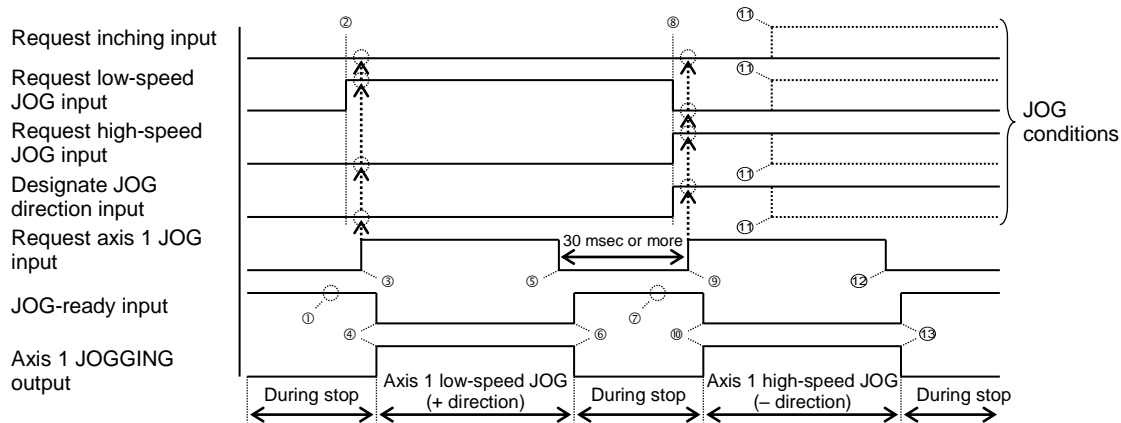
\*1: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

- When the JOG conditions (inching request, low-speed JOG request, high-speed JOG request) and JOG direction are specified, and the JOG request is ON, the corresponding axis performs the JOG operation. Refer to "(2) Example of axis 1 moving".
- JOGGING by I/O signal is not accepted as long as the JOG ready output signal is OFF. The JOG ready output signal is OFF under the following conditions.
  - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - While the "running" output (RXn0) is ON.
  - While the error output (RXn1) is ON.
- When the multiple bits for the "request inching" input, "request low-speed JOG" input and "request high-speed JOG" input are ON, the motions are executed according to the following order.  
Inching > Low-speed JOG > High-speed JOG
- It is not possible to simultaneously move two (2) or more axes at JOGGING. Move each axis separately.
- The axis designated by the JOG move request signal corresponds to the station No.
- The axis stops if the communication through the CC-Link has been severed during JOGGING.

### NOTE

- The JOG operation can be performed within the software limits when the controller understands the current position of the axis (when return to origin is unnecessary). When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in ■ 3.2)
- The JOG operation can be performed even if the controller has lost the current position (return to origin is required). In this case, the software limit is not applied.
- The JOG operation speed can be set in the JOG speed setting in the parameter 1 (refer to sections ■ 13.3.8 to ■ 13.3.11).
- The distance of an inching movement can be set in the JOG increment of the parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in the JOG speed in the parameter 1.
- Each input signal is ORed with each signal of JOG input by I/O. Each signal of JOG output by I/O is also outputted. (Refer to section ■ 10.2.26)

(2) Example of axis 1 moving



- ① Make sure that the JOG-READY signal is ON.
- ② Set the JOG conditions. (In the above figure, low-speed JOG and plus "+" direction are specified.)
- ③ Turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ④ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at low speed in the plus "+" direction.
- ⑤ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑥ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at low speed in the plus "+" direction stops.
- ⑦ Make sure that the JOG-READY signal is ON.
- ⑧ Set the JOG conditions. (In the above figure, high-speed JOG and "-" direction are specified.)
- ⑨ 30 msec or more has passed after ⑤, then turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ⑩ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at high speed in the minus "-" direction.
- ⑪ Even if the JOG conditions have been changed during travel, they are neglected.
- ⑫ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑬ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at high speed in the minus "-" direction stops.

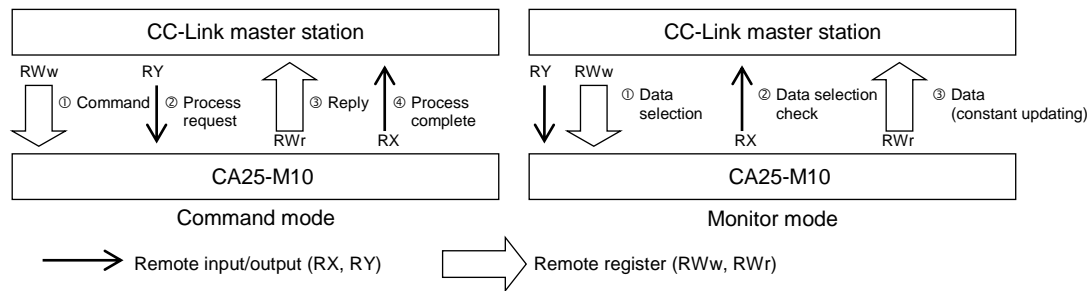
## 11.3 Data Communication

### 11.3.1 Overview of data communication

Two types of data communication are available: Command mode and Monitor mode.

In Command mode, the CA25-M10-<sup>\*</sup>CC returns reply to commands from the CC-Link master station. Although this enables complex data communication, its characteristic of returning replies to commands requires a certain amount of time for the data updating cycle.

In Monitor mode, the data selected by data selection input [RY(n+6)C to RY(n+6)F] and RWw(n) is constantly updated. This eliminates the need for complex handshake signals for realizing high-speed updating cycles.



In Command mode, set all the data selection input [RY(n+6)C to RY(n+6)F] to 0. In Monitor mode, set from 0001 to 1111 based on the monitoring content.

No	RY(n+6)F	RY(n+6)E	RY(n+6)D	RY(n+6)C	Mode	Description
1	0	0	0	0	Command mode (section ■ 11.3.2)	Status request Writing/reading of coordinate table Current position request (monitor) Current offset value request (monitor) Counter value request (monitor) Counter set Writing/reading of speed table Writing/reading of acceleration/deceleration table Writing/reading of override Torque monitor Writing/reading of torque limit table
2	0	0	0	1	Monitor mode (section ■ 11.3.3)	Status monitor
3	0	0	1	0		Current position monitor
4	0	0	1	1		Counter monitor ① Arbitrary selection mode (RWw(n) = 0000h) ② Designated sequence number mode (RWw(n) = 0001h)
5	0	1	0	0		Torque monitor
:	:	:	:	:		Reserved
16	1	1	1	1		Reserved

The value of the data selection input [RY(n+6)C to RY(n+6)F] is output unchangedly to the data selection check output [RX(n+6)C to RX(n+6)F]. During this output, a time difference (t = several 10 mSEC) occurs, and so pay attention to the timing when changing.

Signal name	Device	Timing
Data selection input signal	RY(n+6)C~RY(n+6)F	
Data selection check output signal	RX(n+6)C~RX(n+6)F	

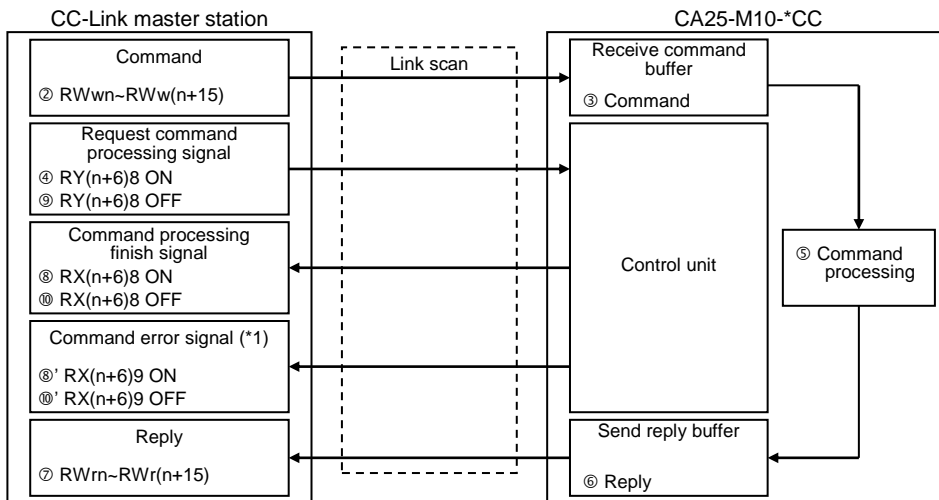
\*: The input and output are based on the direction viewed from the robot controller.

## 11.3.2 Command mode

In the relationship between the CA25-M10-\*CC and CC-Link master station, the CC-Link master station is always the main station, and the CA25-M10-\*CC is the secondary station. Communication uses a half-duplex system where the CC-Link master station issues commands and the CA25-M10-\*CC sends back a reply.

When the CA25-M10-\*CC receives a command that can be processed, an affirmative response or the necessary data is returned. If the process is not possible because the CA25-M10-\*CC is busy or other reasons, an error reply is returned.

The method of data transmission and reception (data flow and timing) is shown in the following figure.



\*1: Only when an error has occurred.

Signal name	Device	Timing
Command	RWwn~RWw(n+15)	Previous command, Command
Request command processing signal	RY(n+6)8	②, ④
Reply	RWrn~RWr(n+15)	Previous reply, Reply
Command processing finish signal	RX(n+6)8	⑦, ⑩
Command error signal	RX(n+6)9	①, ⑧, ⑧', ⑩'
Data selection input signal	RY(n+6)C~RY(n+6)F	0000
Data selection check output signal	RX(n+6)C~RX(n+6)F	0000

Set the data selection input RY(n+6)C to RY(n+6)F to 0000.

- ① Before sending a command, make sure that all handshake signals (request command processing signal, command processing finish signal and command error signal) are set OFF.
- ② Set the command in the remote register.
- ③ The command set in the remote register is transferred to the CA25-M10-\*CC "receive command" buffer via the link scan of the CC-Link.
- ④ The request command processing signal is turned ON.
- ⑤ The command is processed based on the data in the "receive command" buffer in Step ③ above.
- ⑥ The results are set in the "send reply" buffer.
- ⑦ The response set in the "send reply" buffer is transferred to the remote register of the CC-Link master station via the link scan of the CC-Link.
- ⑧ The command processing finish signal turns ON.
- ⑧' If an error has occurred, the command error signal turns ON at the same time.
- ⑨ The request command processing signal turns OFF.
- ⑩ The command processing finish signal turns OFF.
- ⑩' If the command error signal is ON, it turns OFF at the same time.

● Command table

No.	Description	Command/ reply	Remote register (Command = RWwn, Reply = RWrn)					
			+0	+1	+2	+3	+4~+11	+12~+15
1	Request status	Command	B900H	Status No.	Reserved (0 fixed)			
		Reply			Status value	Error code	Reserved (0 fixed)	
2	Write coordinate table	Command	C2C1H	Table No.	Task No.	0 fixed	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
		Reply				Error code		Reserved (0 fixed)
3	Read coordinate table	Command	C3C1H	Table No.	Task No.	Reserved (0 fixed)		
		Reply				Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
4	Request current position (monitor)	Command	E300H	Task No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
5	Request current offset value (monitor)	Command	E400H	Task No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
6	Request counter value (monitor)	Command	E500H	Counter No.	Reserved (0 fixed)			
		Reply			Counter value	Error code	Reserved (0 fixed)	
7	Set counter	Command	E700H	Counter No.	Counter value	Reserved (0 fixed)		
		Reply			0 fixed	Error code	Reserved (0 fixed)	
8	Write speed table	Command	C2C2H	Table No.	0 fixed	0 fixed	Speed	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
9	Read speed table	Command	C3C2H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Speed	Reserved (0 fixed)
10	Write acceleration/deceleration table	Command	C2C3H	Table No.	0 fixed	0 fixed	Time to set speed	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
11	Read acceleration/deceleration table	Command	C3C3H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Time to set speed	Reserved (0 fixed)
12	Write override	Command	D900H	Override value	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Reserved (0 fixed)	
13	Read override	Command	DA00H	Reserved (0 fixed)				
		Reply		Override	0 fixed	Error code	Reserved (0 fixed)	
14	Torque monitor	Command	EE08 H	Reserved (0 fixed)				
		Reply		0 fixed	0 fixed	Error code	Axis 1 torque	Reserved (0 fixed)
15	Writing of torque limit table	Command	C2C5H	Table No.	0 fixed	0 fixed	Torque limit value Load output reference value	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
16	Reading of torque limit table	Command	C3C5H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Torque limit value Load output reference value	Reserved (0 fixed)



- Error code 0000H Normal
- 1000H Command analysis error (An error is found in the command.)
- 20\*\*H Command cannot be executed. (See the explanation of each command.)

● Descriptions on each command

(1) "Request Status" command (B900H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	B9H	00H	Command	RWr(n+0)	B9H	00H	Same value as command
RWw(n+1)	K0-K2		Status number	RWr(n+1)	K0-K2		Status number
RWw(n+2)	Fixed at K0		Use prohibited	RWr(n+2)	00	**H	Status value (*1)
~ RWw(n+15)				RWr(n+3)	Error code		
				RWr(n+4)	Fixed at K0		Unused
				~ RWr(n+15)			



● n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$

\*1: The status value is saved in the lower byte. The upper byte is always fixed at "00".

● Error code 0000H Normal

1000H Command analysis error (An error is found in the command)

Details of each status

Status 0		Status 1		Status 2	
BIT	Description	BIT	Description	BIT	Description
0	1: Error is found.	0	Error code (See Chapter 18)	0	00: Sequential mode 01: Palletizing mode
1	1: During execution	1		10: External point designation mode	
2	1: During pause	2		00: Auto mode 01: Step mode	
3	1: During return to origin	3		10: Program mode	
4	1: Return to origin complete	4		1: Single operation mode	
5	1: Positioning complete	5			
6		6		1: Teach pendant ON	
7	1: Change in Parameter 2.	7		1: Host computer ON	

(2) "Write coordinate table" command (C2C1H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C2H	C1H	Command	RWr(n+0)	C2H	C1H	Same value as command
RWw(n+1)	K1-K999		Table number	RWr(n+1)	K1-K999		Table number
RWw(n+2)	K1-K4		Task number	RWr(n+2)	K1-K4		Task number
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	Error code		
RWw(n+4)	K-800000~K+800000		Axis 1 coordinate	RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused
RWw(n+5)							
RWw(n+6)	K-800000~K+800000		Axis 2 coordinate				
RWw(n+7)							
RWw(n+8)	K-800000~K+800000		Axis 3 coordinate				
RWw(n+9)							
RWw(n+10)	K-800000~K+800000		Axis 4 coordinate				
RWw(n+11)							
RWw(n+12)	Fixed at K0		Use prohibited				
~							
RWw(n+15)							



● n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$

● Data length of coordinate value: 32 bits

● Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)

● When writing "\*\*\*\*\*", specify H7FFFFFFF.

● Error code 0000H Normal

1000H Command analysis error (An error is found in the command.)

(3) "Read coordinate table" command (C3C1H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C3H	C1H	Command	RWr(n+0)	C3H	C1H	Same value as command
RWw(n+1)	K1-K999		Table number	RWr(n+1)	K1-K999		Table number
RWw(n+2)	K1-K4		Task number	RWr(n+2)	K1-K4		Task number
RWw(n+3) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+3)	Error code		
				RWr(n+4)	K-800000~K+800000		Axis 1 coordinate
				RWr(n+5)	K-800000~K+800000		Axis 2 coordinate
				RWr(n+6)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+7)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+8)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+9)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+10)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+11)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+12) ~ RWw(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- When writing "\*\*\*\*\*", reply H7FFFFFFF.
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(4) "Request current position" (monitor) command (E300H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	E3H	00H	Command	RWr(n+0)	E3H	00H	Same value as command
RWw(n+1)	K1-K4		Task number	RWr(n+1)	K1-K4		Task number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K-800000~K+800000		Axis 1 coordinate
				RWr(n+5)	K-800000~K+800000		Axis 2 coordinate
				RWr(n+6)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+7)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+8)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+9)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+10)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+11)	K-800000~K+800000		Axis 4 coordinate
RWr(n+12) ~ RWw(n+15)	Fixed at K0		Unused				



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)



(5) "Request current offset value" (monitor) command (E400H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	E4H	00H	Command	RWr(n+0)	E4H	00H	Same value as command
RWw(n+1)	K1-K4		Task number	RWr(n+1)	K1-K4		Task number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K-800000~K+800000		Axis 1 coordinate
				RWr(n+5)			
				RWr(n+6)	K-800000~K+800000		Axis 2 coordinate
				RWr(n+7)			
				RWr(n+8)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+9)			
				RWr(n+10)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+11)			
RWr(n+12) ~ RWw(n+15)	Fixed at K0		Unused				



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → K+10000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(6) "Request counter value" (monitor) command (E500H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	E5H	00H	Command	RWr(n+0)	E5H	00H	Same value as command
RWw(n+1)	K1-K99		Counter number	RWr(n+1)	K1-K99		Counter number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	K0-K9999		Counter value
				RWr(n+3)	Error code		
				RWr(n+4) ~ RWw(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(7) "Set counter" command (E700H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	E7H	00H	Command	RWr(n+0)	E7H	00H	Same value as command
RWw(n+1)	K1-K99		Counter number	RWr(n+1)	K1-K99		Counter number
RWw(n+2)	K0-K9999		Counter value	RWr(n+2)	Fixed at K0		Unused
RWw(n+3) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+3)	Error code		
				RWr(n+4) ~ RWw(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(8) " Write speed table " command (C2C2H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C2H	C2H	Command	RWr(n+0)	C2H	C2H	Same value as command
RWw(n+1)	K1-K20		Table number	RWr(n+1)	K1-K20		Table number
RWw(n+2)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	Error code		
RWw(n+4)	K10~K99999		Speed	RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused
RWw(n+5)							
RWw(n+6) ~ RWw(n+15)	Fixed at K0		Use prohibited				



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00 [mm/SEC] → K+1000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(9) " Read speed table " command (C3C2H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C3H	C2H	Command	RWr(n+0)	C3H	C2H	Same value as command
RWw(n+1)	K1-K20		Table number	RWr(n+1)	K1-K20		Table number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K10~K99999		Speed
				RWr(n+5)			
				RWr(n+6) ~ RWr(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00 [mm/SEC] → K+1000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(10) " Write acceleration/deceleration table " command (C2C3H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C2H	C3H	Command	RWr(n+0)	C2H	C3H	Same value as command
RWw(n+1)	K1-K20		Table number	RWr(n+1)	K1-K20		Table number
RWw(n+2)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	Error code		
RWw(n+4)	K1~K999		Time to set speed	RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused
RWw(n+5)							
RWw(n+6) ~ RWw(n+15)	Fixed at K0		Use prohibited				



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of "time to set speed" value: 32 bits
- Unit of "time to set speed" value: 0.01 [SEC] (Ex.: +0.30 [SEC] → K+30)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(11) " Read acceleration/deceleration table " command (C3C3H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C3H	C3H	Command	RWr(n+0)	C3H	C3H	Same value as command
RWw(n+1)	K1-K20		Table number	RWr(n+1)	K1-K20		Table number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K1~K999		Time to set speed
				RWr(n+5)			
				RWr(n+6) ~ RWr(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of "time to set speed" value: 32 bits
- Unit of "time to set speed" value: 0.01 [SEC] (Ex.: +0.30 [SEC] → K+30)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(12) " Write override " command (D900H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	D9H	00H	Command	RWr(n+0)	D9H	00H	Same value as command
RWw(n+1)	K1-K100		Override	RWr(n+1)	K1-K100		Override
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Unit of override value: [%]
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)  
2000H Controller error state

(13) " Read override " command (DA00H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	DAH	00H	Command	RWr(n+0)	DAH	00H	Same value as command
RWw(n+1) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+1)	K1-K100		Override
				RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Unit of override value: [%]
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)  
2000H Controller error state

(14) " Torque monitor " command (EE08H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	EEH	08H	Command	RWr(n+0)	EEH	08H	Same value as command
RWw(n+1) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+1)	Fixed at K0		Unused
				RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K-999~K+999		Task 1
				RWr(n+5)			Axis 1 torque
				RWr(n+6) ~ RWr(n+15)	Fixed at K0		Unused



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of torque value: 32 bits
- Unit of torque value: 0.01 [T] (Ex.: +2.00 [T] → K+200)
- T: Rating torque
- Torque of axes 2 and larger numbers in task 1 cannot be monitored.
- Torque of axes in tasks 2 to 4 cannot be monitored.
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(15) " Writing of torque limit table " command (C2C5H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)				
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks	
RWw(n+0)	C2H	C5H	Command	RWr(n+0)	C2H	C5H	Same value as command	
RWw(n+1)	K1-K8		Table number	RWr(n+1)	K1-K8		Table number	
RWw(n+2)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused	
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	Error code			
RWw(n+4)	K1~K999		Torque limit value	RWr(n+4) ~ RWr(n+15)	Fixed at K0		Unused	
RWw(n+5)								Load output reference value
RWw(n+6)								
RWw(n+7)	K1~K999							
RWw(n+8)	Fixed at K0		Use prohibited					
RWw(n+15)								



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Torque limit value data length: 32 bits
- Load output reference value data length: 32 bits
- Unit: 0.01 [T] (Ex.: 3.00 [T] → K+300)
- T: Rating torque
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(16) " Reading of torque limit table " command (C3C5H)

Command (CC-Link master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	C3H	C5H	Command	RWr(n+0)	C3H	C5H	Same value as command
RWw(n+1)	K1-K8		Table number	RWr(n+1)	K1-K8		Table number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Error code		
				RWr(n+4)	K1-K999		Torque limit value
				RWr(n+5)			
				RWr(n+6)	K1-K999		Load output reference value
				RWr(n+7)			
				RWr(n+8) ~ RWr(n+15)	Fixed at K0		Use prohibited

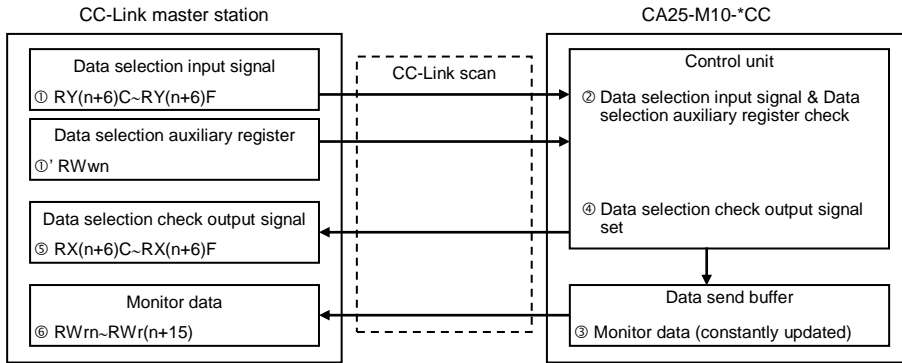


- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Torque limit value data length: 32 bits
- Load output reference value data length: 32 bits
- Unit: 0.01 [T] (Ex.: 3.00 [T] → K+300)
- T: Rating torque
- Error code   0000H   Normal  
                  1000H   Command analysis error (An error is found in the command.)

### 11.3.3 Monitor mode

In Monitor mode, the data selected by data selection input [RY(n+6)C to RY(n+6)F] is constantly updated for realizing high-speed updating cycles.

The method of data transmission and reception (data flow and timing) is shown in the following figure.



Signal name	Device	Timing
Data selection input signal	RY(n+6)C~RY(n+6)F	A
Data selection auxiliary register	RWwn	A'
Monitor data	RWrn~RWr(n+15)	Previous data / Monitor data (constantly updated)
Data selection check output signal	RX(n+6)C~RX(n+6)F	A

• The data selection auxiliary register may not be used depending on a selected monitor.

- ① Set the data selection signal and data selection auxiliary register.
- ② The data selection signal is transferred to CA25-M10-\*CC by the CC-Link scan.
- ③ The data selected by the data selection signal and data selection auxiliary register is set to the data send buffer. The data send buffer is updated at 1-ms cycles.
- ④ Set the data selection check output signal. Set the value of the data selection check output signal to the same value as the data selection signal.
- ⑤ The data selection check output signal that was set in step ④ is transferred to the remote input (RX) of the CC-Link master station by the CC-Link scan.
- ⑥ The data that was set in step ③ is transferred to the remote register (RWr) of the CC-Link master station by the CC-Link scan.

#### • List of monitors

No.	Description	Data selection input signal				Auxiliary register	Remarks
		RY(n+6)F	RY(n+6)E	RY(n+6)D	RY(n+6)C	RWwn	
1	Status monitor	0	0	0	1	Unused	
2	Current position monitor	0	0	1	0	Used	Task number
3	Counter monitor	0	0	1	1	0000h	Arbitrary selection mode
						0001h	Designated sequence number mode
4	Torque monitor	0	1	0	0	Unused	
5	Reserved	0	1	0	1	-	
:	Reserved	...	...	...	...	-	
15	Reserved	1	1	1	1	-	

● Explanation of monitors

(1) Status monitor

Remote register	b15-----b8	b7-----b0	Remarks
RWr(n+0)	00H	01H	Data selection check (*1)
RWr(n+1)	Fixed at K0		Use prohibited
RWr(n+2)	Fixed at K0		Use prohibited
RWr(n+3)	Fixed at K0		Use prohibited
RWr(n+4)	00H	**H	Status 0 (*2)
RWr(n+5)	00H	**H	Status 1 (*2)
RWr(n+6)	00H	**H	Status 2 (*2)
RWr(n+7)	00H	**H	Status 3 (*2)
RWr(n+8) ~ RWr(n+15)	Fixed at K0		Use prohibited



● n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$

\*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.

\*2: The status value is stored to the lower byte.

The upper byte is constantly fixed at 00.

Status descriptions

Status 0		Status 1		Status 2		Status 3	
BIT	Description	BIT	Description	BIT	Description	BIT	Description
0	1: Error occurred	0	Error code (Refer to Chapter 18)	0	00: Sequential mode 01: Palletizing mode	0	1: Servo ON
1	1: Execution in progress	1		1	10: External point designation mode	1	
2	1: Pause in progress	2		2	00: Auto mode	2	
3	1: Return to origin in progress	3		3	01: Step mode 10: Program mode	3	
4	1: Return to origin complete	4		4	1: Single operation mode	4	
5	1: Positioning complete	5		5		5	
6		6		6	1: Teach pendant ON	6	
7	1: Parameter 2 modified	7		7	1: Host computer ON	7	

(2) Current position monitor

Monitor (CC-Link Master station → CA25-M10-*CC)				Response (CC-Link Master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	Fixed at K0		Use prohibited	RWr(n+0)	00H	02H	Data selection check (*1)
RWw(n+1)	K1-K4		Task number	RWr(n+1)	K1-K4		Task number
RWw(n+2) ~ RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+2)	Fixed at K0		Unused
				RWr(n+3)	Fixed at K0		Unused
				RWr(n+4)	K-800000~K+800000		Axis 1 coordinate
				RWr(n+5)	K-800000~K+800000		Axis 2 coordinate
				RWr(n+6)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+7)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+8)	K-800000~K+800000		Axis 3 coordinate
				RWr(n+9)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+10)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+11)	K-800000~K+800000		Axis 4 coordinate
				RWr(n+12)	00H	**H	Status 0 (*2)
RWr(n+13)	00H	**H	Status 1 (*2)				
RWr(n+14)	00H	**H	Status 2 (*2)				
RWr(n+15)	00H	**H	Status 3 (*2)				



● n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$

● Coordinate data length: 32 bits

● Coordinate units: 0.01 mm (Ex.: +100.00 mm → K +10000)

\*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.

\*2: The status values are stored at lower byte.

Upper byte are always fixed at 00.

Refer to section (1) Status monitor for the status description.

(3) Counter monitor

The counter monitor can be operated in two modes: "arbitrary selection mode" for monitoring arbitrary seven counters; and "designated subsequent number mode" for monitoring subsequent 14 counters. Either of two modes can be selected using the data selection auxiliary register RWwn.

① Arbitrary selection mode (RWwn = 0000H)

Monitoring up to seven arbitrary counters set to RWw(n+2, 4, 6, 8, A, C, E)

Monitor (CC-Link master station → CA25-M10-*CC)				Response (CC-Link master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	00H	00H	Mode selection	RWr(n+0)	00H	03H	Arbitrary selection mode (*1)
RWw(n+1)	Fixed at K0		Use prohibited	RWr(n+1)	Fixed at K0		Unused
RWw(n+2)	K1-K99 (*2)		Counter number 1	RWr(n+2)	K1-K99		Counter number 1
RWw(n+3)	Fixed at K0		Use prohibited	RWr(n+3)	K0-K9999		Value of counter number 1
RWw(n+4)	K1-K99 (*2)		Counter number 2	RWr(n+4)	K1-K99		Counter number 2
RWw(n+5)	Fixed at K0		Use prohibited	RWr(n+5)	K0-K9999		Value of counter number 2
RWw(n+6)	K1-K99 (*2)		Counter number 3	RWr(n+6)	K1-K99		Counter number 3
RWw(n+7)	Fixed at K0		Use prohibited	RWr(n+7)	K0-K9999		Value of counter number 3
RWw(n+8)	K1-K99 (*2)		Counter number 4	RWr(n+8)	K1-K99		Counter number 4
RWw(n+9)	Fixed at K0		Use prohibited	RWr(n+9)	K0-K9999		Value of counter number 4
RWw(n+10)	K1-K99 (*2)		Counter number 5	RWr(n+10)	K1-K99		Counter number 5
RWw(n+11)	Fixed at K0		Use prohibited	RWr(n+11)	K0-K9999		Value of counter number 5
RWw(n+12)	K1-K99 (*2)		Counter number 6	RWr(n+12)	K1-K99		Counter number 6
RWw(n+13)	Fixed at K0		Use prohibited	RWr(n+13)	K0-K9999		Value of counter number 6
RWw(n+14)	K1-K99 (*2)		Counter number 7	RWr(n+14)	K1-K99		Counter number 7
RWw(n+15)	Fixed at K0		Use prohibited	RWr(n+15)	K0-K9999		Value of counter number 7



\*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored at lower byte of RWr(n+0). "00H" is stored at upper byte.

\*2: In the case where a number other than "K1 to K99" is designated for counter number, 0 will be returned to that counter number.



② Designated subsequent mode (RWw = 0001H)

Monitoring subsequent counters (up to 14) starting with the counter number set to RWw(n+1).

Monitor (CC-Link master station → CA25-M10-*CC)				Response (CC-Link master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWw(n+0)	00H	01H	Mode selection	RWr(n+0)	01H	03H	Designated subsequent mode (*1)
RWw(n+1)	K1-K99 (*2)		First counter number	RWr(n+1)	K1-K99		First counter number
RWw(n+2)	Fixed at K0		Use prohibited	RWr(n+2)	K0-K9999		Value of first counter
RWw(n+3)				RWr(n+3)	K0-K9999		Value of first counter +1
RWw(n+4)				RWr(n+4)	K0-K9999		Value of first counter +2
RWw(n+5)				RWr(n+5)	K0-K9999		Value of first counter +3
RWw(n+6)				RWr(n+6)	K0-K9999		Value of first counter +4
RWw(n+7)				RWr(n+7)	K0-K9999		Value of first counter +5
RWw(n+8)				RWr(n+8)	K0-K9999		Value of first counter +6
RWw(n+9)				RWr(n+9)	K0-K9999		Value of first counter +7
RWw(n+10)				RWr(n+10)	K0-K9999		Value of first counter +8
RWw(n+11)				RWr(n+11)	K0-K9999		Value of first counter +9
RWw(n+12)				RWr(n+12)	K0-K9999		Value of first counter +10
RWw(n+13)				RWr(n+13)	K0-K9999		Value of first counter +11
RWw(n+14)				RWr(n+14)	K0-K9999		Value of first counter +12
RWw(n+15)				RWr(n+15)	K0-K9999		Value of first counter +13



\*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored at lower byte of RWr(n+0). "01H" is stored at upper byte.

\*2: In the case where a number other than "K1 to K99" is designated for counter number, 0 will be returned to that counter number. In the case where a number K87 or larger is designated for the first counter number, 0 will be returned to the values after counter number 99.

(4) Torque monitor

Remote register	b15-----b8	b7-----b0	Remarks
RWr(n+0)	00H	04H	Data selection check (*1)
RWr(n+1)	Fixed at K0		Unused
RWr(n+2)	Fixed at K0		Unused
RWr(n+3)	Fixed at K0		Unused
RWr(n+4)	K-999~K+999		Task 1
RWr(n+5)			Axis 1 torque
RWr(n+6)	Fixed at K0		Unused
RWr(n+7)	Fixed at K0		Unused
RWr(n+8)	Fixed at K0		Unused
RWr(n+9)	Fixed at K0		Unused
RWr(n+10)	Fixed at K0		Unused
RWr(n+11)			Unused
RWr(n+12)	00H	**H	Status 0 (*2)
RWr(n+13)	00H	**H	Status 1 (*2)
RWr(n+14)	00H	**H	Status 2 (*2)
RWr(n+15)	00H	**H	Status 3 (*2)



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Data length of torque value: 32 bits
- Unit of torque value: 0.01 [T] (Ex.: +2.00 [T] → K+200)
- T: Rating torque
- Torque of axes 2 and larger numbers in task 1 cannot be monitored.
- Torque of axes in tasks 2 to 4 cannot be monitored.
- \*1: The same value as the data selection check output signal RX(n+6)C to RX(n+6)F is stored.
- \*2: The status values are stored at lower byte.  
Upper bytes are always fixed at 00.  
Refer to section (1) Status monitor for the status description.

## ■ 11.4 Speed control mode through CC-Link

### ■ 11.4.1 Overview

This controller is operable in the speed control mode when instructed via the CC-Link. This mode can be used for applications that features continued unidirectional rotation, such as the drive source of a belt-driven device.

**⚠ CAUTION** The speed control mode is not subject to the software limit. Therefore, do not set the speed control mode for mechanisms whose operating range is limited. Doing so can cause damage to the machines and workpieces or personal injury.

### ■ 11.4.2 Speed control specifications

Speed control specifications

Number of control axes	1 (*1)
Speed specification range	-3000 to +3000 [rpm] (Specified with RWwn)
Acceleration/deceleration time	20 steps (variable)

\*1: Speed control cannot be performed through slave units. To use the speed control mode with multiple motors, control all the motors through the master unit.

### ■ 11.4.3 Items prohibited

Do not perform any of the following operations/settings when the speed control mode is active:

- Operations performed by the teach pendant or SF98D
  - Return to origin
  - Start operation
  - JOG operation
  - Servo locking
- Change to any of the following modes
  - External point designation mode
  - Palletizing mode

## ■ 11.4.4 Settings of speed control mode

This section describes the setting method of the speed control mode.

(1) CC-Link setting

To activate the speed control mode, set "9" as the ones digit of the option value in the CC-Link setting of the mode setting. (Refer to section 0)

Turn OFF the power once after changing the value.

```
[PARA]M17
CC STATION : 01
-Link BAUDRATE:156K
OPTION :0009
```

(2) Setting of motor rotation direction

Specify the rotation direction with the motor output shaft viewed from the load side in the direction of motor rotation setting of the parameter 2. (Refer to section ■ 13.4.5)

Turn OFF the power once after changing the value.

```
[PARA]K05 A0=1
ROTATION A1=1
DIRECTION A2=1
          A3=1
```

Setting value	Rotation direction
0	Counterclockwise (CCW)
1	Clockwise (CW)

(3) Encoder type setting

Set the incremental encoder type "i" in the encoder type setting of the parameter 2. (Refer to section ■ 13.4.17)

If the absolute encoder type "a" is left unchanged, an encoder backup error occurs each time the power is turned ON.

Turn OFF the power once after changing the value.

```
[PARA]K17
ENCODER TYPE

[ i ]
```

## 11.4.5 List of I/O signals

If the speed control mode is set, the I/O signals are changed as shown in the following table:

Signal direction (CC-Link master station ← CA25-M10-*CC)		Signal direction (CC-Link master station → CA25-M10-*CC)	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
RXn0	Running output	RYn0	Rotation command input
RXn1	Error output	RYn1	Servo-on input
RXn2	Target speed achievement output	RYn2	Use prohibited
RXn3	Use prohibited	RYn3	Reset input
RXn4~RXn7	Target speed validation output	RYn4~RYn7	Target speed validation input
RXn8~RXnF	Acceleration/deceleration table number selection output	RYn8~RYnF	Acceleration/deceleration table number selection input
RX(n+1)0~RX(n+7)F	Use prohibited	RY(n+1)0~RY(n+7)F	Use prohibited



- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 2$
- Inputs and outputs in the signal names are based on direction viewed from the CA25-M10-\*CC
- Set "use prohibited" bits to 0.

## 11.4.6 List of I/O data

If the speed control mode is set, the I/O data is changed as shown in the following table:

(CC-Link master station → CA25-M10-*CC)				(CC-Link master station ← CA25-M10-*CC)			
Remote register	b15-----b8	b7-----b0	Remarks	Remote register	b15-----b8	b7-----b0	Remarks
RWwn	K-3000 to K+3000		Target speed	RWrn	Current speed		Unit: [rpm]
RWw(n+1)	K0 fixed		Use prohibited	RWr(n+1)	K0 fixed		Unused
RWw(n+2)							
RWw(n+3)							
RWw(n+4)				00H	**H	Status 0 (*1)	
RWw(n+5)				00H	**H	Status 1 (*1)	
RWw(n+6)				00H	**H	Status 2 (*1)	
RWw(n+7)				00H	**H	Status 3 (*1)	
RWw(n+8)				K0 fixed		Unused	
~							
RWw(n+15)							

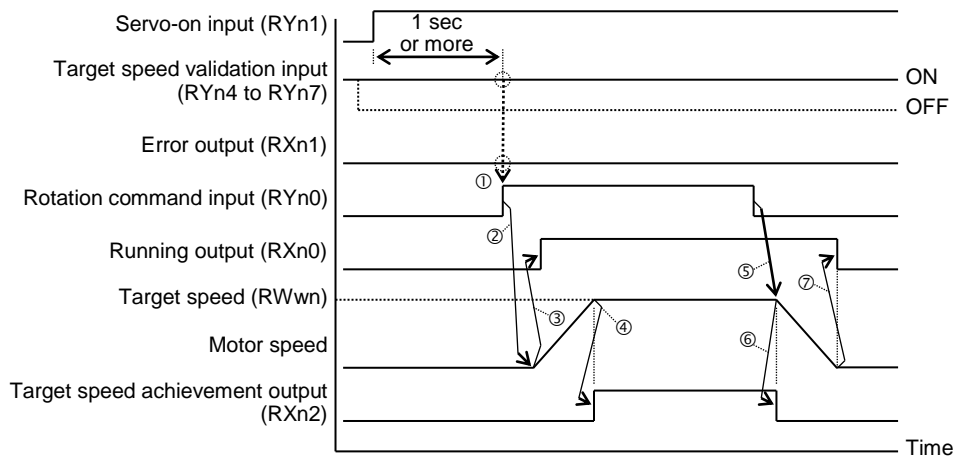


- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 4$
- Target speed unit: 1 [rpm] (Ex.: +1000 [rpm] → K+1000)
- Current speed is speed at which the motor is running. The units of current speed and target speed are the same.
- \*1: The status value is stored in the lower byte. The upper byte is always set to 00.  
For the details of each status, refer to section ■ 11.3.3-(1).

- The target speed (RWwn) value can be changed while the motor is running. For example, when the target speed (RWwn) is changed from K+1,500 to K+3,000, the motor speed changes from 1,500 [rpm] to 3,000 [rpm].
- To change the sign of the target speed (RWwn) value (i.e., to reverse the rotation direction of the motor), set the target speed (RWwn) to K+0, and change the sign of the value after the motor has stopped (with running output (RXn0) OFF). The motor is stopped if the sign of the target speed value is changed without this procedure being performed. To recover the motor, turn OFF the rotation command input (RYn0), and then turn it ON.

## ■ 11.4.7 Details of I/O signals

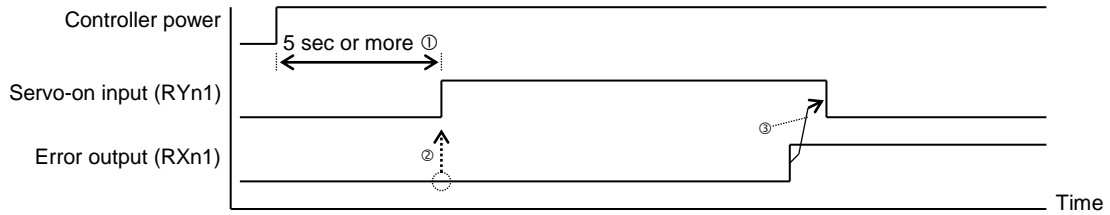
- (1) Rotation command input (RYn0), running output (RXn0), and target speed achievement output (RXn2)
- When the rotation command input (RYn0) is turned ON, the motor starts running; when it is turned OFF, the motor stops.
  - The rotation command input (RYn0) is not accepted in the following cases:
    - Servo-on input (RYn1) is OFF.
    - Error output (RXn1) is ON.
    - Not all the target speed validation inputs (RYn4 to RYn7) are set to 1's.
    - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - Turn ON the rotation command input (RYn0) one second or more after the servo-on input (RYn1) is turned ON. If the time interval is too short, the motor will not start running. If the motor does not start, turn OFF the rotation command input (RYn0), and turn it ON one second or more after the servo-on input is turned ON.
  - If the error output (RXn1) is turned ON, turn OFF both the rotation command input (RYn0) and the servo-on input (RYn1).
  - The running output (RXn0) is ON during motor rotation.
  - The target speed achievement output (RXn2) is ON while the motor speed is maintained at the target speed (RWwn). This output is based on the speed command value in the controller, and the actual motor speed is not reflected in the output. Thus, use the output as a rough standard. If the information of actual motor speed is necessary, refer to the current speed (RWrn).



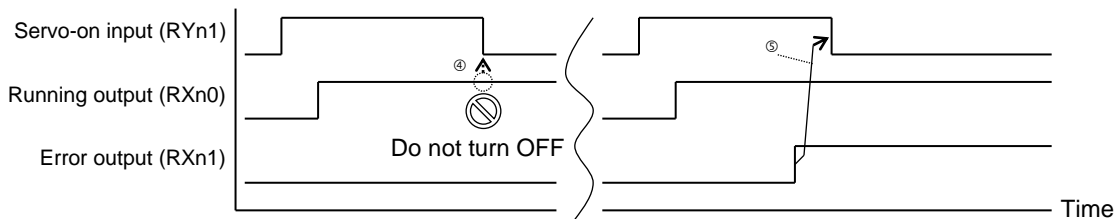
- ① Before turning ON the rotation command input (RYn0), confirm that:
  - one second or more has passed after turning ON the servo-on input (RYn1),
  - the four bits of target speed validation inputs (RYn4 to RYn7) are all ON, and
  - the error output (RXn1) is OFF.
- ② When the rotation command input (RYn0) is turned ON, the motor starts running.
- ③ When the motor starts running, the running output (RXn0) is turned ON.
- ④ When the target speed (RWwn) is achieved, the target speed achievement output (RXn2) is turned ON.
- ⑤ When the rotation command input (RYn0) is turned OFF, the motor starts deceleration.
- ⑥ When the motor starts deceleration, the target speed achievement output (RXn2) is turned OFF.
- ⑦ When the motor has stopped, the running output (RXn0) is turned OFF.

(2) Servo-on input (RYn1)

- This signal gets the motor to enter the servo-on state. When the signal is turned ON, the servo is turned ON; when it is turned OFF, the servo is turned OFF.  
The signal is valid when the error output (RXn1) is OFF.
  - The servo-on input (RYn1) is not accepted in any of the following cases:
    - Error output (RXn1) is ON.
    - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - If the error output (RXn1) is turned ON, turn OFF the servo-on input (RYn1).
  - Do not turn OFF the servo-on input (RYn1) when the running output (RXn0) is ON.  
(Except when the error output (RXn1) is turned ON)
- If the servo-on input (RYn1) is turned OFF during motor rotation, the motor enters the servo-off state, and runs through inertia until it stops.



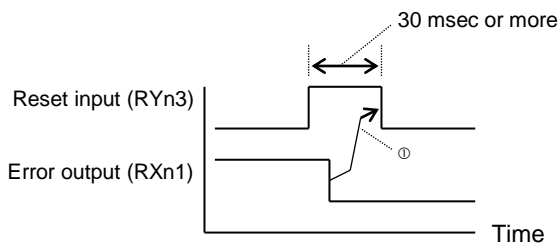
- ① Turn ON the servo-on input at least five seconds after turning ON the power.
- ② Before turning ON the servo-on input (RYn1), confirm that the error output (RXn1) is OFF.  
If the error output (RXn1) is ON, eliminate the cause of the error, and then reset the error state.
- ③ When the error output (RXn1) is turned ON, turn OFF the servo-on input (RYn1).



- ④ Do not turn OFF the servo-on input (RYn1) when the running output (RXn0) is ON.  
(The motor enters the servo-off state, and runs through inertia until it stops.)
- ⑤ Even when the running output (RXn0) is ON, turn OFF the servo-on input (RYn1) if the error output (RXn1) is turned ON.

(3) Reset input (RYn3)

- This signal resets the error state.



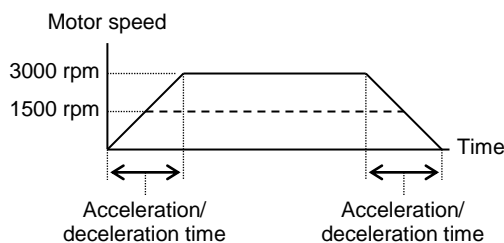
- ① After the error output (RXn1) is turned OFF, change the reset input (RYn3) back to OFF.  
Alternatively, turn it OFF 30 msec or more after the reset input (RYn3) is turned ON.  
Note that if the cause of the error is not eliminated, the error output (RXn1) is not turned OFF.

- (4) Target speed validation inputs (RYn4-RYn7), and target speed validation outputs (RXn4-RXn7)
- Target speed validation inputs (RYn4-RYn7) are interlock signals to prevent the motor from accidentally running.
  - When all the target speed validation inputs (RYn4-RYn7) are set to 1's, the target speed (RWwn) value becomes valid. If any of the bits is not set to 1, the target speed (RWwn) value becomes invalid and the motor does not run.
  - For target speed validation outputs (RXn4-RXn7), the values of target speed validation inputs (RYn4-RYn7) are output without being changed.
- (5) Acceleration/deceleration table number selection inputs (RYn8-RYnF), and acceleration/deceleration table number selection outputs (RXn8-RXnF)
- Specify an acceleration/deceleration table number (1-20) with acceleration/deceleration table number selection input (RYn8-RYnF). (Refer to section ■ 13.5.3)
  - The acceleration/deceleration table value turns out to be motor acceleration/deceleration time (unit: seconds). This value can be changed with the acceleration/deceleration table in the parameter.
  - Acceleration/deceleration time is a period of time until the motor speed reaches 0-3000 rpm.
  - If the target speed (RWwn) is lower than 3000 rpm, time for reaching the target speed (RWwn) is shorter than the acceleration/deceleration time.
  - For acceleration/deceleration table number selection outputs (RXn8-RXnF), the values of acceleration/deceleration table number selection inputs (RYn8-RYnF) are output without being changed.

		Bit Patterns							
		RYnF	RYnE	RYnD	RYnC	RYnB	RYnA	RYn9	RYn8
Acceleration/deceleration table numbers to be specified	1	0	0	0	0	0	0	0	1
	2	0	0	0	0	0	0	1	0
	.								
	10	0	0	0	0	1	0	1	0
	.								
	19	0	0	0	1	0	0	1	1
	20	0	0	0	1	0	1	0	0



The table number 20 is selected when the bit pattern is not any of those in the above table.



- (6) Error output (RXn1)
- This signal is turned ON if a controller error occurs.
  - When the error output (RXn1) is turned ON, turn OFF both the rotation command input (RYn0) and the servo-on input (RYn1).
  - When error is removed and then the reset input (RYn3) is turned ON, the error output (RXn1) turns OFF.



## ■ 11.5 Maximum torque limit function

### ■ 11.5.1 Overview

This controller enables the limitation of the maximum torque when indicated via the CC-Link. This function can be used for clamping or inserting workpieces.

The maximum torque limit function described in this section is equipped for compatibility with conventional models. To newly use a maximum torque limit function, use the maximum torque limit function described in section ■ 16.11.

If contention with the maximum torque limit function described in section ■ 16.11 occurs, the lower torque limit will be valid.

**CAUTION** If the maximum torque limit is too low when used with a vertical axis, the current position cannot be retained, and a sudden drop can cause damage to the workpiece or the hand, or cause your hand to be caught in.

### ■ 11.5.2 Specifications for the maximum torque limit function

Specifications for the maximum torque limit function

Number of control axes	1 (*1)
Number of torque selection	4
Torque setting range	0.01 to 9.99 T (*2)
Operation with the maximum torque limit function excluded	Return to origin (*3)

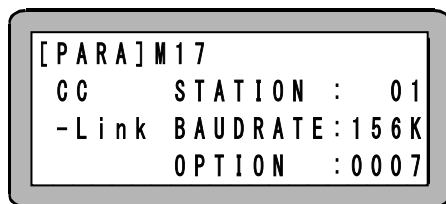
\*1: The maximum torque limit function cannot be used through slave units. To perform the maximum torque limit function with multiple axes, control all the axes through the master unit.

\*2: T: Rated torque (Torque larger than the motor instantaneous maximum torque is not outputted.)

\*3: If a maximum torque limit is applied, return to origin might not be performed normally. Thus, the maximum torque limit function is disabled during return to origin.

### ■ 11.5.3 Setting of the maximum torque limit function

To activate the maximum torque limit function, set "7" as the ones digit of the option value in the CC-Link setting of the mode setting (refer to section 0). Turn OFF the power once after changing the value.



## 11.5.4 Setting of a maximum torque limit value

Use the setting value of an acceleration/deceleration table Nos. 17 to 20.

- For how to set an acceleration/deceleration table, refer to section 13.5.3.
- For the method to set the acceleration/deceleration table from CC-Link data communication, refer to section 11.3.2-(10).
- Assuming the rated torque to be 1.00, set n-fold torque to be the maximum torque.
- The input range is from 0.01 to 9.99T, but torque larger than the motor instantaneous maximum torque is not outputted.
- Select a table number through table selection input. (Refer to section 11.5.5-(1))
- An acceleration/deceleration table value can be changed at arbitrary timing. The new value is reflected to the maximum torque of the motor immediately after the change. (For the change method, refer to section 11.3.2-(10))
- The initial values are as follows:

Acceleration/deceleration table number	17	18	19	20
Maximum torque limit value [T]	0.90	0.95	1.00	1.05

**NOTE** To prevent unintentional torque limit from being applied, set the unused acceleration/deceleration table No. 17 to 20 to the instantaneous maximum torque of 3.00.  
The accuracy of torque is not guaranteed, so use it as a rough standard.  
As the maximum torque limit value is smaller, the error of torque increases due to an influence from the sliding resistance.

## 11.5.5 Special I/O signals

If the maximum torque limit function is set, the following I/O signals are assigned as special I/O signals.

Signal direction (CC-Link master station ← CA25-M10-*CC)		Signal direction (CC-Link master station → CA25-M10-*CC)	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
RX(n+4)0~RX(n+4)1	Table confirmation output	RY(n+4)0~RY(n+4)1	Table selection input

- ?**
- n: Address assigned to CA25-M10-\*CC by station number setting.  $n = (\text{Station number} - 1) \times 2$
  - Inputs and outputs in the signal names are based on direction viewed from the CA25-M10-\*CC
  - No change to the I/O signals other than the above. (Refer to section 11.2.1)

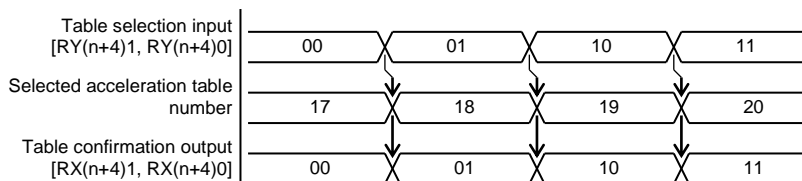
### (1) Table selection inputs [RY(n+4)0 to RY(n+4)1]

- Select one of the acceleration/deceleration tables Nos. 17 to 20.
- Another table can be selected during movement.
- Table selection inputs are assigned to general input ports, so the status can be viewed through the sequential program.
  - RY(n+4)0: General input port 0-08-1
  - RY(n+4)1: General input port 0-08-2

Acceleration/ deceleration table to be selected	Table selection input	
	[RY(n+4)1]	[RY(n+4)0]
17	0	0
18	0	1
19	1	0
20	1	1

### (2) Table confirmation outputs [RX(n+4)0 to RX(n+4)1]

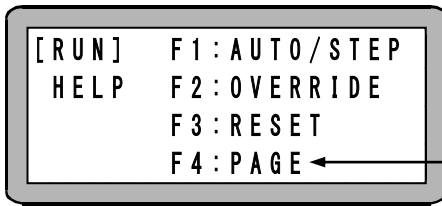
- Use the signals to confirm the acceleration/deceleration table number selected.
- For the table confirmation outputs, the values of table selection inputs [RY(n+4)0 to RY(n+4)1] are output without being changed.



- Table confirmation outputs [RX(n+4)0 to RX(n+4)1] are assigned to general output ports, so the values can be changed through the sequential program. However, note that they are overwritten with the values of table selection inputs [RY(n+4)0 to RY(n+4)1] in a cyclic manner.
  - RX(n+4)0: General input port 0-08-1
  - RX(n+4)1: General input port 0-08-2

## ■ 11.6 CC-Link status

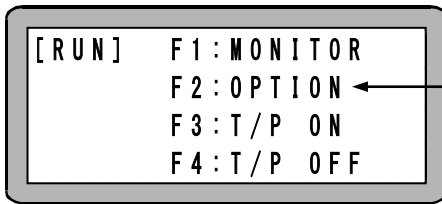
CC-Link status can be monitored through the teach pendant.



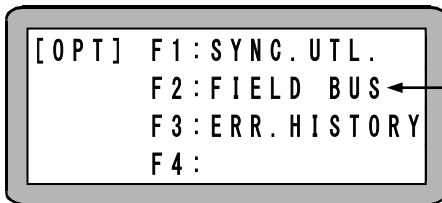
**STEP 1** Activate the RUN mode, and press the **(HELP)** key. The screen on the left will appear.  
Press the **(F4)** key.



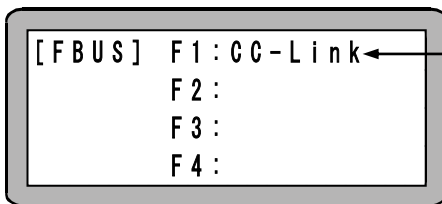
"AUTO/STEP" does not appear when the external point designation mode is set.



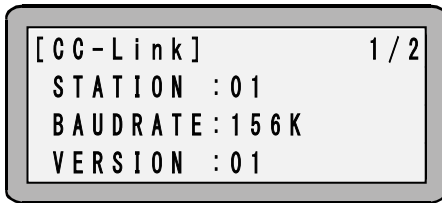
**STEP 2** Press the **(F2)** key.  
To return to RUN mode, press the **(ESC)** key.



**STEP 3** Press the **(F2)** key.  
To return to STEP 2, press the **(ESC)** key.



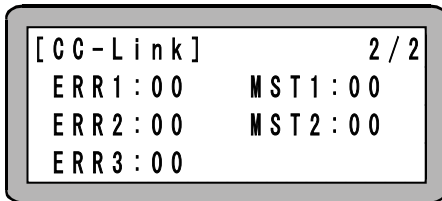
**STEP 4** Press the **(F1)** key.  
To return to STEP 3, press the **(ESC)** key.



**STEP 5** CC-Link status monitor screen (1/2) appears.  
To display the STEP 6 screen, press the **(NEXT)** key.  
To return to STEP 4, press the **(ESC)** key.



- If the CC-Link module is not connected, a hyphen (-) is displayed instead of the setting value.
- "STATION" indicates the currently set CC-Link station number.
- "BAUDRATE" indicates the currently set communication speed.
- "VERSION" indicates the version number of the LSI mounted on the CC-Link board.



**STEP 6** CC-Link status monitor screen (2/2) appears.  
To display the STEP 5 screen, press the **(NEXT)** key.  
To return to STEP 4, press the **(ESC)** key.



- If the CC-Link module is not connected, a hyphen (-) is displayed instead of the numeric value.

● ERR1: Error information 1

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	0	0	STERR

STERR: Station number setting error      0: Normal      1: Error (Zero, 62 or a greater value is set as a station number.)

● ERR2: Error information 2 (transmission status)

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	ERR22	ERR21	ERR20

ERR20: CRC error      0: Normal      1: Error  
 ERR21: Time-out error      0: Normal      1: Error  
 ERR22: Channel-0 carrier detection status      0: Normal      1: CRC Error

● ERR3: Error information 3 (number of received-data items)

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
0	0	0	0	0	ERR32	ERR31	ERR30

ERR30: RY or RWw data count error      0: Normal      1: Less than the local station data count  
 ERR31: RY data count error      0: Normal      1: Less than the local station data count  
 ERR32: RWw data count error      0: Normal      1: Less than the local station data count

● MST1: Status information 1

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
MST17	MST16	MST15	MST14	MST13	MST12	MST11	MST10

MST10: Sequencer CPU      0: STOP      1: RUN  
 MST11: Sequencer CPU      0: Normal      1: Abnormal  
 MST12: Refresh      0: Stop      1: Start  
 MST13: Transient      0: No      1: Yes  
 MST14: Transient receiving      0: Permitted      1: Not permitted  
 MST15: Transfer      0: Permitted      1: Not permitted  
 MST16: Transfer to the master station      0: No      1: Yes  
 MST17: Master station      0: Current master station      1: Standby master station

● MST2: Status information 2

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
MST27	MST26	MST25	MST24	MST23	MST22	MST21	MST20

MST23	MST22	MST21	MST20	RY data transmission points
0	0	0	0	0 points
0	0	0	1	256 points (32 bytes)
0	0	1	0	512 points (64 bytes)
0	0	1	1	768 points (96 bytes)
0	1	0	0	1024 points (128 bytes)
0	1	0	1	1280 points (160 bytes)
0	1	1	0	1536 points (192 bytes)
0	1	1	1	1792 points (224 bytes)
1	0	0	0	2048 points (256 bytes)

MST27	MST26	MST25	MST24	RWw data transmission points
0	0	0	0	0 points
0	0	0	1	32 points (64 bytes)
0	0	1	0	64 points (128 bytes)
0	0	1	1	96 points (192 bytes)
0	1	0	0	128 points (256 bytes)
0	1	0	1	160 points (320 bytes)
0	1	1	0	192 points (384 bytes)
0	1	1	1	224 points (448 bytes)
1	0	0	0	256 points (512 bytes)

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# Chapter 12 DeviceNet

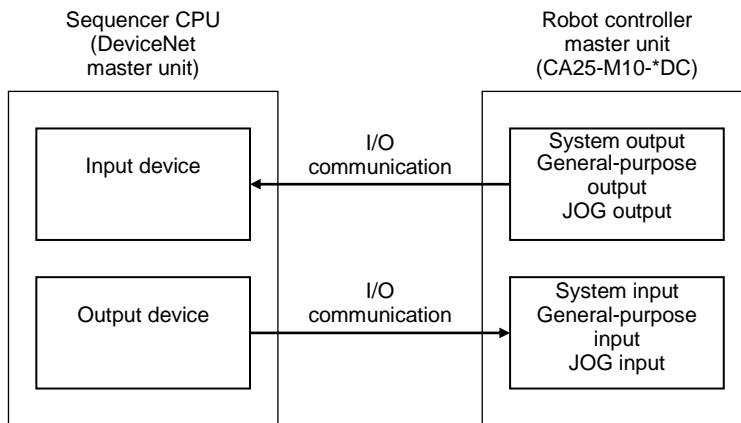
## 12.1 DeviceNet function

When the controller is equipped with the DeviceNet unit, DeviceNet can be used. This chapter describes the DeviceNet interface.

DeviceNet is a field network interface that features a minimized wiring design in a low-cost structure and high-speed data communication. The DeviceNet interface allows data communication for various input/output and JOG operation.

### 12.1.1 Overview

This controller can be handled as a DeviceNet slave station for enabling I/O data communication. For details of the DeviceNet system specifications and various limitations, refer to the document published by ODVA (Open DeviceNet Vendor Association, Inc.) or the document supplied with the master station unit of the DeviceNet system.

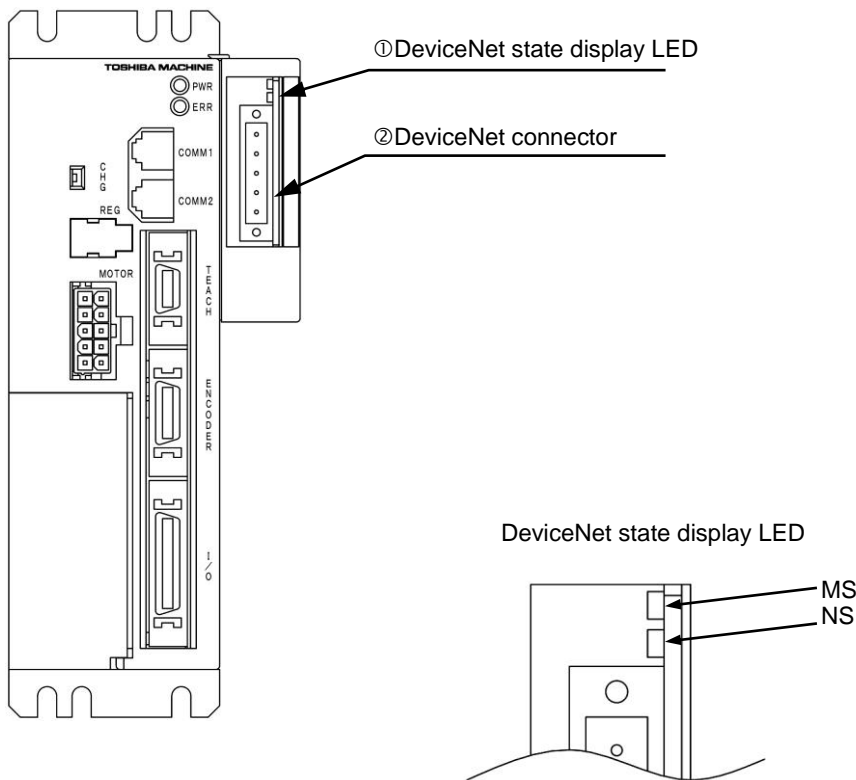


### 12.1.2 DeviceNet specifications

Item	Specification		
Communication protocol	Compliant with DeviceNet		
Support connection	I/O connection (polling)		
Communication speed	125k/250k/500k bps (Set by parameter)		
Station number setting	0 – 63 (Set by parameter)		
Cable lengths	Communication speed	Thick cable	Thin cable
	125 k	500 m	100 m
	250 k	250 m	
	500 k	100 m	
Number of occupied points	Send: 128 points    Receive: 128 points		
Number of input/output points (*1)	System input: 4 points, System output: 4 points		
	General-purpose input: 64 points, General-purpose output: 64 points		
	JOG input: 8 points, JOG output: 8 points		
Vendor ID	733		
Device type	0 (Generic Device)		
Product code	11 (CA25-M10-*DC)		

\*1: The input and output are based on the direction viewed from the robot controller.

### ■ 12.1.3 Explanation of DeviceNet component



① DeviceNet status display LED

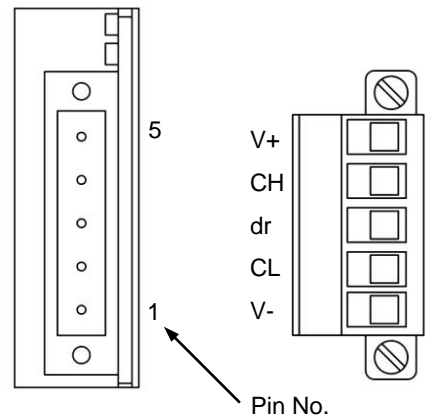
Name	Color	On/Off		Cause/Remedy
MS	Green	● On	Normal	Normal status
		★ Flashing	Unset status	An error has occurred in the setting value in the CA25-M10. Check the settings and restart. This can also indicate standby status. Check if the master unit has started normally.
	Red	● On	Critical fault	A hardware error has occurred (such as DPRAM, internal ROM, internal RAM, EEPROM, CAN error, or WDT error). Restart. If the error occurs again, replace the unit.
		★ Flashing	Minor fault	An error has occurred in the user settings, and a user-side interrupt timeout has occurred. Re-check the settings, and restart.
	-	○ Off	No power supply	The power is not supplied, or initialization is in progress. Check the power supply.
NS	Green	● On	Normal	One or more connections are established (running) in online status.
		★ Flashing	Connection wait	The master unit is not starting normally. (A configuration error has occurred in the master unit I/O area.) Check if the master unit has started normally.
	Red	● On	Critical communication error	A communication error has occurred (such as a duplicate node address, busoff detection, mismatched baud rate, etc.) Check the connection, noise, node address settings, baud rate settings, and other parameters, and then restart.
		★ Flashing	Minor communication error	Communication with the master unit has timed out. Check the master unit status, connection, noise, node address settings, baud rate settings, and other parameters, and then restart.
	-	○ Off	No power supply	Either there is no power supply, or there is a WDT error, baud rate check in progress, or duplicate node address check in progress. Check the power supply.

\* ★ Flashing repeats ON and OFF every 0.5 seconds.

② DeviceNet connector

The exclusive DeviceNet cable for data linkage is connected to this connector.  
The cable is supplied with the controller.

Pin No.	Signal name	Symbol	Wire color
5	V+	V+	Red
4	CANH	CH	White
3	Shield	dr	Shield
2	CANL	CL	Blue
1	V-	V-	Black

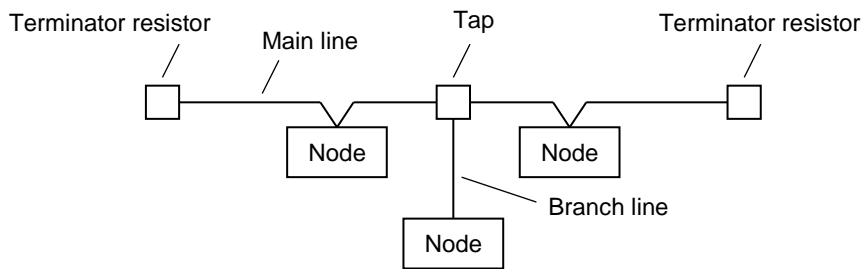


### ■ 12.1.4 Connection of exclusive DeviceNet cable

The cable connection order is not related to the station number setting (MAC ID).

Be sure to always connect a terminator resistor (121 Ω, 1% metal coating, 1/4 W) at both ends of the main line. Connect the terminator resistor between CANH and CANL.

A terminator resistor is not supplied with this controller.



For details on the cable connections, refer to the master station operating manual or document published by the ODVA.

### ■ 12.1.5 DeviceNet settings

(1) CA25-M10-\*DC settings

The station number (MAC ID) and baud rate are specified by DeviceNet settings in the mode setting. To enable a modified value, turn the power off and then on again. (Refer to section ■ 13.2.18.)

(2) DeviceNet master station settings

Make the DeviceNet master station settings by following the master station operating manual.



## ■ 12.2 Connection with external devices

### ■ 12.2.1 List of master unit (CA25-M10-\*DC) I/O signals

Signal direction: DeviceNet master station ← CA25-M10-*DC		Signal direction: DeviceNet master station → CA25-M10-*DC (*1)	
Input Device No. (Offset) (*2)	Signal name	Output Device No. (Offset) (*2)	Signal name (*5)
+0	Running output	+0	Return to origin input
+1	Error output	+1	Start input
+2	Positioning complete output	+2	Stop input
+3	Return to origin complete output	+3	Reset input
+4 ~ +7	Use prohibited	+4 ~ +7	Use prohibited
+8 ~ +15	General output port 1-1 ~ 8	+8 ~ +15	General input port 1-1 ~ 8
+16 ~ +23	General output port 2-1 ~ 8	+16 ~ +23	General input port 2-1 ~ 8
+24 ~ +31	General output port 3-1 ~ 8	+24 ~ +31	General input port 3-1 ~ 8
+32 ~ +39	General output port 4-1 ~ 8	+32 ~ +39	General input port 4-1 ~ 8
+40 ~ +47	General output port 5-1 ~ 8	+40 ~ +47	General input port 5-1 ~ 8
+48 ~ +55	General output port 6-1 ~ 8	+48 ~ +55	General input port 6-1 ~ 8
+56 ~ +63	General output port 7-1 ~ 8	+56 ~ +63	General input port 7-1 ~ 8
+64 ~ +71	General output port 8-1 ~ 8	+64 ~ +71	General input port 8-1 ~ 8
+72 ~ +79	JOG output (*3)	+72 ~ +79	JOG input (*3)
+80 ~ +127	Reserved (*4)	+80 ~ +127	Reserved (*4)



\*1: If DeviceNet communication is cut off, the stop input is set to 1, and all others are cleared to 0. However, during T/P operation, the stop input is also cleared to 0.

\*2: Offset amount from the start device (unit: bits)

\*3: Refer to sections ■ 12.2.2 and ■ 12.2.4.

\*4: Area reserved for future function expansion (Fix at 0.)

\*5: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

## ■ 12.2.2 System I/O

### (1) System input (DeviceNet master station → CA25-M10-\*DC)

Signal name	Remote device (*1)	Normal mode	External point designation mode	Remarks
Return to origin	+0	ON: Start of return to origin operation.	Return to origin	Detection of leading edge
Start input	+1	ON: Restart from currently stopped step or from pausing.	ON: Starts moving based on currently specified table information.	
Stop input	+2	ON: Stops after current step has been executed.	Invalid	When this input is ON, return to origin and start input are invalid.
Reset input	+3	ON: Cancels an error status. (Valid while program execution is stopped.)	ON: Cancels an error status.	
JOG input	+72 ~ +79	A selected axis is moved by JOGGING after the motion mode (JOG, low-speed or high-speed) and travel direction are specified.		Section ■ 12.2.4

\*1: Offset amount from the start device (unit: bits)



The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

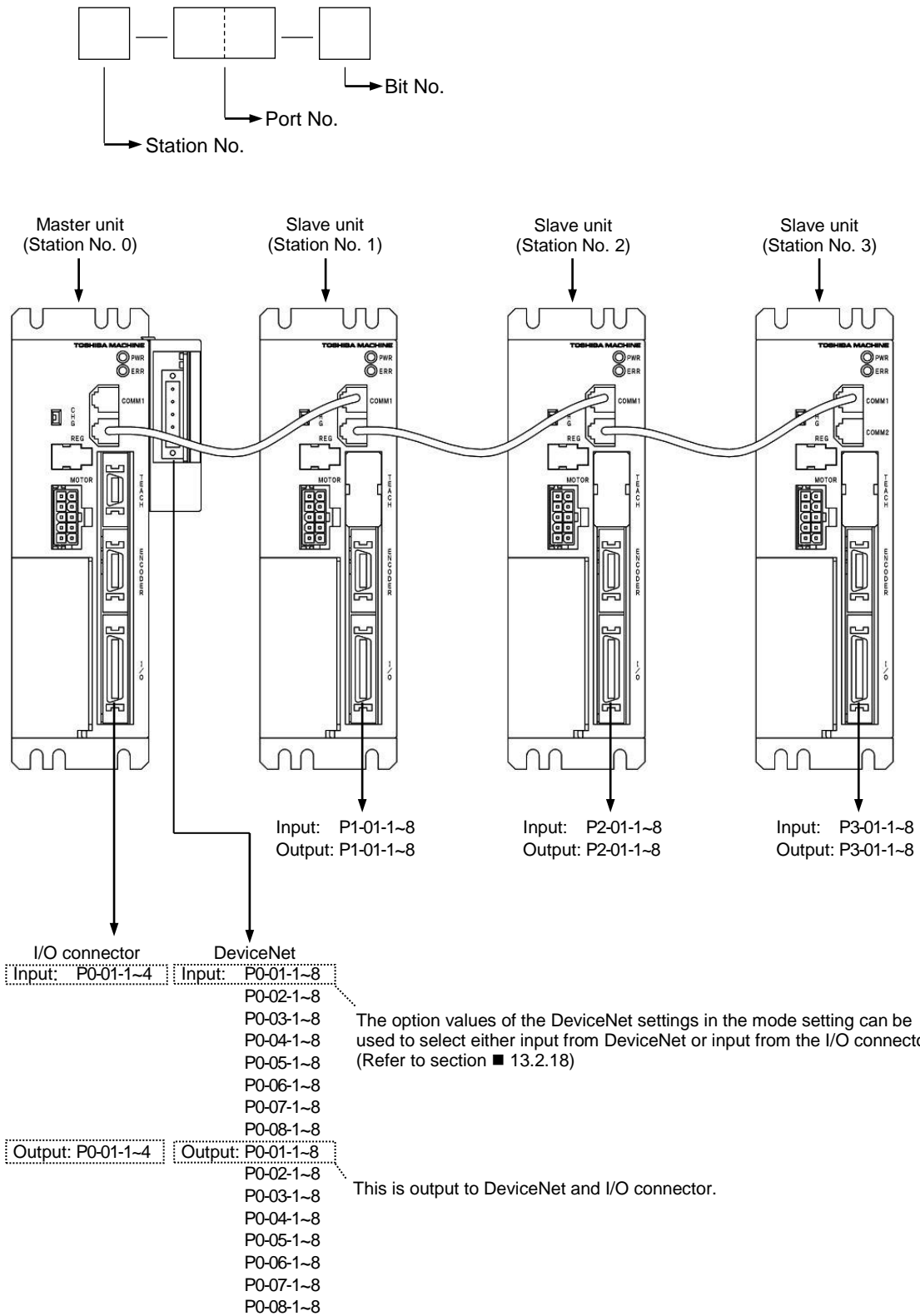
### (2) System output (CA25-M10-\*DC → DeviceNet master station)

Signal name	Remote device (*1)	Normal mode	External point designation mode	Ref.
Running output	+0	ON during controller operation and during return to origin.	ON during robot operation.	Section ■ 10.2.13
Error output	+1	ON at error generation.	Same as left	Section ■ 10.2.14
Positioning complete output	+2	ON when the robot has been located at a predetermined position. OFF while the robot is moving. (Remains OFF when it is paused.)	Same as left	Section ■ 10.2.15
Return to origin complete output	+3	ON when return to origin is completed.	Same as left	Section ■ 10.2.16
JOG output	+72 ~ +79	Acceptance or rejection of JOG, active status, etc. are displayed.		Section ■ 12.2.4

\*1: Offset amount from the start device (unit: bits)

### ■ 12.2.3 Name of general-purpose I/O port and teach pendant display

In the controller's system configuration, there are master unit, slave unit and DeviceNet unit input/output ports. These input/output ports are displayed on the Teach Pendant as shown below.



● For the correspondence between the port numbers and input/output device, refer to section ■ 12.2.1.

## ■ 12.2.4 JOG input/output

(1) List of JOG input/output signals

Signal direction: DeviceNet master station ← CA25–M10–*DC		Signal direction: DeviceNet master station → CA25–M10–*DC	
Input Device No. (Offset) (*1)	Signal name	Output Device No. (Offset) (*1)	Signal name (*2)
+72	" Axis 1 JOGGING" output (Station No. 0)	+72	"Request axis 1 JOG" input (Station No. 0)
+73	" Axis 2 JOGGING" output (Station No. 1)	+73	"Request axis 2 JOG" input (Station No. 1)
+74	" Axis 3 JOGGING" output (Station No. 2)	+74	"Request axis 3 JOG" input (Station No. 2)
+75	" Axis 4 JOGGING" output (Station No. 3)	+75	"Request axis 4 JOG" input (Station No. 3)
+76	JOG-READY output	+76	"Request inching" input
+77	Unused	+77	"Request low-speed JOG" input
+78	Unused	+78	"Request high-speed JOG" input
+79	Unused	+79	"Designate JOG direction" input OFF: + direction, ON: – direction



\*1: Offset amount from the start device (unit: bits)

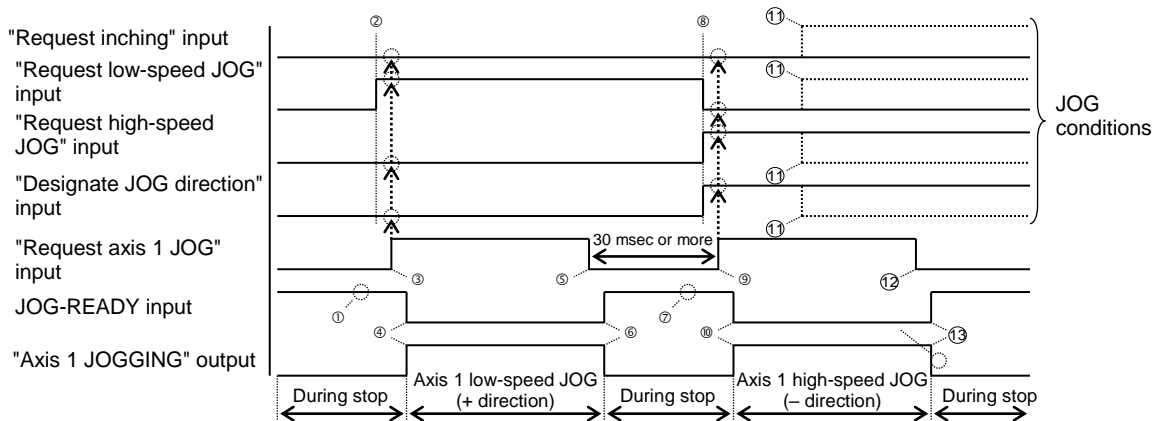
\*2: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

- When the JOG conditions (inching request, low-speed JOG request, high-speed JOG request) and jog direction are specified, and the JOG request is ON, the corresponding axis performs the JOG operation. Refer to "(2) Example of axis 1 moving".
- JOGGING by I/O signal is not accepted as long as the JOG READY output signal is OFF. The JOG READY output signal is OFF under the following conditions.
  - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - While the running output is ON.
  - While the error output is ON.
- When the multiple bits for the "request inching" input, "request low-speed JOG" input and "request high-speed JOG" input are ON, the motions are executed according to the following order.  
Inching > Low-speed JOG > High-speed JOG
- It is not possible to simultaneously move two (2) or more axes at JOGGING. Move each axis separately.
- The axis designated by the JOG move request signal corresponds to the station No.
- The axis stops if the communication through the DeviceNet has been severed during JOGGING.

### NOTE

- The JOG operation can be performed within the software limits when the controller understands the current position of the axis (when return to origin is unnecessary). When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in section ■ 3.2)
- The JOG operation can be performed even if the controller has lost the current position (return to origin is required). In this case, the software limit is not applied.
- The JOG operation speed can be set in the JOG speed setting in the parameter 1 (refer to sections ■ 13.3.8 to ■ 13.3.11).
- The distance of an inching movement can be set in the JOG increment of the parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in the JOG speed in the parameter 1.
- Each input signal is ORed with each signal of JOG input by I/O. Each signal of JOG output by I/O is also outputted. (Refer to section ■ 10.2.26)

(2) Example of axis 1 moving



- ① Make sure that the JOG-READY signal is ON.
- ② Set the JOG conditions. (In the above figure, low-speed JOG and plus "+" direction are specified.)
- ③ Turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ④ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at low speed in the plus "+" direction.
- ⑤ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑥ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at low speed in the plus "+" direction stops.
- ⑦ Make sure that the JOG-READY signal is ON.
- ⑧ Set the JOG conditions. (In the above figure, high-speed JOG and "-" direction are specified.)
- ⑨ 30 msec or more has passed after ⑤, then turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ⑩ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at high speed in the minus "-" direction.
- ⑪ Even if the JOG conditions have been changed during travel, they are neglected.
- ⑫ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑬ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at high speed in the minus "-" direction stops.

# Chapter 13 Parameter Setting

Various parameters can be set in the PRGM modes other than the palletizing mode. The parameters can be divided into the following four kinds.

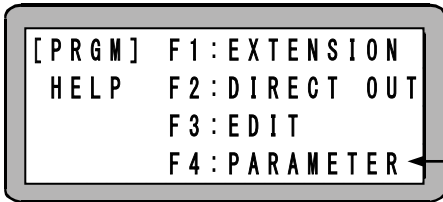
- Mode setting Designation of the bits for system input, and external point designation mode, etc., can be carried out.
- Parameter 1 Parameters whose settings will be changed frequently
- Parameter 2 Parameters whose settings will be changed less frequently than parameter 1
- Table Tables of coordinates, speed, acceleration, MVM, and torque limit

**NOTE**

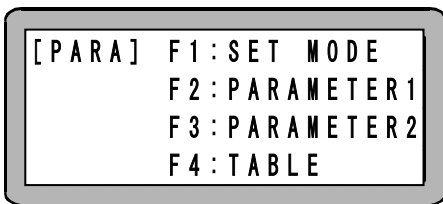
- Data displayed on the teach pendant is written into the controller when the screen is changed by pressing the (NEXT), (-NEXT) or (ESC) key.  
Note that pressing the (ENT) key for entry of the parameter value does not write the data into the controller.

## ■ 13.1 How to enter and leave the PARA mode

Press the (HELP) key in PRGM mode. The following display appears. (Refer to section ■ 5.1.1)



**STEP 1** When this display appears, press the (F 4) key to go to PARA mode instruction.  
Press the (ESC) key to return to the PRGM mode screen.



**STEP 2** Press the (F 1) key to enable mode setting.  
Press the (F 2) key to set parameter 1.  
Press the (F 3) key to set parameter 2.  
Press the (F 4) key to set table.  
Press the (ESC) key to return to the PRGM mode screen.

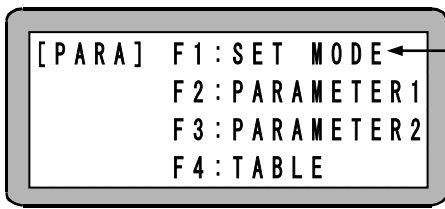
## ■ 13.2 Method of mode setting

The mode should be set for the following items.

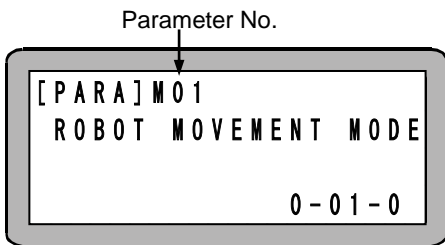
No.	Name	Compatible start version		
		CA25-M10	TPH-4C	SF-98D
1	Single operation mode input bit designation			
2	Continuous start input bit designation			
3	Escape input bit designation			
4	Pause input bit designation			
5	Program selection input bit designation			
6	Palletizing input bit designation			
7	Pausing output bit designation			
8	Input wait output bit designation			
9	Teach Pendant display Japanese/English			
10	Invalid/point			
11	General-purpose output clear for emergency stop or reset Valid/Invalid	4.12	2.28	3.1.2
12	Direct output bit designation			
13	READY output bit designation			
14	Task positioning complete output bit designation			
15	Task return to origin complete output bit designation			
16	BS amplifier transmission fiber cable length designation			
17	CC-Link setting			
18	DeviceNet setting (*1)			
19	Battery alarm output bit designation			
20	Moving coordinate table number output in external point designation mode Valid/Invalid			
21	Servo ON input bit designation	4.14	2.31	3.1.4
22	Torque limit input bit designation			
23	Coordinate table base designation in external point designation mode			
24	Task load output bit designation	4.29	2.33	3.1.6
25	Task limit output bit designation			
26	Task lock output bit designation			
27	Positive logic/negative logic selection (input 1)	4.35	2.37	3.2.1
28	Positive logic/negative logic selection (input 2)			
29	Positive logic/negative logic selection (input 3)			
30	Positive logic/negative logic selection (input 4)			
31	Positive logic/negative logic selection (output 1)			
32	Positive logic/negative logic selection (output 2)			
33	Positive logic/negative logic selection (output 3)			
34	Positive logic/negative logic selection (output 4)			
35	JOG input bit designation	4.36	2.38	3.2.2
36	JOG output bit designation			
37	Special function setting	Depend on function	2.39	3.3.0
38	IP address	4.41	2.40	3.3.1
39	Subnet mask			
40	Default gateway			

\*1: Turn OFF the power and then turn ON again after change of 18. Setting of DeviceNet. For the other parameters, turning OFF the power is unnecessary.

Enter the PARA mode to set the mode. (Refer to section ■ 13.1)



**STEP 1** When this display appears, press the **F1** key.



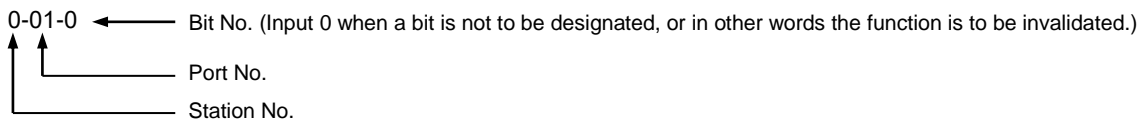
**STEP 2** Press the **NEXT** key or the **-NEXT** key to move to the M01 to M23 mode setting screens.  
To quit the parameter setting, press the **ESC** key.

● Search function

When the **SEARCH** key is pressed and the parameter No. is input, the mode setting screen can be searched.

● Bit designation screen

When designating a bit, 0-01-0 will display on the lower right of the screen. The meanings of the numbers are as follow.

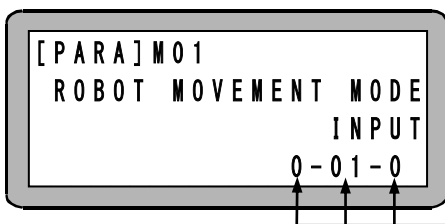


Refer to section ■ 10.1.5 for the names of the ports.

● Jump function

When the **F1** key is pressed, the mode setting screen jumps. For example, when M01 to M09, M10 appears.

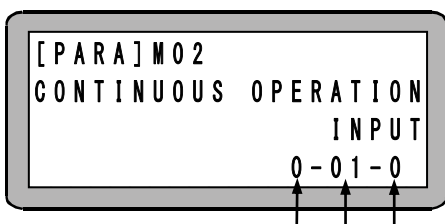
■ 13.2.1 Bit designation of single operation mode input



**STEP 1** Use the numeric keypad to designate the input bit and press the **ENT** key.  
Press the **NEXT** key to display the next screen  
Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to section 0.

■ 13.2.2 Bit designation of continuous start input

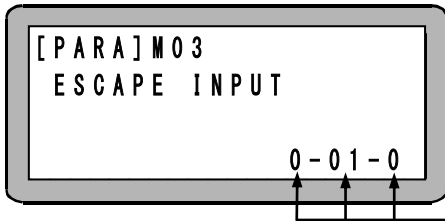


**STEP 1** Use the numeric keypad to designate the input bit and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.

**?** ● Only the station No. 0 (master unit) can be used.  
● For details of the function, refer to section ■ 10.2.6.



### ■ 13.2.3 Bit designation of escape input



STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.

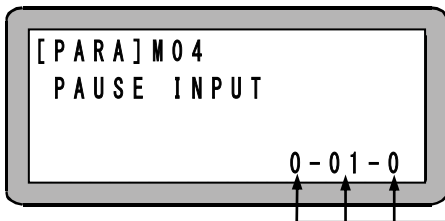
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.7.

### ■ 13.2.4 Bit designation of pause input



STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.

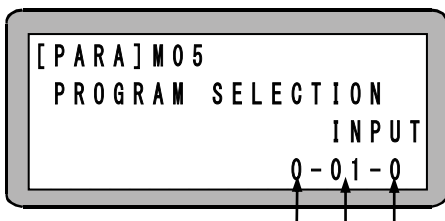
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.8.

### ■ 13.2.5 Bit designation of program selection input



STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.

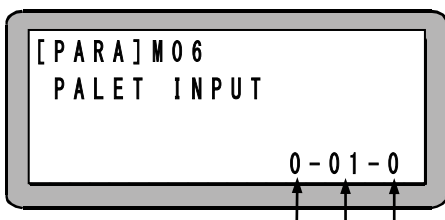
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.9.

### ■ 13.2.6 Bit designation of palletizing input



STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.

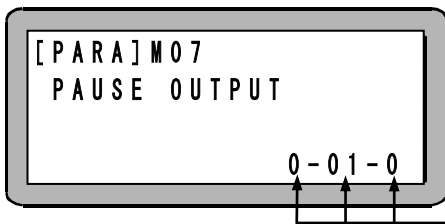
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.10.

### ■ 13.2.7 Bit designation of pausing output



STEP 1

Use the numeric keypad to designate the output bit and press the **ENT** key.

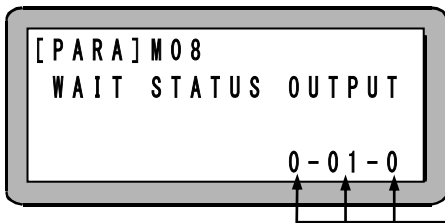
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.17.

### ■ 13.2.8 Bit designation of input wait output



STEP 1

Use the numeric keypad to designate the output bit and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

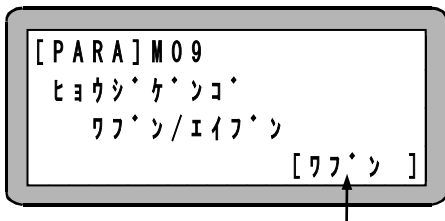
Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.18.

### ■ 13.2.9 Setting of Teach Pendant display (Japanese/English)

(1) Japanese language setting



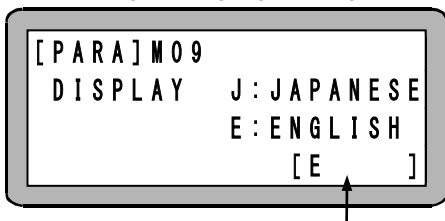
STEP 1

Switch between Japanese/English by pressing the **ALT** key and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.

(2) English language setting



STEP 1

Switch between Japanese/English by pressing the **ALT** key and press the **ENT** key.

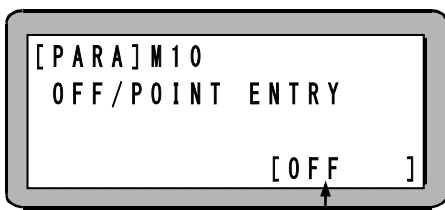
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



- The screen display language of the teach pendant can be selected with this setting.
- Default setting: English

### ■ 13.2.10 Setting of invalid/point

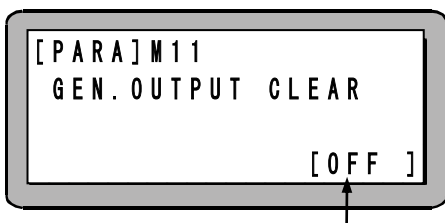


**STEP 1** Toggle OFF (invalid)/POINT with the **(ALT)** key, and then press the **(ENT)** key.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to return to the PARA mode screen.

**?** The mode can be selected with this setting. The relation of the display and mode is as follows.

Display	Mode	Reference
OFF (invalid)	Sequential mode or palletizing mode	Chapter 5 and Chapter 7
POINT	External point designation mode	Chapter 8

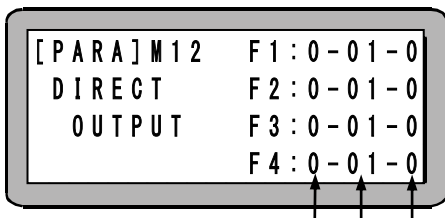
### ■ 13.2.11 Setting of general-purpose output clear for emergency stop or reset



**STEP 1** Switch between Invalid/Valid with the **(ALT)** key.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to return to the PARA mode screen.

- ?** When this mode setting is validated, all general-purpose outputs will be turned OFF during emergency stop or reset. When "invalid" is set, the state of general-purpose output will be held.
- When continuous start input is set, the continuous start setting will have a priority. (Refer to section ■ 10.2.6)

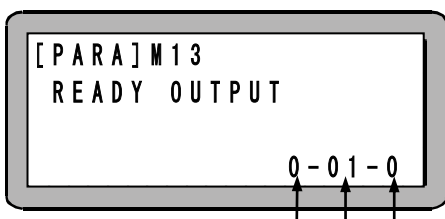
### ■ 13.2.12 Bit designation of direct output



**STEP 1** Use the numeric keypad to designate the output bit and press the **(ENT)** key.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to return to the PARA mode screen.

**?** Direct output means to turn the general-purpose output ON or OFF directly by pressing the function keys (F1 to F4) on the Teach Pendant. (Refer to section ■ 16.8.1) The general-purpose output bit assigned to each function key is set here.

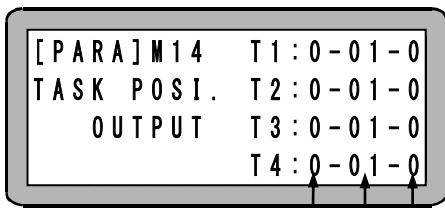
### ■ 13.2.13 Bit designation of READY output



**STEP 1** Use the numeric keypad to designate the output bit and press the **(ENT)** key.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to return to the PARA mode screen.

**?** For details of the function, refer to section ■ 10.2.19.

### ■ 13.2.14 Bit designation of task positioning complete output



STEP 1

Use the numeric keypad to designate the output bit and press the (ENT) key.

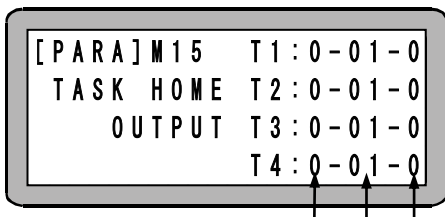
Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.

Press the (ESC) key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.20.

### ■ 13.2.15 Bit designation of task return to origin complete output



STEP 1

Use the numeric keypad to designate the output bit and press the (ENT) key.

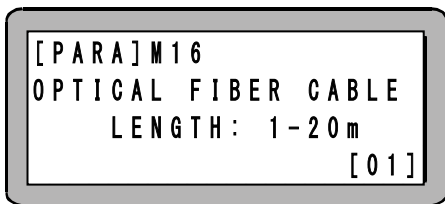
Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.

Press the (ESC) key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.21.

### ■ 13.2.16 Designation of BS amplifier transmission fiber cable length



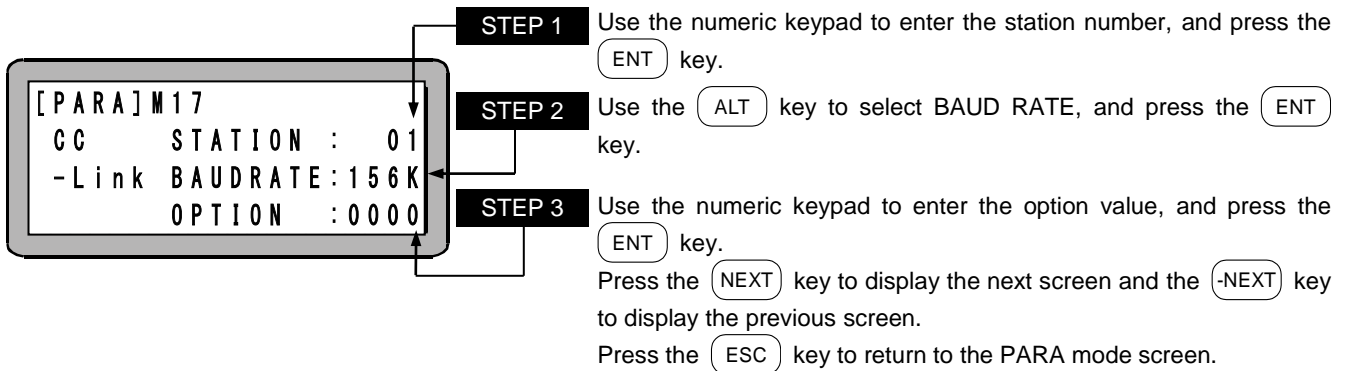
STEP 1

This parameter is invalid for this machine.

Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.

Press the (ESC) key to return to the PARA mode screen.

## ■ 13.2.17 Setting of CC-Link

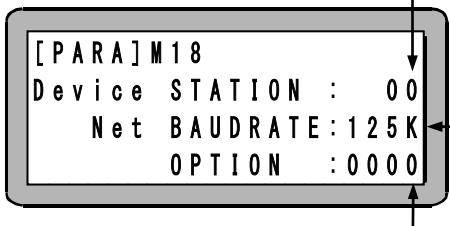


- The STATION option sets the CC-Link unit station number. This controller occupies the four consecutive stations from the station number that was set. Therefore, the valid range of setting values is 1 to 61. The setting is invalid if the 0 station or 62 station or higher is set.  
(Initial value: 0, Setting range: 0 to 99)
- The BAUD RATE option sets the CC-Link transmission speed. The settable transmission speed varies depending on the total cable length, CC-Link version, and cable types.  
(Initial value: 156K, Selection range: 156K, 625K, 2.5M, 5M, 10M)
- For the controller equipped with CC-Link unit, when the thousands place of the option value is "0", all system input and general-purpose input from CC-Link is enabled.  
When "1" is set, system input and general-purpose input (port 1) of the master unit is enabled from the input/output connectors.  
(Initial value: 0000, Setting range: 0000 to 9999) (Refer to section ■ 11.2.3)
- The functions below are assigned to the ones place of the option value.
  - 0: Normal
  - 7: Maximum torque limit function (Refer to section ■ 11.5)
  - 9: Speed control mode (Refer to section ■ 11.4)

### **CAUTION**

The other functions are assigned to the ones, tens and hundreds place of the option value. Change a value after understanding the contents of the applicable function well. When a value is changed carelessly, the robot may move unexpectedly and a machine or a workpiece may be damaged or someone may be injured.

### ■ 13.2.18 Setting of DeviceNet



**STEP 1** Use the numeric keypad to enter the station number, and press the **ENT** key.

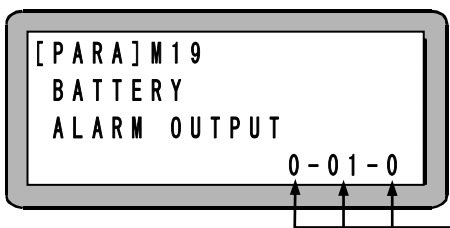
**STEP 2** Use the **ALT** key to select BAUD RATE, and press the **ENT** key.

**STEP 3** Use the numeric keypad to enter the option value, and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.



- The power must be turned OFF and then on again after changing the value of this parameter.
- The STATION option sets the DeviceNet unit station number. (Initial value: 0, Setting range: 0 to 99)
- The BAUD RATE option sets the DeviceNet transmission speed. The settable transmission speed varies depending on the total cable length and cable types. (Initial value: 125K, Selection range: 125K, 250K, 500K)
- For the controller equipped with the DeviceNet, when the thousands place of the option value is "0", all system input and general-purpose input from DeviceNet is enabled.  
When "1" is set, system input and general-purpose input (port 1) of the master unit is enabled from the input/output connectors. (Initial value: 0000, Setting range: 0000 to 9999) (Refer to section ■ 12.2.3)

### ■ 13.2.19 Bit designation of battery alarm output




**STEP 1** Use the numeric keypad to designate the output bit and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.



For details of the function, refer to section ■ 10.2.22.

### ■ 13.2.20 Setting of moving coordinate table number output in external point designation mode

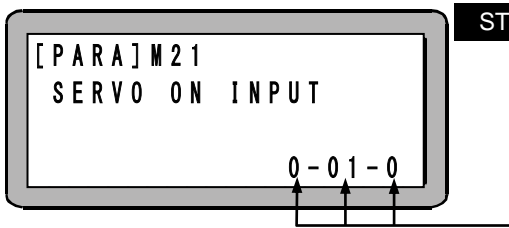


**STEP 1** Switch between Invalid/Valid with the **ALT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.



When this setting is valid, the output port will be valid in the external point designation mode. For details of the function, refer to Chapter 8.

### ■ 13.2.21 Bit designation of servo on input

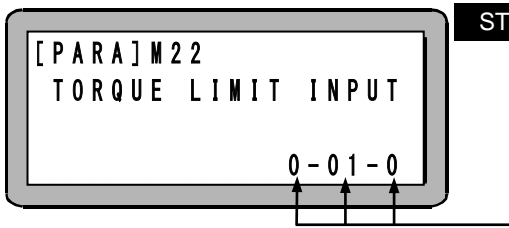


STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to section ■ 10.2.11.

### ■ 13.2.22 Bit designation of torque limit input

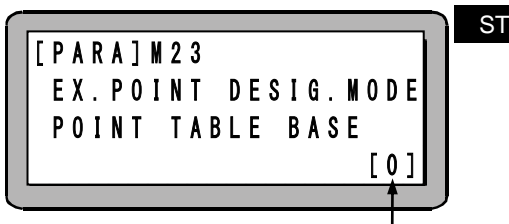


STEP 1

Use the numeric keypad to designate the input bit and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to sections ■ 10.2.12 and ■ 16.11.

### ■ 13.2.23 Designation of Coordinate table base in external point designation mode



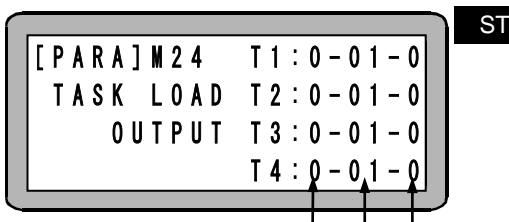
STEP 1

Designate the base with the numeric keypad and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode screen.

- ?**
- When the input port values are arranged in the order of  $2^9, 2^8, \dots, 2^1, 2^0$  and interpreted as binaries, the obtained value is the table No. for the cases where the base 1 is set, and the value obtained by adding 1 to that value is the table No. for the cases where the base 0 is set.
  - Initial value: 0, Setting range: 0, 1
  - For details of the function, refer to sections ■ 8.1.2 and ■ 8.1.3.

**NOTE** This parameter is supported by CA25-M10 version 4.14 or later, TPH-4C version 2.31 or later, and SF-98D version 3.1.4 or later.

### ■ 13.2.24 Bit designation of task load output



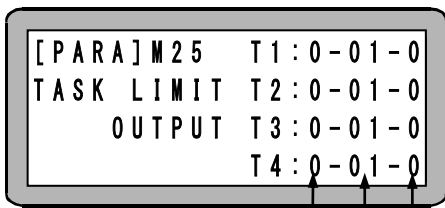
STEP 1

Use the numeric keypad to designate the output bit and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to section 0.

**NOTE** This parameter is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, and SF-98D version 3.1.6 or later.

### ■ 13.2.25 Bit designation of task limit output



STEP 1

Use the numeric keypad to designate the output bit and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.

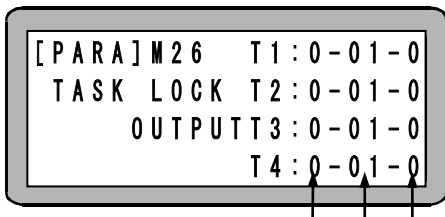


For details of the function, refer to section ■ 10.2.24.

**NOTE**

This parameter is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, and SF-98D version 3.1.6 or later.

### ■ 13.2.26 Bit designation of task lock output



STEP 1

Use the numeric keypad to designate the output bit and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.

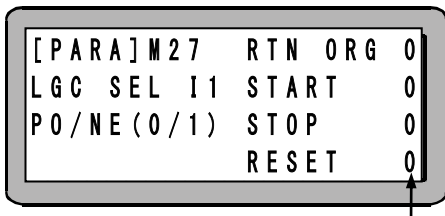


For details of the function, refer to section ■ 10.2.25.

**NOTE**

This parameter is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, and SF-98D version 3.1.6 or later.

### ■ 13.2.27 Positive logic/negative logic selection (input 1)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

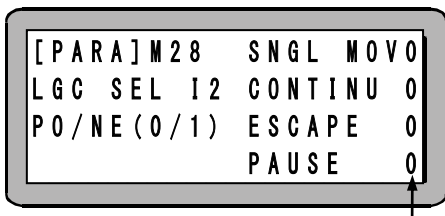
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



Each input logic of return to origin input, start input, stop input and reset input (refer to section ■ 10.2.1 to ■ 10.2.4) is selected. Each input is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

### ■ 13.2.28 Positive logic/negative logic selection (input 2)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

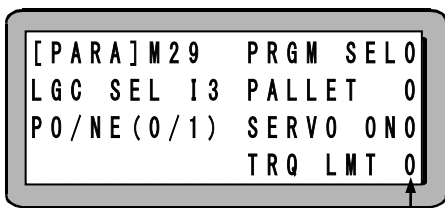
Press the **ESC** key to return to the PARA mode screen.



Each input logic of single operation input, continuous start input, escape input and pause input (refer to section ■ 10.2.5 to ■ 10.2.8) is selected. Each input is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)



### ■ 13.2.29 Positive logic/negative logic selection (input 3)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

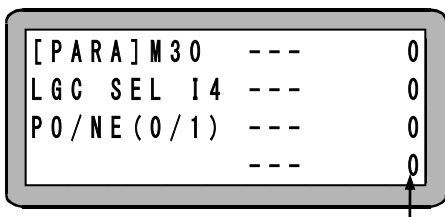
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



Each input logic of program No. selection input, palletizing input, servo-on input and torque limit input (refer to section ■ 10.2.9 to ■ 10.2.12) is selected. Each input is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

### ■ 13.2.30 Positive logic/negative logic selection (input 4)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

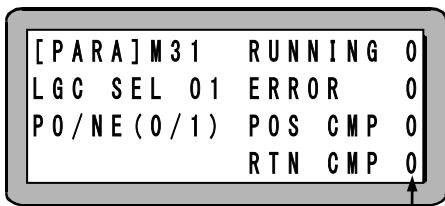
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



The corresponding input is not assigned.

### ■ 13.2.31 Positive logic/negative logic selection (output 1)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

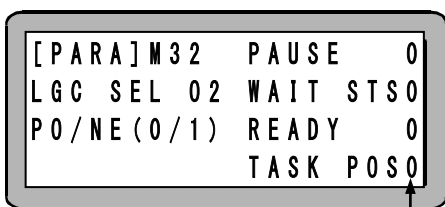
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



Each output logic of running output, error output, positioning complete output and return to origin complete output (refer to section ■ 10.2.13 to ■ 10.2.16) is selected. Each output is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

### ■ 13.2.32 Positive logic/negative logic selection (output 2)



STEP 1

Use the numeric keypad to select the logic and press the **ENT** key.

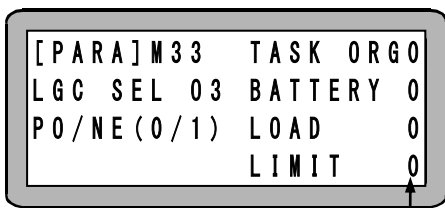
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



Each output logic of pausing output, input wait output, ready output and task positioning complete output (refer to section ■ 10.2.17 to ■ 10.2.20) is selected. Each output is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

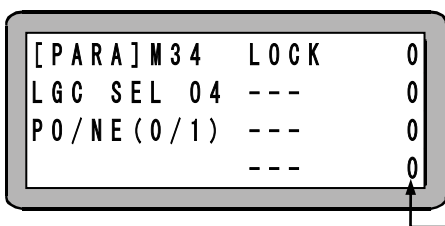
### ■ 13.2.33 Positive logic/negative logic selection (output 3)



**STEP 1** Use the numeric keypad to select the logic and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.

**?** Each output logic of task return to origin complete output, battery alarm output, task load output and task limit output (refer to section ■ 10.2.21 to ■ 10.2.24) is selected. Each output is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

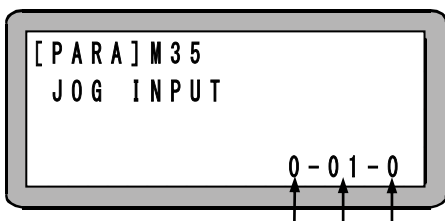
### ■ 13.2.34 Positive logic/negative logic selection (output 4)



**STEP 1** Use the numeric keypad to select the logic and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.

**?** The output logic of task lock output (refer to section ■ 10.2.25) is selected. The output is positive logic (no inverse) the case of selecting 0, negative logic (inverse) the case of selecting 1. (Initial value: 0, Setting range: 0, 1)

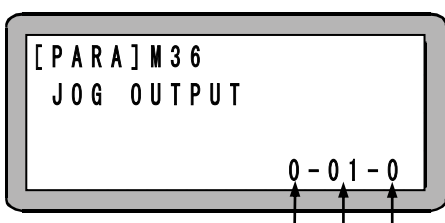
### ■ 13.2.35 Bit designation of JOG input



**STEP 1** Use the numeric keypad to designate the input bit and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to section ■ 10.2.26.

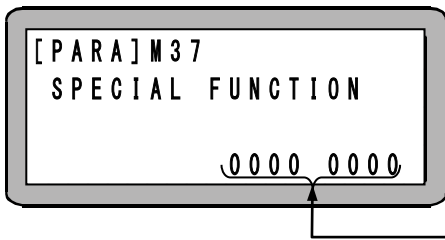
### ■ 13.2.36 Bit designation of JOG output



**STEP 1** Use the numeric keypad to designate the output bit and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode screen.

**?** For details of the function, refer to section ■ 10.2.26.

### ■ 13.2.37 Setting of special function



**STEP 1**

Use the numeric keypad to enter the setting value and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

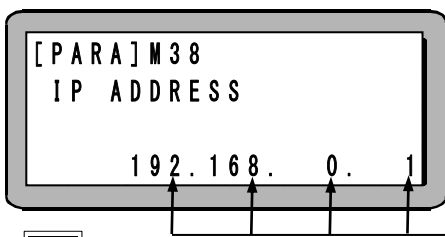
Press the **ESC** key to return to the PARA mode screen.



- Initial value: 0, Setting range: 0 to 9
- The function of each digit (left end is 8th digit) is as the following table.

Digit	Function name	Setting value	Reference	Compatible start version of CA25-M10
8	Counter hold function	0: Clear 1: Hold	Section ■ 10.2.6	4.37
7	Start input delay function	0: Invalid 1 to 9: Valid	Section ■ 10.2.2	4.38
6	Selection of input source when using EtherNet/IP	0: EtherNet/IP 1: I/O connector	Section ■ 19.2.3	4.41
5	Invalid	-	-	-
4	Invalid	-	-	-
3	Invalid	-	-	-
2	Invalid	-	-	-
1	Invalid	-	-	-

### ■ 13.2.38 Setting of IP address



**STEP 1**

Use the numeric keypad to enter the IP address and press the **ENT** key.

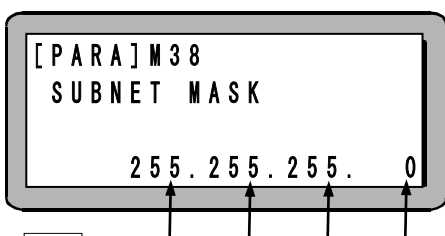
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



- The power must be turned OFF and then on again after changing the value of this parameter.
- Initial value: 192. 168. 0. 1, Setting range: 0 to 255, 0 to 255, 0 to 255, 0 to 255.

### ■ 13.2.39 Setting of subnet mask



**STEP 1**

Use the numeric keypad to enter the IP address and press the **ENT** key.

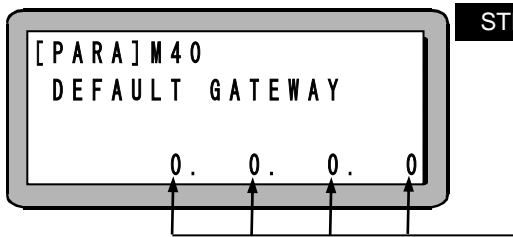
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



- The power must be turned OFF and then on again after changing the value of this parameter.
- Initial value: 255. 255. 255. 0, Setting range: 0 to 255, 0 to 255, 0 to 255, 0 to 255.

## ■ 13.2.40 Setting of default datewai



**STEP 1**

Use the numeric keypad to enter the IP address and press the **ENT** key.

Press the **-NEXT** key to display the previous screen.

Press the **ESC** key to return to the PARA mode screen.



- The power must be turned OFF and then on again after changing the value of this parameter.
- Initial value: 0. 0. 0. 0, Setting range: 0 to 255, 0 to 255, 0 to 255, 0 to 255.

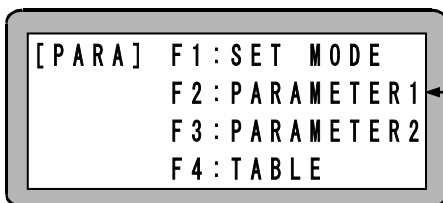
### ■ 13.3 Parameter 1 setting

Parameter 1 must be set for the following items. For items marked with ◆, the most appropriate parameters are set automatically when the robot type is selected.

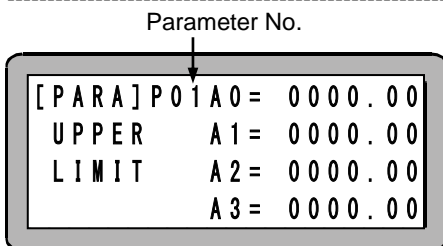
Refer to section ■ 4.2 for details on selecting the robot type.

No.	Name	Remarks	Compatible start version		
			CA25-M10	TPH-4C	SF-98D
1	Software limit value (upper limit)		4.12	2.28	3.12
2	Software limit value (lower limit)				
3	Servo gain (position)	◆			
4	Servo gain (speed)	◆			
5	Pass area				
6	Origin offset value	◆			
7	Sequence of Return to Origin				
8	JOG speed (A0)				
9	JOG speed (A1)				
10	JOG speed (A2)				
11	JOG speed (A3)				
12	JOG inching movement				
13	Bit designation of area output (A0)				
14	Bit designation of area output (A1)				
15	Bit designation of area output (A2)				
16	Bit designation of area output (A3)				
17	Setting of synchronous offset				
18	Setting of synchronous allowable error				

Set PARA mode for setting parameter 1. (Refer to section ■ 13.1)



**STEP 1** When this display appears, press the **( F2 )** key.



**STEP 2** Use the **( NEXT )** and **( -NEXT )** keys to move to the P01 to P08 parameter 1 setting screen.  
To quit the parameter setting, press the **( ESC )** key.

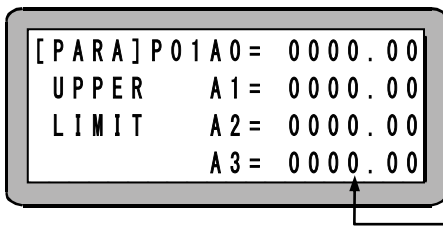
● Search function

When the **( SEARCH )** key is pressed and the parameter No. is input, the parameter 1 setting screen can be searched.

● Jump function

When the **( F1 )** key is pressed, the parameter 1 setting screen jumps. For example, when P01 to P09, P10 appears.

### ■ 13.3.1 Setting of software limit value (upper limit)



**STEP 1**

Use the numeric keypad to enter the coordinates and press the **ENT** key.  
 Press the **NEXT** key to display the next screen.  
 Press the **ESC** key to return to the PARA mode.

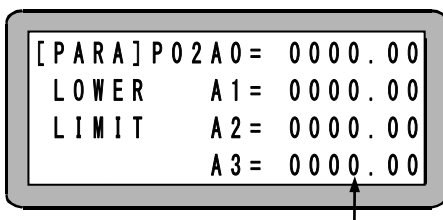


The software limit value (upper limit) indicates the maximum value [mm] of the robot's movement range. (Refer to section ■ 4.3)  
 (Initial value: 0.00 [mm], setting range: -8000.00 to 8000.00 [mm])

**NOTE**

- For return to origin, the software limit is not checked.
- When the BA-C axis is moved by JOG operation, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in ■ 3.2)

### ■ 13.3.2 Setting of software limit value (lower limit)



**STEP 1**

Use the numeric keypad to enter the coordinates and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.

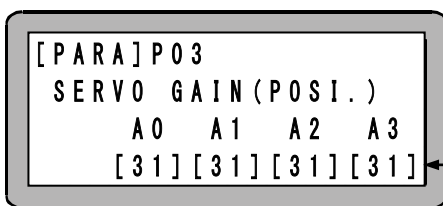


The software limit value (lower limit) indicates the minimum value [mm] of the robot's movement range. (Refer to section ■ 4.3)  
 (Initial value: 0.00 [mm], setting range: -8000.00 to 8000.00 [mm])

**NOTE**

- For return to origin, the software limit is not checked.
- When the BA-C axis is moved by JOG operation, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in ■ 3.2)

### ■ 13.3.3 Setting of servo gain (position)



**STEP 1**

Use the numeric keypad to enter the servo gain (position) and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.

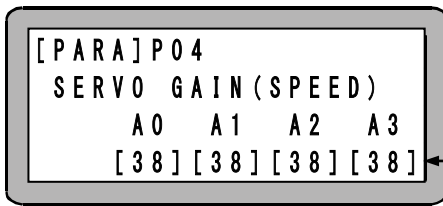


- If the servo system position gain setting value is too small, the positioning time will increase, and if too large, hunting (vibration) will occur. (Setting range: 0 to 98) (Refer to section ■ 4.4)
- 99 is for adjustment by the maker. Do not set the value.

**NOTE**

When the robot type is input, the optimum values for the servo gain (position) are automatically set. However, these should be changed as required. For the set value, refer to the instruction manual for the axis unit.

### ■ 13.3.4 Setting of servo gain (speed)



STEP 1

Use the numeric keypad to enter the servo gain (speed) and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.

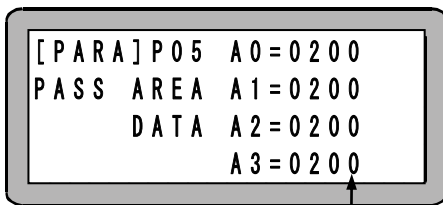


- If the servo system speed gain setting value is too small, hunting (vibration) will increase, and if too large, a groaning sound will be heard. (Setting range: 0 to 98) (Refer to section ■ 4.4)
- 99 is for adjustment by the maker. Do not set the value.

**NOTE**

When the robot type is input, the optimum values for the servo gain (speed) are automatically set. However, these should be changed as required. For the set value, refer to the instruction manual for the axis unit.

### ■ 13.3.5 Setting of pass area



STEP 1

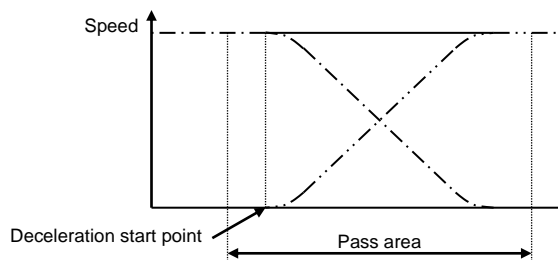
Use the numeric keypad to enter the pass area value and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.



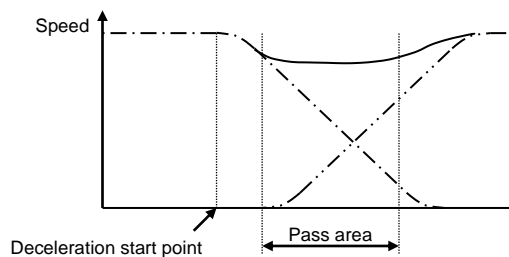
This parameter sets the radius (mm) of the pass area. If the PASS is selected with the MOV commands, movement proceeds to the next point smoothly when the axis enters the pass area and starts deceleration. (Initial value: 200 mm, setting range: 0 to 9999 mm)

The command proceeds to the next one at the time point set by this parameter or the time point set by the PASS command (pass rate setting command), whichever is earlier.

- Pass area and speed change



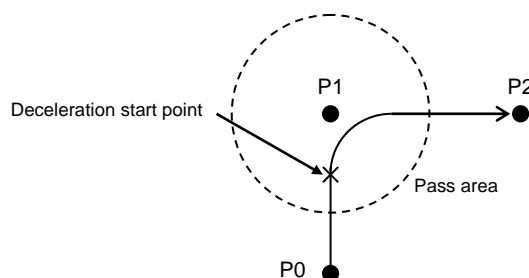
- When the deceleration start point exists inside the pass area
- ..... Move speed with first command  
 ..... Move speed with second command  
 \_\_\_\_\_ Composed speed of the axis



- When the deceleration start point exists outside the pass area

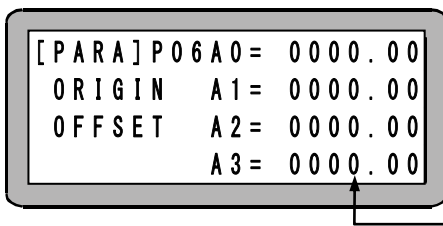
**NOTE**

When the deceleration start point exists outside the pass area, speed change occurs.



- Movement path from P0 through P1 to P2 with the point P1 designated by PASS. (When the deceleration start point exists inside the pass area)

### ■ 13.3.6 Setting of origin offset value



**STEP 1** Use the numeric keypad to enter coordinates of the origin offset value and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.

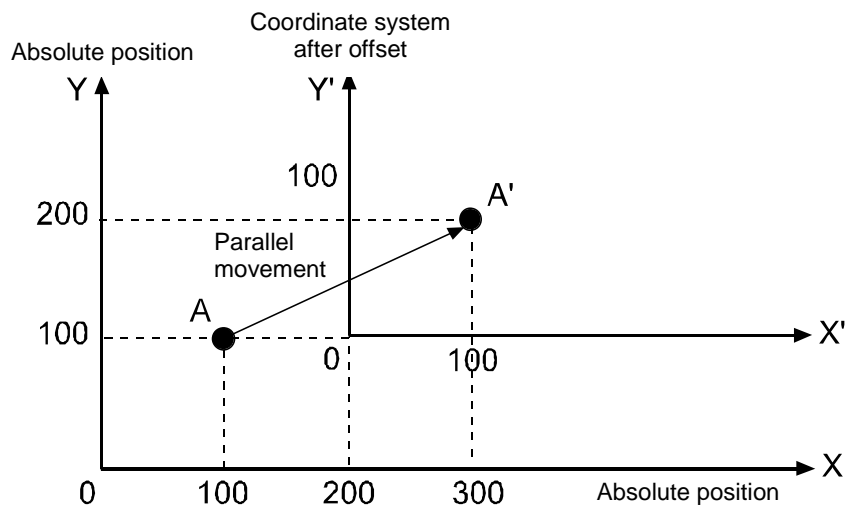


- The offset value is the distance [mm] to offset the origin when required. This is used to move all points in the program parallel in respect to the coordinate axis. After changing the origin offset, all points in the program will be moved in parallel by the offset value. The movement coordinates will also be offset when using the sequential, palletizing or external point designation mode. (Initial value: 0.00 [mm], setting range: -8000.00 to 8000.00 [mm])
- Also the software limit value will be moved in parallel by the offset value.
- If the OFS command is used in the sequential mode, this offset value will be added.

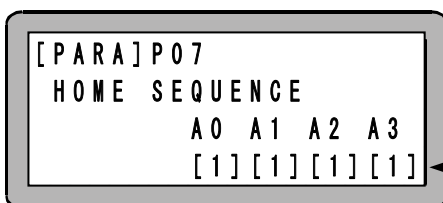
$$\left[ \begin{array}{c} \text{General offset value} \end{array} \right] = \left[ \begin{array}{c} \text{Offset value set in} \\ \text{parameter 1} \end{array} \right] + \left[ \begin{array}{c} \text{Offset value set with} \\ \text{OFS command} \end{array} \right]$$

- Always return to the origin after changing the origin offset. If the origin is not returned to, the origin offset will not be set.

[Example] When using a two-axis combination and the origin offset values (X axis = 200 and Y axis = 100) are validated, the point A (X = 100, Y = 100 in the program) will be moved in parallel 200 in the X axis direction and 100 in the Y axis direction. This will change the point A' position to X = 300, Y = 200 (absolute position).



### ■ 13.3.7 Setting of sequence of return to origin



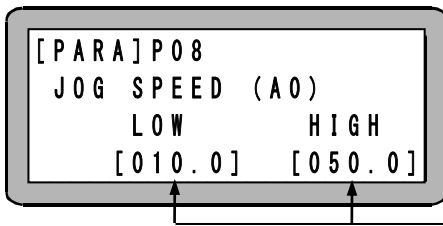
**STEP 1** Use the numeric keypad to enter the sequence of return to origin and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to return to the PARA mode.



The sequence of return to origin is the order that each axis of the robot returns to the origin. For example, if the sequence of return to origin for station No. 0 is set to "1" and the sequence of return to origin for station No. 1 is set to "2", the axis controlled by the station No. 0 unit will return to the origin, and then the axis controlled by the station No. 1 unit will return to the origin. If both are set to "1", both axes will simultaneously return to the origin. (Initial value: 1, setting range: 1 to 4)



### ■ 13.3.8 Setting of JOG speed (A0)



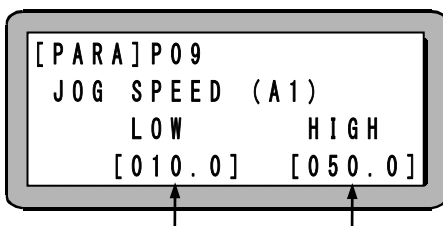
STEP 1

Use the numeric keypad to enter the JOG speed (low and high) of the axis A0 and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode.



- JOG speed refers to the speed [mm/s] for manual operation (JOG operation) using the movement keys. (Refer to section ■ 16.5) (Initial value: L = 10.0 [mm/s], H = 50.0 [mm/s], setting range: 1.0 to 250.0 [mm/s])
- The operation will be based on the value that the numbers below decimal point are truncated even if they are entered.
- The JOG speed settings of the axes A1 to A3 (P09 to P11) are similar to this setting.

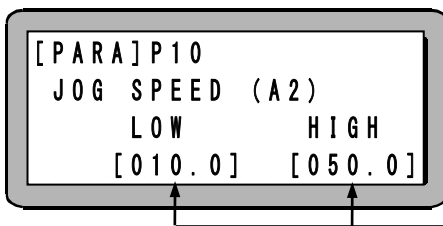
### ■ 13.3.9 Setting of JOG speed (A1)



STEP 1

Use the numeric keypad to enter the JOG speed (low and high) of the axis A1 and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode.

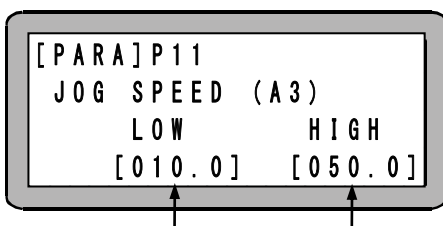
### ■ 13.3.10 Setting of JOG speed (A2)



STEP 1

Use the numeric keypad to enter the JOG speed (low and high) of the axis A2 and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode.

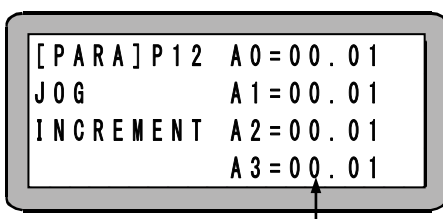
### ■ 13.3.11 Setting of JOG speed (A3)



STEP 1

Use the numeric keypad to enter the JOG speed (low and high) of the axis A3 and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode.

### ■ 13.3.12 Setting of JOG inching movement



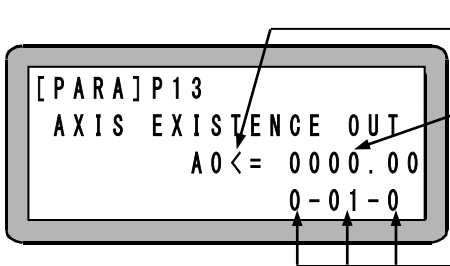
STEP 1

Use the numeric key pad to enter the JOG inching movement rate and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the PARA mode.



The JOG inching movement rate is the movement amount [mm] when the movement keys are pressed for a short time during JOG operation. (Refer to section ■ 16.5) (Initial value: 0.01 [mm/s], setting range: 0.00 to 65.00 [mm/s])

### ■ 13.3.13 Bit designation of area output (A0)



**STEP 1** Use the (ALT) key to select "<=" or ">=", and then press the (ENT) key.

**STEP 2** Use the numeric keypad to enter the area output coordinate of the axis A0, and then press the (ENT) key.

**STEP 3** Use the numeric keypad to designate the output bit, and then press the (ENT) key.  
Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.  
Press the (ESC) key to return to the PARA mode.

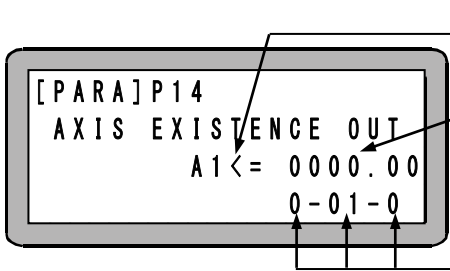


- When the area output bit is designated and the slider position of the axis is within the designated area, the designated bit turns ON. To invalidate the function, enter zero in the bit No.  
(Initial coordinate value: 0.00 [mm], Coordinate setting range: -8000.00 to 8000.00 [mm])
- The bit designation of area output for the axes A1 to A3 (P14 to P16) is similar to this setting.

#### NOTE

If an error occurs and return to origin is required, this bit is forcibly turned OFF.

### ■ 13.3.14 Bit designation of area output (A1)

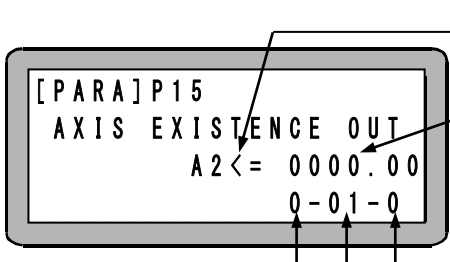


**STEP 1** Use the (ALT) key to select "<=" or ">=", and then press the (ENT) key.

**STEP 2** Use the numeric keypad to enter the area output coordinate of the axis A1, and then press the (ENT) key.

**STEP 3** Use the numeric keypad to designate the output bit, and then press the (ENT) key.  
Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.  
Press the (ESC) key to return to the PARA mode.

### ■ 13.3.15 Bit designation of area output (A2)

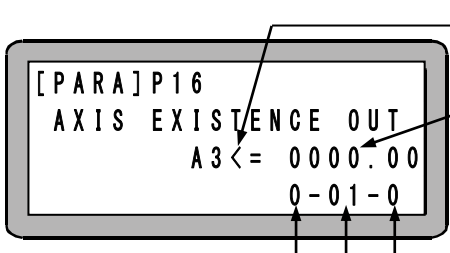


**STEP 1** Use the (ALT) key to select "<=" or ">=", and then press the (ENT) key.

**STEP 2** Use the numeric keypad to enter the area output coordinate of the axis A2, and then press the (ENT) key.

**STEP 3** Use the numeric keypad to designate the output bit, and then press the (ENT) key.  
Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.  
Press the (ESC) key to return to the PARA mode.

### ■ 13.3.16 Bit designation of area output (A3)

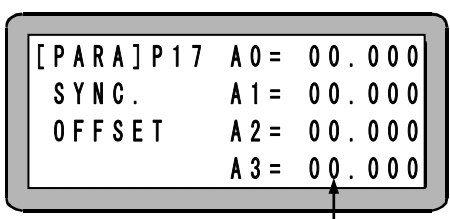


**STEP 1** Use the (ALT) key to select "<=" or ">=", and then press the (ENT) key.

**STEP 2** Use the numeric keypad to enter the area output coordinate of the axis A3, and then press the (ENT) key.

**STEP 3** Use the numeric keypad to designate the output bit, and then press the (ENT) key.  
 Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.  
 Press the (ESC) key to return to the PARA mode.

### ■ 13.3.17 Setting of synchronous offset value



**STEP 1** Use the numeric key pad to enter the synchronous offset value and press the (ENT) key.  
 Press the (NEXT) key to display the next screen and the (-NEXT) key to display the previous screen.  
 Press the (ESC) key to return to the PARA mode.

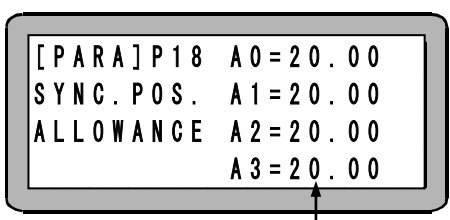


- The installation error amount refers to the position error to the driven axis Z-phase position as viewed from the drive axis Z-phase position.  
(Initial value: 0.000[mm], Setting range: -99.999 to 99.999[mm])
- This parameter is set to the driven axis. (The value set to the drive axis or normal axis (non-synchronized axis) is ignored.)

#### NOTE

- A synchronized offset amount that exceeds one-quarter of a motor rotation cannot be set. When [-NEXT] or [NEXT] is pressed, a beeping alarm occurs, and the value returns to the value before it was modified.  
 Example: This occurs when a lead 20 mm ball screw type is set to a value exceeding  $\pm 5$  mm.
- If this parameter is modified, be sure to execute the return to origin operation.  
 (If program operation is started without performing the return to origin operation, "ER61 Return to Origin Incomplete Error" occurs.)

### ■ 13.3.18 Setting of synchronous allowable error



**STEP 1** Use the numeric key pad to enter the synchronous allowable error value and press the (ENT) key.  
 Press the (-NEXT) key to display the previous screen.  
 Press the (ESC) key to return to the PARA mode.



- The upper limit of the position error for the drive axis and driven axis that occurs during synchronized operation is specified.  
(Initial value: 20.00[mm], Setting range: 1.00 to 99.99[mm])
- This parameter is set to the driven axis. (The value set to the drive axis or normal axis (non-synchronized axis) is ignored.)

#### NOTE

- If the position error exceeds this parameter, "ER65 Synchronized Error Exceeded" occurs.

## ■ 13.4 Parameter 2 setting

Parameter 2 contains the following items.

For the items marked with ◆, the optimum values are automatically entered when the robot type is entered. Refer to section ■ 4.2 on how to enter the robot type.

When an item marked with ★ is changed, return to origin is required after turning ON the power.

After setting parameter 2, turn the controller power OFF and ON. As opposed to parameter 1, parameter 2 will not be validated unless the controller power is turned OFF.

Change of the number of axes or replacement of the slave unit may not be valid unless the controller power is turned OFF twice.

No.	Name	Remarks	Compatible start version					
			CA25-M10	TPH-4C	SF-98D			
1	Axis display		4.12	2.28	3.1.2			
2	In position data value							
3	Overflow data value	◆						
4	Feed forward data value	Invalid for this machine.						
5	Direction of motor rotation	◆ ★						
6	Maximum speed	◆						
7	Return to origin speed (A0)	◆						
8	Return to origin speed (A1)	◆						
9	Return to origin speed (A2)	◆						
10	Return to origin speed (A3)	◆						
11	Return to origin method	◆ ★						
12	Origin sensor logic	◆ ★						
13	High speed return to origin position							
14	Lead	◆ ★						
15	Encoder division number	◆						
16	Encoder pulse multiplier	◆ ★						
17	Encoder type	★						
18	Acceleration/deceleration time constant	Fixed to 60 for this machine						
19	Task and axis combination	★						
20	Task order of priority							
21	Task coordinate table	Fixed to 999 for each task of this machine						
22	Task step number							
23	BA I/O compatibility mode	★						
24	Return to origin direction	★						
25	Dynamic brake	Invalid for this machine						
26	Synchronous axis	★				4.46	2.41	
27	Return to origin torque limit					4.32	2.34	3.1.9

### NOTE

- Some settings in parameter 2 have been created for future axis developments. Be careful not to use inappropriate settings.  
Also do not change initial values set when the robot type is entered. If these initial value are changed, malfunctions may occur.

Set PARA mode to input parameter 2. (Refer to section ■ 13.1)

```
[PARA] F1:SET MODE
        F2:PARAMETER1
        F3:PARAMETER2
        F4:TABLE
```

**STEP 1**

When this display is shown, press the **F3** key.

```
[PARA]
CHANGE PARAMETER 2

YES:ENT NO:ESC
```

**STEP 2**

Press the **ENT** key to change parameter 2 and go to STEP 3. Press the **ESC** key to ignore changes and return to the previous screen.

Parameter No.

```
[PARA]K01
AXIS DISPLAY
      A0 A1 A2 A3
      [X][Y][X][X]
```

**STEP 3**

Use the **NEXT** and **-NEXT** keys to move to the K01 to K26 parameter setting screens from this state. To end the parameter setting, press the **ESC** key. Press the **ESC** key to move to step 4.

● Search function

When the **SEARCH** key is pressed and the parameter No. is input, the parameter 2 setting screen can be searched.

● Jump function

When the **F1** key is pressed, the parameter 2 setting screen jumps. For example, when K01 to K09, K10 appears.

```
PLEASE POWER OFF !!
```

**STEP 4**

This is the parameter 2 end screen.

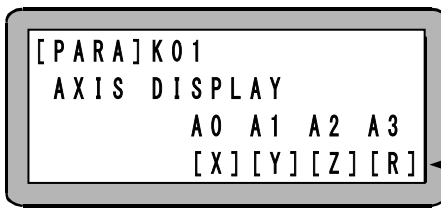
Follow the instructions on the screen, and turn the power OFF. The parameter 2 setting will be validated when the power is turned ON again.

**NOTE**

In the cases of the followings, "PLEASE POWER OFF!!" may be displayed after turning ON the power again. In such a case, turn OFF the power again. When the power is turned ON again, the set parameter 2 will be validated.

- ① When the power is turned ON for the first time after change of the parameter and then replacement of the slave unit.
- ② When the power is turned ON for the first time after the axis setting is changed in the task and axis combination setting (refer to section ■ 13.4.19).
- ③ When the link cable is connected and the power is turned ON after the parameter of the slave unit for the station No. to which the link cable is not connected is changed.

### ■ 13.4.1 Setting of axis display



STEP 1

Select the axis display (X, Y, Z, R, ?) with the **(ALT)** key and press the **(ENT)** key.  
Press the **(NEXT)** key to display the next screen.  
Press the **(ESC)** key to display the parameter 2 end screen.

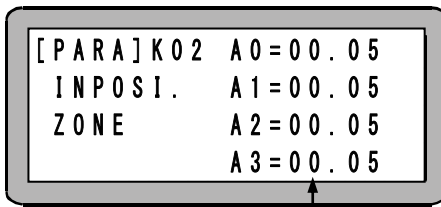


- The axis display refers to the name of the axis connected to each unit when displayed on the Teach Pendant. (Selective display: X, Y, Z, R and ?)
- The axis display of an unused axis is "?" even when other axis display is set in this setting.

**NOTE**

If two or more same displays are selected in one same task, the axis with smaller station No. will override for commands SVON, SVOF, and OUTS.

### ■ 13.4.2 Setting of in-position data value



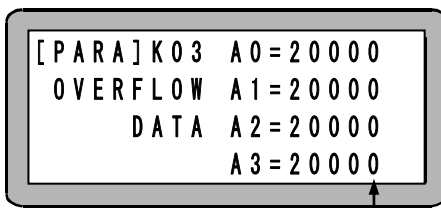
STEP 1

Use the numeric keypad to enter the in-position data and press the **(ENT)** key.  
Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
Press the **(ESC)** key to display the parameter 2 end screen.



- The in-position data is an item used as a judgment standard of the completion of positioning. (Initial value: 0.05, setting range: 0.01 to 65.00, unit: mm)
- When the instruction position reaches the target position (condition 1) and the deflection counter (difference of target position and current position) becomes less than this value (condition 2), it will be judged that positioning has been completed, and the program will move to the next operation (step).
- Even if this value is increased, the positioning will not be completed until the two conditions are established.

### ■ 13.4.3 Setting of overflow data value



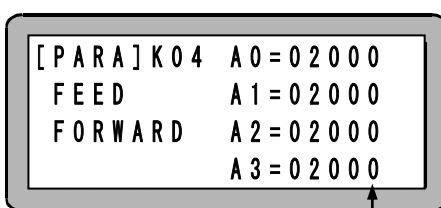
STEP 1

Use the numeric keypad to enter the overflow data and press the **(ENT)** key.  
Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
Press the **(ESC)** key to display the parameter 2 end screen.



- When the value of the deflection counter (difference of target position and current position) increases above this value, an overflow error will occur. (Initial value: 20000, setting range: 1 to 65535, unit: pulse)
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

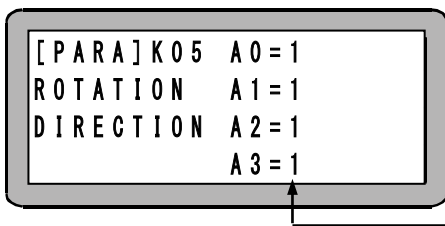
### ■ 13.4.4 Setting of feed forward data value



STEP 1

The parameter is invalid for this machine.  
Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
Press the **(ESC)** key to display the parameter 2 end screen.

### ■ 13.4.5 Setting of direction of motor rotation



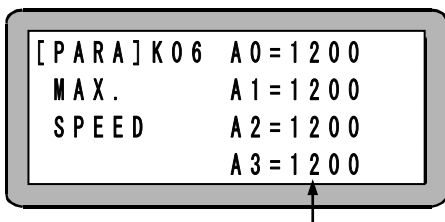
**STEP 1**

Use the numeric keypad to enter the direction of motor rotation (0: forward, 1: reverse) and press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen. Press the **ESC** key to display the parameter 2 end screen.



- Forward (0): Motor rotates in clockwise direction in respect to the positive movement command when the motor output shaft is looked from the load side.
- Reverse (1): Motor rotates in counterclockwise direction in respect to the positive movement command when the motor output shaft is looked from the load side.
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.6 Setting of maximum speed



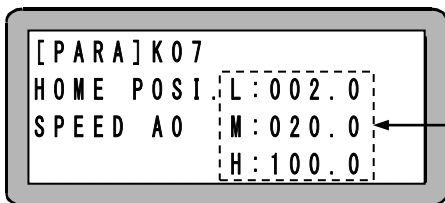
**STEP 1**

Use the numeric keypad to enter the maximum speed and press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen. Press the **ESC** key to display the parameter 2 end screen.



- This is the movement speed limit value, this set value is the upper limit for all speed setting. (Setting range: 1 to 9999, unit: mm/s)
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.7 Setting of return to origin speed (A0)



**STEP 1**

Use the numeric keypad to enter return to origin speed data of the axis A0, and then press the **ENT** key. Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen. Press the **ESC** key to display the parameter 2 end screen.

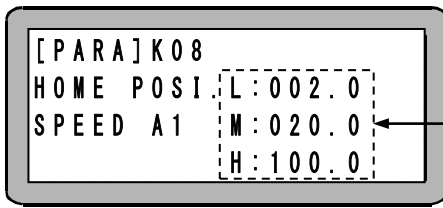


- Set movement speed L (low speed), M (medium speed) and H (high speed) for returning to the origin. (Setting range: L, M = 1.0 to 250.0, H = 1.0 to 999.0, unit: mm/s)
- For details of return to origin operation, refer to section ■ 4.5.1.
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)
- Setting of return to origin speed data of the axes A1 to A3 (K08 to K10) is similar to this setting.

#### **NOTE**

- If movement speed L (low speed) and M (medium speed) are set to more than the initial value, normal return to the origin may not be possible.
- Even if a value after the decimal point is entered, it is assumed to be a numeric value rounded down for operation.
- Acceleration/deceleration time for high speed (H) return to origin is the table value set by the latest executed ACC. If no ACC command has been executed, the acceleration/deceleration time will be the value of table 5.

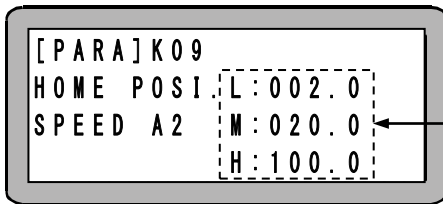
### ■ 13.4.8 Setting of return to origin speed (A1)



STEP 1

Use the numeric keypad to enter return to origin speed data of the axis A1, and then press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

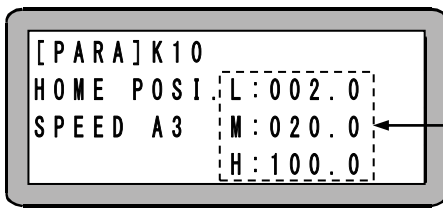
### ■ 13.4.9 Setting of return to origin speed (A2)



STEP 1

Use the numeric keypad to enter return to origin speed data of the axis A2, and then press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

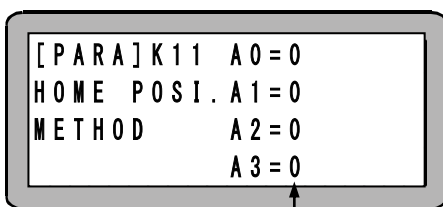
### ■ 13.4.10 Setting of return to origin speed (A3)



STEP 1

Use the numeric keypad to enter return to origin speed data of the axis A3, and then press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

### ■ 13.4.11 Setting of return to origin method



STEP 1

Use the numeric keypad to enter the return to origin method and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.



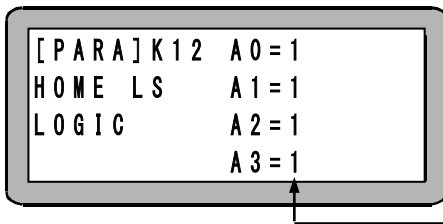
- This parameter sets the return to origin method. (Initial value: 0, setting range: 0 to 4)
- For return to origin operation of each return to origin method, refer to section ■ 4.5.1.
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)
- If this parameter is set to 4, the operation is same as that with the parameter set to zero.

#### NOTE

- When a return to origin method has been set under a condition where an axis type is wrong, this makes this equipment impossible to return to the origin, or causes a difference in origine position, so that the values set when the robot type is entered must not be changed.



### ■ 13.4.12 Setting of origin sensor logic



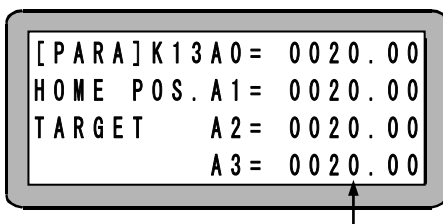
STEP 1

Use the numeric keypad to enter the origin sensor logic and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.



- Setting of the origin sensor logic means to select whether the output signal of the sensor assembled in the axis turns OFF or ON when detected. (Initial value: 1, selective value: 0 or 1)  
1: OFF when detected 0: ON when detected
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.13 Setting of high speed return to origin position



STEP 1

Use the numeric keypad to enter the high speed return to origin position data and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

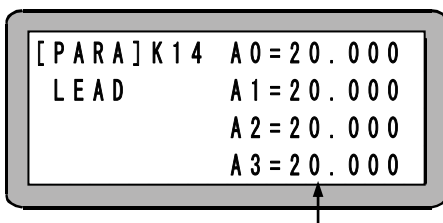


- The high speed return to origin position refers to the target position when moving at a high speed (return to origin speed H) while executing high speed return to origin. (Refer to section ■ 4.5.1) The initial value is 20, and a value less than this must not be set.  
(Initial value: 20.00, setting range: -8000.00 to 8000.00, unit: mm)

**NOTE**

For high speed return to origin, the software limit value is invalid.

### ■ 13.4.14 Setting of lead



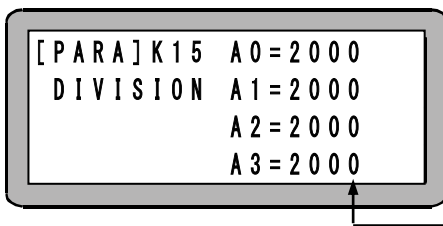
STEP 1

Use the numeric keypad to enter the axis lead and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.



- The lead is the advance distance per motor rotation.  
(Initial value: 20.00, setting range: 1.000 to 99.999, unit: mm)
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.15 Setting of encoder division number



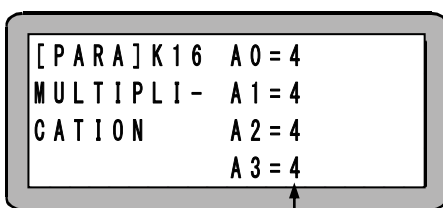
**STEP 1**

Use the numeric keypad to enter the encoder division number and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to display the parameter 2 end screen.



- The encoder division number refers to the No. of pulses per rotation of the encoder installed on the motor. (Initial value: 2768, setting range; 1 to 9999, unit: pulse/rev)
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.16 Setting of encoder pulse multiplier



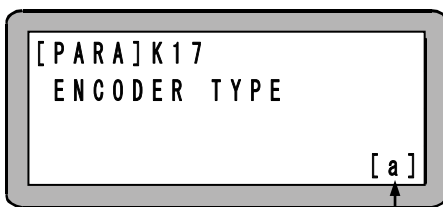
**STEP 1**

Use the numeric keypad to enter the encoder pulse multiplier and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to display the parameter 2 end screen.



- The multiplier determines at what fold to generate the pulses of the encoder installed on the motor. (If a multiplier of 3 is set, the operation will be 2-fold.) (Initial value: 4, setting range: 1 to 4)
- This value is set automatically when the robot type is entered. (Refer to section ■ 4.2)

### ■ 13.4.17 Setting of encoder type



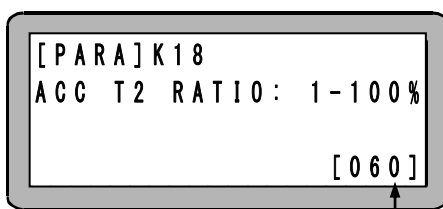
**STEP 1**

Select the encoder type with the **ALT** key and press the **ENT** key.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to display the parameter 2 end screen.



- The encoder type is the type of encoder installed on the motor. The following types are available.  
 a: Absolute encoder  
 i : Incremental encoder  
 (Initial value: a, selective types: a, i)
- If "i" is set, an absolute encoder is used as an incremental encoder. For difference of encoder types, refer to sections ■ 4.5.2 and ■ 16.10.2.

### ■ 13.4.18 Acceleration/deceleration time constant



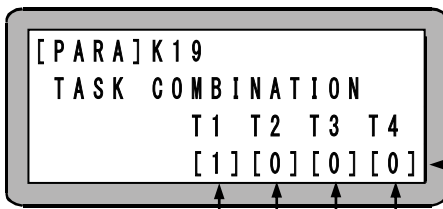
**STEP 1**

This value is fixed to 60 for this machine.  
 Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
 Press the **ESC** key to display the parameter 2 end screen.

**NOTE**

Any value from 1 to 100 can be entered, but no value except for 60 cannot be set. (Initial value: 60 (%), setting range: 60 (fixed))

## ■ 13.4.19 Setting of task and axis combination

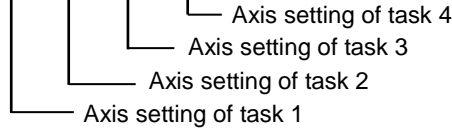


**STEP 1**

Use the numeric keypad to enter the axis setting of each task, and press the **ENT** key.

Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.

Press the **ESC** key to display the parameter 2 end screen.



- Set the axis setting according to the followings. (Initial value: [1] [0] [0] [0])

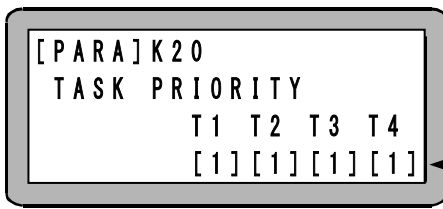
Axis setting	Task 1	Task 2	Task 3	Task 4
[1] [0] [0] [0]	1-axis specifications	0-axis specifications	0-axis specifications	0-axis specifications
[1] [1] [0] [0]	1-axis specifications	1-axis specifications	0-axis specifications	0-axis specifications
[2] [0] [0] [0]	2-axis specifications	0-axis specifications	0-axis specifications	0-axis specifications
[1] [1] [1] [0]	1-axis specifications	1-axis specifications	1-axis specifications	0-axis specifications
[1] [2] [0] [0]	1-axis specifications	2-axis specifications	0-axis specifications	0-axis specifications
[2] [1] [0] [0]	2-axis specifications	1-axis specifications	0-axis specifications	0-axis specifications
[3] [0] [0] [0]	3-axis specifications (2D)	0-axis specifications	0-axis specifications	0-axis specifications
[4] [0] [0] [0]	3-axis specifications (3D)	0-axis specifications	0-axis specifications	0-axis specifications
[1] [1] [1] [1]	1-axis specifications	1-axis specifications	1-axis specifications	1-axis specifications
[1] [1] [2] [0]	1-axis specifications	1-axis specifications	2-axis specifications	0-axis specifications
[1] [2] [1] [0]	1-axis specifications	2-axis specifications	1-axis specifications	0-axis specifications
[1] [3] [0] [0]	1-axis specifications	3-axis specifications (2D)	0-axis specifications	0-axis specifications
[1] [4] [0] [0]	1-axis specifications	3-axis specifications (3D)	0-axis specifications	0-axis specifications
[2] [1] [1] [0]	2-axis specifications	1-axis specifications	1-axis specifications	0-axis specifications
[2] [2] [0] [0]	2-axis specifications	2-axis specifications	0-axis specifications	0-axis specifications
[3] [1] [0] [0]	3-axis specifications (2D)	1-axis specifications	0-axis specifications	0-axis specifications
[4] [1] [0] [0]	3-axis specifications (3D)	1-axis specifications	0-axis specifications	0-axis specifications
[5] [0] [0] [0]	4-axis specifications	0-axis specifications	0-axis specifications	0-axis specifications

Axis setting	Setting	Description
0	0 axis specification	No control axis
1	1 axis specification	1 axis setting
2	2 axes specification	2 axes setting capable of 2-dimensional circular interpolation
3	3 axes specification (2D)	3 axes setting capable of 2-dimensional circular interpolation with axes 1 and 2. The axis 3 reaches simultaneously.
4	3 axes specification (3D)	3 axes setting capable of 3-dimensional circular interpolation
5	4 axes specification	4 axes setting capable of 3-dimensional circular interpolation with axes 1, 2, and 3. The axis 4 reaches simultaneously.

### NOTE

- The axis setting 0 is a task with no axis, in which only commands other than MOV system commands can be executed.
  - If the task of the synchronized axes set in section ■ 13.4.26 are different each other by setting, "ER66 Synchronized Axes Parameter Error" occurs.

### ■ 13.4.20 Setting of task order of priority



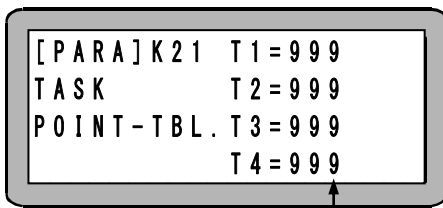
STEP 1

This parameter is fixed to 1 for each task of this machine.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to display the parameter 2 end screen.



Any value from 0 to 4 can be entered for tasks 2 to 4, but no values except for 1 cannot be set.  
 (Initial value: 1 for T1 to T4, setting range: Fixed to 1 for T1 to T4)

### ■ 13.4.21 Setting of task coordinate table



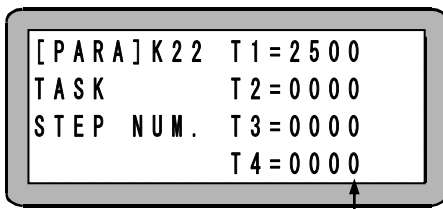
STEP 1

This parameter is fixed to 999 for each task of this machine.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to display the parameter 2 end screen.



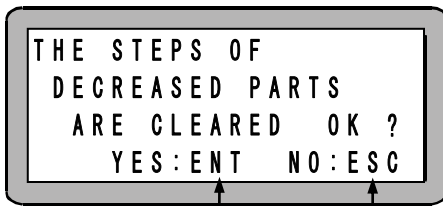
Any value from 0 to 999 can be entered for each task, but no value except for 999 cannot be set.  
 (Initial value: 999 for T1 to T4, setting range: Fixed to 999 for T1 to T4)

### ■ 13.4.22 Setting of task step number



STEP 1

Use the numeric keypad to enter the max. No. of steps in each task and press the **(ENT)** key.  
 Press the **(NEXT)** key to display the next screen and the **(-NEXT)** key to display the previous screen.  
 Press the **(ESC)** key to display the parameter 2 end screen.  
 When this setting is changed, the procedure proceeds to the STEP 2.



STEP 2

The screen shown at the left appears.  
 To change the setting, press the **(ENT)** key, otherwise press the **(ESC)** key.

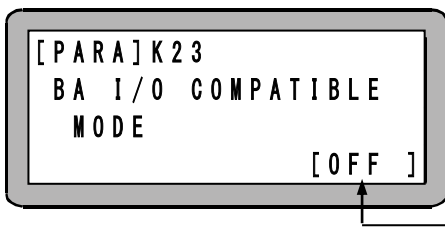


The number of steps is up to 5000 in total for all tasks.  
 (Initial value: 2500 for T1 and 0 for T2 to T4, setting range: 1 to 5000 for T1 and 0 to 4999 for T2 to T4)

#### NOTE

- If the max. No. of steps is set to lower than the current value for each task, the program of that step will be cleared.
- If the total number of steps exceeds 5000, a parameter error (ERA8) occurs.
- A maximum of 5000 steps in total for all tasks is supported only by CA25-M10 version 4.30 or later, and SF-98D version 3.1.7 or later. For other than the above, a maximum of 2500 steps in total for all tasks.

### ■ 13.4.23 Selection of BA I/O compatibility mode



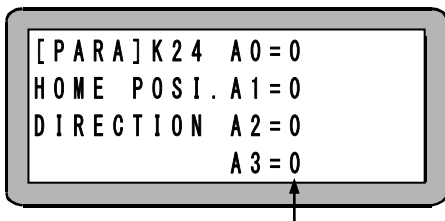
#### STEP 1

Press the **ALT** key to switch between Valid and Invalid and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.



When this mode is set to Valid, the positioning complete signal and return to origin complete signal are based on the BA series controller specifications. (Refer to section ■ 16.10)

### ■ 13.4.24 Setting of return to origin direction



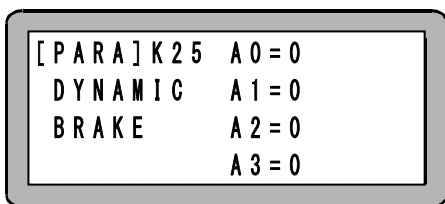
#### STEP 1

Use the numeric keypad to enter a return to origin direction (0: minus direction, 1: plus direction), and then press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

#### NOTE

When the return to origin direction is set to 1, the positive and negative of the set value of section ■ 13.4.13 high speed return to origin position will be reversed in the case of high speed return to origin.

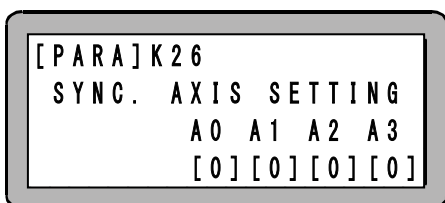
### ■ 13.4.25 Setting of dynamic brake



#### STEP 1

The parameter is invalid for this machine.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

### ■ 13.4.26 Setting of synchronous axis



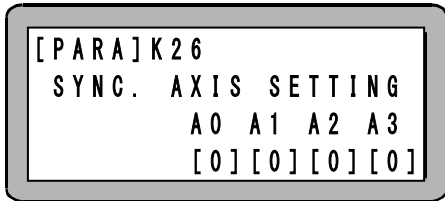
#### STEP 1

Press **ALT** key to switch between the M: Drive Axis and 0: Normal Axis and press the **ENT** key. (In Addition, if M: Drive Axis is set, the next axis automatically becomes S: Driven axis.)  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to display the parameter 2 end screen.

#### NOTE

If the set axis do not exist or the task of the set synchronized axes are different each other, "ER65 Synchronized Error Exceeded" occurs.

### ■ 13.4.27 Setting of return to origin torque limit



#### STEP 1

Use the numeric keypad to enter torque limit table No.(00 to 08), and then press the **ENT** key.

Press the **-NEXT** key to display the previous screen.

Press the **ESC** key to display the parameter 2 end screen.



When middle and low speed return to origine, torque is limited up to the torque limit value (T.LMT) of torque limit table No. (refer to section ■ 13.5.5) set here. If 00 is set, torque is not limited.

#### NOTE

- When high speed return to origine, torque is not limited.
- This is supported only by CA25-M10 version 4.32 or later, TPH-4C version 2.34 or later and SF-98D version 3.1.9 or later.

## ■ 13.5 Setting of the tables

The tables are groups of data for which addresses (table Nos.) are assigned to each data item. To use the table, designate the data indirectly using the address (table No.) in the program. As an example, the concept of the coordinate table is shown in a table below.

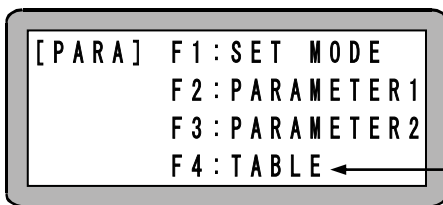
Coordinate table No. (address)	Coordinate data [mm]
001	X=100, Y=150, Z=200, R=250
002	X=700, Y=500, Z=300, R=100
:	:
999	X=600, Y=300, Z=150, R=100

The following types of tables are available.

- Coordinate (point) table      Table Nos. 1 to 999 × 4 tasks (Refer to section ■ 13.5.1)
- Speed table                      Table Nos. 1 to 20 (Refer to section ■ 13.5.2)
- Acceleration (ACC) table      Table Nos. 1 to 20 (Refer to section ■ 13.5.3)
- MVM table                        Table Nos. 1 to 32 (Refer to section ■ 13.5.4)
- Torque limit table              Table Nos. 1 to 8 (Refer to section ■ 13.5.5)

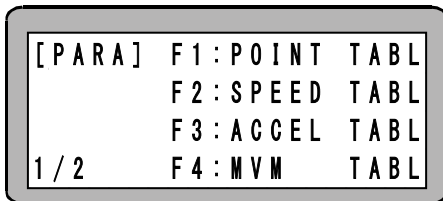
Refer to section ■ 5.1.6 for details on the MVM command.

Enter the PRGM mode. Press the **(HELP)** key and then the **(F4)** key to enter the PARA mode. (Refer to section ■ 13.1)



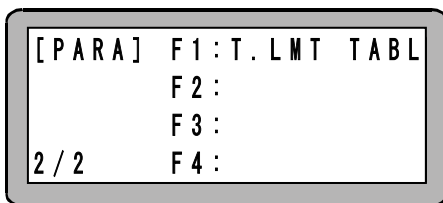
**STEP 1**

When the display at left is shown, press the **(F4)** key. Press the **(ESC)** key to return to PRGM mode.



**STEP 2**

Press the **(F1)** key to set the coordinate table.  
 Press the **(F2)** key to set the speed table.  
 Press the **(F3)** key to set the acceleration/deceleration table.  
 Press the **(F4)** key to set the MVM table.  
 Press the **(NEXT)** key to proceed to the STEP 3.  
 Press the **(ESC)** key to return to the PARA mode.

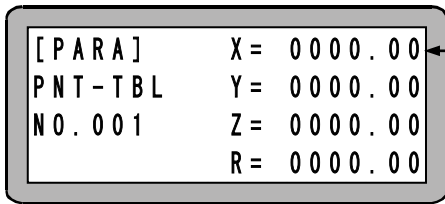


**STEP 3**

Press the **(F1)** key to set the torque limit table.  
 Press the **(-NEXT)** key to return to the STEP 2.  
 Press the **(ESC)** key to return to the PARA mode.

### ■ 13.5.1 Setting of coordinate table

Press the **F1** in the table selection screen shown in section ■ 13.5, and coordinate table is selected.



**STEP 1**

Use the numeric keypad to enter the coordinates and press the **ENT** key.

(Setting range: -8000.00 to 8000.00, unit: mm)

Press the **NEXT** key or the **-NEXT** key to scroll the table.

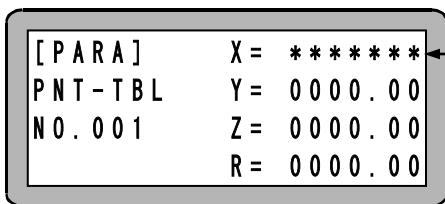
If the **SEARCH** key is pressed and the table No. is input, the display will jump to that table.

Press the **SEARCH** key twice and enter the task No. to jump to the coordinate table of the task.

Press the **ESC** key to return to the table selection screen.



- The tables that can be set are Nos. 1 to 999.
- The screen shows the 4 axes setting.
- The coordinate table exists for each task.
- The coordinate value of the unused axis is not stored.
- The unused axis is displayed as "?".
- Remote teaching and direct teaching can be used. (Refer to section ■ 4.7.2)
- The axis can be moved to the coordinate position shown in the screen. (Refer to section ■ 16.6)
- The coordinate table can be cleared (initialized). (Refer to section ■ 16.7)



**STEP 2**

If the **ALT** key is pressed instead of a value, the display will change to \*\*\*\*\*, and that coordinate will be handled in the same manner as the current coordinate value.



■ Structure of coordinate table

The coordinate table has a storage area on the memory that can store 999 tables for each station No.

Coordinate table No. (address)	Coordinate data on memory [mm]			
	Station No. 0	Station No. 1	Station No. 2	Station No. 3
001 to 999	A	B	C	D

Table 13-5-1

When the coordinate table of a task is edited, the memory area of the corresponding station No. is edited automatically according to the information set in the K19 combination of task and axis (refer to section ■ 13.4.19).

For example, when the K19 combination of task and axis is [2][2][0][0] (table 13-5-2) and the data of the first axis of the task 1 ("A") is edited, the data in the area of the station No. 0 in table 13-5-1 ("A") is automatically edited. When the data of the first axis of the task 2 ("C") is edited, the data in the area of the station No. 2 in the table 13-5-1 ("C") is automatically edited. Data of the fields in the table 13-5-2 in which oblique lines are drawn cannot be edited because no corresponding data exists.

When the K19 combination of task and axis is [2][2][0][0]								
Coordinate table No. (Address)	Task 1 coordinate data [mm]				Task 2 coordinate data [mm]			
	First axis	Second axis	Third axis	Fourth axis	First axis	Second axis	Third axis	Fourth axis
001 to 999	A	B			C	D		
Coordinate table No. (Address)	Task 3 coordinate data [mm]				Task 4 coordinate data [mm]			
	First axis	Second axis	Third axis	Fourth axis	First axis	Second axis	Third axis	Fourth axis
001 to 999								

Table 13-5-2

When the K19 combination of task and axis is changed from [2][2][0][0] (table 13-5-2) to [1][1][1][1] (table 13-5-3), the data "B" of the second axis of the task 1 moves to the first axis of the task 2, the data "C" of the first axis of the task 2 moves to the first axis of the task 3, and the data "D" of the second axis of the task 2 moves to the first axis of the task 4. Data of the fields in the table 13-5-3 in which oblique lines are drawn cannot be edited because no corresponding data exists.

When the K19 combination of task and axis is [1][1][1][1]								
Coordinate table No. (Address)	Task 1 coordinate data [mm]				Task 2 coordinate data [mm]			
	First axis	Second axis	Third axis	Fourth axis	First axis	Second axis	Third axis	Fourth axis
001 to 999	A				B			
Coordinate table No. (Address)	Task 3 coordinate data [mm]				Task 4 coordinate data [mm]			
	First axis	Second axis	Third axis	Fourth axis	First axis	Second axis	Third axis	Fourth axis
001 to 999	C				D			

Table 13-5-3

**NOTE**

The coordinate table can hold only coordinate values for the number of axes set in the corresponding task. For example, even when coordinate values for four axes are written in the coordinate table of a task set for 2 axes, the coordinate values of the third and fourth axes are not stored. Therefore the coordinate table setting should be performed after setting of the number of axes for each task in the K19 combination of task and axis (refer to section ■ 13.4.19).

If the setting of the K19 combination of task and axis is changed after setting of the coordinate table, the coordinate data moves to the coordinate table of the other task.

## ■ 13.5.2 Setting of speed table

Press the **F2** key in the table selection screen shown in section ■ 13.5, and the speed table is selected.

```
[ PARA ]
SPD-TBL NO 01:0100.0
          NO 02:0200.0
          NO 03:0300.0
```

**STEP 1**

Input is possible for the speed table at the second line from the top. Use the numeric keypad to enter the speed and press the **ENT** key. (Setting range: 1.0 to 9999.9, unit: mm/s)  
Press the **NEXT** key to scroll the screen of the STEP 2.



- The operation will be based on the value that the numbers below decimal point are truncated even if they are entered.
- Even if the speed is specified with this parameter, the speed is limited by the value set in "setting of maximum speed data" in parameter 2.
- The tables that can be set are Nos. 1 to 20. The initial values are as shown below.

SPD table No.	1	2	3	4	5	6	7	8	9	10
Initial value [mm/s]	100	200	300	400	500	600	700	800	900	1000

SPD table No.	11	12	13	14	15	16	17	18	19	20
Initial value [mm/s]	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000

**NOTE**

The No. 1 to 20 are supported by CA25-M10 version 4.15 or later, TPH-4C version 2.32 or later, and SF-98D version 3.1.5 or later. The earlier version supports No. 1 to 10 only.

```
[ PARA ] NO 01:0100.0
SPD-TBL NO 02:0200.0
          NO 03:0300.0
          NO 04:0400.0
```

**STEP 2**

Press the **NEXT** key or the **-NEXT** key to scroll the screen. If the **SEARCH** key is pressed and the table No. is input, the display will jump to that table. Press the **ESC** key to return to the table selection screen.

## ■ 13.5.3 Setting of acceleration/deceleration table

Press the **F3** key in the table selection screen shown in section ■ 13.5, and the acceleration table is selected.

```
[ PARA ]
ACC-TBL NO 01:0.10
          NO 02:0.15
          NO 03:0.20
```

**STEP 1**

Input is possible for the acceleration table at the second line from the top. Use the numeric keypad and enter acceleration/deceleration time and press the **ENT** key. (Setting range: 0.01 to 9.99, unit: s)  
Press the **NEXT** key to scroll the screen of the STEP 2.



- Acceleration/deceleration time is the time period required for reach to the set speed or for stop from the set speed.
- The table No. 1 to 20 can be set. The initial values are as the followings.

ACC table No.	1	2	3	4	5	6	7	8	9	10
Time [s]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55

ACC table No.	11	12	13	14	15	16	17	18	19	20
Time [s]	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05

```
[ PARA ] NO 01:0.10
ACC-TBL NO 02:0.15
          NO 03:0.20
          NO 04:0.25
```

**STEP 2**

Press the **NEXT** key or the **-NEXT** key to scroll the screen. If the **SEARCH** key is pressed and the table No. is input, the display will jump to that table. Press the **ESC** key to return to the table selection screen.

**NOTE**

The maximum portable weight will differ according to the acceleration or deceleration speed.

## ■ 13.5.4 Setting of MVM table

Press the **F4** key in the table selection screen shown in section ■ 13.5, and the MVM table is selected.

```
[ PARA ]  ORG : NO = 001
MVM-TBL  P1 : NO = 000
01-1     P2 : NO = 000
          P3 : NO = 000
```

MVM table No.

### STEP 1

Use the numeric keypad to enter the P0 (ORG), P1, P2 and P3 coordinate table Nos. (1 to 999) and press the **ENT** key.  
Press the **NEXT** key to display the next screen.  
Press the **ESC** key to return to the table selection screen.



- If a specific MVM table is to be displayed or set while inputting the MVM table, press the **SEARCH** key and then enter the table No. with the numeric keypad (setting range: 1 to 32).
- Asterisks (\*\*\*\*\*) cannot be used for the coordinate table. If used, a parameter error (ERA8) occurs when an MVM command is executed.
- Refer to section ■ 5.1.6 for program examples using the MVM table.

```
[ PARA ]  NUMBER
MVM-TBL  P1 : 0000
01-2     P2 : 0000
          P3 : 0000
```

### STEP 2

Use the numeric keypad to enter the No. of pieces to be moved and loaded and then Press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the table selection screen.

```
[ PARA ]  CNT NO.
MVM-TBL  P1 : NO = 00
01-3     P2 : NO = 00
          P3 : NO = 00
```

### STEP 3

Use the numeric keypad to enter the No. of the counter to be used and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the table selection screen.

```
[ PARA ]  APPROACH
MVM-TBL  a Z = 0000.00
01-4     a R = 0000.00
```

### STEP 4

Select "a" (absolute coordinate) or "i" (relative coordinate) using the **ALT** key, and then press the **ENT** key.

### STEP 5

Then enter the coordinate of the approach point for the Z axis using the numeric keypad, and press the **ENT** key.

### STEP 6

Next, enter the coordinate of the approach point for the R axis (absolute coordinate designation only) using the numeric keypad, and press the **ENT** key.  
Press the **NEXT** key to display the next screen and the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the table selection screen.

```
[ PARA ]  DESTINATION
MVM-TBL  a R = 0000.00
01-5
```

### STEP 7

Enter the coordinate of the destination point for the R axis (absolute coordinate designation only) using the numeric keypad, and press the **ENT** key.  
Press the **-NEXT** key to display the previous screen.  
Press the **ESC** key to return to the table selection screen.



- The approach point is a point right above the matrix type point through which the robot moves to a point. If "i" (relative coordinate) is selected, the relative coordinate from the destination point is set.
- The destination is the coordinate of the R axis during movement to a point.
- (\*\*\*\*\*) cannot be used for the coordinate of the approach point and the destination point.



- The axis driving force is calculated for reference purposes only as the followings.

$$F = 2\pi \times T \times V \times \mu \times 1000 \div L$$

F: Axis driving force (N)

$T$ : Rated torque (N·m) (as the following table)

$V$ : Torque limit value (designated from torque limit table)

$\mu$ : Efficiency ( $\approx 0.9$ )

$L$ : Axis lead (mm)

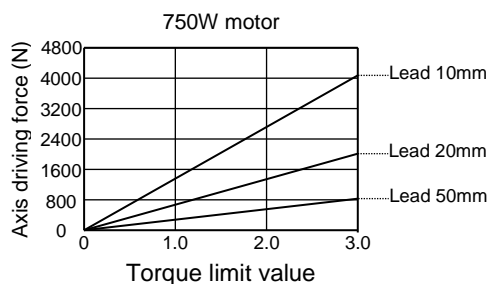
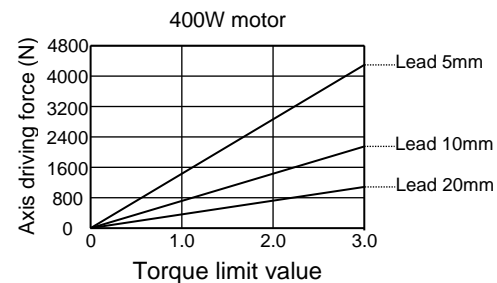
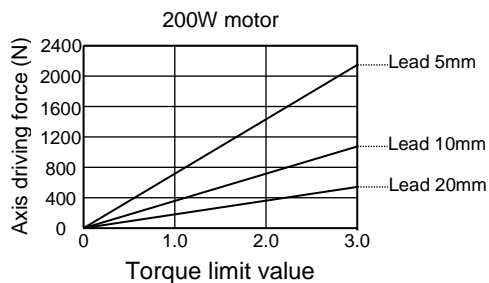
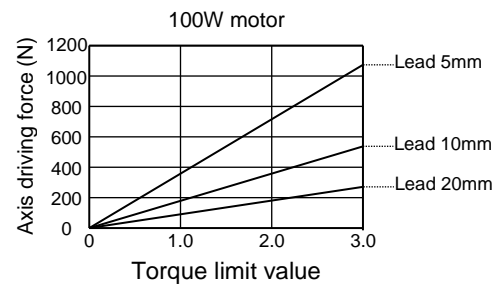
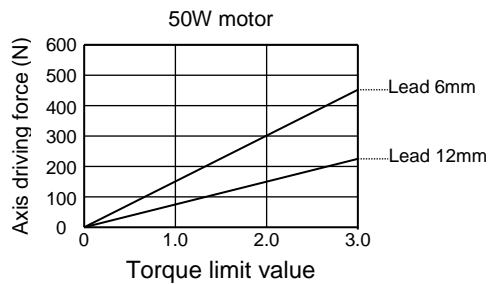
Motor capacity	50 W	100 W	200 W	400 W	750 W
Rated torque (N·m)	0.159	0.318	0.64	1.27	2.39

[Example]

In the case the motor capacity is 200W, the torque limit value is 1.50 and the axis lead is 10mm, the axis driving force is as the followings.

$$2\pi \times 0.64 \times 1.5 \times 0.9 \times 1000 \div 10 = 543$$

Therefore, the axis driving force is about 540 N.



**NOTE**

- This is presented for reference purposes only, and no guarantees are made for the values presented here.
- Smaller torque limit values result in a larger error due to effect of sliding resistance.
- If operation continues at an output where the rated torque is exceeded, an overload error occurs.

# Chapter 14 Monitoring

This robot has a function to monitor the various status. The status that can be monitored is as shown below.

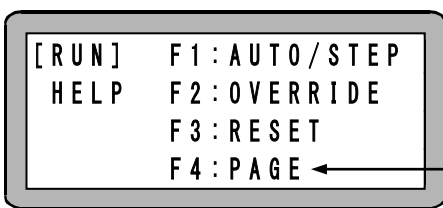
- 1. Program step No. monitor----- Step status during execution of the sequential program  
Step status of the external point designation coordinate
- 2. Input/output monitor ----- Input status of system and general purpose port  
Output status of system and general purpose port  
Status of origin sensor ON/OFF  
Output status of internal port
- 3. Counter and timer monitor ----- Status of counter  
Status of timer  
Setting of counter
- 4. Coordinate monitor----- Current position coordinate  
Offset coordinate  
Coordinate input from RS-232C

**NOTE**

- Stop input of the Teach Pendant is not effective during monitoring.
- When using multitasking, the status of the task displayed on the Teach Pendant will be monitored.
- For monitoring through CC-Link, refer to section ■ 11.3.3. For monitoring CC-Link status, refer to section ■ 11.6.

There are two methods of monitoring: monitoring from the RUN mode and monitoring with T/P not turned ON after turning ON the power.

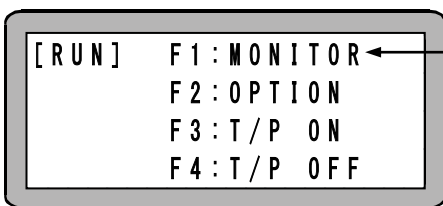
(1) Monitoring from the RUN mode



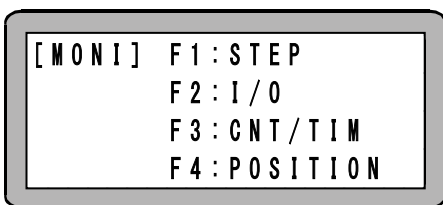
**STEP 1** The display at left is displayed when the **HELP** key is pressed in run mode. When it appears, press the **F4** key.



In the external point designation mode, display of "AUTO/STEP" does not appear.

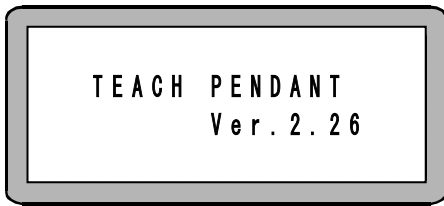


**STEP 2** When the display at left appears, press the **F1** key to enter the monitor mode.  
Press the **ESC** key to return to RUN mode.

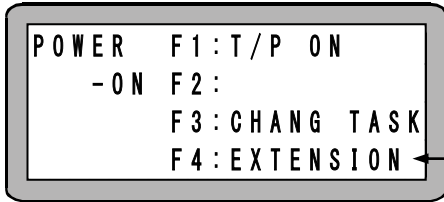


**STEP 3** This is the initial display for monitoring.  
Press the **F1** key to monitor the step.  
Press the **F2** key to monitor the I/O.  
Press the **F3** key to monitor the counter or the timer.  
Press the **F4** key to monitor the current coordinate and offset.  
Press the **ESC** key to return to STEP 2.

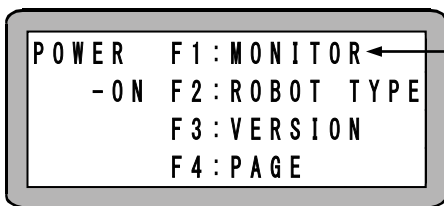
- (2) Monitoring with the T/P not turned ON after turning ON the power  
 This machine can perform monitoring without turning ON the T/P after turning ON the power. If monitoring cannot be performed from the RUN mode because of an error, use the following method.



**STEP 1** Turn ON the power. The initial screen is displayed.



**STEP 2** After the initial screen, the screen shown at the left appears. Press the **F4** key.



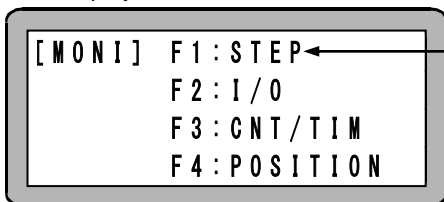
**STEP 3** Press the **F1** key.  
 Press the **ESC** key to return to the STEP 2.

The subsequent procedures are same as the STEP 3 of (1).

## ■ 14.1 Program step No. monitoring

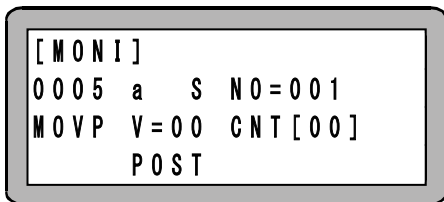
The content of the currently executed program step of the sequential program and the palletizing program, and the content of the currently coordinate step of the external point designation are displayed according to the progress of the program.

- Display the initial screen for monitoring.



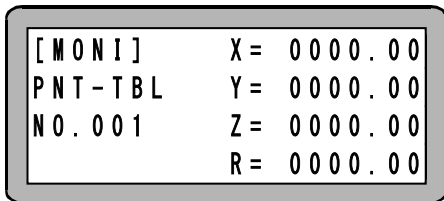
**STEP 1** When this display is shown, press the **F1** key.

- In the sequential mode and the palletizing mode



**STEP 2A** The currently executed program step is displayed. The screen display changes according to the progress of the program.  
 Press the **ALT** key or the **SEARCH** key and enter the task No. to display the program step of the task.  
 Press the **ESC** key to return to STEP 1.

- In the external point designation mode

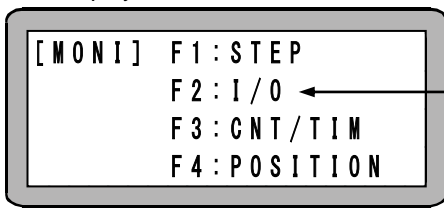


**STEP 2B** The currently executed coordinate step is displayed. The screen display changes according to the progress of the program.  
 Press the **ESC** key to return to STEP 1.

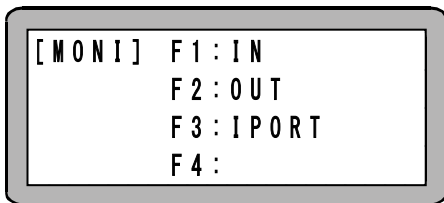
## ■ 14.2 Input/output monitoring

Status of input/output port in program execution is monitored according to the progress of the program.

- Display the initial screen for monitoring.



**STEP 1** When this display is shown, press the **F2** key.



**STEP 2** Press the **F1** key to monitor the input port and the **F2** key to monitor the output port.

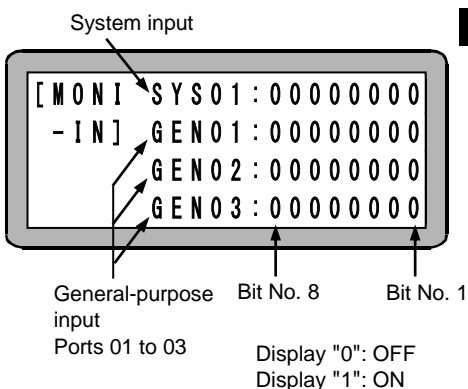
Press the **F3** key to monitor the internal port.

Press the **ESC** key to return to STEP 1.

- ① When the **F1** key is pressed (Input port monitor)



**STEP 3A** Enter the station No. of the controller to be monitored and press the **ENT** key.



**STEP 4A** The status of the current system input port and general-purpose input port will be displayed with bit units.

Press the **NEXT** key or the **-NEXT** key to scroll the display.

Press the **ESC** key to return to STEP 2.

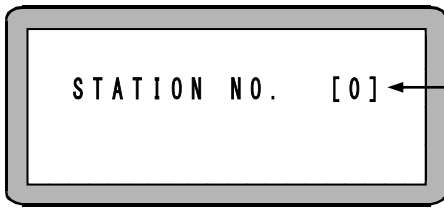
Bit	Signal name	
	System input	General-purpose input port 09
No. 1	Return to origin	Request axis 1 jog
No. 2	Start	Request axis 2 jog
No. 3	Stop	Request axis 3 jog
No. 4	Reset	Request axis 4 jog
No. 5	Origin sensor (station No. 0)	Request inching
No. 6	Origin sensor (station No. 1)	Request low-speed jog
No. 7	Origin sensor (station No. 2)	Request high-speed jog
No. 8	Origin sensor (station No. 3)	Designate jog direction OFF: + direction, ON: - direction

### NOTE

- For the station Nos. 1 to 3 (slave unit), the system input is not displayed.
- The display for the invalid bits is 0.
- The reverse of real signal is displayed in No. 1 to 4 of System input the case 1 is set in "M27: Positive logic/negative logic selection (input 1)" of the mode setting.
- The reverse of real signal is displayed in No. 1 to 4 of General-purpose input 09 the case 1 is set in start input of "M27: Positive logic/negative logic selection (input 1)" of the mode setting..

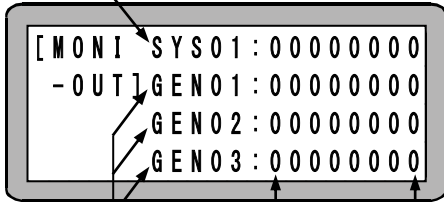


② When the **F2** key is pressed (output port monitor)



**STEP 3B** Enter the station No. of the controller to be monitored and press the **ENT** key.

System output



General-purpose output Ports 01 to 03  
 Bit No. 8  
 Bit No. 1  
 Display "0": OFF  
 Display "1": ON

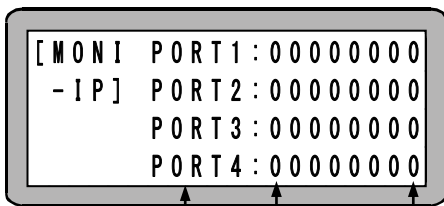
**STEP 4B** The status of the current system output port and general-purpose output port will be displayed with bit units.  
 Press the **NEXT** key or the **-NEXT** key to scroll the display.  
 Press the **ESC** key to return to STEP 2.

Bit	Signal name	
	System output	General-purpose output port 09
No. 1	Running	Axis 1 jogging
No. 2	Error	Axis 2 jogging
No. 3	Positioning complete	Axis 3 jogging
No. 4	Return to origin complete	Axis 4 jogging
No. 5	invalid	Jog-ready
No. 6	invalid	invalid
No. 7	invalid	invalid
No. 8	invalid	invalid

**NOTE**

- For the station Nos. 1 to 3 (slave unit), the system input is not displayed.
- The display for the invalid bits is 0.
- The reverse of real signal is displayed in No. 1 to 4 of System output the case 1 is set in "M31: Positive logic/negative logic selection (output 1)" of the mode setting.
- The reverse of real signal is displayed in No. 1 to 4 of General-purpose output 09 the case 1 is set in running output of "M31: Positive logic/negative logic selection (output 1)" of the mode setting.
- The reverse of real signal is displayed in No. 5 of General-purpose output 09 the case 1 is set in ready output of "M32: Positive logic/negative logic selection (output 2)" of the mode setting.

③ When the **F3** key is pressed (internal port monitor)



Internal port Bit No. 8 Bit No. 1  
 Display "0": OFF  
 Display "1": ON

**STEP 3C** Current status of the internal port is displayed per bit.  
 Press the **ESC** key to return to STEP 2.



For details of the internal port, refer to INSP and IOUT commands in Chapter 17 Commands.

## ■ 14.3 Counter and timer monitoring

Current counter and timer condition are monitored according to the progress of the program.

- Display the initial screen for monitoring.

```
[MONI] F1:STEP
        F2:I/O
        F3:GNT/TIM ←
        F4:POSITION
```

**STEP 1** When the display at left is shown, press the **F3** key.

```
[MONI] F1: COUNTER
        F2: TIMER
        F3:
        F4: SET COUNT
```

**STEP 2** To monitor the counter, press the **F1** key.  
Press the **F2** key to monitor the timer.  
To set the counter directly, press the **F4** key.  
Press the **ESC** key to return to STEP 1.

- ① When the **F1** key is pressed: Counter monitoring

```
[MONI   NO. 01 = 0000
- GNT]  NO. 02 = 0000
        NO. 03 = 0000
        NO. 04 = 0000
```

**STEP 3A** The current conditions of the counter are monitored.  
Press the **NEXT** key or the **-NEXT** key to scroll the display. (No. 01 to No. 99)  
Press the **SEARCH** key and enter the counter number to perform a search in the counter monitor screen.  
Press the **ESC** key to return to STEP 2.

- ② When the **F2** key is pressed: Timer monitoring

```
[MONI   NO. 1 = 000.0
- TIM]  NO. 2 = 000.0
        NO. 3 = 000.0
        NO. 4 = 000.0
```

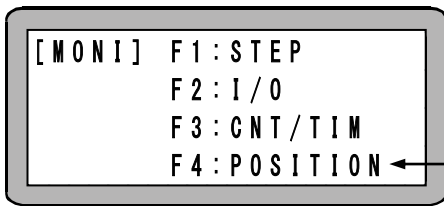
**STEP 3B** The current conditions of the timer are monitored.  
Press the **NEXT** key or the **-NEXT** key to scroll the display. (No. 01 to No. 9)  
Press the **ESC** key to return to STEP 2.  
\* The time is set by the TIMP command.

- ③ When the **F4** key is pressed (Direct setting of the counter)  
Refer to section ■ 16.3.

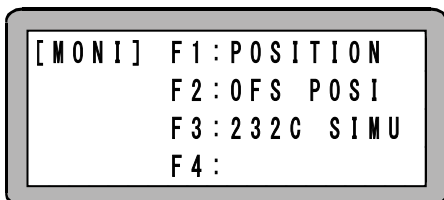
## ■ 14.4 Coordinate monitoring

Current coordinates are monitored according to the progress of the program.

- Display the initial screen for monitoring.

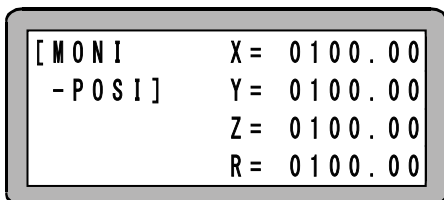


**STEP 1** When the display at left appears, press the **F4** key.



**STEP 2** Press the **F1** key to monitor the current position coordinate (absolute coordinate).  
 Press the **F2** key to monitor the offset coordinates.  
 Press the **F3** key to perform RS-232C coordinate input.  
 Press the **ESC** key to return to STEP 1.

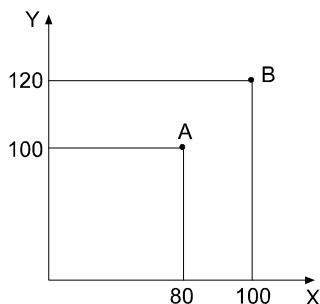
① When the **F1** key is pressed (Coordinate monitoring)



**STEP 3A** Current position coordinate is displayed.  
 Press the **ALT** key or the **SEARCH** key and enter the task No. to display the coordinate of the task.  
 Press the **ESC** key to return to STEP 2.

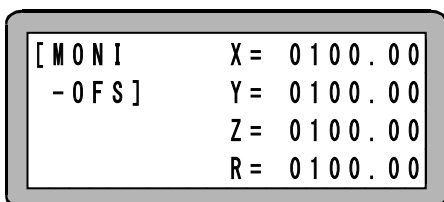
### NOTE

- The value displayed for the current position is the absolute value minus the offset value.
- The displayed value does not reflect the origin offset value setting in the parameter 1.
- When the controller does not execute the OFS command, the display shows OFS = 0 in the current position monitor.



When the point A movement command is executed in the program (MOV X=80, Y=100, Z=0), if the offset command (OFS X=20, Y=20, Z=0) is executed before the movement, the robot will move to point B. If this point B is monitored as the current position, (X=80, Y=100, Z=0) will display.

② When the **F2** key is pressed: Offset coordinate monitoring



**STEP 3B** Current offset coordinate is displayed.  
 Press the **ALT** key or the **SEARCH** key and enter the task No. to display the offset coordinate of the task.  
 Press the **ESC** key to return to STEP 2.



- The offset coordinates refer to the coordinate system using the origin that has been offset (moved in parallel) with the OFS command.
- The displayed value does not reflect the origin offset value setting in the parameter 1.

③ When the **F3** key is pressed (RS-232C coordinate input)  
 Refer to section ■ 16.9.

## Chapter 15 Search Function

When the **SEARCH** key is pressed in each mode, the following search operation can be carried out.

### ■ 15.1 Search of sequential step No.

When multitasking, the step No. of the currently displayed task is searched. Therefore switch to the task for which step No. search is to be performed before following procedures. (Refer to section ■ 6.3.2-(3))

When the **SEARCH** key is pressed in the sequential PRGM mode or RUN mode, the following screen will display.

```
[SRCH]
STEP NO. SEARCH
          [0010]
```

**STEP 1** Use the numeric keypad to enter the step No. and press the **ENT** key. (Input range: 1 to 9999)  
Press the **ESC** key to return to the original screen.

---

```
[RUN]
0010
NOP
```

**STEP 2** The designated step will display.

**?** If a nonexistent step No. is searched, a STEP NO. error occurs.

### ■ 15.2 Search of tag No.

When multitasking, the tag No. of the currently displayed task is searched. Therefore switch to the task for which tag No. search is to be performed before following procedures. (Refer to section ■ 6.3.2-(3))

If the **SEARCH** key is pressed twice in the sequential PRGM mode or RUN mode, the following screen will display.

```
[SRCH]
TAG NO. SEARCH
          [020]
```

**STEP 1** Use the numeric keypad to enter the tag No. and press the **ENT** key. (Input range: 1 to 999)  
Press the **ESC** key to return to the original screen.

---

```
[RUN]
0001
TAG 020
```

**STEP 2** The designated tag No. step will display.

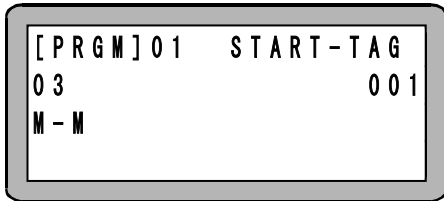
**?** If a nonexistent tag No. or a tag No. of a task other than the current task is searched, a TAG NO. error occurs.

### ■ 15.3 Search of palletizing program No.

If the **SEARCH** key is pressed in the palletizing mode's PRGM mode or RUN mode, the following screen will display.



**STEP 1** Use the numeric keypad to enter the palletizing program No. and press the **ENT** key. (Input range: 1 to 16)  
Press the **ESC** key to return to the original screen.



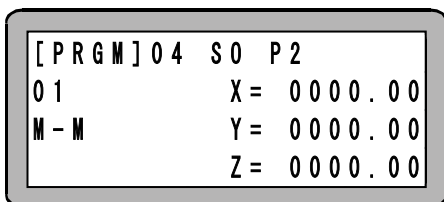
**STEP 2** The designated palletizing program will display.

### ■ 15.4 Search of palletizing program screen No.

If the **SEARCH** key is pressed twice in the palletizing mode's PRGM mode, the following screen will display.



**STEP 1** Use the numeric keypad to enter the screen No. and press the **ENT** key. (Input range: 1 to 16)  
Press the **ESC** key to return to the original screen.

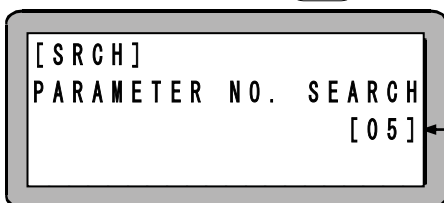


**STEP 2** The designated screen will display.

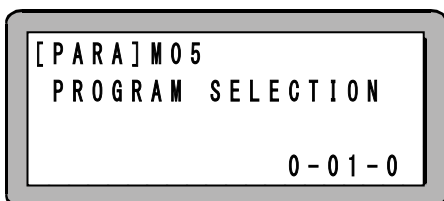
### ■ 15.5 Search of parameter No.

In the mode setting, the parameter 1 setting, and the parameter 2 setting, the parameter No. can be searched.

For example, when the **SEARCH** key is pressed in the mode setting, the following screen will be displayed.



**STEP 1** Use the numeric keypad to enter the parameter No. and press the **ENT** key.  
(Input range: 1 to 21)  
Press the **ESC** key to return to the original screen.



**STEP 2** The designated parameter will display.

## ■ 15.6 Search of table No.

In the PRGM mode, the RUN mode, the coordinate table setting, the speed table setting, the acceleration/deceleration table setting, and the MVM table setting of the external point designation mode, the table No. can be searched. For example, when the **SEARCH** key is pressed in the coordinate table setting, the following screen will be displayed.

```
[SRCH]
POINT TBL. NO. SEARCH
                [006]
```

**STEP 1** Use the numeric keypad to enter the table No. and press the **ENT** key. (Input range: 1 to 999)  
Press the **ESC** key to return to the original screen.

```
[PARA]      X= 0000.00
PNT-TBL     Y= 0000.00
NO.006      Z= 0000.00
            R= 0000.00
```

**STEP 2** The designated coordinate table will display.

## ■ 15.7 Search of counter No.

When the **SEARCH** key is pressed in the counter monitor, the following screen will be displayed.

```
[SRCH]
COUNTER NO. SEARCH
                [07]
```

**STEP 1** Use the numeric keypad to enter the counter No. and press the **ENT** key.  
(Input range: 1 to 99)  
Press the **ESC** key to return to the original screen.

```
[MONI      NO. 07=0000
-GNT]     NO. 08=0000
          NO. 09=0000
          NO. 10=0000
```

**STEP 2** The designated counter will display.

## ■ 15.8 Search of error history No.

When the **SEARCH** key is pressed in the error history display, the following screen will be displayed.

```
[SRCH]
ERROR HISTORY
NO. SEARCH [08]
```

**STEP 1** Use the numeric keypad to enter the error history No. and then press the **ENT** key.  
(Input range: 1 to 99)  
Press the **ESC** key to return to the original screen.

```
[ERR]HISTORY  H M S
08 ER62AL*** 0000605
09 ER13AL*** 0000236
10 *****  *****
```

**STEP 2** The designated error history will be displayed.

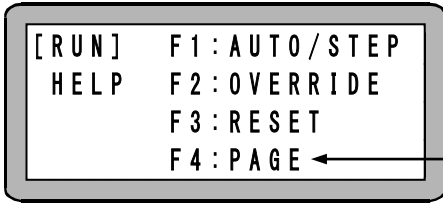
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# Chapter 16 Other Handy Operations

## ■ 16.1 Teach Pendant ON/OFF

When the Teach Pendant is physically connected to the controller, it can be logically disconnected by the following key operation and make system input signals effective.

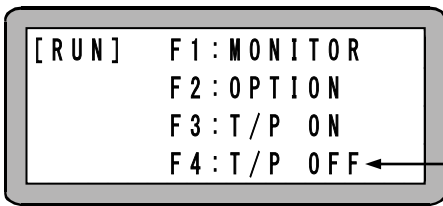
- T/P OFF (teach pendant OFF) operation



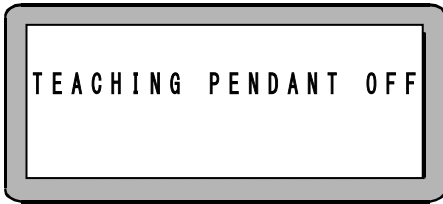
**STEP 1** Start RUN mode, and press the **HELP** key to display the screen on the left.  
Press the **F4** key.  
Press the **ESC** key to return to RUN mode.



When the external point designation mode is set, "AUTO/STEP" indication will not be displayed.

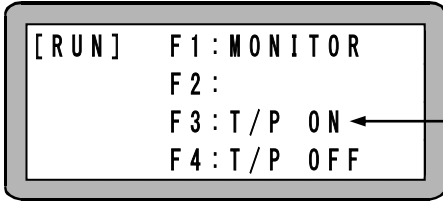


**STEP 2** Press the **F4** key.  
Press the **ESC** key to return to RUN mode.



**STEP 3** The Teach Pendant OFF screen is displayed. This enables simulation with the T/P OFF (teach pendant disconnected).

- T/P ON (teach pendant ON) operation



**STEP 4** When the teach pendant is OFF, press the **HELP** key to display the screen on the left.  
Press the **F3** key to turn ON the T/P (teach pendant connected) and return to the RUN mode.  
Press the **ESC** key to return to RUN mode.

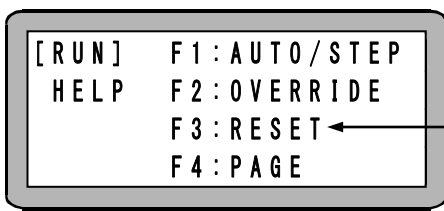
**NOTE**

- If the teach pendant is physically disconnected with the T/P turned ON, the T/P turns OFF after three seconds have passed.
- Monitoring is possible even when the T/P is turned OFF.



## ■ 16.2 Reset operation

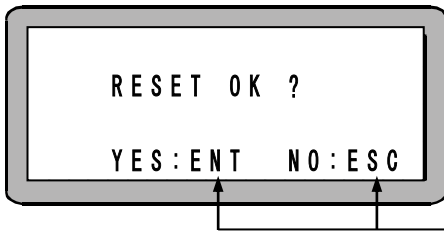
The Teach Pendant can perform the same function as the reset signal (Pin No. 31) of the system input.



**STEP 1** In RUN mode, press the **HELP** key to display the screen on the left.  
Press the **F3** key.  
Press the **ESC** key to return to RUN mode.



When the external point designation mode is set, "AUTO/STEP" indication will not be displayed.

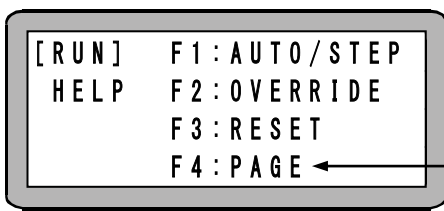


**STEP 2** To reset, press the **ENT** key. To not reset, press the **ESC** key.  
After pressing the key, operation returns to RUN mode.

● For operation after reset input, refer to section ■ 10.2.4.

## ■ 16.3 Counter direct set

Teach Pendant can be used to set the counter value directly.



### STEP 1

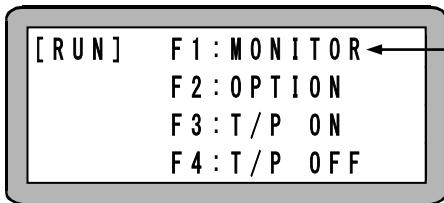
In RUN mode, press the **HELP** key to display the screen on the left.

Press the **F4** key.

Press the **ESC** key to return to RUN mode.



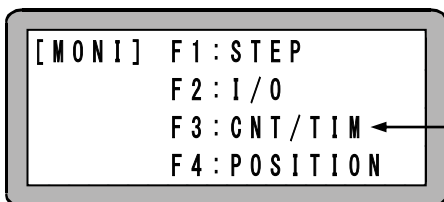
When the external point designation mode is set, "AUTO/STEP" indication will not be displayed.



### STEP 2

Press the **F1** key to display MONITOR mode.

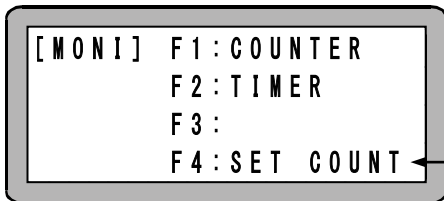
Press the **ESC** key to return to RUN mode.



### STEP 3

Press the **F3** key.

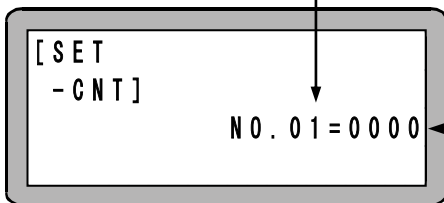
Press the **ESC** key to return to STEP 2.



### STEP 4

Press the **F4** key.

Press the **ESC** key to return to STEP 3.



### STEP 5

Enter the specified counter No. with the numeric keypad, and press the **ENT** key. (Input range: 1 to 99)

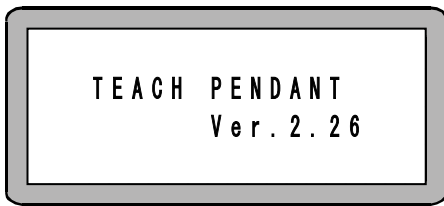
### STEP 6

Enter the counter value with the numeric keypad, and press the **ENT** key. (Setting range: 0 to 9999)

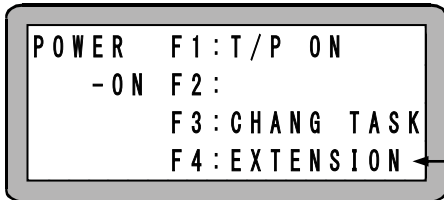
Press the **ESC** key to return to STEP 4.

## ■ 16.4 Version display

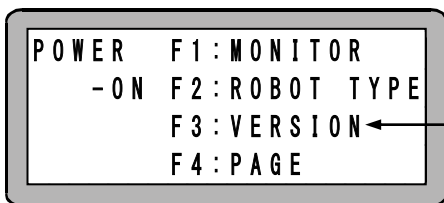
The firmware version of the controller and Teach pendant can be displayed.



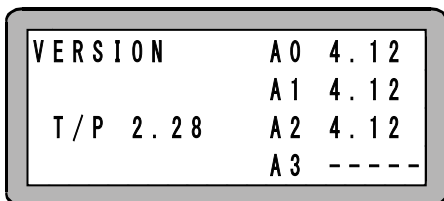
**STEP 1** When you turn ON the power, the initial screen is displayed.



**STEP 2** When this display appears after the initial screen, press the **F4** key.



**STEP 3** Press the **F3** key.  
Press the **ESC** key to return to STEP 2.



**STEP 4** The version will display on the screen.  
Press the **ESC** key to return to STEP 3.



- The displayed indicators on the screen have the meanings below.

A0: Master unit (station No. 0)  
A1: Slave unit (station No. 1)  
A2: Slave unit (station No. 2)  
A3: Slave unit (station No. 3)  
T/P: Teach pendant

- The version of the slave unit to which the communication has not been established is displayed as "-----". Therefore you can confirm to which slave unit communication has not been established in the waiting status for establishment of the slave communication (refer to section ■ 18.4-(1)).
- To reload the screen, return to the STEP 3 to display the version.

## ■ 16.5 JOG operation (Manual operation of axis)

JOG operation is the operation in which the axis is moved with remote operations.

This is used to stop the automatic operation and move the axis, or to move the axis during a program editing.

If the axis is provided with brakes, the brakes will be applied and the axis will not move in the servo free state. Thus, the JOG operation is used to move the axis.

For the JOG operation from other than T/P, refer to section ■ 10.2.26 from I/O, section ■ 11.2.4 from CC-Link, section ■ 12.2.4 from DeviceNet, and section ■ 19.2.4 from EtherNet/IP.



For the method to input the positional data using JOG operation (remote teaching), refer to section ■ 4.7.2.

The JOG operation can be used in the PRGM mode and the RUN mode when the T/P is turned ON.

An example of operation in the sequential mode is given below.

```
[ PRGM ]
0001
SPD  V = 05
```

**STEP 1** Press the key in PRGM mode or RUN mode under servo-lock.

When multitasking in the sequential mode, it is necessary to switch to the task for which JOG operation is to be performed before pressing the key. (Refer to section ■ 6.3.2-(3))

```
[ PRGM ]      X = 0000.00
JOG           Y = 0000.00
OPERATION    Z = 0000.00
SPD: LOW     R = 0000.00
```

**STEP 2** The JOG screen is displayed, and JOG operation is enabled.

**STEP 3** The JOG speed is switched between HIGH and LOW by pressing the key.

As an example, the first axis will move when the key is pressed.

After moving the axis to the designated position, press the key.

### NOTE

- For the axis movement during JOG operation, movement keys (the and keys for the first axis, the and keys for the second axis the and keys for the third axis, and the and keys for the fourth axis) are used. If a plus key is held down, the axis will move in the direction opposite the origin, and if a minus key is held down, the axis will move in the direction of the origin.
- The number on a movement key represents the axis number in the task. For example, to move the first axis of the task 2, use the and keys.
- The JOG operation can be performed within the software limits when the controller grasps the current position of the axis (when return to origin is unnecessary). When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in section ■ 3.2)
- Jog operation can be executed even when the controller has lost track of the current axis position (when return to origin is required). In this case, the soft limit is not applied.
- The JOG operation speed can be set with parameter 1 JOG speed. (Refer to sections ■ 13.3.8 to ■ 13.3.11) With the TPH-4C the version of which is 2.29 or later, the JOG speed setting screen of the parameter 1 will be displayed when the key is pressed.
- Inching during JOG operation is possible by pressing and quickly releasing the movement keys. The distance of an inching movement can be set by the inching distance setting of the parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in JOG speed in parameter 1.
- The screen indicates the current position of the axis. This can be used as the coordinate monitor.

```
[ PRGM ]
0001
SPD  V = 05
```

**STEP 4** The JOG operation will be canceled, and the display will return to the first screen.

## ■ 16.6 Movement operation on coordinate table setting screen

This operation is used to move the axis to the coordinate position in the coordinate table currently displayed during setting of the coordinate table.

When multitasking, the axis moves to the coordinate table of the task currently displayed. Therefore switch to the task in which the table to be moved exists before following procedures. (Refer to section ■ 6.3.2-(3)).

Call the coordinate table setting screen. (Refer to section ■ 13.5.1)

```
[ PARA ]   X = 0000.00
PNT-TBL   Y = 0000.00
NO.001    Z = 0000.00
           R = 0000.00
```

**STEP 1** Use the (NEXT), (-NEXT) and (SEARCH) keys to display the coordinate table to be moved.

```
[ PARA ]   X = 0100.00
PNT-TBL   Y = 0200.00
NO.002    Z = 0300.00
           R = 0400.00
```

**STEP 2** To change the coordinate, enter the coordinate with the numeric keypad and then press the (ENT) key. (Setting range: -8000.00 to 8000.00, Unit: mm) (Refer to section ■ 13.5.1)  
Press the (START) key to move to the STEP 3.

**NOTE** Pressing the (START) key when the controller has lost the current position of the axis (when return to origin is necessary) or when the servo is free leads to an error beep. In this case, the procedure does not proceed to the STEP 3.

```
[ PARA ]
START OK ?

YES:ENT NO:ESC
```

**STEP 3** The confirmation screen is displayed.  
Press the (ENT) key to start movement to the coordinate on the coordinate table screen in the STEP 2 and to proceed to the STEP 4.  
Press the (ESC) key to return to the STEP 2.

```
R U N !!!
```

**STEP 4** During movement, the screen at the left is shown.  
When the movement finishes, the procedure returns to the STEP 2.

**?** The specifications of the operation are as the followings.

Speed:	Speed table No. 1
Acceleration/deceleration time:	Acceleration/deceleration table No. 5
Coordinate system:	Absolute coordinate

## ■ 16.7 Clearing (initializing) coordinate table

All coordinate tables in the controller memory can be cleared.

When using multitasking, only the coordinate table of the displayed task will be cleared. Thus, change to the task containing the table to be cleared before carrying out the following operation. (Refer to section ■ 6.3.2-(3))

Enter the PRGM mode (sequential) and press the **HELP** key. (Refer to section ■ 5.1.1)

The following screen will display.

```
[PRGM] F1:EXTENSION
        F2:DIRECT OUT
        F3:EDIT ←
        F4:PARAMETER
```

**STEP 1** Press the **F3** key in this state.  
Press the **ESC** key to return to PRGM mode.

```
[EDIT] F1:INS STEP
        F2:DEL STEP
        F3:CLEAR ←
        F4:PAGE
```

**STEP 2** Press the **F3** key to proceed to clear mode.  
Press the **ESC** key to return to PRGM mode.

```
[CLR]  F1:SEQUN
        F2:PALET
        F3:SEQ/PALET
        F4:PAGE ←
```

**STEP 3** Press the **F4** key.  
Press the **ESC** key to return to STEP 2.

```
[CLR]  F1:MEMORY INT
        F2:
        F3:POINT TABLE ←
        F4:ERR. HISTORY
```

**STEP 4** Press the **F3** key.  
Press the **ESC** key to return to STEP 3.

```
[CLR]
ALL POINT TABLE
      CLEAR ?
YES:ENT NO:ESC
```

**STEP 5** To clear the coordinate table, press the **ENT** key.  
To not clear the table, press the **ESC** key.  
After pressing the key, operation returns to STEP 4.

## ■ 16.8 Manual Operation of General-purpose Outputs


The general-purpose output from the Teach Pendant can be directly turned ON and OFF. There are two methods for this outputting method.

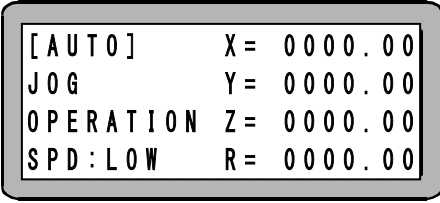
1. Manual output using function keys
2. Manual output of arbitrary bit from PRGM mode

### ■ 16.8.1 Manual output using function keys

The general-purpose output bits set in the mode setting can be manually output using the function keys. This method is valid only during the JOG mode or remote teaching mode.


**NOTE** Set the output bit to be directly output with the mode setting before starting this operation. (Refer to section ■ 13.2.12)


Enter the AUTO mode or the PRGM mode and set the servo lock. Press the  key.

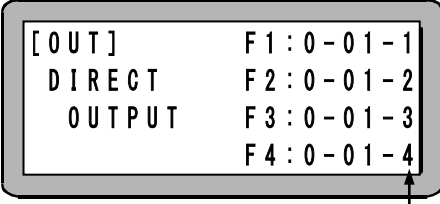


```
[ AUTO ]      X = 0000.00
JOG           Y = 0000.00
OPERATION    Z = 0000.00
SPD:LOW     R = 0000.00
```



**STEP 1** The JOG screen display will appear, and JOG operation will be possible.



Press the  key to proceed to STEP 2.


Press the  key to return to the original screen.



```
[ OUT ]       F1:0-01-1
DIRECT       F2:0-01-2
OUTPUT      F3:0-01-3
            F4:0-01-4
```

**STEP 2** The bit Nos. set in the bit setting of the direct output in the mode setting are displayed for the  to  keys.

When the  to  keys is pressed, the designated port is ON, when pressed again, it is OFF. (The same operation can be performed in the screen of the STEP 1.)

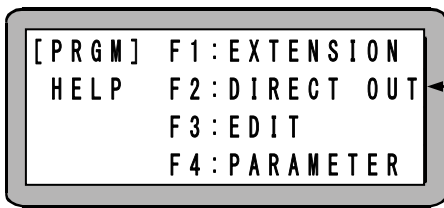
Press the  key to return to STEP 1.

Bit No.

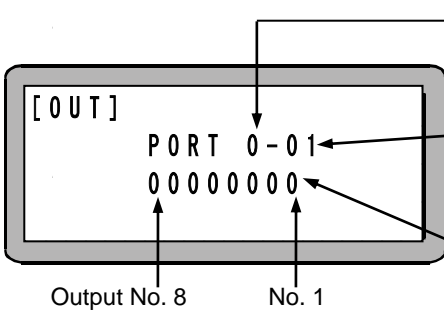
## ■ 16.8.2 Manual output of arbitrary bit designation from PRGM mode

A arbitrary bit can be manually output in the PRGM mode (sequential).

Enter the PRGM mode and press the **HELP** key. The following screen will display. (Refer to section ■ 5.1.1)



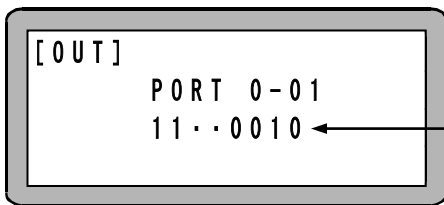
**STEP 1** Press the **F2** key and enter the direct output mode.  
Press the **ESC** key to return to PRGM mode.



**STEP 2** Use the numeric keypad to enter the station No. and press the **ENT** key. (0 to 3)

**STEP 3** Use the numeric keypad to enter the port No. and press the **ENT** key.

**STEP 4** The status of the output port designated in STEPS 2 and 3 is displayed.



**STEP 5** Enter the output data with the **RET**/**0**, **IN**/**1** and **TAG**/**.** keys.  
Then press the **ENT** key to turn ON/OFF the output bit of the general-purpose output set.

The keys for entry of output data are shown as the followings.

- RET**/**0** Output OFF
- IN**/**1** Output ON
- TAG**/**.** Holding the current status

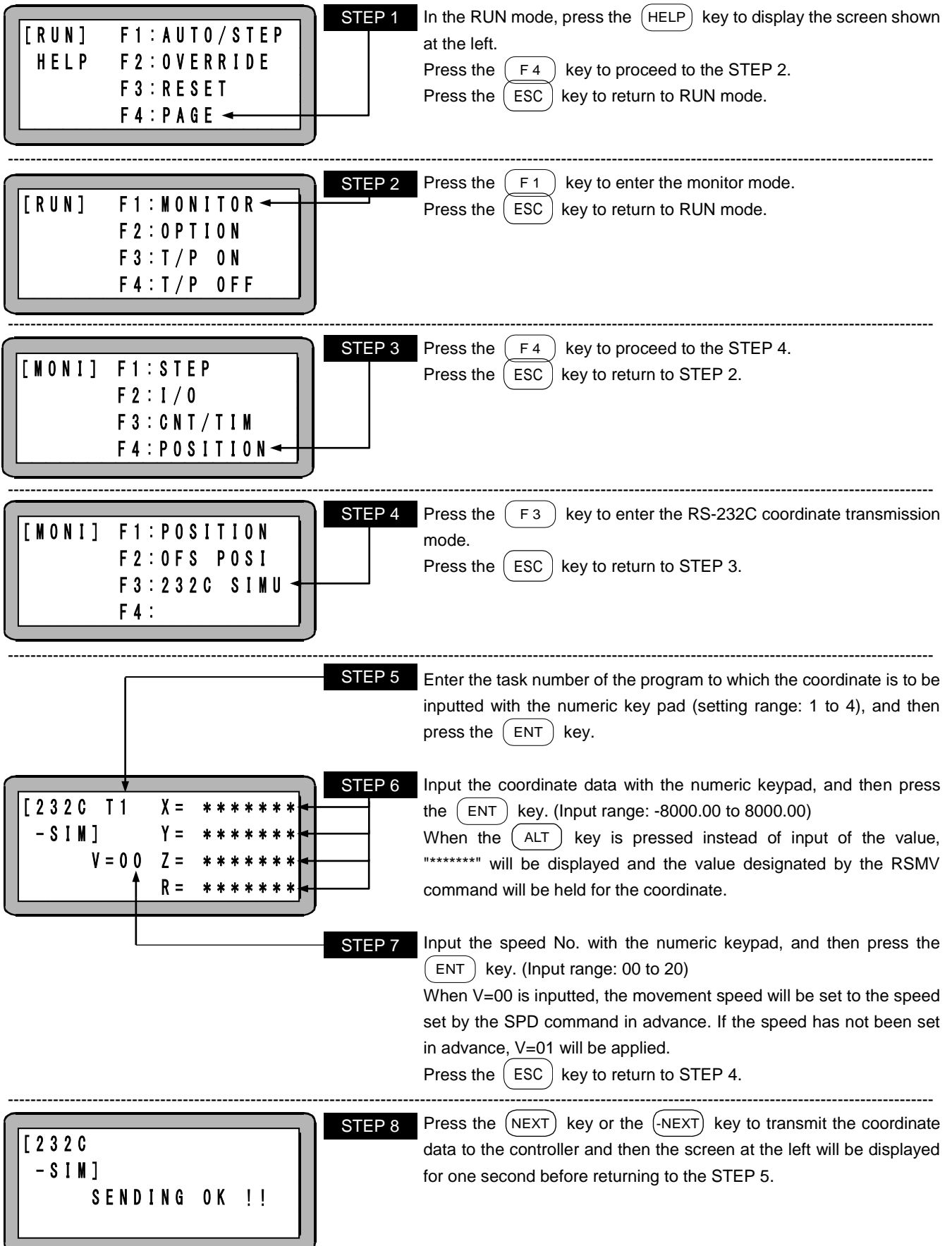
Press the **ESC** key to return to the PRGM mode.

**NOTE** For the station No., port No. and bit No. which can be used, refer to section ■ 10.1.5.



## ■ 16.9 Transmission of coordinate through RS-232C

In execution of RSMV commands, the coordinate data can be transmitted from the teach pendant through RS-232C.



## ■ 16.10 BA I/O Compatibility Mode

The BA I/O compatibility mode is a function that sets the operation specifications for return to origin complete output and positioning complete output to match the BA series.

### ■ 16.10.1 Selection method of BA I/O compatibility mode

BA I/O compatibility mode can be selected by the OFF/ON setting in "K23: BA I/O Compatibility Mode" of Parameter 2. (Refer to section ■ 13.4.23)

Setting	Mode	Output signal specifications (*1)	Remarks
OFF	Standard mode	BA III, II series controller specifications	Default
ON	BA I/O compatibility mode	BA series controller specifications	

\*1: Positioning complete signal/Return to origin complete signal

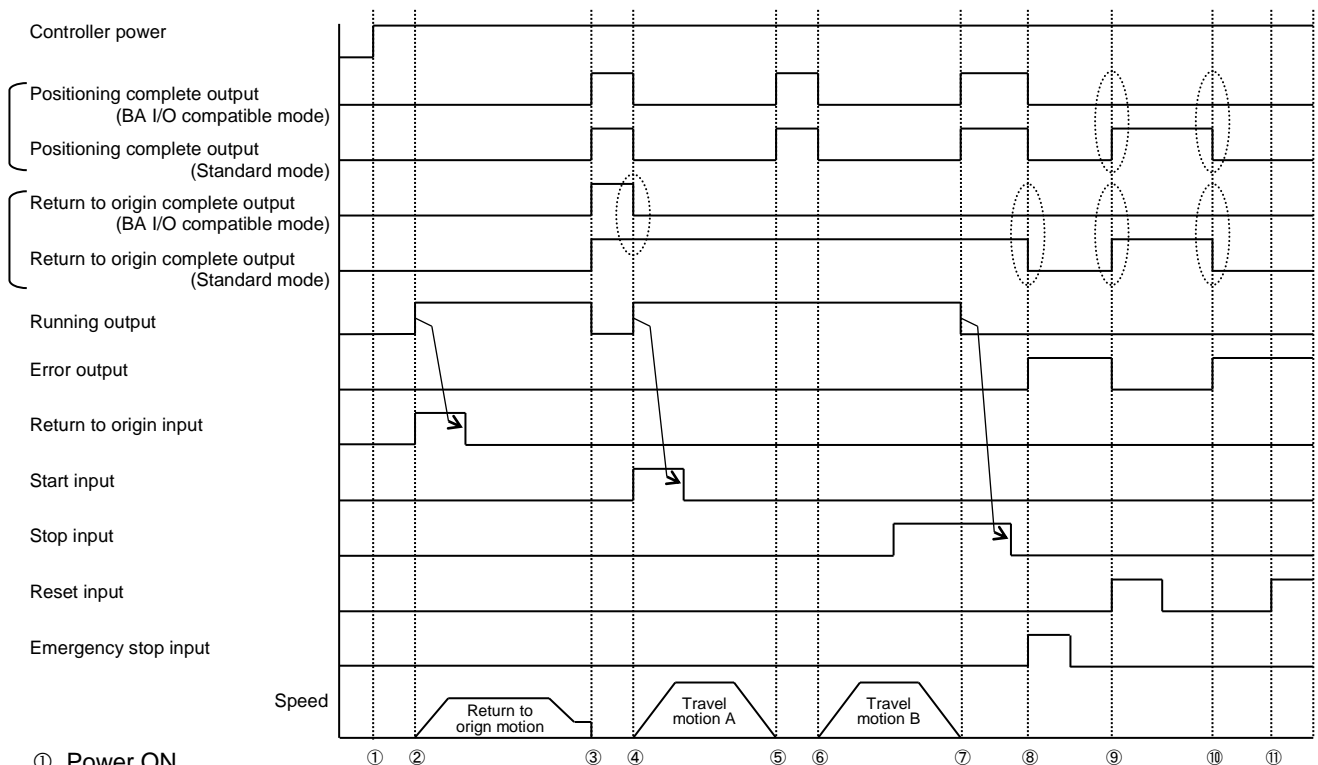


The initial value is "OFF".

### ■ 16.10.2 Operation specifications for positioning complete output and return to origin complete output

The operation of positioning complete output and return to origin complete output varies depending on whether the incremental encoder type or the absolute encoder type has been selected in the encoder type setting (K17: section ■ 13.4.17).

(1) When incremental encoder type is specified



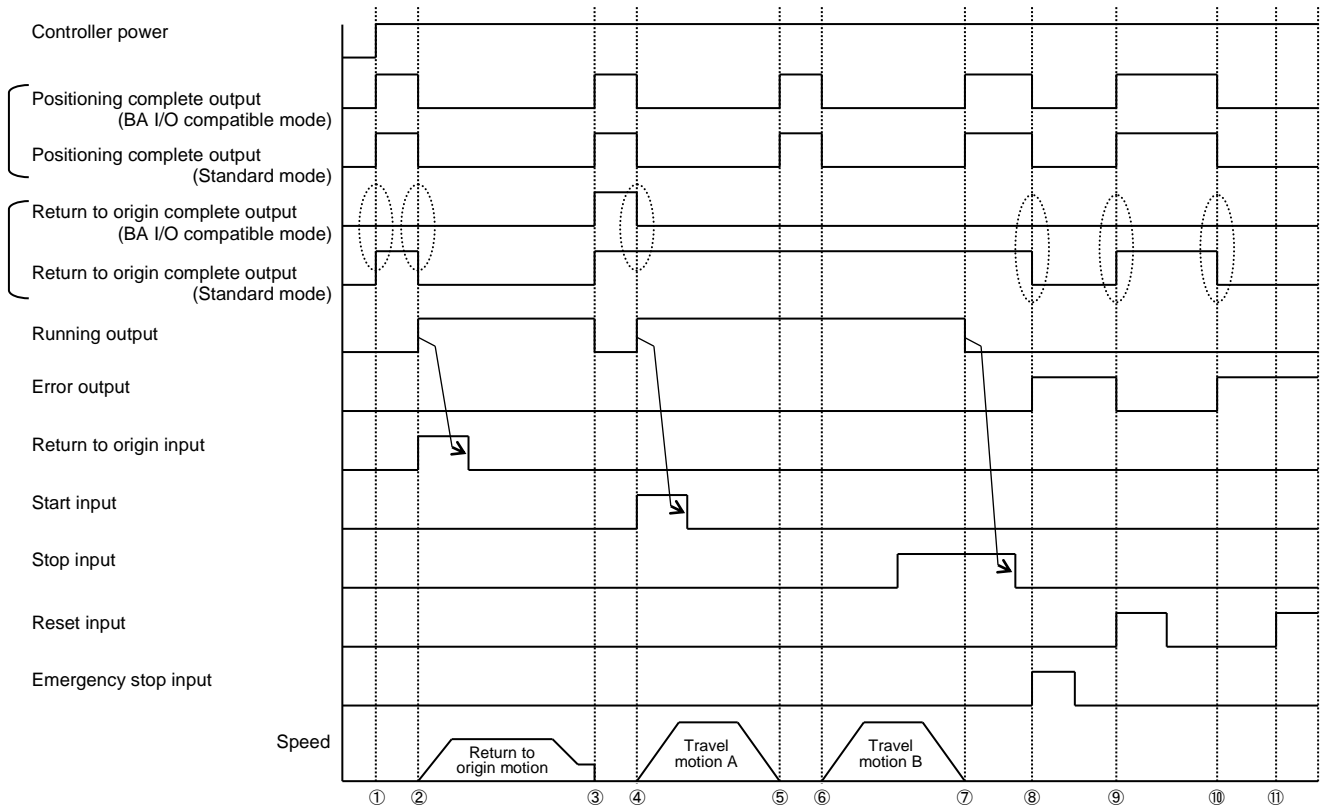
- ① Power ON
- ② Return to origin start
- ③ Return to origin complete
- ④ Travel motion A start
- ⑤ Travel motion A finish
- ⑥ Travel motion B start
- ⑦ Travel motion B finish
- ⑧ Emergency stop input ON
- ⑨ Reset input (Emergency stop cancel)
- ⑩ Encoder error generation
- ⑪ Reset input → Error clear is not possible.

```

Motion program
MOV A
TIM ***
MOV B
    
```

Difference


(2) When absolute encoder type is specified



- ① Power ON
- ② Return to origin start
- ③ Return to origin complete
- ④ Travel motion A start
- ⑤ Travel motion A finish
- ⑥ Travel motion B start
- ⑦ Travel motion B finish
- ⑧ Emergency stop input ON
- ⑨ Reset input (Emergency stop cancel)
- ⑩ Encoder error generation
- ⑪ Reset input → Error clear is not possible.

```

Motion program
MOV A
TIM ***
MOV B
    
```

 Difference

## ■ 16.11 Maximum torque limit function

### ■ 16.11.1 Overview

This controller can limit the maximum torque using a direction from the general-purpose input port. This function can be used for pressing/holding or insertion of a workpiece. If contention with the maximum torque limit function described in section ■ 11.5 occurs, the lower torque limit will be valid.

**⚠ CAUTION** If the maximum torque limit is too low when used with a vertical axis, the current position cannot be retained, and a sudden drop can cause damage to the workpiece or the hand, or cause your hand to be caught in.

### ■ 16.11.2 Specifications for the maximum torque limit function

Specifications for the maximum torque limit function

Number of control axes	1 (*1)
Number of torque selection	8
Torque setting range	0.01T to 9.99T (*2)
Operation with the maximum torque limit function excluded	Return to origin(*3)

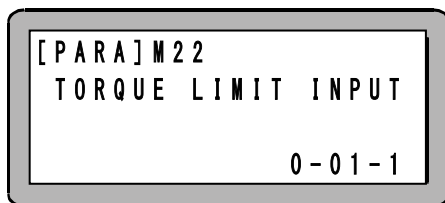
\*1: The maximum torque limit function cannot be used through slave units. To perform the maximum torque limit function with multiple axes, control all the axes through the master unit.

\*2: T: Rated torque (Torque greater than the motor instantaneous maximum torque is not outputted.)

\*3: If a maximum torque limit is applied, return to origin might not be performed normally. Thus, the maximum torque limit function is disabled during return to origin.

### ■ 16.11.3 Designation of input port

Designate the general-purpose input port in the bit designation of torque limit input in the mode setting. (Refer to sections ■ 10.2.12 and ■ 13.2.22)



- The torque limit table number is selected by the consecutive three bits in this port (refer to section ■ 13.5.5).
- The table can be switched to the other one during movement.

## ■ 16.11.4 Setting of maximum torque limit value

Use the torque limit value (T.LMT) in the torque limit table (refer to section ■ 13.5.5).

- Assuming the rated torque to be 1.00, set how many times of torque to be the maximum torque.
- A torque value can be entered in a range of 0.01 to 9.99 T, but a value higher than the motor instantaneous maximum torque (approximately three times larger than the rated torque) is not outputted.
- The table number is selected by the consecutive three bits in the port designated by the torque limit input (refer to section ■ 13.2.22).
- A torque limit table value can be changed at arbitrary timing. The new value is reflected to the maximum torque of the motor immediately after the change.
- The initial values are as follows.

Table number	1	2	3	4	5	6	7	8
Torque limit value (T.LMT)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

**NOTE** Set the initial value of 3.00 for tables which are not used in order to prevent unintentional torque limit from being applied.

The torque accuracy is not guaranteed, so use it as a rough standard.

As the maximum torque limit value is smaller, error of torque increases due to an influence from the sliding resistance.

- When the torque limit input (refer to section ■ 13.2.22) is set to 0-01-1, the torque limit table to be selected is as the followings.

Table number	General-purpose input port No.		
	0-01-3	0-01-2	0-01-1
	$2^2$	$2^1$	$2^0$
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

## Chapter 17 Commands

Program commands and the key operation for this robot are listed below.

### ● Moving robot

Command	Reading	Function	Key operation	Refer to
MOV	Move	Linear interpolation movement	Press the $\left(\frac{\text{MOV}}{9}\right)$ key.	17-30
MOVP	Move P	Linear interpolation movement (coordinate table designation)	Press the $\left(\frac{\text{MOV}}{9}\right)$ key twice.	17-31
MVC	Move C	Circular interpolation movement	Press the $\left(\frac{\text{MVC}}{8}\right)$ key.	17-33
MVCP	Move CP	Circular interpolation movement (coordinate table designation)	Press the $\left(\frac{\text{MVC}}{8}\right)$ key twice.	17-35
MVB	Move B	Move back to last point	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{OUT}}{2}\right)$ keys.	17-32
MVE	Move E	Escape move	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{TIM}}{6}\right)$ keys.	17-37
MVM	Move M	Palletizing movement	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{CAL}}{4}\right)$ keys.	17-39
RSMV	RS Move	Axis movement through RS232C	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{MOV}}{9}\right)$ keys.	17-53
TLMV	Torque Limit Move	Torque limit move instruction	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{CNT}}{3}\right)$ and $\left(\frac{\text{CAL}}{4}\right)$ keys.	17-63
HOME	Home	Return to origin	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{MOV}}{9}\right)$ keys.	17-18

### ● Setting parameters

Command	Reading	Function	Key operation	Refer to
SPD	Speed	Speed setting	Press the $\left(\frac{\text{SPD}}{7}\right)$ key.	17-55
ACC	Accel	Acceleration setting	Press the $\left(\frac{\text{SPD}}{7}\right)$ key twice.	17-4
DEC	Decel	Deceleration setting	Press the $\left(\frac{\text{SPD}}{7}\right)$ key three times.	17-16
PASS	Pass	Pass rate setting	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{CNT}}{3}\right)$ and $\left(\frac{\text{CNT}}{3}\right)$ keys.	17-50
OFS	Offset	Offset	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{IN}}{1}\right)$ keys.	17-42
OFSP	Offset P	Offset (coordinate table designation)	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{CNT}}{3}\right)$ and $\left(\frac{\text{OUT}}{2}\right)$ keys.	17-43

### ● Palletizing movement control

Command	Reading	Function	Key operation	Refer to
MINI	Matrix Initial	counter initial for MVM	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{CNT}}{3}\right)$ keys.	17-29
LOOP	Loop	loop for MVM	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{JMP}}{5}\right)$ keys.	17-28

### ● Servo control

Command	Reading	Function	Key operation	Refer to
SVON	Servo-ON	Servo-ON	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{SPD}}{7}\right)$ keys.	17-58
SVOF	Servo-OFF	Servo-OFF	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{IN}}{1}\right)$ and $\left(\frac{\text{MVC}}{8}\right)$ keys.	17-57

● Input/output port control

Command	Reading	Function	Key operation	Refer to
OUT	Out	General-purpose port output	Press the $\left(\frac{\text{OUT}}{2}\right)$ key.	17-44
OUTP	Out P	General-purpose port pulse output	Press the $\left(\frac{\text{OUT}}{2}\right)$ key twice.	17-46
OUTC	Out C	General-purpose port output from counter	Press the $\left(\frac{\text{OUT}}{2}\right)$ key three times.	17-45
OUTS	Out S	Designated coordinate general-purpose output	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{OUT}}{2}\right)$ keys.	17-47
CANS	Cancel	Cancel of designated coordinate general-purpose output	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{SPD}}{7}\right)$ keys.	17-10
IOUT	I Out	Internal port output	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{CNT}}{3}\right)$ and $\left(\frac{\text{IN}}{1}\right)$ keys.	17-23
IN	In	Waiting for general-purpose port input	Press the $\left(\frac{\text{IN}}{1}\right)$ key.	17-19
INPC	In PC	Setting general-purpose port input to counter	Press the $\left(\frac{\text{IN}}{1}\right)$ key twice.	17-20
INSP	In SP	Waiting for internal port input	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{CNT}}{3}\right)$ and $\left(\frac{\text{RET}}{0}\right)$ keys.	17-21





● Timer and counter control

Command	Reading	Function	Key operation	Refer to
TIM	Time	Waiting	Press the $\left(\frac{\text{TIM}}{6}\right)$ key.	17-61
TIMP	Time P	Preset timer	Press the $\left(\frac{\text{TIM}}{6}\right)$ key twice.	17-62
CNT	Counter	Preset counter	Press the $\left(\frac{\text{CNT}}{3}\right)$ key.	17-11
CNT+	Counter Plus	Count up	Press the $\left(\frac{\text{CNT}}{3}\right)$ key twice.	17-12
CNT-	Counter Minus	Count down	Press the $\left(\frac{\text{CNT}}{3}\right)$ key three times.	17-13
CNTC	Counter Clear	Clear all counters	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{IN}}{1}\right)$ keys.	17-14
CWIT	Counter wait	Waiting for counter condition	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{MVC}}{8}\right)$ keys.	17-15









● Jump

Command	Reading	Function	Key operation	Refer to
JMP	Jump	Unconditional jump	Press the $\left(\frac{\text{JMP}}{5}\right)$ key.	17-24
JMPI	Jump I	Input conditional jump	Press the $\left(\frac{\text{JMP}}{5}\right)$ key twice.	17-26
JMPC	Jump C	Counter conditional jump	Press the $\left(\frac{\text{JMP}}{5}\right)$ key three times.	17-25
JMPT	Jump T	Timer conditional jump	Press the $\left(\frac{\text{JMP}}{5}\right)$ key four times.	17-27
BRAC	Branch	Counter jump	Press the $\left(\text{F } 1\right)$ , $\left(\frac{\text{OUT}}{2}\right)$ and $\left(\frac{\text{RET}}{0}\right)$ keys.	17-5













● Subroutine call





Command	Reading	Function	Key operation	Refer to
CAL	Call	Unconditional call	Press the  key.	17-6
CALI	Call I	Input conditional call	Press the  key twice.	17-8
CALC	Call C	Counter conditional call	Press the  key three times.	17-7
CALT	Call T	Timer conditional call	Press the  key four times.	17-9

● Program control

Command	Reading	Function	Key operation	Refer to
NOP	NOP	No function	Press the  key.	17-41
RET	Return	Return	Press the  key.	17-52
STOP	Stop	Stop	Press the  key twice.	17-56
END	End	Program end	Press the  key three times.	17-17
TAG	Tag	Tag	Press the  key.	17-59
PSEL	P Sel	Program selection	Press the  ,  and  keys.	17-51

● Task control

Command	Reading	Function	Key operation	Refer to
TSTR	Task Start	Task start	Press the  ,  and  keys.	17-67
TSTO	Task Stop	Task stop	Press the  ,  and  keys.	17-66
TRSA	Task Restart	Task restart	Press the  ,  and  keys.	17-63
TCAN	Task Cancel	Task forced end	Press the  ,  and  keys.	17-60

 During inputting an expansion command (inputted by the  key and number), the number corresponding to the command inputted can be displayed on the screen after the command by pressing the  key and then the  key. For details, refer to section ■ 5.1.5.



# ACC

## Acceleration Command

[Function] This command is used to set the acceleration for movement.

[Explanation] ● Acceleration can be set by designating acceleration/deceleration time from the acceleration/deceleration tables No. 1 to 20 (twenty levels). (If deceleration time has not been designated by the DEC command, the deceleration time is set to the value same as the acceleration time.)

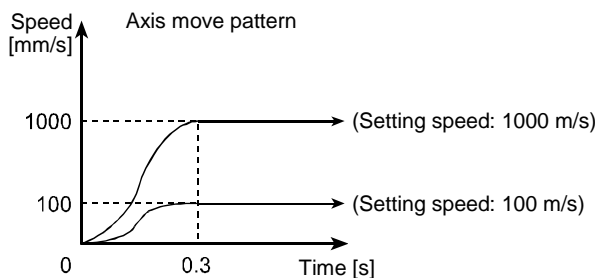
The initial values are shown in the table below. The value for each No. can be changed. (Refer to section ■ 13.5.3)

Acceleration/deceleration tables No.	1	2	3	4	5	6	7	8	9	10
Time [s]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55

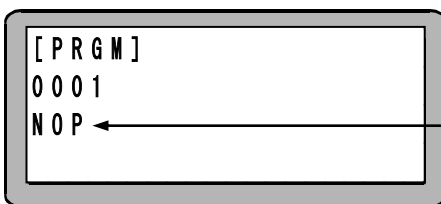
Acceleration/deceleration tables No.	11	12	13	14	15	16	17	18	19	20
Time [s]	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05

- ACC command must be set before a Move command (MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, RSMV, and HOME).
- When using multitasking, a setting must be made for each task.
- The value at each level sets the time required for the robot to reach a specified speed.
- Once set, the acceleration time remains unchanged until it is set subsequently, it is reset, or the power is turned OFF and ON. If you do not set it, the acceleration/deceleration table No. 5 is used.
- The acceleration time of high speed return to origin is current setting value.
- Curved acceleration/deceleration control method is used.

(Example) The axis move pattern at the set value of 0.30 is as the following.

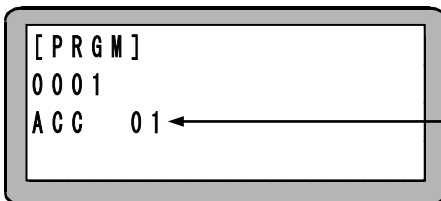


[Key operation]



**STEP 1**

Press the  $\frac{\text{SPD}}{7}$  key twice. NOP changes to ACC. Next, press the ENT key.



**STEP 2**

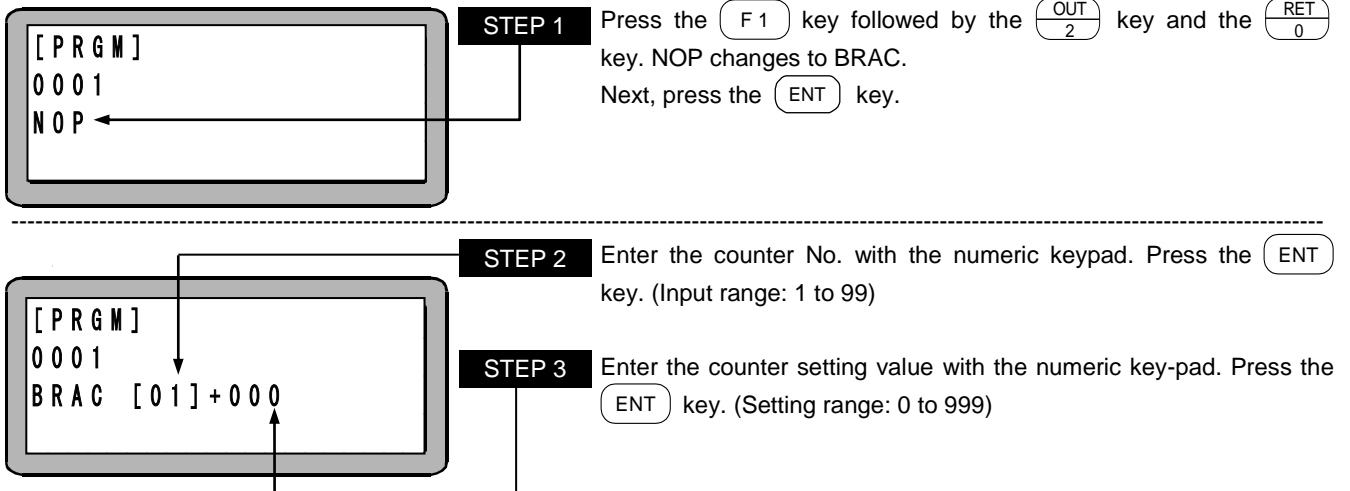
Input an acceleration/deceleration table No. with the numeric keypad and press the ENT key. (Setting range: 1 to 20)

# BRAC

## Counter Jump

[Function] The command BRAC is used to jump to a program of the tag No. which is the resultant value of a counter No. plus the set value.

[Key operation]



### NOTE

- This command is only used to jump to the tag No. which is the resultant value of the counter value + set value. The counter content will remain unchanged after the execution of this command.
- If there is no tag No. corresponding to the sum of the counter value and the set value, a "TAG NOT FOUND" error occurs.
- When the counter value details are "0" and the number to be added is "0", if the command is executed, the "TAG NOT FOUND" error will occur.
- If any total of (counter value) + (set value) exceeds "999", "TAG NO. error" will occur.

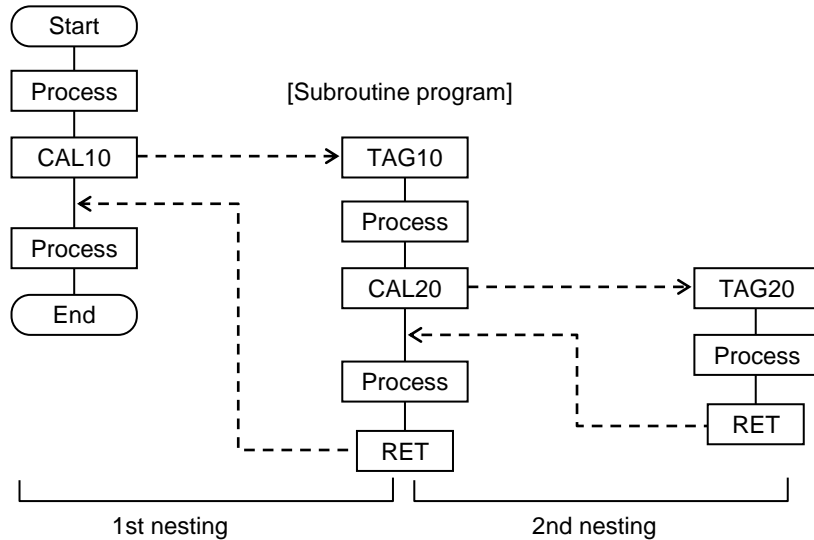
# CAL

## Unconditional Call

[Function] This command is used to call a subroutine program.

- [Explanation]
- This command is used to call a subroutine program of a designated program step identified by tag No.
  - This command requires a RET (return) command after the last step jumped to. When the RET command is executed, the program returns to the step following the CAL (call) step.
  - Subroutines can be nested up to 10 levels. Nesting is the system in which another subroutine is called in a subroutine program.
  - A diagram of the main routine and subroutine relation is shown below.

[Main routine program]



[Key operation]

```
[ PRGM ]
0001
NOP ←
```

**STEP 1**

Press the  $\frac{\text{CAL}}{4}$  key.  
NOP changes to CAL.  
Next, press the  $\text{ENT}$  key.

```
[ PRGM ]
0001
CAL 000
```

**STEP 2**

Use the numeric keypad to enter the tag No. to be called. Press the  $\text{ENT}$  key. (Setting range: 0 to 999)

**NOTE**

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, calling a tag No. in another task leads to occurrence of a "TAG NO. ERROR".

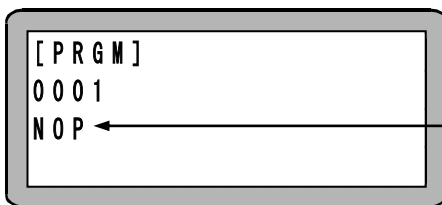
# CALC

## Counter Conditional Call

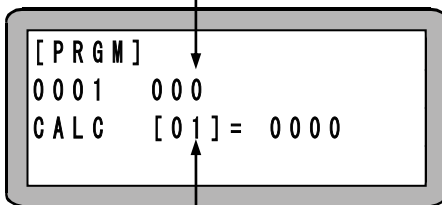
[Function] This command is used to call a subroutine of a specified tag No. when the specified counter contents agree with the setting condition.

- [Explanation]
- The program proceeds to the next step when the contents of the specified counter do not meet the setting conditions.
  - This command is used in the program with the command used to set the counter value (CNT) and the command to increment (CNT+) or decrement (CNT-) the counter value.
  - Five comparisons are available: (=), (<), (>), ( $\leq$ ), ( $\geq$ ).
  - Refer to the CAL command for the relation of the main routine and subroutine.

[Key operation]



- STEP 1** Press the  $\frac{\text{CAL}}{4}$  key three times.  
NOP changes to CALC.  
Next, press the **ENT** key.

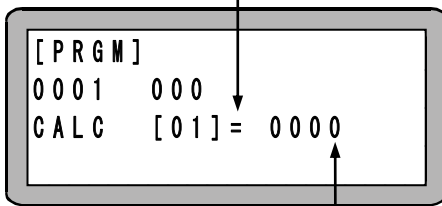


- STEP 2** Use the numeric keypad to enter the tag No. to be called and press the **ENT** key. (Setting range: 0 to 999)

- STEP 3** Use the numeric keypad to enter the counter No. and press the **ENT** key. (Setting range: 1 to 99)

### NOTE

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, calling a tag No. in another task leads to occurrence of a "TAG NO. ERROR".



- STEP 4** Every time pressing the **ALT** key, operators (=, <, >,  $\leq$ , and  $\geq$ ) are displayed one by one. Select one and press the **ENT** key.

- STEP 5** Use the numeric keypad to enter the counter value to be compared and press the **ENT** key. (Setting range: 0 to 9999)

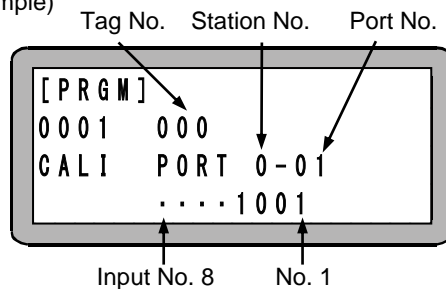
# CALI

## Input Conditional Call

[Function] The subroutine program with the specified tag No. is called when the input state of the specified general-purpose input corresponds to the setting conditions.

- [Explanation]
- If all of the details of the designated general-purpose input do not match the set conditions, the subroutine of the designated tag No. will not be called, and the program will move to the next step.
  - If the CALI command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 1-1) and No. 4 (general-purpose input port 1-4) are ON and the general-purpose input port 1 No. 2 (general-purpose input port 1-2) and No. 3 (general-purpose input port 1-3) are OFF for the unit of which the station No. is set to "0", the designated subroutine will be called. The subroutine will not be called unless all of the ON and OFF conditions match. The general-purpose input signal at the "." display section will not judge the conditions.

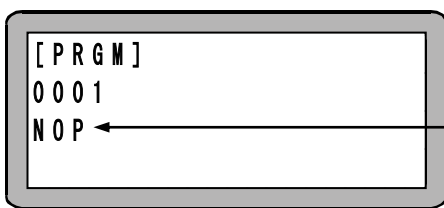
(Example)



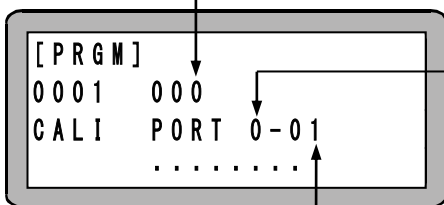
"1" Input ON  
 "0" Input OFF  
 "." Ignored  
 The input signal is judged with an AND condition.

- Refer to the CAL command for the relation of the main routine and subroutine.

[Key operation]



**STEP 1** Press the  $\left(\frac{\text{CAL}}{4}\right)$  key twice.  
 NOP changes to CALI.  
 Next, press the  $\left(\text{ENT}\right)$  key.



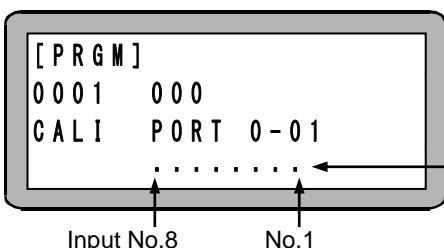
**STEP 2** Use the numeric keypad to enter the tag No. to be called, and Press the  $\left(\text{ENT}\right)$  key. (Setting range: 0 to 999)

**STEP 3** Use the numeric keypad to enter a station No., and press the  $\left(\text{ENT}\right)$  key.

**STEP 4** Use the numeric keypad to enter a port No., and press the  $\left(\text{ENT}\right)$  key.

**NOTE**

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, calling a tag No. in another task leads to occurrence of a "TAG NO. ERROR".



**STEP 5** Enter the input conditions with the  $\left(\frac{\text{RET}}{0}\right)$ ,  $\left(\frac{\text{IN}}{1}\right)$  and  $\left(\frac{\text{TAG}}{\cdot}\right)$  keys, and press the  $\left(\text{ENT}\right)$  key. The input conditions are inputted by the following keys.

- $\left(\frac{\text{RET}}{0}\right)$  Input OFF
- $\left(\frac{\text{IN}}{1}\right)$  Input ON
- $\left(\frac{\text{TAG}}{\cdot}\right)$  Not referred (ignored)

**NOTE**

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).
- Don't use any port which is not present.

# CALT

## Timer Conditional Call

[Function] This subroutine program with specified tag No. is called when the content of the specified timer meets the setting condition.

- [Explanation]
- When the content of the specified timer does not meet the setting condition, the program proceeds to the next step.
  - When CALT is used in a program, another command TIMP is necessary in the program to set the timer.
  - Nine timers are available: 1 to 9.
  - Five comparisons are available: (=), (<), (>), (≤), (≥).
  - Refer to the CAL command for the relation of the main routine and subroutine.

[Key operation]

**STEP 1** Press the  $\frac{\text{CAL}}{4}$  key four times. NOP changes to CALT. Next, press the  $\text{ENT}$  key.

**STEP 2** Use the numeric keypad to enter the tag No. to be called. Press the  $\text{ENT}$  key. (Setting range: 0 to 999)

**STEP 3** Use the numeric keypad to enter the timer No. and press the  $\text{ENT}$  key. (Setting range: 1 to 9)

**STEP 4** Every time pressing the  $\text{ALT}$  key, operators (=, <, >, ≤, and ≥) are displayed one by one. Select one and press the  $\text{ENT}$  key.

**STEP 5** Use the numeric keypad to enter the timer value to be compared, then press the  $\text{ENT}$  key. (Setting range: 0 to 999.9)

**NOTE**

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, calling a tag No. in another task leads to occurrence of a "TAG NO. ERROR".

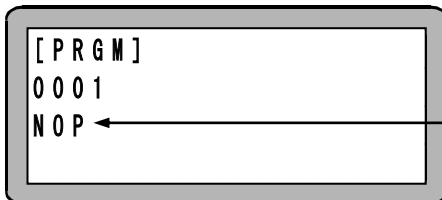
# CANS

## Designated Coordinate General-purpose Output Cancel

[Function] This command is used to cancel the data that is set with the OUTS command and remains unexecuted due to unestablishment of conditions.

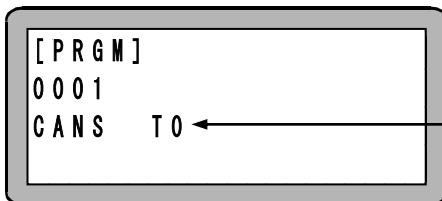
- [Explanation]
- This command is used in combination with the OUTS command and the movement command.
  - This command clears designated coordinate general-purpose output data set in the internal buffer. To clear data of the own task, select T0. To clear data of the other task, select either one of task numbers T1 to T4.

[Key operation]



**STEP 1**

Press the **F1**, **OUT<sub>2</sub>**, and **SPD<sub>7</sub>** keys in this order. Then NOP display changes to CANS. Next, press the **ENT** key.



**STEP 2**

Use the numeric keypad to enter the task No. the data of which is to be cleared, and then press the **ENT** key. (Setting range: 0 to 4).

**NOTE**

When the CANS command is executed, the internal buffer will be cleared, but the status that is outputted by the OUTS command will remain unchanged.

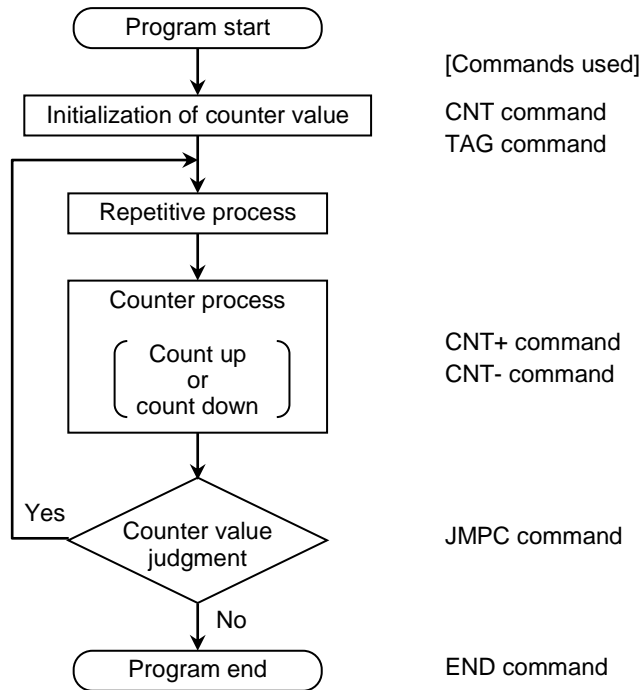
# CNT

## Preset Counter

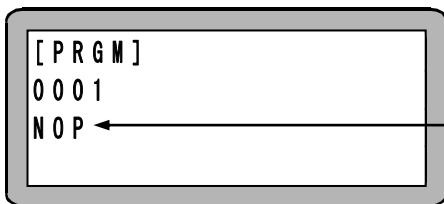
[Function] This command is used to set the value for a specified counter.

- [Explanation]
- Ninety-nine counters from No. 1 through No. 99 can be used.
  - Any value from 0 through 9999 can be set for each counter.
  - A usage example is shown below.

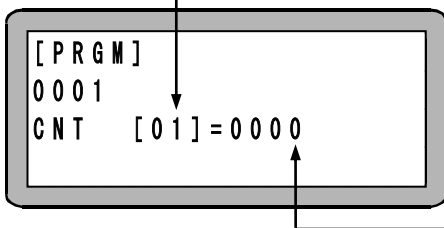
The counter is used when repetitive movement is to be carried out for a designated number of times, etc.



[Key operation]



- STEP 1** Press the  $\frac{\text{CNT}}{3}$  key.  
NOP changes to CNT.  
Next, press the  $\text{ENT}$  key.



- STEP 2** After entering the counter No. with the numeric keypad, press the  $\text{ENT}$  key. (Setting range: 1 to 99)
- STEP 3** Enter preset values (initial values) with the numeric keypad, Press the  $\text{ENT}$  key. (Setting range: 0 to 9999)



Whether to clear the counter details (set the counter details to "0") or to hold (not change the counter details) when the controller power is turned ON or reset is executed can be selected. (Refer to section ■ 10.2.6)

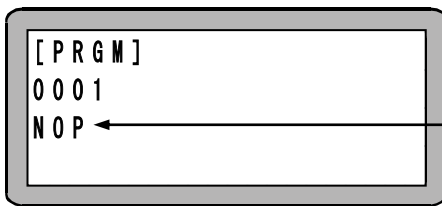


# CNT+

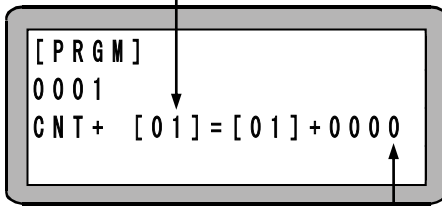
## Counts Up

[Function] This command is used to add an additional value to the designated counter.

[Key operation]



**STEP 1** Press the  $\frac{\text{CNT}}{3}$  key twice.  
NOP changes to CNT+.  
Next, press the  $\text{ENT}$  key.



**STEP 2** After entering the counter No. with the numeric keypad, press the  $\text{ENT}$  key. (Setting range: 1 to 99)

**STEP 3** Enter the increment value with the numeric keypad and press the  $\text{ENT}$  key. (Setting range: 0 to 9999)

**NOTE** If any value gained with addition becomes more than "9999", the counter value will stay at "9999".

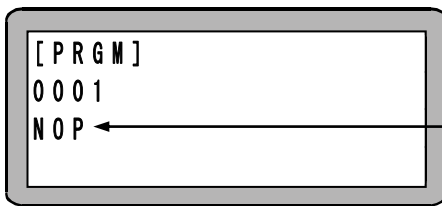
**?** Refer to the CNT command for the usage method.

# CNT-

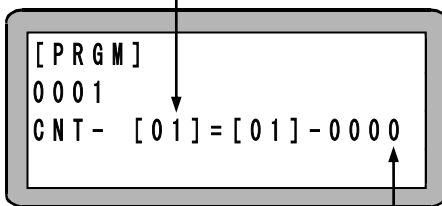
## Counts Down

[Function] This command is used to subtract a subtractive value from the designated counter.

[Key operation]



**STEP 1** Press the  $\frac{\text{CNT}}{3}$  key three times.  
NOP changes to CNT-.  
Next, press the  $\text{ENT}$  key.



**STEP 2** Enter the counter No. with the numeric keypad and press the  $\text{ENT}$  key. (Setting range: 1 to 99)

**STEP 3** Enter the decrement value with the numeric keypad and press the  $\text{ENT}$  key. (Setting range: 0 to 9999)

**NOTE** If any value gained with subtraction becomes less than "0", the counter value will stay at "0".

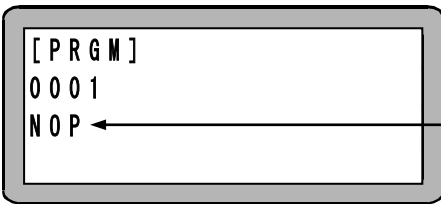
**?** Refer to the CNT command for the usage method.

# CNTC

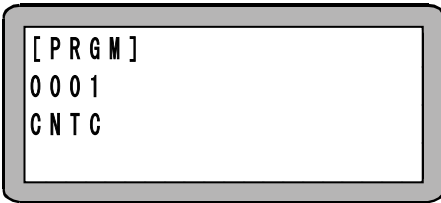
## Counter All Clear

[Function] This command is used to clear all counters, that is to set all counter values to zero.

[Key operation]



**STEP 1** Press the **F 1** , **OUT**<sub>2</sub> and **IN**<sub>1</sub> keys in order. NOP changes to CNTC.  
Next, press the **ENT** key.



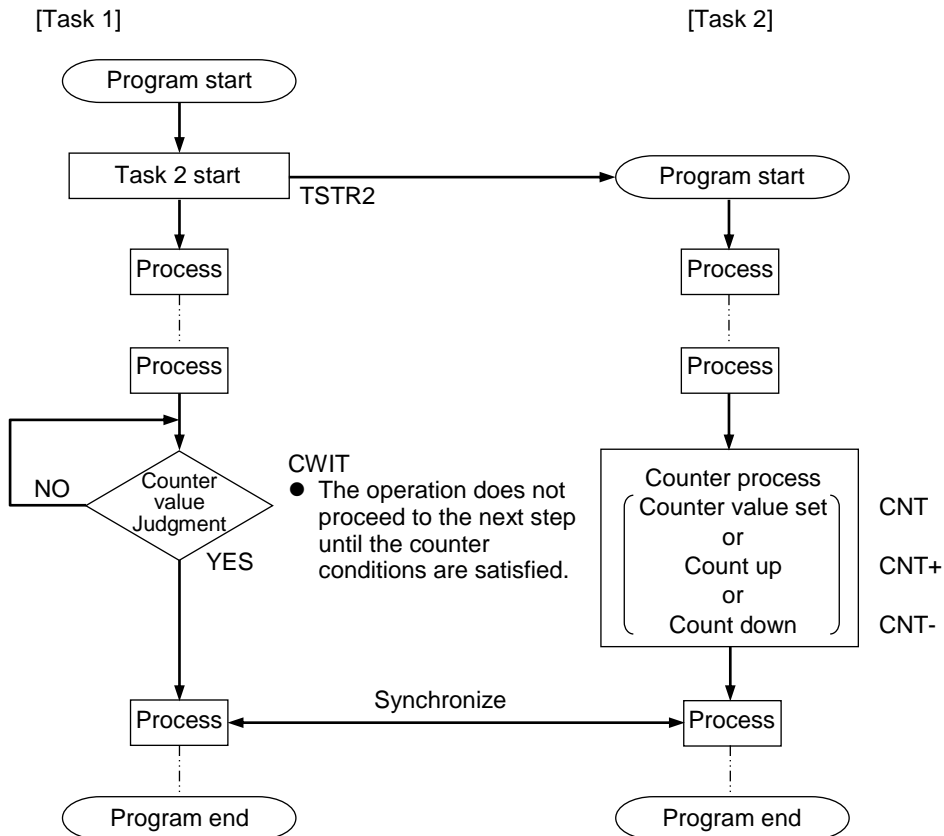
# CWIT

## Waiting for Counter Conditions

[Function] This command is used to stop operation until designated counter conditions are satisfied.

- [Explanation]
- This command is used to synchronize tasks.
  - When operation is stopped by a stop input or the like during waiting for conditions, it stops at this step. When the operation is restarted, it starts from this step.

CWIT command explanation diagram



[Key operation]

```
[ PRGM ]
0001
NOP ←
```

**STEP 1** Press the (F1), (OUT<sub>2</sub>), and (MVC<sub>8</sub>) keys in this order. Then NOP display changes to CWIT. Next, press the (ENT) key.

---

```
[ PRGM ]
0001
CWIT [01] = 0000
```

**STEP 2** Use the numeric keypad to enter the counter No. and press the (ENT) key. (Setting range: 1 to 99)

**STEP 3** Every time pressing the (ALT) key, operators (=, <, >, <=, and >=) are displayed one by one. Select one of them and press the (ENT) key.

**STEP 4** Use the numeric keypad to enter the counter value to be compared, and then press the (ENT) key. (Setting range: 0 to 9999)

# DEC

## Deceleration Command

[Function] This command is used to set the deceleration for movement. This command can be entered and displayed with TPH-4C version 2.29 or later. For SF-98D, version 3.1.3 or later supports this command.

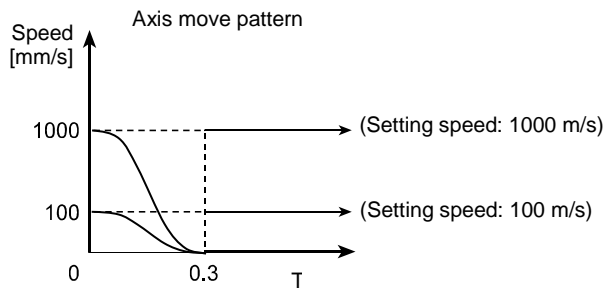
[Explanation] ● The deceleration can be set by designating the deceleration time from the acceleration/deceleration tables No. 1 to 20 (20 stages). The initial values are shown in the table below. The value for each No. can be changed. (Refer to section ■ 13.5.3)

Acceleration/deceleration tables No.	1	2	3	4	5	6	7	8	9	10
Time [s]	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55

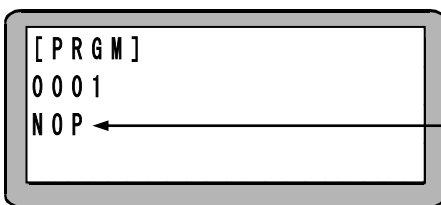
Acceleration/deceleration tables No.	11	12	13	14	15	16	17	18	19	20
Time [s]	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05

- DEC command must be set before a Move command (MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, RSMV, HOME).
- When using multitasking, a setting must be made for each task.
- The set value is the time for stopping from the set speed.
- Once set, the deceleration time remains unchanged until it is set subsequently, it is reset, or the power is turned OFF and ON. If deceleration time has not been designated, the deceleration time is set to the value same as the acceleration time.
- The deceleration time of high speed return to origin is current setting value.
- Curved acceleration/deceleration control method is used.

(Example) The axis move pattern at the set value of 0.30 is as the following.

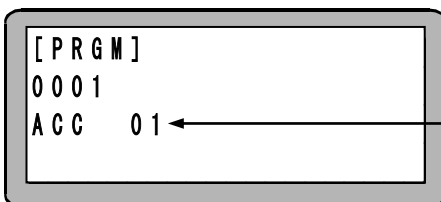


[Key operation]



STEP 1

Press the  $\frac{\text{SPD}}{7}$  key three times. NOP changes to DEC. Next, press the ENT key.



STEP 2

Input an acceleration/deceleration table No. with the numeric keypad and press the ENT key. (Setting range: 1 to 20)

# END

## Program End



[Function] The program end defined with this command.

[Explanation] When this command is executed in the task 1, the program stops after returning to the step 0001. When multitasking, all tasks return to the step 1 and stop after completion of the command.  
If the END command is executed in task 2 to 4 of multitasking, the task will return to step 0001 and stop. Then, it will wait for starting with TSTR.

[Key operation]

```
[ P R G M ]
0 0 0 1
N O P ←
```

STEP 1

Press the  key three times.  
NOP changes to END.  
Next, press the  key.

---

```
[ P R G M ]
0 0 0 1
E N D
```

# HOME

## Return to Origin

[Function] An Axis returns to origin at Home positioning speed set with parameters.  
When using multitasking, only the task that executes this command will return to the origin.

[Explanation] The axes are moved in an order preset with the parameters. (Refer to section ■ 13.3.7)

[Key operation]

```
[ P R G M ]
0 0 0 1
N O P ←
```

**STEP 1**

Press the **F 1** , **IN 1** , and **MOV 9** keys in order. NOP changes to HOME.  
Next, press the **ENT** key.

```
[ P R G M ]
0 0 0 1
H O M E
```



Refer to sections ■ 13.4.7 to ■ 13.4.10 for setting of return to origin speed.

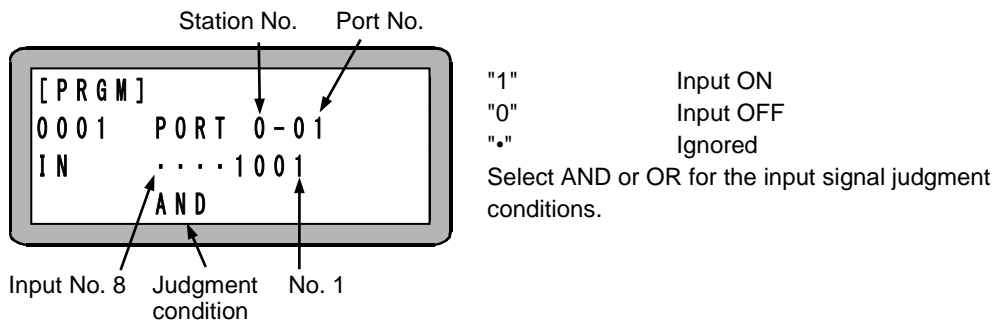
# IN

## Waiting for General Purpose Port Input

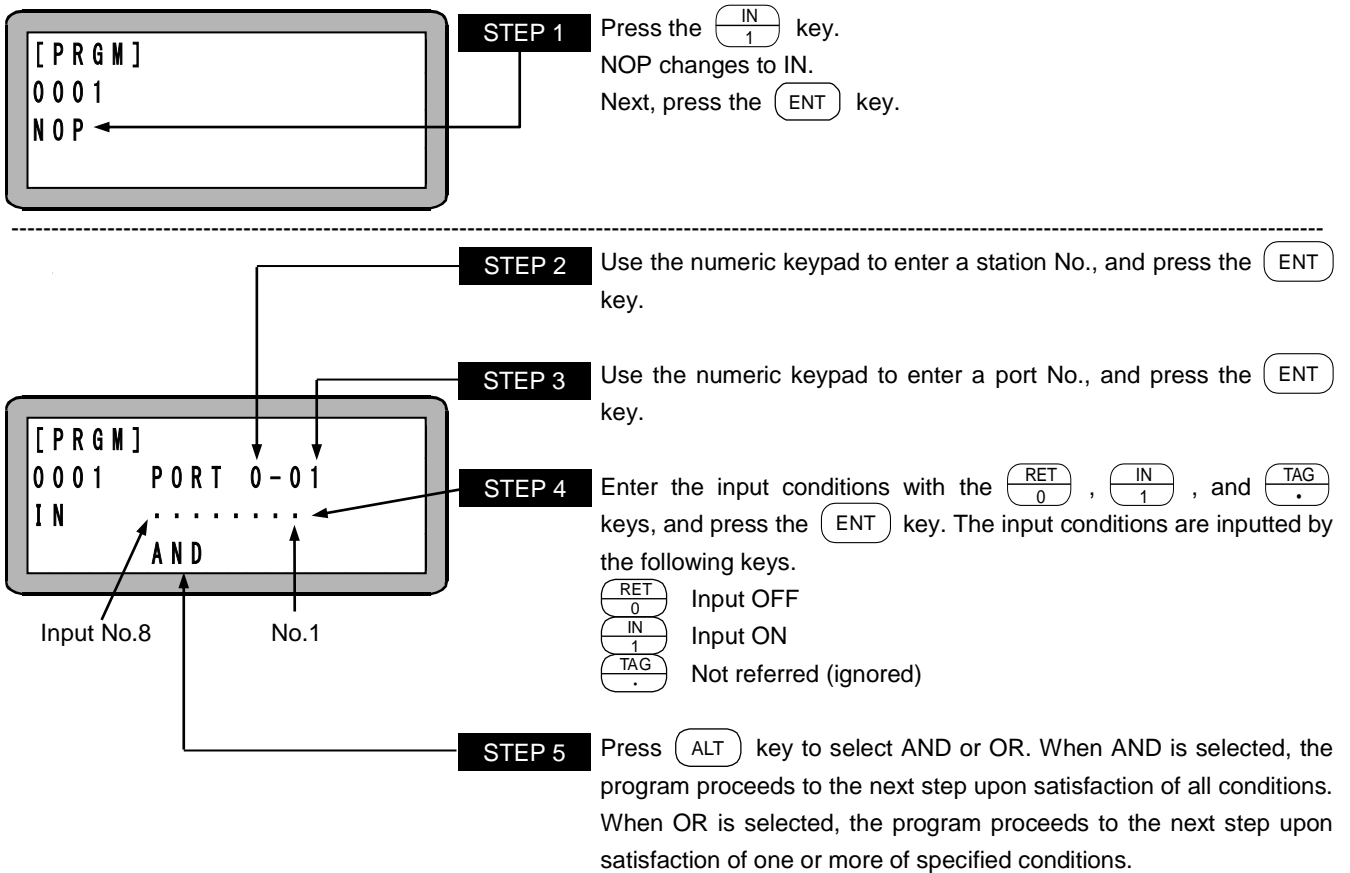
[Function] This command is used to stop a program from proceeding to the next step until conditions set for general purpose input are satisfied.

- [Explanation]
- If stopped by a stop input during waiting for a certain condition, a program stops at this step. When restarted, the execution starts from this step.
  - If the IN command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 1-1) and No. 4 (general-purpose input port 1-4) are ON and the general-purpose input port 1 No. 2 (general-purpose input port 1-2) and No. 3 (general-purpose input port 1-3) are OFF for the unit of which the station No. is set to "0", the program will move to the next step. The general-purpose input signal at the "•" display section will not judge the conditions.

(Example)



[Key operation]



**NOTE**

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).
- Don't use any port which is not present.



# INPC

## Setting General Purpose Input Port to Counter

[Function] This command is used to set general purpose input to the content of a specified counter.

- [Explanation]
- In the unit with the designated station No., the designated general-purpose input port signal is interpreted as a binary value, is converted into a decimal value and is set in the designated counter.
  - The counter values that can be led in varies depending on the number of bits of the input port. For the input port consisting of four bits, they are 0 to 15, and for the input port consisting of eight bits, they are 0 to 255.

General-purpose input bit pattern (Binary)	Counter value (Decimal)	0 ... Input OFF 1 ... Input ON
0000 0000	0	
0000 0001	1	
0000 0010	2	
0000 0011	3	
⋮ ⋮	⋮	
0000 1111	15	
⋮ ⋮	⋮	
1111 1111	255	

↑
↑  
 Input No.8      No.1

[Key operation]

```
[PRGM]
0001
NOP ←
```

**STEP 1** Press the  $\frac{IN}{1}$  key twice. NOP changes to INPC. Next, press the ENT key.

---

```
[PRGM]
0001  PORT 0-01
INPC  CNT [01]
```

**STEP 2** Use the numeric keypad to enter a station No., and press the ENT key.

**STEP 3** Use the numeric keypad to enter a port No., and press the ENT key.

**STEP 4** Enter a counter No. with the numeric keypad and press the ENT key. (Setting range: 1 to 99)

### NOTE

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).

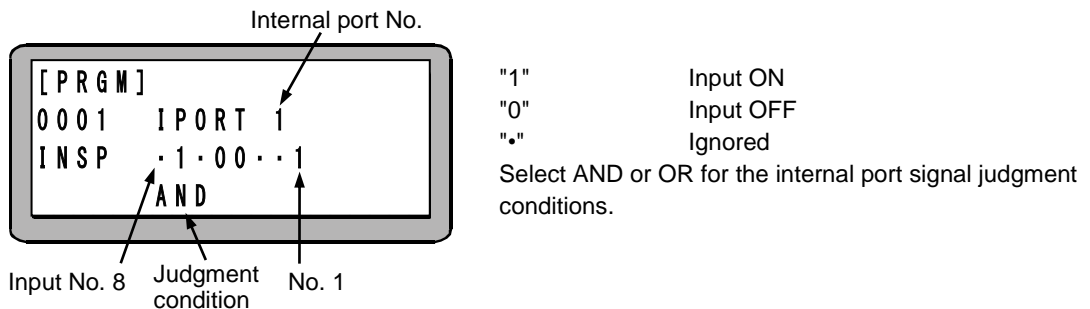
# INSP

## Waiting for Internal Port Input

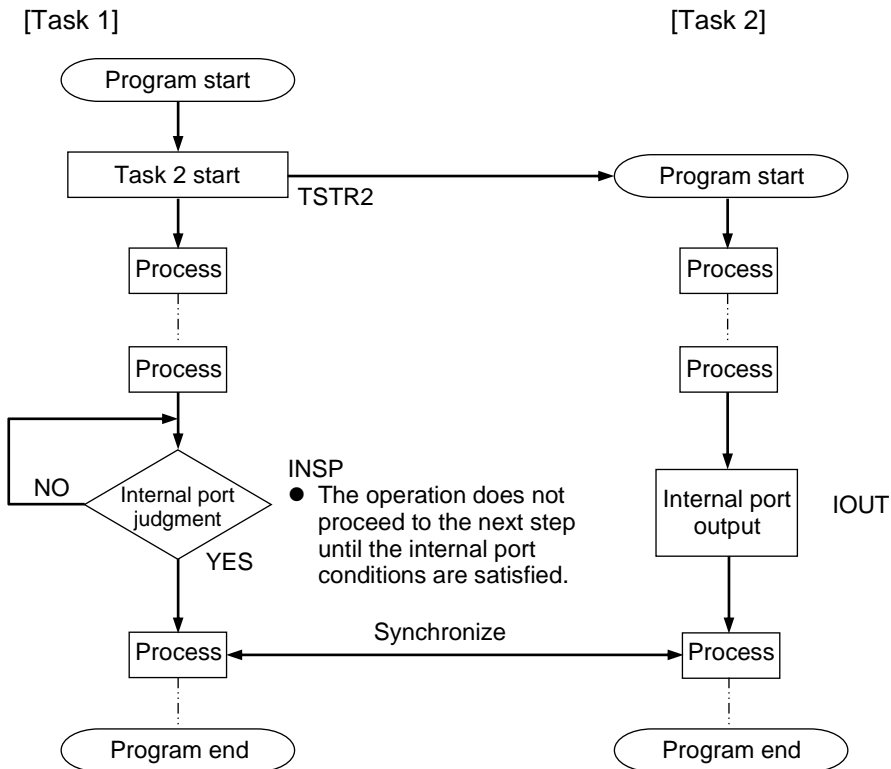
[Function] This command is used to stop operation until designated internal port conditions are satisfied. (The internal port is a port having no substantial hardware.)

- [Explanation]
- This command is used in combination with the IOOUT command.
  - This command is used to synchronize tasks.
  - When operation is stopped by a stop input or the like during waiting for conditions, it stops at this step. When the operation is restarted, it starts from this step.
  - The internal ports are from 1 to 4.
  - With the INSP command set as the following, when the No. 1 and the No. 7 of internal port 1 (internal ports 1-1 and 1-7) are ON and the No. 4 and the No. 5 of internal port 1 (internal ports 1-4 and 1-5) are OFF, the operation proceeds to the next step.  
For the internal port signal displayed as "·", conditions are not judged.

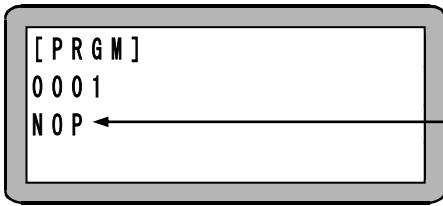
(Example)



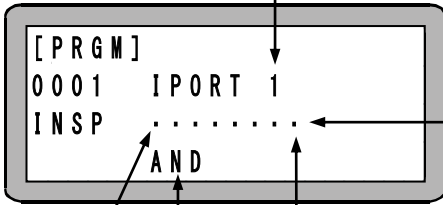
INSP Command Explanation diagram



[Key operation]



**STEP 1** Press the **F1** , **CNT<sub>3</sub>** , and **RET<sub>0</sub>** keys in this order. Then display of NOP changes to INSP. Next, press the **ENT** key.



**STEP 2** Use the numeric keypad to enter the internal port No., and then press the **ENT** key. (Setting range: 1 to 4)

**STEP 3** Use the **RET<sub>0</sub>** , **IN<sub>1</sub>** , and **TAG<sub>.</sub>** keys to enter the input conditions, and then press the **ENT** key. The input conditions are inputted by the following keys.

- RET<sub>0</sub>** Input OFF
- IN<sub>1</sub>** Input ON
- TAG<sub>.</sub>** Not referred (ignored)

Input No.8

No.1

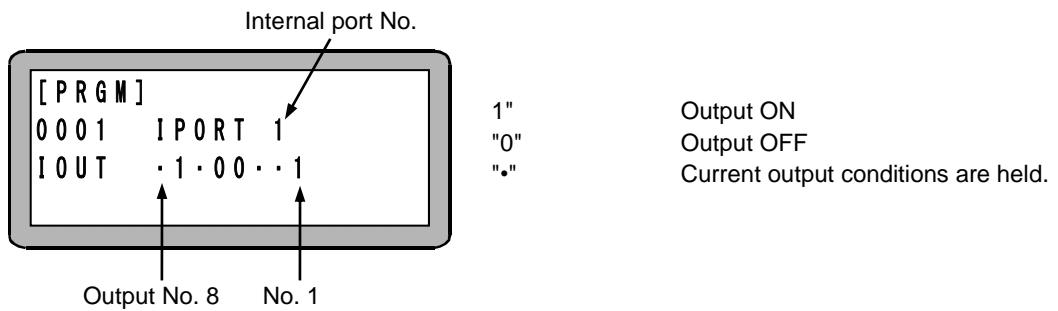
**STEP 4** Use the **ALT** key to select AND or OR. With AND selected, the movement proceeds to the next step when all conditions are satisfied. With OR selected, the movement proceeds to the next step when one or more conditions are satisfied.

# IOUT

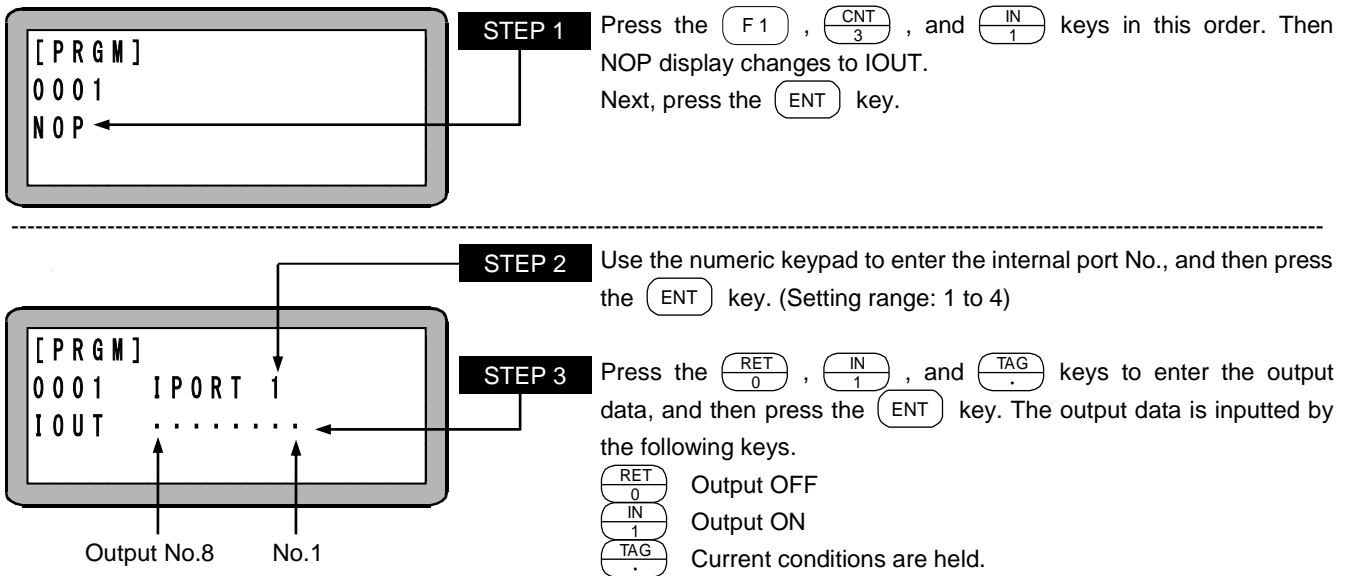
## Internal Port Output

[Function] This command is used to output the set data to the designated internal port.

- [Explanation]
- This command is used in combination with INSP command.
  - This command is used to synchronize tasks.
  - The internal ports are 1 to 4.
  - After execution, the executed data is held until the next IOUT command.  
Even if the program is ended by execution of the END command, the data will be held.
  - To turn OFF the data, set the internal port to "0" with the IOUT command or turn OFF the controller.
  - When the IOUT command is set as the following, the No. 1 and the No. 7 of internal port 1 (internal ports 1-1 and 1-7) are turned ON and the No. 4 and the No. 5 of internal port 1 (internal ports 1-4 and 1-5) are turned OFF.  
For the internal port data displayed as "\*", current data conditions are held.



[Key operation]



**?** For the usage, refer to INSP command.

# JMP

## Unconditional Jump



[Function] This command is used to instruct a program to jump to a specified tag No.

[Explanation] ● This command is used to instruct a program to jump unconditionally to a step specified by a tag No.  
● Refer to the TAG command for usage examples.

[Key operation]


```
[ P R G M ]
0 0 0 1
N O P ←
```

STEP 1

Press the  key.  
NOP changes to JMP.  
Next, press the  key.

```
[ P R G M ]
0 0 0 1
J M P 0 0 0 ←
```

STEP 2

After entering a tag No. with the numeric keypad, press the  key. (Setting range: 0 to 999)

### NOTE

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to. A "TAG NO. error" will occur during execution.

# JMPC

## Counter Conditional Jump

[Function] This command is used to instruct a program to jump to a step with a specified tag No. only when the set counter value meets specified conditions in the program.

- [Explanation]
- When the set counter value does not meet the specified conditions, the program proceeds to the next step.
  - Programs for which this command is used need another program to execute setting of the counter value, CNT and to increment and decrement the counter value, CNT+, CNT-.
  - Five comparisons are available: (=), (<), (>), (≤), (≥).
  - Refer to the CNT command for the usage methods.

[Key operation]

**STEP 1** Press the  $\left(\frac{\text{JMP}}{5}\right)$  key three times. NOP changes to JMPC. Next, press the  $(\text{ENT})$  key.

---

**STEP 2** Use the numeric keypad to enter the tag No. which the program jumps to, then press the  $(\text{ENT})$  key. (Setting range: 0 to 999)

**STEP 3** Enter a counter No. with the numeric keypad and press the  $(\text{ENT})$  key. (Setting range: 1 to 99)

**NOTE**

- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to. A "TAG NO. error" will occur during execution.

---

**STEP 4** Press the  $(\text{ALT})$  key to display operators (=, <, >, <=, >=). Select one and press the  $(\text{ENT})$  key.

**STEP 5** Use the numeric keypad to enter a counter value to be compared and press the  $(\text{ENT})$  key. (Setting range: 0 to 9999)

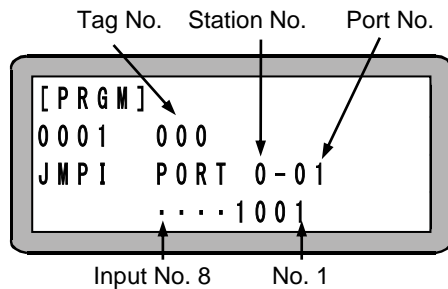
# JMPI

## Input Conditional Jump

[Function] This command is used to instruct a program to jump to a step with a specified tag number when the input conditions of a general purpose input meet the set conditions in the program.

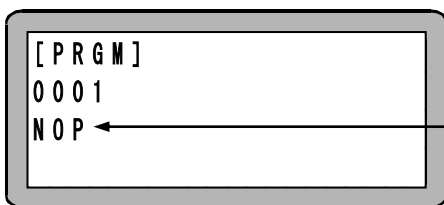
- [Explanation]
- The jump is executed only when all the input of ports set by this command satisfy the ON/OFF conditions of general input; if they do not, the program proceeds to the next step.
  - If the JMP I command is set as shown below, when the general-purpose input port 1 No. 1 (general-purpose input port 01-1) and No. 4 (general-purpose input port 01-4) are ON and the general-purpose input port 1 No. 2 (general-purpose input port 01-2) and No. 3 (general-purpose input port 01-3) are OFF for the unit of which the station No. is set to "0", the program will jump to the designated step. The general-purpose input signal at the "\*" display section will not judge the conditions.

(Example)

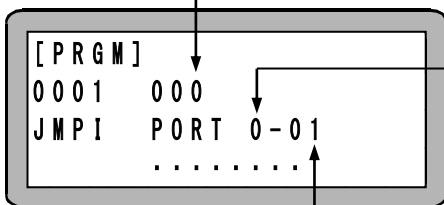


"1" Input ON  
 "0" Input OFF  
 "." Ignored  
 The input signal is judged with an AND condition.

[Key operation]



**STEP 1** Press the  $\left(\frac{JMP}{5}\right)$  key twice.  
 NOP changes to JMP I.  
 Next, press the  $\left(\frac{ENT}{ENT}\right)$  key.

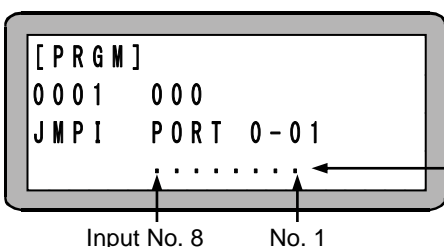


**STEP 2** Use the numeric keypad to enter the No. the program jumps to, then press the  $\left(\frac{ENT}{ENT}\right)$  key. (Setting range: 0 to 999)

**STEP 3** Use the numeric keypad to enter a station No., and press the  $\left(\frac{ENT}{ENT}\right)$  key.

**STEP 4** Use the numeric keypad to enter a port No., and press the  $\left(\frac{ENT}{ENT}\right)$  key.

- NOTE**
- The tag No. for STEP 2 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
  - When using multitasking, a tag No. in another task cannot be jumped to. A "TAG NO. error" will occur during execution.



**STEP 5** Enter the input conditions with the  $\left(\frac{RET}{0}\right)$ ,  $\left(\frac{IN}{1}\right)$ , and  $\left(\frac{TAG}{.}\right)$  keys, and press the  $\left(\frac{ENT}{ENT}\right)$  key. The input conditions are inputted by the following keys.

- $\left(\frac{RET}{0}\right)$  Input OFF
- $\left(\frac{IN}{1}\right)$  Input ON
- $\left(\frac{TAG}{.}\right)$  Not referred (ignored)

- NOTE**
- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
  - For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).
  - Don't use any port which is not present.

# JMPT

## Timer Conditional Jump

[Function] This command is used to instruct a program to jump to a step with a specified tag No. only when the specified timer value meets the set conditions in the program.

- [Explanation]
- When the specified timer value does not meet the set conditions, the program proceeds to the next step.
  - Programs for which this command is used need another program to command the timer setting (TIMP).
  - Nine timers from No. 1 to No. 9 are used.
  - Five comparisons are available: (=), (<), (>), (≤), (≥).
  - Refer to the TIMP command for usage examples.

[Key operation]

**STEP 1** Press the  $\left(\frac{\text{JMP}}{5}\right)$  key four times. NOP changes to JMPT. Next, press the  $(\text{ENT})$  key.

---

**STEP 2** Use the numeric keypad to enter the tag No. which the program jumps to, then press the  $(\text{ENT})$  key. (Setting range: 0 to 999)

**STEP 3** Use the numeric keypad to enter the timer No. and press the  $(\text{ENT})$  key. (Setting range: 1 to 9).

**NOTE**

- The tag No. for STEP 2 can be set to "0" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be jumped to. A "TAG NO. error" will occur during execution.

---

**STEP 4** Every time pressing the  $(\text{ALT})$  key, operators (=, <, >, <=, and >=) are displayed one by one. Select one and press the  $(\text{ENT})$  key.

**STEP 5** Use the numeric keypad to enter a timer value to be compared and press the  $(\text{ENT})$  key. (Setting range: 0 to 999.9)



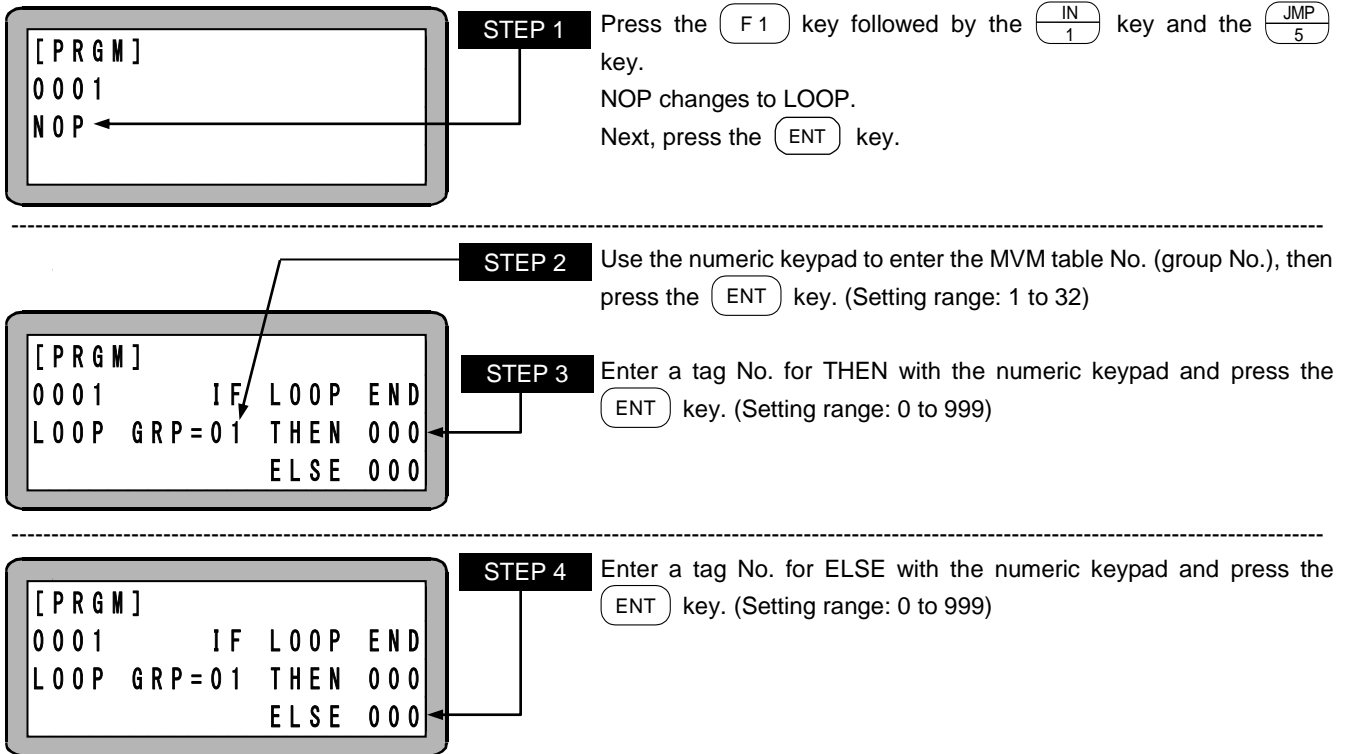
# LOOP

## MVM Loop

[Function] This command is used to control loop operation in the MVM table.

- [Explanation]
- This command is a palletizing-related command used together with MVM and MINI commands.
  - When this command is executed, the counter specified in the MVM table is controlled. The program jumps to the step with the tag No. specified by the content and conditions of the counter.

[Key operation]



Tag for THEN: A program jumps to the THEN tag when an MVM program has completed.

Tag for ELSE: A program jumps to the ELSE tag when an MVM program has not completed.

### NOTE

- The tag No. for STEP 3 and STEP 4 can be set to "000" as a temporary value. However, if the command is executed with that value, the "NO TAG FOUND" error will occur.
- When using multitasking, a tag No. in another task cannot be designated. A "TAG NO. error" will occur during execution.
- For an application example of the command, refer to "Palletizing work with MVM commands" (section 5.1.6).

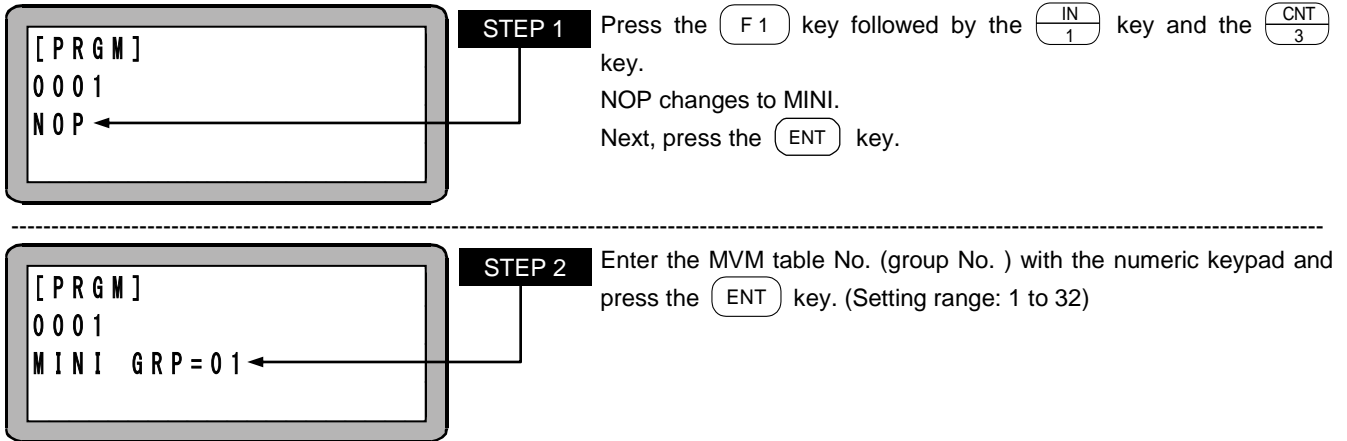
# MINI

## MVM Counter Initial

[Function] This command is used to set "1" to the counter in the MVM table.

- [Explanation]
- This command MINI is a command related to matrix movement and used together with MVM and LOOP.
  - When MINI is executed, the values of all counters in the specified MVM table No. (group No.) are set to "1."

[Key operation]



**NOTE** For an application example of the command, refer to "Palletizing work with MVM commands" (section ■ 5.1.6).

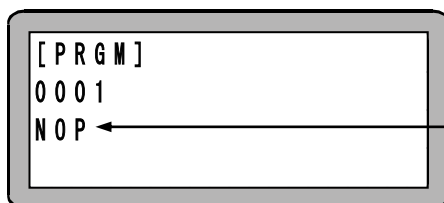
# MOV

## Linear Interpolation Movement

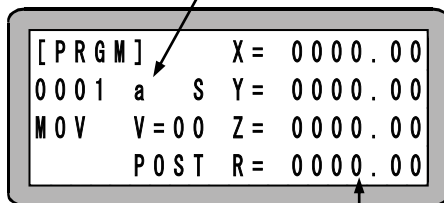
[Function] This command is used to linear-move to the designated coordinate position (linear interpolation)

- [Explanation]
- There are three methods to input the positional data: Numerical input (MDI), remote teaching, and direct teaching. (Refer to section ■ 4.7.2)
  - The speed can be set for the speed tables No. 1 to 20 (20 levels). There are two methods to set the speed: S (axial speed) and T (linear speed).

[Key operation]



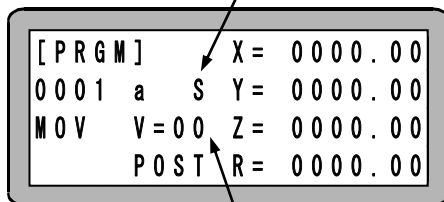
**STEP 1** Press the key to change display of NOP to MOV.  
Next, press the key.



**STEP 2** Press the key to select "a" (absolute coordinate position) or "i" (relative coordinate position), and then press the key.

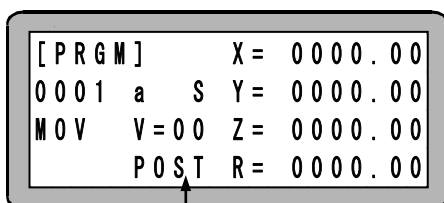
**STEP 3** Enter coordinate of each axis with the numeric keypad, and then press the key.  
(Setting range: -8000 to 8000)  
Press the key to change display to "\*\*\*\*\*". That axis is regarded as the coordinate value before execution of this command.

**NOTE** To perform remote teaching or direct teaching, press the key (refer to section ■ 4.7.2).



**STEP 4** Press the key to select "S" (axial speed) or "T" (linear speed), and then press the key.

**STEP 5** Enter the speed table No. with the numerical keypad, and then press the key.  
(Setting range: 00 to 20)  
When V=00 is entered, the speed designated by the SPD command in advance is set. If not designated in advance, the speed of V=01 is set.



**STEP 6** Press the key to select POST (position) or PASS (pass point), and then press the key.

- NOTE**
- On the screen, the axis set by "setting of axis display" in the parameter 2 is displayed (refer to section ■ 13.4.1).  
The unused axis is displayed as "?".
  - For details of the parameters "a" (absolute coordinate position), "i" (relative coordinate position), "S" (axial speed), "T" (linear speed), POST, and PASS, refer to "MOV system commands and parameters" (section ■ 4.7.3).

# MOV P

## Linear Interpolation Movement (Designated by Coordinate Table)

[Function] This command is used to linear-move to the designated coordinate position set by the coordinate table (linear interpolation)

- [Explanation]
- The axis can be moved to the coordinate set by designating the coordinate table No.
  - There are two ways to designate the coordinate table No. : directly and indirectly by counter.  
When the counter is used to designate the coordinate table No., the counter value of the designated counter is set as the coordinate table No.

[Key operation]

**STEP 1** Press the **MOV<sub>9</sub>** key twice.  
NOP changes to MOV P.  
Next, press the **ENT** key.

**STEP 2** Press the **ALT** key and select either "a" (absolute coordinate) or "I" (relative coordinate) and press the **ENT** key.

**STEP 3** In case of designating the coordinate table No. directly, enter the coordinate table No. with the numeric keypad and press the **ENT** key. (Setting range: 0 to 999. 0 means "No designation.")

**STEP 4** In case of designating the coordinate table No. indirectly by counter, enter the counter No. with the numeric keypad, then press the **ENT** key. (Setting range: 0 to 99. 0 means "No appointment.")

**NOTE** If neither STEP 3 nor STEP 4 or if both are designated, a "PARAMETER ERROR" will occur when the command is executed. If the counter No. is designated in STEP 4 and the counter details are "0", a "TABLE No. ERROR" will occur when the command is executed.

**STEP 5** Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.

**STEP 6** Enter the speed table No. with the numeric keypad and press the **ENT** key. (Setting range: 00 to 20)  
When V=00 is entered, the speed is set to the designated speed preset by SPD command. If not designated in advance, the speed of V=01 is set.

**STEP 7** Press the **ALT** key and select either POST (position) or PASS (pass point) and press the **ENT** key.

**?** If the cursor is at STEP 2 to 7, press the **F1** key to change to the coordinate table display set in STEP 3 and set the coordinates. Press the **ESC** key to return to the original display.

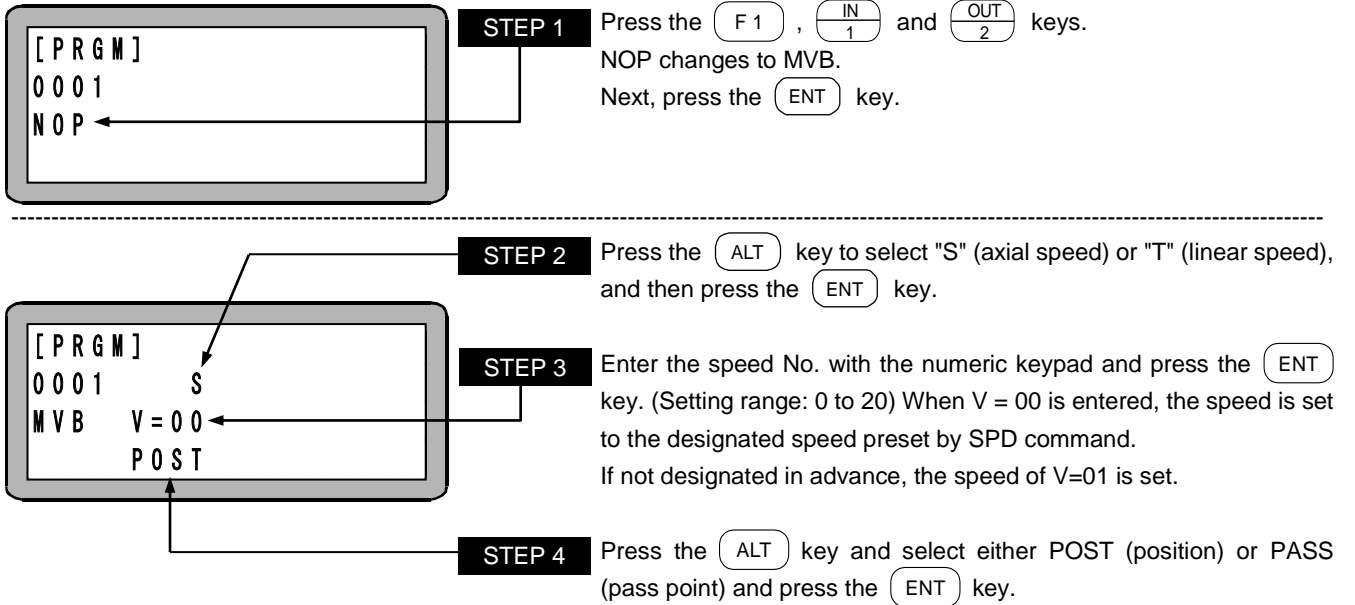
**NOTE** For details of the parameters "a" (absolute coordinate position), "I" (relative coordinate position), "S" (axial speed), "T" (linear speed), POST, and PASS, refer to "MOV system commands and parameters" (section ■ 4.7.3).

# MVB

## Return to Previous Point

[Function] This command is used to return the robot to the start point in which the previous move command was executed.

[Key operation]



**NOTE** For details of the parameters "a" (absolute coordinate position), "i" (relative coordinate position), "S" (axial speed), "T" (linear speed), POST, and PASS, refer to "MOV system commands and parameters" (section ■ 4.7.3).

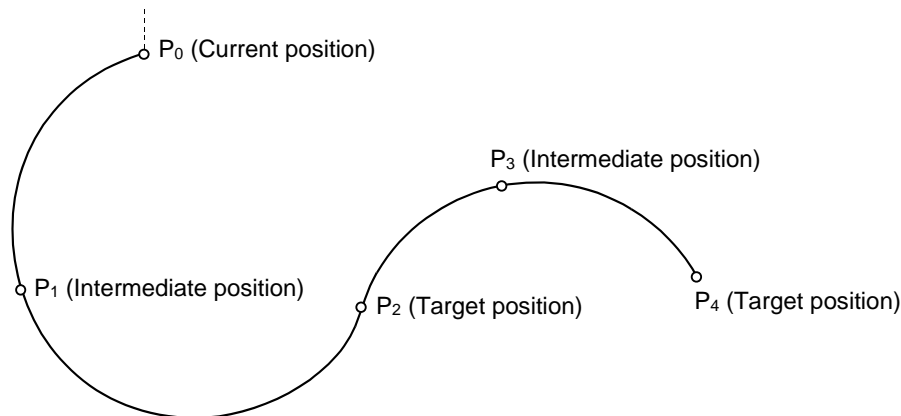
# MVC

## Circular Interpolation Movement

[Function] This command is used to move the robot circularly through designated coordinate positions (intermediate position and target position). (Circular interpolation)

- [Explanation]
- The robot will move on the circle calculated by the positional data of current position, intermediate position, and target position. Also three-dimensional circular movement will be possible.
  - The MVC command must be used as a combination of an MVC command that designates the intermediate position and an MVC that designates the target position. However, the target position can be designated by an MVCP command.

(Example) A program that leads to movement  $P_0 \rightarrow P_1 \rightarrow P_2$  and then  $P_2 \rightarrow P_3 \rightarrow P_4$  is as shown below.

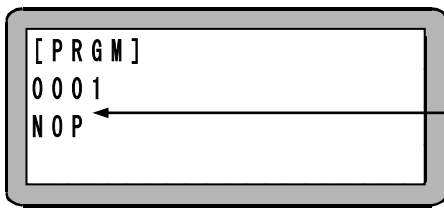


Step	Command	Data (coordinate)	
009	MÓV	P <sub>0</sub>	} Execution of circular movement P <sub>0</sub> →P <sub>1</sub> →P <sub>2</sub>
010	MVC	P <sub>1</sub>	
011	MVC	P <sub>2</sub>	
012	MVC	P <sub>3</sub>	} Execution of circular movement P <sub>2</sub> →P <sub>3</sub> →P <sub>4</sub>
013	MVC	P <sub>4</sub>	

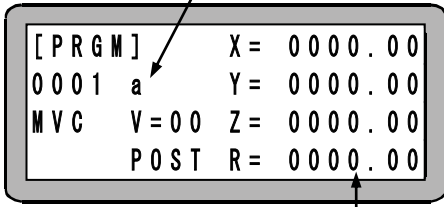
### NOTE

- If any two or all of coordinates of the current position, intermediate position, and target position are identical, or the three positions are located on a straight line, an error (too large radius of circular interpolation) occurs.
- To draw a perfect circle, combine two circular arcs.
- To move the robot without deceleration at a joint of circular arcs, set PASS (pass point) in the later MVC. For example, for no deceleration at the P<sub>2</sub> in the example above, designate PASS in the step 011.
- When "i" (relative coordinate position) is designated for an MVC command, the coordinates of intermediate position and end position are the relative coordinates against the current position. Note that the coordinate of the end position is not the relative coordinate against the intermediate position.

[Key operation]



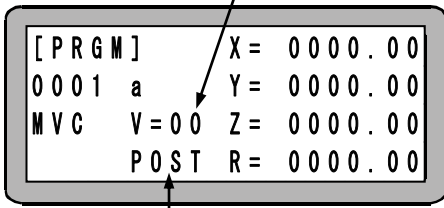
**STEP 1** Press the  $\frac{\text{MVC}}{8}$  key to change the display of NOP to MVC. Next, press the ENT key.



**STEP 2** Press the ALT key to select "a" (absolute coordinate position) or "i" (relative coordinate position), and then press the ENT key.

**STEP 3** Enter the coordinate of each axis with the numeric keypad, and then press the ENT key.  
(Setting range: -8000 to 8000)  
Press the ALT key to change display to "\*\*\*\*\*". That axis is regarded as the coordinate value before execution of this command.

**NOTE** To perform remote teaching or direct teaching, press the  $\frac{\text{DIRECT}}{\text{JOG}}$  key. (Refer to section ■ 4.7.2)



**STEP 4** Enter the speed No. with the numeric keypad, and then press the ENT key. (Setting range: 00 to 20)

When V=00 is entered, the speed designated by the SPD command in advance is set. If not designated in advance, the speed of V=01 is set.

**STEP 5** Press the ALT key to select POST (position) or PASS (pass point), and then press the ENT key.

- ?**
- The movement speed is set by the MVC command designating the intermediate position.
  - The movement of POST (position) or PASS (pass point) is set by the MVC command designating the target position.

- NOTE**
- The MVC command must be written twice in succession.  
If an axis-movement-related command other than an MVC command is executed after an odd number of MVC commands have been executed, an error (lack of circular interpolation data) occurs.
  - For details of the parameters "a" (absolute coordinate position), "i" (relative coordinate position), POST, and PASS, refer to "MOV system commands and parameters" (refer to section ■ 4.7.3).
  - For a three-axis specification robot, two types of simultaneous reaching of the third axis can be designated by three-dimension circular interpolation (spherical interpolation) or two-dimension circular interpolation (interpolating of the first and second axes).  
For a four-axis specification robot, the fourth axis reaches simultaneously with three-dimension circular interpolation (spherical interpolation).  
These settings can be set by "setting of task and axis combination" in the parameter 2. (Refer to section ■ 13.4.19)
  - On the screen, the axis set by "setting of axis display" in the parameter 2 is displayed. (Refer to section ■ 13.4.1)  
The unused axis is displayed as "?".

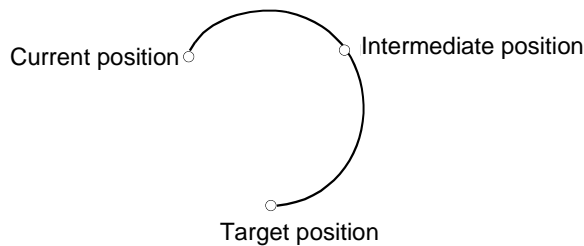
# MVCP

## Circular Interpolation Movement (Designated by Coordinate Table)

[Function] This command is used to move the robot circularly through coordinate positions (intermediate position and target position) set by the coordinate table. (Circular interpolation)

- [Explanation]
- The robot will move on the circle calculated by the positional data of current position, intermediate position, and target position designated by the coordinate table. Also three-dimensional circular movement will be possible.
  - There are two methods to designate the coordinate table No.: direct designation and indirect designation through the counter.
 

When the counter is used to designate the coordinate table No., the counter value of the designated counter is set as the coordinate table No.
  - This command is similar to the MVC command except for designation of the positional data through the coordinate table No.



[Key operation]

```
[ PRGM ]
0001
NOP ←
```

**STEP 1** Press the  $\left(\frac{MVC}{8}\right)$  key twice to change the display of NOP to MVCP. Next, press the  $(ENT)$  key.

---

```
[ PRGM ]
0001 a      NO=000
MVCP V=00 CNT[00]
POST
```

**STEP 2** Press the  $(ALT)$  key to select "a" (absolute coordinate position) or "i" (relative coordinate position), and then press the  $(ENT)$  key.

**STEP 3** To designate directly the destination coordinate table No., enter the coordinate table No. with the numeric keypad, and then press the  $(ENT)$  key.  
(Setting range is from 0 to 999. "0" represents no designation.)

**STEP 4** To designate indirectly the destination coordinate table No., enter the counter No. with the numeric keypad, and then press the  $(ENT)$  key. (Setting range is from 0 to 99. "0" represents no designation.)

**NOTE** If neither STEP 3 nor STEP 4 or if both are designated, a "PARAMETER ERROR" will occur when the command is executed. If the counter No. is designated in STEP 4 and the counter details are "0", a "TABLE No. ERROR" will occur when the command is executed.

```
[ PRGM ]
0001 a      NO=000
MVCP V=00 CNT[00]
POST
```

**STEP 5** Enter the speed No. with the numeric keypad, and then press the  $(ENT)$  key. (Setting range: 00 to 20)  
When V=00 is entered, the speed designated by the SPD command in advance is set. If not designated in advance, the speed of V=01 is set.

**STEP 6** Press the  $(ALT)$  key to select POST (position) or PASS (pass point), and then press the  $(ENT)$  key.





- The movement speed is set by the MVCP command designating the intermediate position.
- The movement of POST (position) or PASS (pass point) is set by the MVCP command designating the target position.
- When the cursor exists in the position of the STEPS 2 to 6, pressing the **F1** key leads to display of the coordinate table designated by the STEP 3 on which the coordinate can be set. To return to the previous display, press the **ESC** key.

**NOTE**

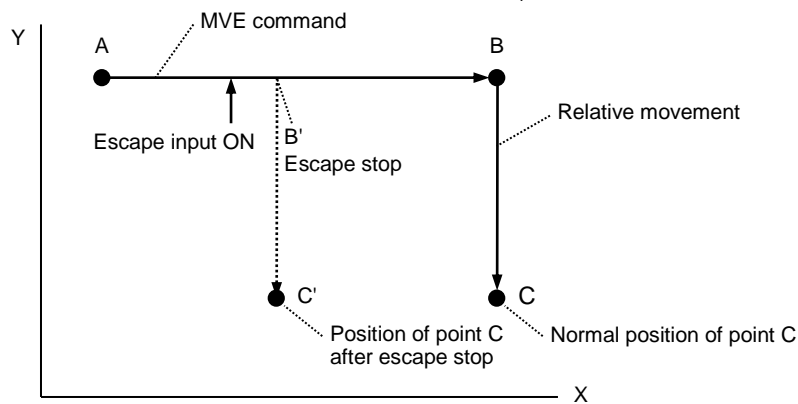
- The MVCP command must be written twice in succession.  
If an axis-movement-related command other than an MVCP command is executed after an odd number of MVCP commands have been executed, an error (lack of circular interpolation data) occurs.
- For details of the parameters "a" (absolute coordinate position), "i" (relative coordinate position), POST, and PASS, refer to "MOV system commands and parameters" (refer to section ■ 4.7.3).
- For a three-axis specification robot, two types of simultaneous reaching of the third axis can be designated by three-dimension circular interpolation (spherical interpolation) or two-dimension circular interpolation (interpolating of the first and second axes).  
For a four-axis specification robot, the fourth axis reaches simultaneously with three-dimension circular interpolation (spherical interpolation).  
These settings can be set by "setting of task and axis combination" in the parameter 2. (Refer to section ■ 13.4.19)

# MVE

## Escape Move

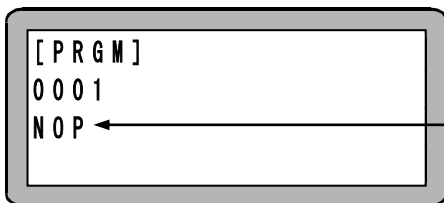
[Function] When the escape input signal is turned ON during movement with the MVE command, the axis will decelerate and stop. It will be interpreted that the step has ended, and the next step will be executed.

- [Explanation]
- The escape input is set in the escape input bit designation of the mode setting (refer to section 0).
  - The deceleration time will be the time set with the ACC/DEC command. If ACC/DEC is not set, acceleration/deceleration table No.5 will be used.
  - If the MVE command is executed while the escape input is ON, the MVE command will not be executed, and the next step will be executed.
  - The set general-purpose input signal will be the escape input only when the MVE command is executed. It will function as the general-purpose input port during commands other than the MVE command.
  - If the axis has been decelerated and stopped with the escape input and the next command is a move command to a relative position, the relative movement will take place using this stop position as a reference. (In the program that directs movement from A to B with an MVE command and the movement from B to C with a relative movement command as shown in the figure below, if the escape input is turned ON during movement from A to B and the robot decelerates and stops at the point B', it will move to the point C' with the next relative movement command.)

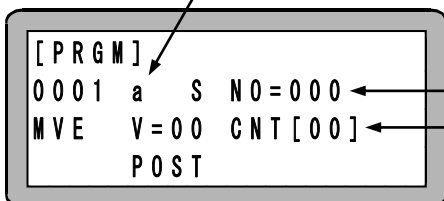


- The MVE command includes a method to directly designate the coordinate table No. and a method to designate the coordinate table No. indirectly using a counter. When the counter is used to designate the coordinate table No., the counter value of the designated counter is set as the coordinate table No.

[Key operation]



- STEP 1** Press the **F1**, **IN<sub>1</sub>** and **TIM<sub>6</sub>** keys.  
NOP changes to MVE.  
Next, press the **ENT** key.



- STEP 2** Press the **ALT** key to select "a" (absolute coordinate) or "i" (relative coordinate) and press the **ENT** key.
- STEP 3** To designate directly the destination coordinate table No., enter the coordinate table No. with the numeric keypad and press the **ENT** key. (Setting range: 0 to 999, 0: No designation.)
- STEP 4** To designate indirectly the destination coordinate table No., use the numeric keypad to enter the counter No. Press the **ENT** key. (Setting range: 0 to 99, 0: No designation.)

**NOTE** If neither STEP 3 nor STEP 4 or if both are designated, a "PARAMETER ERROR" will occur when the command is executed. If the counter No. is designated in STEP 4 and the counter details are "0", a "TABLE No. ERROR" will occur when the command is executed.

**STEP 5** Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.

**STEP 6** Enter the speed table No. with the numeric keypad and press the **ENT** key. (Setting range: 0 to 20)  
When V=00 is entered, the speed is set to the designated speed preset by SPD command. If not designated in advance, the speed of V=01 is set.

**?** If the cursor is at STEP 2 to 6, press the **F1** key to change to the coordinate table display and set the coordinates. Press the **ESC** key to return to the original display. (Refer to section ■ 13.5.1 for details on setting of coordinate table)

**NOTE** For details of the parameters "a" (absolute coordinate position), "i" (relative coordinate position), "S" (axial speed), "T" (linear speed), POST, and PASS, refer to "MOV system commands and parameter" (section ■ 4.7.3).

# MVM

## Palletizing Move

[Function] This command is used to execute palletizing movement according to the MVM table.

- [Explanation]
- This is a palletizing-movement-related command that is used in combination with the MINI and LOOP commands.
  - Before using the MVM command, set the MVM table. (Refer to section ■ 13.5.4)
  - When MVM command is executed, movement of the coordinates is calculated by the following equations:

Coordinates of each matrix point

P0: (X0, Y0, Z0)

P1: (X1, Y1, Z1)

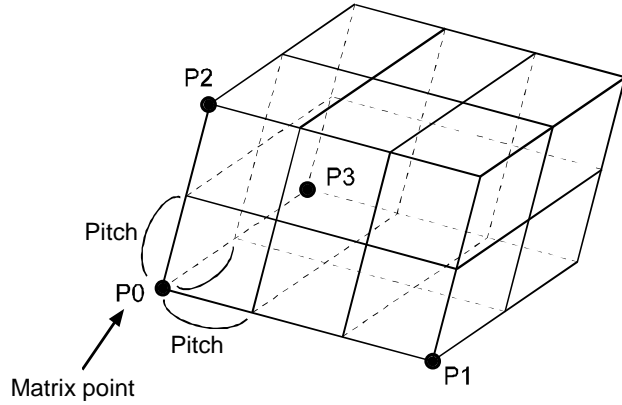
P2: (X2, Y2, Z2)

P3: (X3, Y3, Z3)

P0→P1 pieces: n<sub>1</sub>

P0→P2 pieces: n<sub>2</sub>

P0→P3 pieces: n<sub>3</sub>



Value of counter used in P0→P1 direction: C<sub>1</sub> } C<sub>1</sub> to C<sub>3</sub> are incremented by one with  
 Value of counter used in P0→P2 direction: C<sub>2</sub> } the LOOP command.  
 Value of counter used in P0→P3 direction: C<sub>3</sub> } These are variables that are the details  
 (value) of the counter.

MVM calculation  
 expression

X coordinate value = X<sub>0</sub> + x<sub>1</sub>(C<sub>1</sub>-1) + x<sub>2</sub>(C<sub>2</sub>-1) + x<sub>3</sub>(C<sub>3</sub>-1)

Y coordinate value = Y<sub>0</sub> + y<sub>1</sub>(C<sub>1</sub>-1) + y<sub>2</sub>(C<sub>2</sub>-1) + y<sub>3</sub>(C<sub>3</sub>-1)

Z coordinate value = Z<sub>0</sub> + z<sub>1</sub>(C<sub>1</sub>-1) + z<sub>2</sub>(C<sub>2</sub>-1) + z<sub>3</sub>(C<sub>3</sub>-1)

Where, x<sub>1</sub>, y<sub>1</sub>, and z<sub>1</sub> are the X, Y, and Z elements of the pitch in the P<sub>0</sub>→P<sub>1</sub> direction

$$x_1 = \frac{X_1 - X_0}{n_1 - 1}, \quad y_1 = \frac{Y_1 - Y_0}{n_1 - 1}, \quad z_1 = \frac{Z_1 - Z_0}{n_1 - 1}$$

x<sub>2</sub>, y<sub>2</sub>, and z<sub>2</sub> are the X, Y, and Z elements of the pitch in the P<sub>0</sub>→P<sub>2</sub> direction

$$x_2 = \frac{X_2 - X_0}{n_2 - 1}, \quad y_2 = \frac{Y_2 - Y_0}{n_2 - 1}, \quad z_2 = \frac{Z_2 - Z_0}{n_2 - 1}$$

x<sub>3</sub>, y<sub>3</sub>, and z<sub>3</sub> are the X, Y, and Z elements of the pitch in the P<sub>0</sub>→P<sub>3</sub> direction

$$x_3 = \frac{X_3 - X_0}{n_3 - 1}, \quad y_3 = \frac{Y_3 - Y_0}{n_3 - 1}, \quad z_3 = \frac{Z_3 - Z_0}{n_3 - 1}$$

[Key operation]

```
[PRGM]
0001
NOP ←
```

**STEP 1** Press the **F1**, **IN**<sub>1</sub> and **CAL**<sub>4</sub> keys.  
NOP changes to MVM.  
Next, press the **ENT** key.

```
[PRGM]
0001 S GRP=01 ←
MVM V=00
POST DIST
```

**STEP 2** Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.

**STEP 3** Enter the group No. with the numeric keypad and press the **ENT** key. (Setting range: 1 to 32)

```
[PRGM]
0001 S GRP=01
MVM V=00 ←
POST DIST
```

**STEP 4** Enter the speed No. with the numeric keypad and press the **ENT** key. (Setting range: 0 to 20)

When V = 00 is entered, the speed becomes the value preset by the SPD command. If not designated in advance, the speed of V=01 is set.

**STEP 5** Press the **ALT** key and select either POST (position) or PASS (pass point) and press the **ENT** key.

```
[PRGM]
0001 S GRP=01
MVM V=00
POST DIST ←
```

**STEP 6** Press the **ALT** key and select either DIST (destination) or APPR (approach) and press the **ENT** key.

**NOTE**

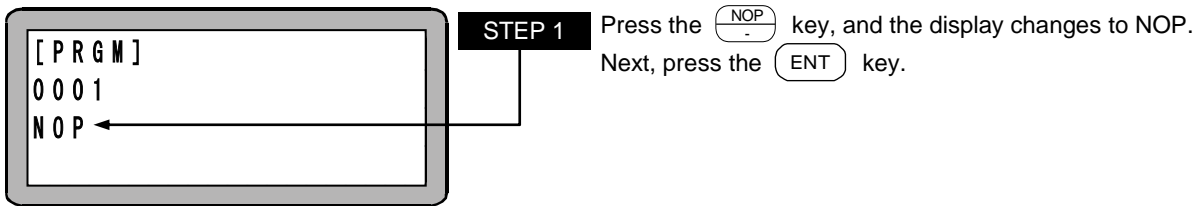
- For details of the parameters "S" (axial speed), "T" (linear speed), POST, and PASS, refer to "MOV system commands and parameters" (refer to section ■ 4.7.3).
- For an application example of the command, refer to "Palletizing work with MVM commands" (section ■ 5.1.6).
- For the coordinate table used for this command, asterisk (\*\*\*\*\*) cannot be used. If used, a parameter error (ERA8) occurs when the MVM command is executed.

# NOP

## No Operation

[Function] There is no execution at this step, and the program proceeds to the next step.

[Key operation]



**NOTE** NOP is entered in any program step in which no instruction is written.

# OFS

## Offset

[Function] This command is used to shift parallel the coordinate by the amount of the specified offset value.

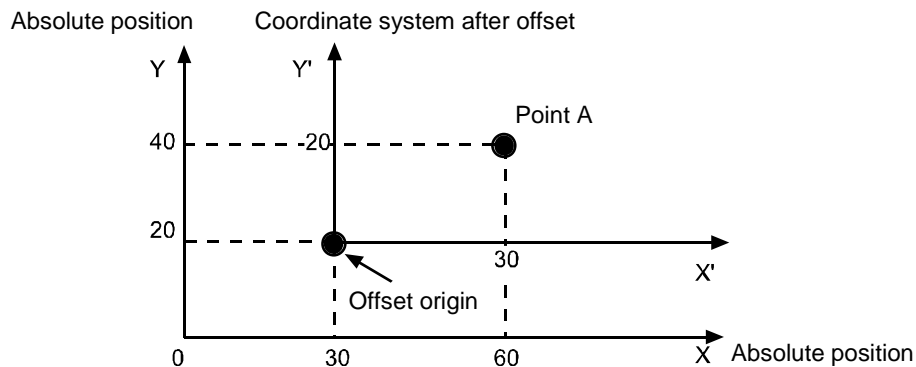
- [Explanation]
- It can be used for movement-related commands (except HOME).
  - The OFS command, once executed, remains effective until the next OFS or OFSP command is executed.
  - To release the offset, set the offset value of each axis to zero and execute an OFS command, designate the coordinate table No. the coordinate value of which is zero and execute an OFSP command, turn OFF the power, or perform resetting.
  - Note that the current position after the execution of the offset command is displayed as follows.  

$$[\text{Current position monitor display}] = [\text{Absolute position}] - [\text{Executed offset value}]$$

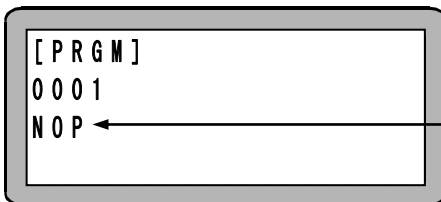
(Example)

When offset value is X = 30, Y = 20

Point A absolute coordinates:	X = 60, Y = 40
-) Executed offset value:	X = 30, Y = 20
Current position monitor display:	X = 30, Y = 20

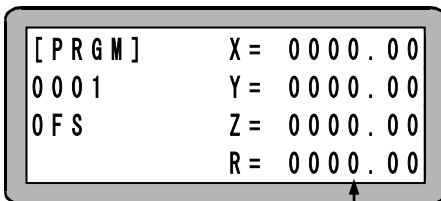


[Key operation]



**STEP 1**

Press the **F1**, **IN 1** and **IN 1** keys in this order.  
 NOP changes to OFS.  
 Next, press the **ENT** key.



**STEP 2**

Enter the coordinate with the numeric keypad and press the **ENT** key.  
 (Setting range: -8000 to 8000)  
 Press the **ALT** key to change display to "\*\*\*\*\*". That axis is regarded as the offset value before execution of this command.

**NOTE**

- Remote teaching or direct teaching can be performed by pressing the **DIRECT JOG** key. (Refer to section ■ 4.7.2)
- On the screen, the axis set by "setting of axis display" in the parameter 2 is displayed (refer to section ■ 13.4.1). The unused axis is displayed as "?".
- For monitor display of the current coordinate and the offset coordinate, refer to section ■ 14.4.

# OFSP

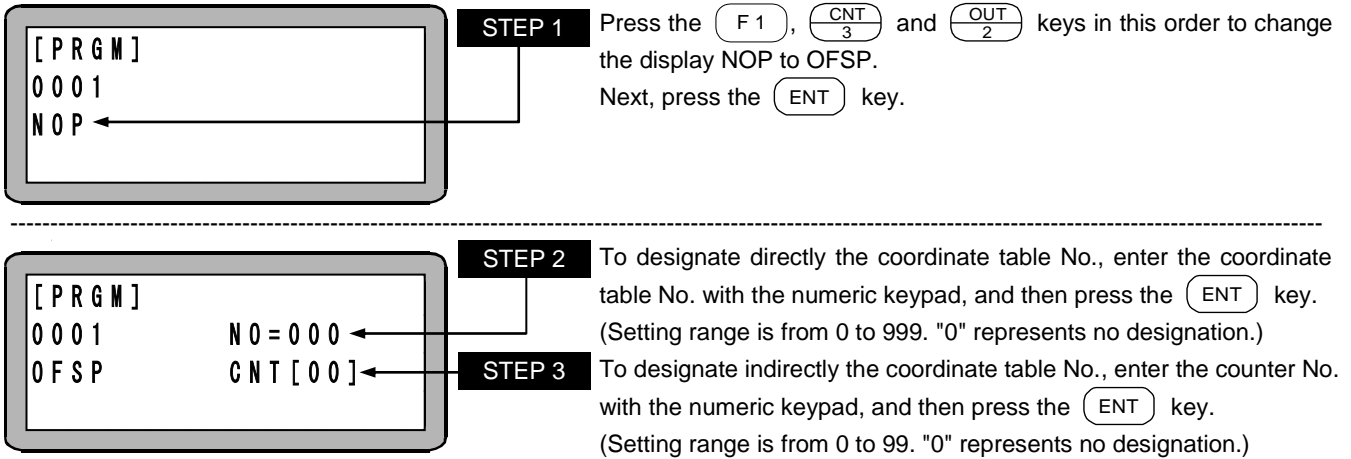
## Offset (Designated by Coordinate Table)

[Function] This command is used to shift parallel the coordinate by the amount of the offset value specified by the coordinate table.

- [Explanation]
- There are two methods to designate the coordinate table No.: direct designation and indirect designation through the counter. When the counter is used to designate the coordinate table No., the counter value of the designated counter is set as the coordinate table No.
  - This command is effective for movement-related commands (except for HOME).
  - Once executed, this command is valid until next execution of an OFS command or an OFSP command.
  - To release the offset, set the offset value of each axis to zero and execute an OFS command, designate the coordinate table No. the coordinate value of which is zero and execute an OFSP command, turn OFF the power, or perform resetting.
  - After execution of an offset command, monitor display of the current position will be as shown in the followings. For details, refer to the OFS command.

[Display of current position monitor] = [Absolute position] - [Executed offset value]

[Key operation]



**STEP 1** Press the **F1**, **CNT<sub>3</sub>** and **OUT<sub>2</sub>** keys in this order to change the display NOP to OFSP. Next, press the **ENT** key.

**STEP 2** To designate directly the coordinate table No., enter the coordinate table No. with the numeric keypad, and then press the **ENT** key. (Setting range is from 0 to 999. "0" represents no designation.)

**STEP 3** To designate indirectly the coordinate table No., enter the counter No. with the numeric keypad, and then press the **ENT** key. (Setting range is from 0 to 99. "0" represents no designation.)

**?** When the cursor exists in the position of the STEPS 2 to 3, pressing the **F1** key leads to display of the coordinate table designated by the STEP 2 on which the coordinate can be set. To return to the previous display, press the **ESC** key.

- NOTE**
- If neither of the STEP 2 nor the STEP 3 is designated, or both of them are designated, a "parameter error" occurs when the command is executed. If the counter No. of the STEP 3 is designated and the counter is other than the range 1 to 999, a "table No. error" occurs when the command is executed.
  - If the coordinate table is "\*\*\*\*\*", that axis is regarded as the offset value before execution of this command.

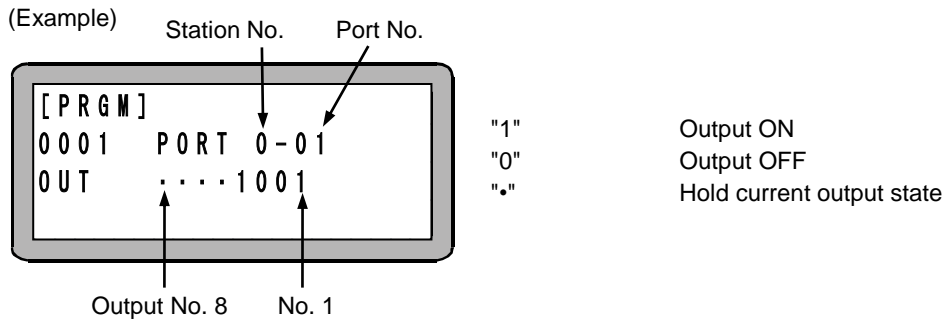


# OUT

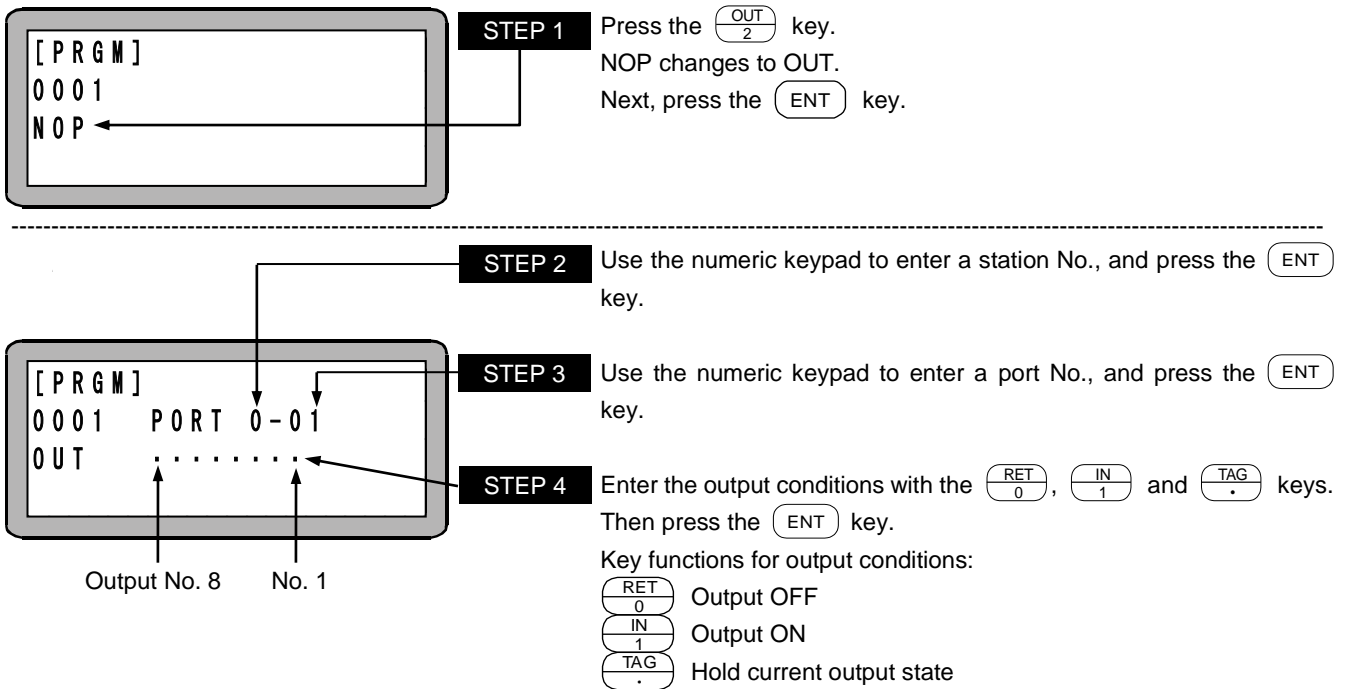
## General-purpose Port Output

[Function] The general-purpose output of the unit is turned ON or OFF.

- [Explanation]
- After execution, the output state is held until the next OUT command is executed. Even if the END command is executed and the program ended, the output signal will be held.
  - To turn OFF the output signal, set "0" at the output bit desired to be turned OFF with OUT command, or turn OFF the power supply of the controller.
  - If the OUT command is set as shown below, the general-purpose output port 1 No. 1 (general-purpose output port 01-1) and No. 4 (general-purpose output port 01-4) will turn ON and the general-purpose output port 1 No. 2 (general-purpose output port 01-2) and No. 3 (general-purpose output port 01-3) will turn OFF for the unit of which the station No. is set to "0".  
The general-purpose output signal at the "\*" display section will hold the current signal state.



[Key operation]



### NOTE

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).

# OUTC

## Counter Value General-purpose Port Output

[Function] The designated counter details are interpreted as a binary value, and are output to the designated general-purpose output port.

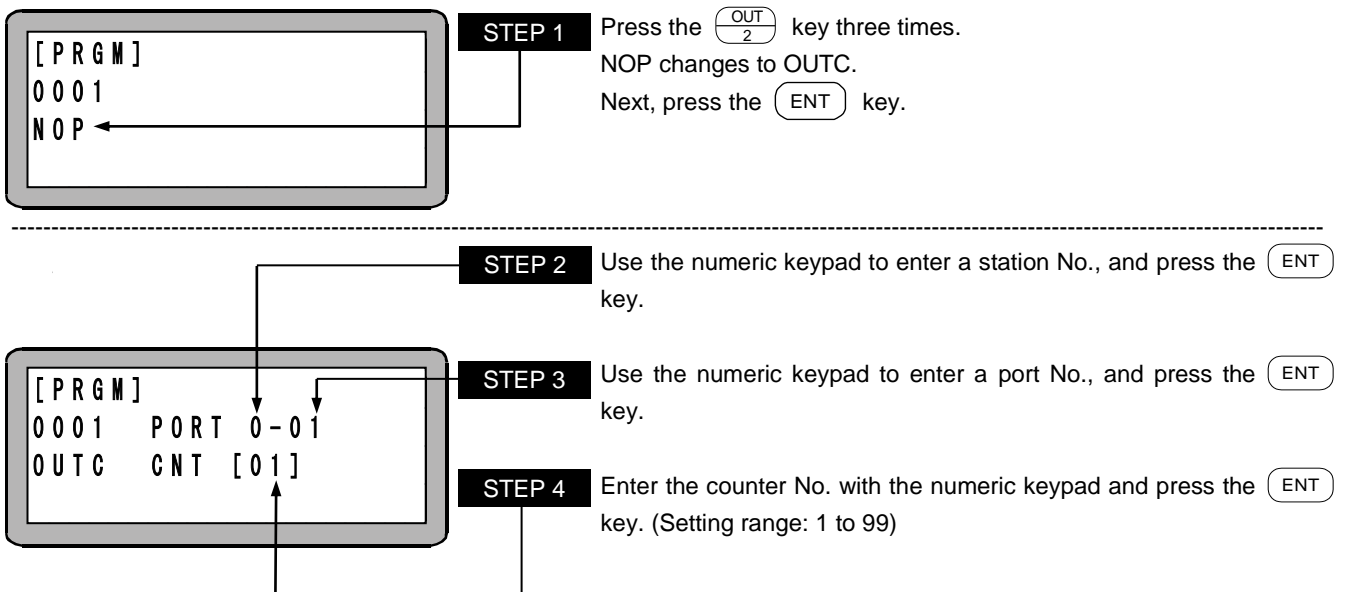
- [Explanation]
- The counter values that can be output are "0 to 15" for the four-bit output port and "0 to 255" for the eight-bit output port. (A parameter error will occur if the counter value is 256 or more.)
  - For up to four-bit output port, the lower four digits of converted binary number are displayed.

Counter value (Decimal)	General-purpose output bit pattern (Binary)	
0	0000	0000
1	0000	0001
2	0000	0010
3	0000	0011
:	:	:
15	0000	1111
:	:	:
255	1111	1111

0 ... Output OFF  
1 ... Output ON

↑
↑  
 Output No. 8      No. 1

[Key operation]



### NOTE

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).

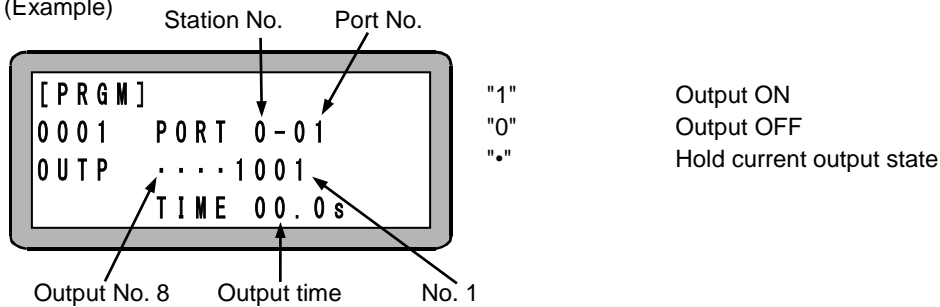
# OUTP

## General-purpose Port Pulse Output

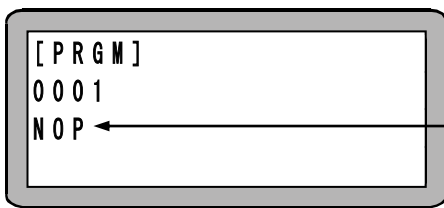
[Function] The output of the designated general-purpose output is turned ON or OFF for a designated time.

- [Explanation]
- The next step will not be moved to unless the set time has passed.
  - The time, whose unit is 0.1 second, can be set between 0 and 99.9 sec.
  - The status of the general-purpose output signal after the OUTP command execution is returned to the status before the OUTP command execution.
  - If the OUTP command is set as shown below, the general-purpose output port 1 No. 1 (general-purpose output port 01-1) and No. 4 (general-purpose output port 01-4) will turn ON and the general-purpose output port 1 No. 2 (general-purpose output port 01-2) and No. 3 (general-purpose output port 01-3) will turn OFF for the unit of which the station No. is set to "0" for a designated time. The general-purpose output signal at the "\*" display section will hold the current signal state.

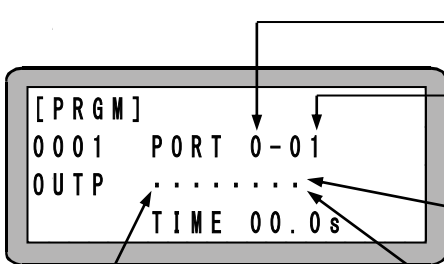
(Example)



[Key operation]



- STEP 1** Press the  $\left(\frac{\text{OUT}}{2}\right)$  key twice.  
NOP changes to OUTP.  
Next, press the  $\left(\text{ENT}\right)$  key.



- STEP 2** Use the numeric keypad to enter a station No., and press the  $\left(\text{ENT}\right)$  key.
- STEP 3** Use the numeric keypad to enter a port No., and press the  $\left(\text{ENT}\right)$  key.

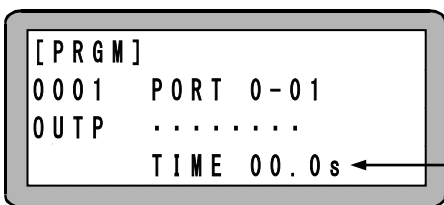
Output No. 8

No. 1

- STEP 4** Enter output conditions with the  $\left(\frac{\text{RET}}{0}\right)$ ,  $\left(\frac{\text{IN}}{1}\right)$  and  $\left(\frac{\text{TAG}}{\cdot}\right)$  keys. Then press the  $\left(\text{ENT}\right)$  key.

Key functions for output conditions:

- $\left(\frac{\text{RET}}{0}\right)$  Output OFF  
 $\left(\frac{\text{IN}}{1}\right)$  Output ON  
 $\left(\frac{\text{TAG}}{\cdot}\right)$  Hold current output state.



- STEP 5** Enter the output time (in seconds) with the numeric key pad and press the  $\left(\text{ENT}\right)$  key.  
(Setting range: 0 to 99.9)

### NOTE

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station No., port No. and bit No. which can be used, refer to "Names of general-purpose input/output ports and Teach Pendant displays" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).
- If the output time is set to "0", any signal will be output.
- If this command is executed in multitasking, the other tasks become the ready state and will not proceed to the next step until elapse of the set time period.

# OUTS

## Designated Coordinate General-purpose Output

[Function] This command compares the designated coordinate with the axis coordinate. When conditions are met, the designated general-purpose output is turned ON or OFF.

- [Explanation]
- This command is used to designate the coordinate to be compared, comparison conditions, and general-purpose output to be outputted before axis movement. Up to 64 settings can be stored in a time. Also this command can be used to clear the setting value stored by a CANS command.
  - When multiple OUTS commands are executed, comparison is performed one by one in the order of execution. When conditions are met once, the data will be deleted. Therefore it is necessary to execute an OUTS command again for use of the same conditions.
  - The coordinate is compared in a cycle of approximately 1 ms.
  - Coordinate data remaining due to unestablishment of conditions can be cleared by a CANS command.

(Example)

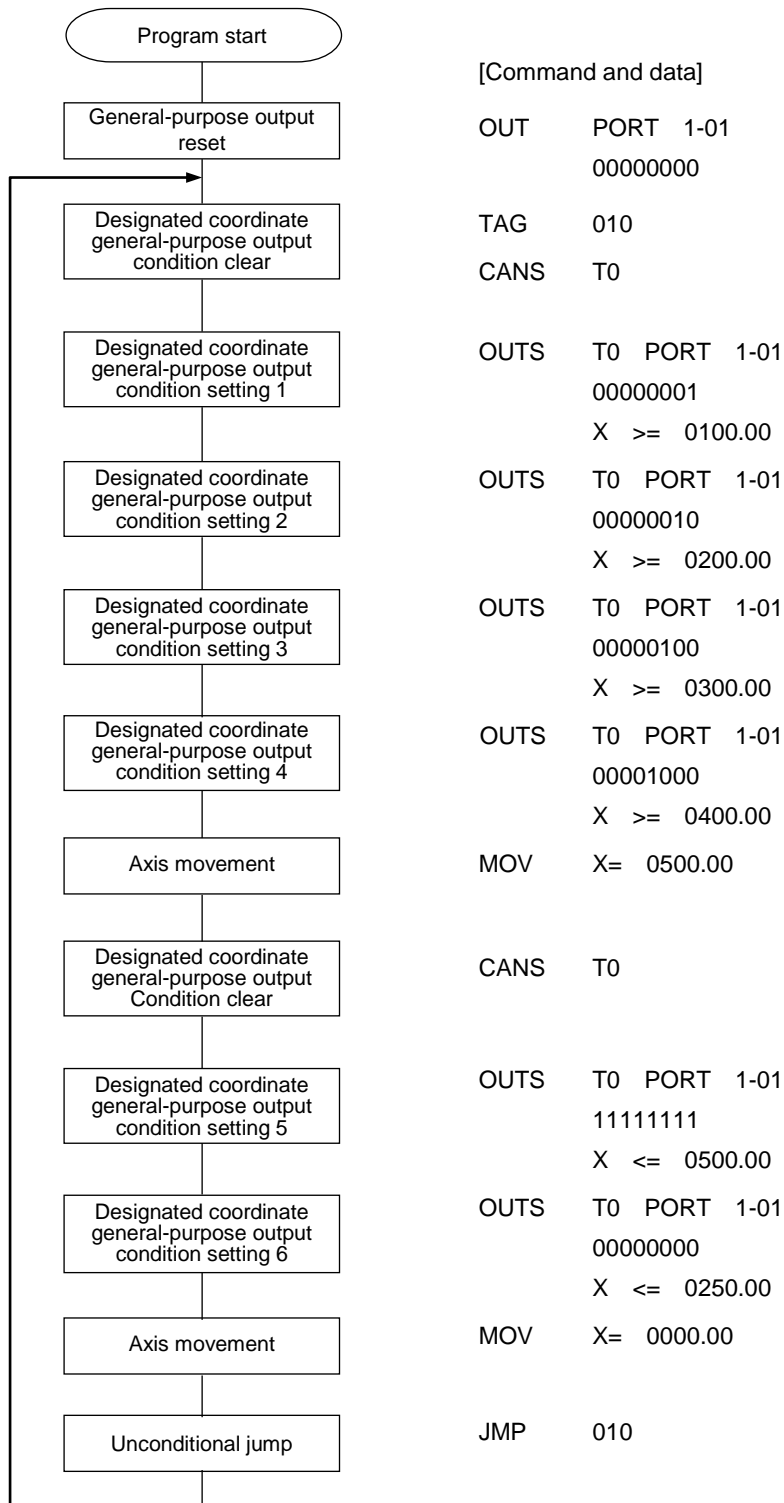
- ① While the X axis moves from 0 mm to 500 mm, general purpose-output port 1-01 is turned ON or OFF as the following table.

Move of X axis [mm]	State of general-purpose port 1-01							
	No. 8	No. 7	No. 6	No. 5	No. 4	No. 3	No. 2	No. 1
Start	0	0	0	0	0	0	0	0
Passing 100 mm	0	0	0	0	0	0	0	1
Passing 200 mm	0	0	0	0	0	0	1	0
Passing 300 mm	0	0	0	0	0	1	0	0
Passing 400 mm	0	0	0	0	1	0	0	0

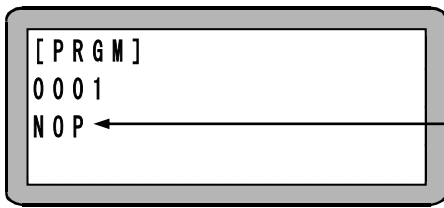
- ② While the X axis moves from 500 mm to 0 mm, general purpose-output is turned ON or OFF as the following table.

Move of X axis [mm]	State of general-purpose port 1-01							
	No.8	No.7	No.6	No.5	No.4	No.3	No.2	No.1
Start	1	1	1	1	1	1	1	1
Passing 250 mm	0	0	0	0	0	0	0	0

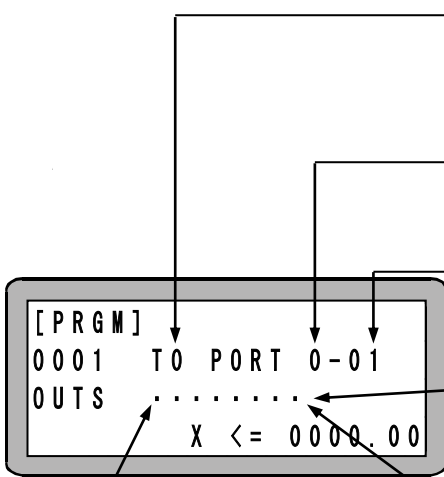
- ③ The cycle of above ① and ② is repeated. (①→②→①→②...)



[Key operation]



**STEP 1** Press the **F1**, **OUT<sub>2</sub>** and **OUT<sub>2</sub>** keys to change the display of NOP to OUTS.  
Next, press the **ENT** key.



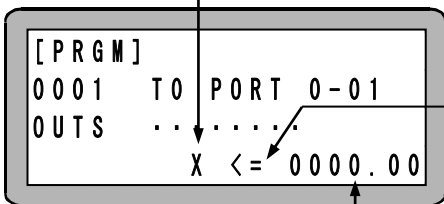
**STEP 2** Enter the task No. with the numeric keypad, and then press the **ENT** key. (Setting range: 0 to 4)  
0: own task, 1 to 4: other tasks

**STEP 3** Enter the station No. with the numeric keypad, and then press the **ENT** key.

**STEP 4** Enter the port No. with the numeric keypad, and then press the **ENT** key.

**STEP 5** Press the **RET<sub>0</sub>**, **IN<sub>1</sub>** and **TAG<sub>.</sub>** keys to enter the output data, and then press the **ENT** key. The output data is inputted by the following keys.

- RET<sub>0</sub>** Output OFF
- IN<sub>1</sub>** Output ON
- TAG<sub>.</sub>** Current conditions are held.



**STEP 6** Every time pressing the **ALT** key, the axes are displayed one by one. Select the axes to be compared, and then press the **ENT** key.

**STEP 7** Every time pressing the **ALT** key, operators (<= and >=) are displayed one by one. Select any one, and then press the **ENT** key.

**STEP 8** Enter the designated coordinate with the numeric keypad, and press the **ENT** key.  
(Setting range: -8000.00 to 8000.00)

**NOTE**

- The station No. is a number assigned to each unit. (Refer to section ■ 2.5.4-(2))
- For the station Nos., port Nos., and bit Nos. that can be used, refer to "General-purpose input/output name and teach pendant display" (section ■ 10.1.5, ■ 11.2.3, or ■ 12.2.3).
- Axis display on the screen is set as "setting of axis display" in the parameter 2. (Refer to section ■ 13.4.1)  
The unused axis is displayed as "?".
- When two or more same axis displays are used in a task, the axis with smaller station No. will override.
- If 65 or more conditions are set for a task, an error occurs.
- When a reset input is turned ON, remaining data that is set in the buffer is cleared.
- The data is not held for continuous start.

# PASS

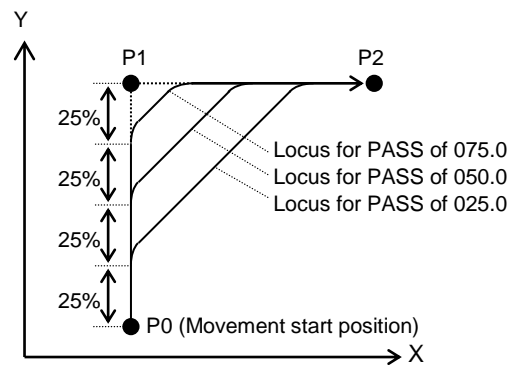
## Pass Rate Setting

[Function] This command is used to set the timing for proceeding to the next command as percentage of movement amount, for the cases where PASS is selected with an MOV command etc.

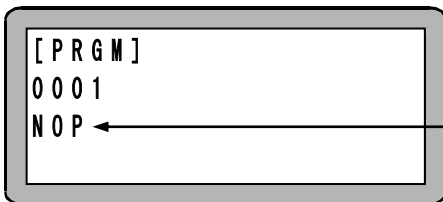
- [Explanation]
- The pass rate is valid when PASS is selected with a liner movement command such as MOV, MOV P, MVB, MVM, and RSMV.
  - If movement commands are executed overlappingly, the composite movement direction and speed will be used.
  - The maximum number of commands that can be executed overlappingly is two. When two movement commands are executed overlappingly, the next movement command will be waiting until either one of the two finishes.
  - This command is intended to reduce operation time, and therefore do not perform constant speed control.
  - The setting range is from 0.1 to 100.0[%], but a value equal to or lower than 1.0[%] is set, it will be regarded as 1.0[%].
  - Numerical figures after a decimal point will be cut off. (Example: When 50.5[%] is set, it will be regarded as 50.0[%].)
  - The operation proceeds to the next command at the timing set by the pass area setting of the parameter 1 (refer to section ■ 13.3.5) or the timing set by this command, whichever comes earlier.
  - Once set, the pass rate will be held until next setting, resetting, or turning OFF and ON of the power. If not set, this value will be regarded as 100.0[%].

(Example) Movement of P0→P1→P2

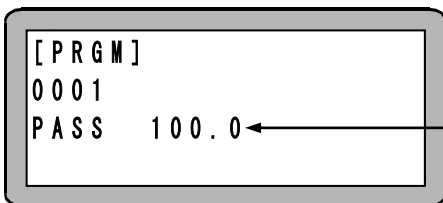
```
PASS 025.0 (050.0) (075.0)
MOV P1 PASS
MOV P2 POST
```



[Key operation]



**STEP 1** Press the **F1**, **CNT/3** and **CNT/3** keys in this order to change the display of NOP to PASS. Next, press the **ENT** key.

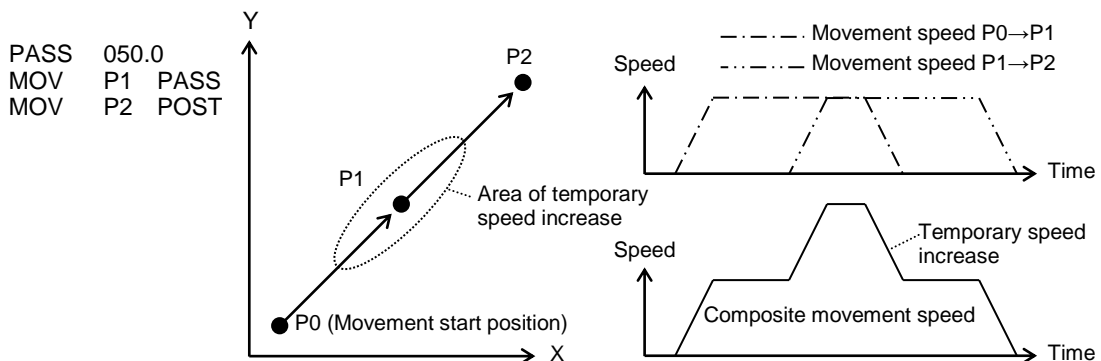


**STEP 2** Enter the pass rate with the numeric keypad, and then press the **ENT** key. (Setting range: 0.1 to 100.0[%])

**NOTE**

- If movement commands including same directional vector are executed in succession, the speed temporarily increases depending on the pass rate setting.

(Example) When the pass rate is set to 50.0%, the movement of P0→P1→P2 will be as follows.

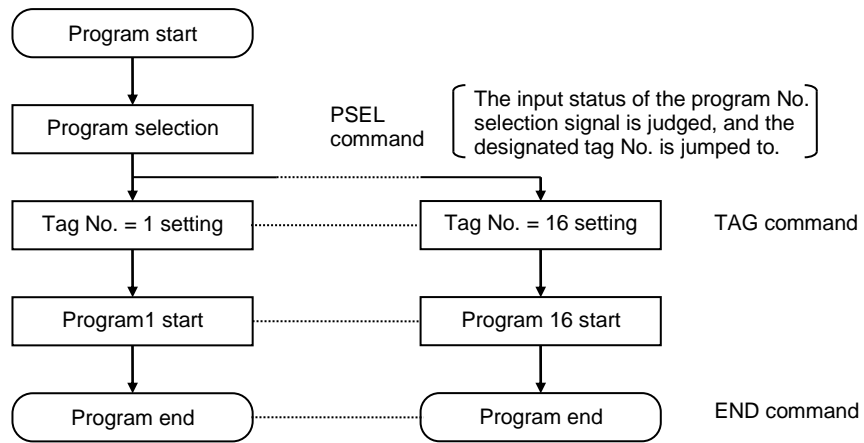


# PSEL

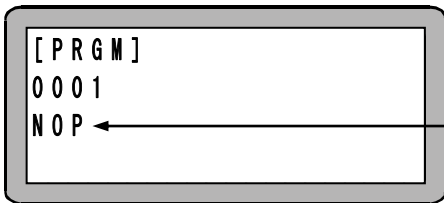
## Program Selection

[Function] The status of the program selection input signal set with the mode setting is judged, and the designated tag No. is jumped to according to the input state. (Refer to section ■ 10.2.9)

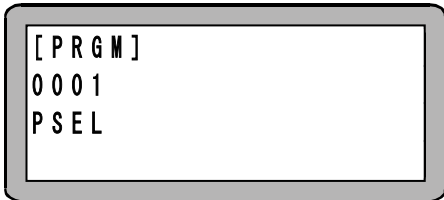
- [Explanation]
- The program No. input signal is judged at the point the PSEL command is executed.
  - A case example is shown below:



[Key operation]



**STEP 1** Press the **F 1** key, and then press the **IN 1** key and the **RET 0** key. NOP changes to PSEL.  
Next, press the **ENT** key.



- Refer to section ■ 13.2.5 for details on the program selection input bit designation.
- During multitasking, jumping to a tag No. in another task is also not possible. A "TAG NO. error" will occur during execution.





# RET

## Return Command

[Function] The RET command is used with a CAL-related command (CAL, CALI, CALC and CALT) in pairs to return the program to the next step following the step called by it.

[Key operation]

```
[ P R G M ]
0 0 0 1
N O P ←
```

**STEP 1** Press the  key.  
NOP changes to RET.  
Next, press the  key.

---

```
[ P R G M ]
0 0 0 1
R E T
```



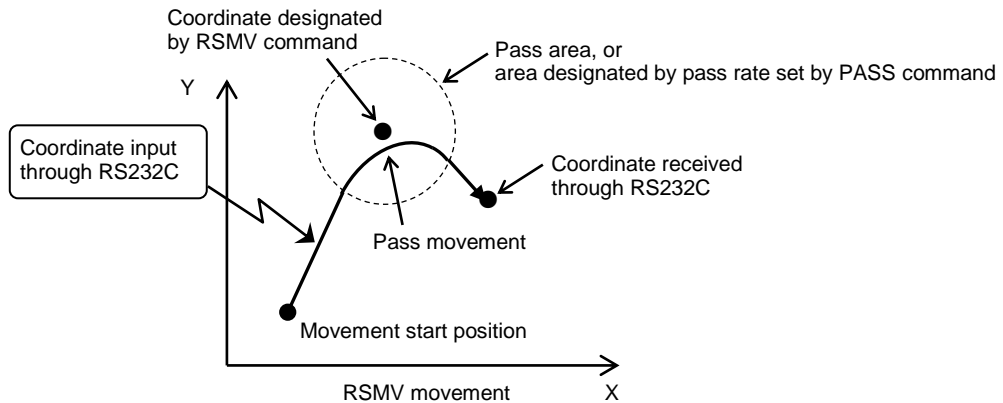
Refer to the CAL command for the ideology on the main routine and subroutine.

# RSMV

## Axis Movement through RS232C

[Function] This command is used to change the target position to the coordinate data received through RS232C communication during axis movement to the designated coordinate.

- [Explanation]
- This command is used to correct the target position through RS232C.
  - When coordinate data is received through RS232C before the axis reaches the coordinate designated by an RSMV command (before deceleration), it will not decelerate and will move to the received coordinate by pass movement. When coordinate data is received before the axis enters into the dotted circle through RS232C, movement to the received coordinate will not start immediately. In the case of a pass area, movement to the received coordinate will not start until reach to the deceleration start position.



- If coordinate data is not input through RS232C after reach to the coordinate designated by the RSMV command, the robot waits for receipt of coordinate data.
- When stopped by a stop input and then restarted, the robot starts from waiting for receipt of coordinate data through RS232C.
- For coordinate data receipt through RS232C, "\*\*\*\*\*" is valid.

[Format for coordinate data input through RS232C]

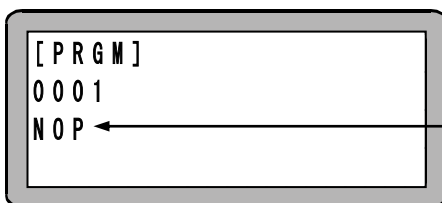
@MRSS△TASK=01△X=±0000.00△Y=±0000.00△Z=±0000.00△R=±0000.00△V=00CRLF  
(△ represents a space.)

The designated coordinate is an absolute coordinate position and POST designation.



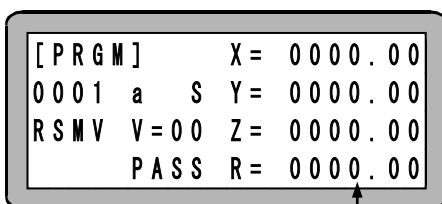
For details of RS-232C communication, refer to RS-232C communication specifications.  
The RS-232C communication specifications is available from your nearest branch or sales office of us.

[Key operation]



**STEP 1**

Press the **F1**, **OUT<sub>2</sub>** and **MOV<sub>9</sub>** keys in this order to change the display of NOP to RSMV.  
Next, press the **ENT** key.



**STEP 2**

Enter the coordinate of each axis with the numeric keypad, and then press the **ENT** key. (Setting range: -8000.00 to 8000.00)  
Press the **ALT** key to change display to "\*\*\*\*\*". That axis is regarded as the coordinate value before execution of this command.

**NOTE**

To perform remote teaching or direct teaching, press the **DIRECT JOG** key. (Refer to section ■ 4.7.2)

**STEP 3** Press the **ALT** key to select "S" (axial speed) or "T" (linear speed), and then press the **ENT** key.

**STEP 4** Enter speed No. with the numeric keypad, and then press the **ENT** key. (Setting range: 00 to 20)  
When V=00 is entered, the speed designated by the SPD command in advance is set. If not designated in advance, the speed of V=01 is set.

**?** When this command is executed, RS232C data can be transmitted on trial with the teach pendant. For details, refer to "Coordinate transmission through RS232C" (section ■ 16.9).

- NOTE**
- On the screen, the axis set by "setting of axis display" in the parameter 2 is displayed (refer to section ■ 13.4.1). The unused axis is displayed as "?".
  - For details of the parameters "S" (axial speed) and "T" (linear speed), refer to "MOV system commands and parameter" (section ■ 4.7.3).
  - If coordinate data through RS232C is not received before pass movement process, the normal POST movement will be performed. The robot will stop at the designated coordinate, and then move to the received coordinate.
  - Coordinate data received through RS232C is stored in the memory of the controller. However, it will be cleared after the robot starts moving to the coordinate received through RS232C or by resetting.
  - Coordinate data through RS232C can be received before execution of an RSMV command.
  - When multiple coordinate data are received through RS232C, the last data is stored in the memory.

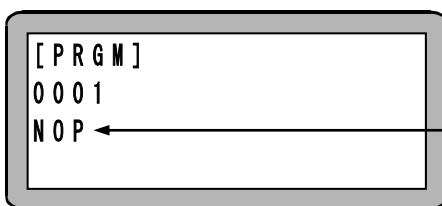
# SPD

## Speed Setting Command



[Function] This command is used to set the speed for the actuator movement.

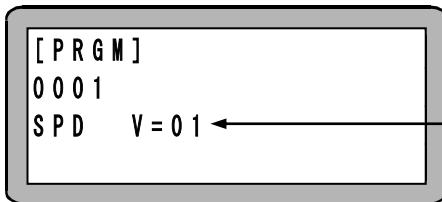
- [Explanation]
- The speed setting can be set from the speed table Nos. 1 to 20 (20 levels).
  - This command must be set before a Move command (MOV, MOVP, MVC, MVCP, MVB, MVE, MVM, and RSMV).
  - When using multitasking, a setting must be made for each task.
  - The speed at each level can be changed with the speed table. (Refer to section ■ 13.5.2)
  - Once the speed is set, this value remains unchanged until the next setting, resetting or turning OFF and ON of the power. If no speed value is set, the SPD1. is set.
  - Do not set the speed higher than the maximum allowed. If the speed exceeds the maximum, the speed set in parameter 2 is set. (Refer to section ■ 13.4.6)
  - The allowable maximum speed depends on the length of the axis stroke and ball screw lead. Refer to the Axis unit instruction manual for details.

[Key operation]




**STEP 1**

Press the  key.  
NOP changes to SPD.  
Next, press the  key.



**STEP 2**

Enter speed No. with the numeric keypad and press the  key.  
(Setting range: 01 to 20)

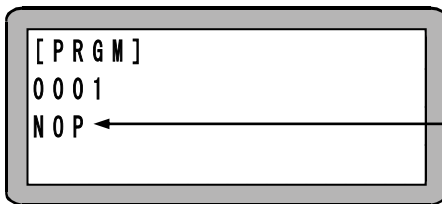
# STOP

## Stop Command



[Function] This command is used to stop the program and display the next program step.

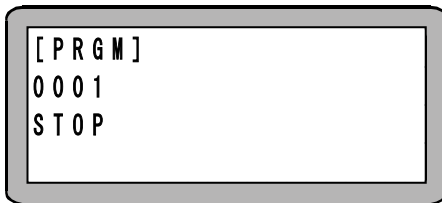
- [Explanation]
- If the program is to be continued after stopping it with a command, input the start signal. When the other task is in process, this command is invalid.
  - If the program is to be returned to step No. 1 and then executed, input the reset signal, and then input the start signal. Note that the setting of the continuous start mode and the status of the continuous start input signal are related. (Refer to section ■ 10.2.6)
  - When using multitasking, the task that executed this command will stop.

[Key operation]



STEP 1

Press the  key twice.  
NOP changes to STOP.  
Next, press the  key.



# SVOF

## Servo-off Command

[Function] This command is used to turn all axes or designated axis servo-free.

[Explanation] When the SVOF command is executed, any axis equipped with a brake is applied with brakes.

[Key operation]

```
[ P R G M ]
0 0 0 1
N O P ←
```

### STEP 1

Press the **F 1**, **IN**<sub>1</sub> and **MVC**<sub>8</sub> keys.  
NOP changes to SVOF.  
Next, press the **ENT** key.

```
[ P R G M ]
0 0 0 1
S V O F A L L ←
```

### STEP 2

Every time you press the **ALT** key, "ALL", "X", "Y", "Z" and "R" is displayed in this order. Select the axis to be turned servo-free, and then press the **ENT** key.  
"ALL" ----- All axes

### NOTE

- The axis display on the screen is set in "Axis display setting" in the parameter 2. (Refer to section ■ 13.4.1)
- When two or more same axis displays are used in a task, the axis with smaller station No. will override.

# SVON

## Servo-on Command

[Function] This command is used to turn all axes or designated axis servo-locked.

[Explanation] When SVON command is executed, any axis brake is released.

[Key operation]

```
[ P R G M ]
0 0 0 1
N O P ←
```

### STEP 1

Press the **F 1**, **IN**<sub>1</sub> and **SPD**<sub>7</sub> keys.  
NOP changes to SVON.  
Next, press the **ENT** key.

```
[ P R G M ]
0 0 0 1
S V O N  A L L ←
```

### STEP 2

Every time you press the **ALT** key, "ALL", "X", "Y", "Z" and "R" is displayed in this order. Select the axis to be turned servo-locked, and then press the **ENT** key.  
"ALL" ----- All axes

### NOTE

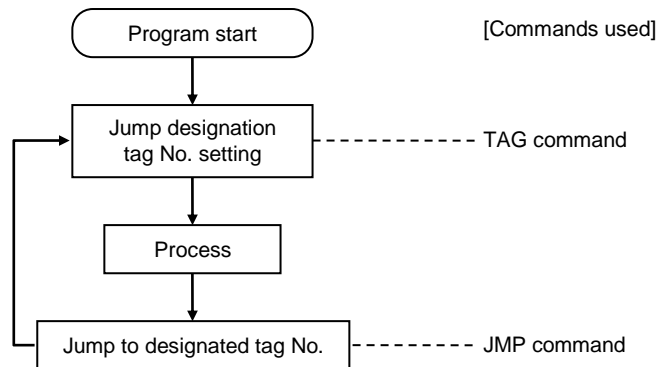
- The axis display on the screen is set in "Axis display setting" in the parameter 2. (Refer to section ■ 13.4.1)
- When two or more same axis displays are used in a task, the axis with smaller station No. will override.

# TAG

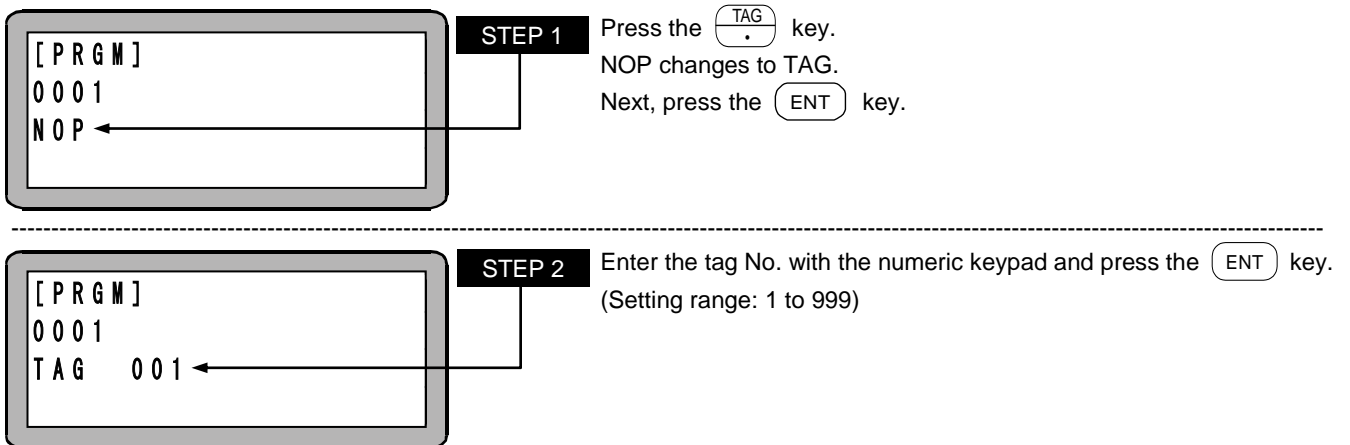
## Tag Command

[Function] This command is used to enter the tag No. in the program.

- [Explanation]
- The tag No. is an address that designates the jump designation of JMP command or CAL command.
  - The tag No. can be entered from No. 1 to 999.
  - The program can be started from the tag (No. 1 to 16) selected by the PSEL command.
  - When this command is executed, the program proceeds to the next step with no program execution similarly to NOP command.
  - A usage example is shown below.  
This is a program that repeats a certain process.



[Key operation]



**NOTE** If the same tag No. is input, the "DOUBLE TAG ERR." will occur.  
When using multitasking, if the same tag No. is input even in another task, the "DOUBLE TAG ERR." will occur.  
When a TAG command is copied, the destination tag No. will be 000. (Refer to section ■ 5.1.3)



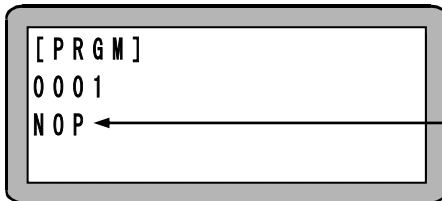
# TCAN

## Task Forced End

[Function] The task is ended.

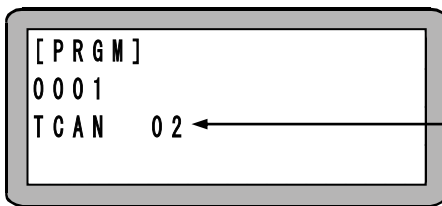
[Explanation] The designated task will be set in the same state as when that task executes the END command.

[Key operation]



**STEP 1**

Press the **F 1**, **OUT**<sub>2</sub> and **TIM**<sub>6</sub> keys in this order.  
NOP changes to TCAN.  
Next, press the **ENT** key.



**STEP 2**

Enter the task No. with the numeric keypad and press the **ENT** key.  
(Setting range: 2 to 4)

**NOTE** Refer to Chapter 6 for tasks.

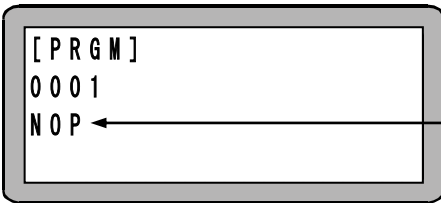
# TIM

## Wait Command



[Function] This command is used to stop the program execution for a specified period of time.

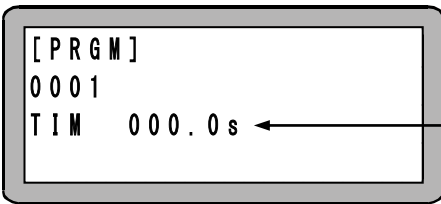
[Explanation] The amount of time to wait can be set from 0.0 to 999.9 seconds in increments of 0.1 seconds.

[Key operation]




**STEP 1**

Press the  key.  
NOP changes to TIM.  
Next, press the  key.



**STEP 2**

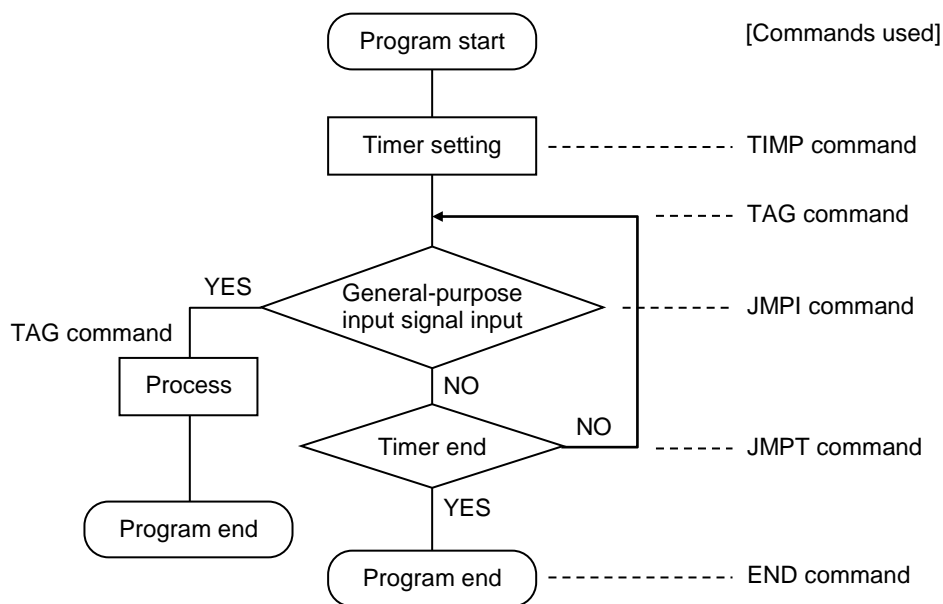
Enter the wait period (in seconds) with the numeric keypad and press the  key. (Setting range: 0.0 to 999.9)

# TIMP

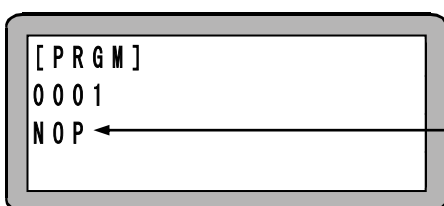
## Timer Preset Command

[Function] This command is used to set the time value to a timer.

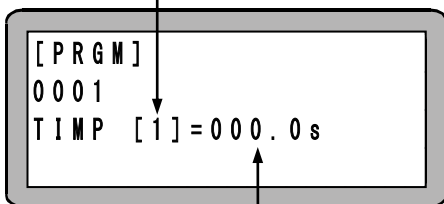
- [Explanation]
- There are nine timers from No. 1 to No. 9. Initial time value can be set in each timer from 0.0 to 999.9 seconds in increments of 0.1 second.
  - After the time is set, the timer begins counting down to "0". However, the program does not stop even in downcounting and executes the subsequent steps.
  - This command is used together with JMPT and CALT commands.
  - A usage example is shown below.  
The program waits the specified time for the general-purpose input signal input from an external source. If there is an input signal, it is processed. If there is no signal input within the designated time, the program is ended.



[Key operation]



- STEP 1** Press the  $\frac{TIM}{6}$  key twice.  
NOP changes to TIMP.  
Next, press the ENT key.



- STEP 2** Enter the timer No. with the numeric keypad and press the ENT key. (Setting range: 1 to 9)
- STEP 3** Enter the preset value (initial value) with the numeric keypad and press the ENT key. (Setting range: 0.0 to 999.9)

# TLMV

## Torque Limit Move Instruction Command

[Function] MOV command and MOVP command after this command are made Torque limit move.  
This command is supported by CA25-M10 version 4.29 or later, TPH-4C version 2.33 or later, SF-98D version 3.1.6 or later.

- [Explanation]
- Torque limit move is the move suitable for pushing a work. For details, refer to section ■ 5.1.7.
  - Only 1 axis for each task can move with torque limit move. Others move normally.
  - Torque limit value can be set from the torque limit table (TT). Refer to section ■ 13.5.5.
  - Torque limit judgement time (TM) can be use for judging whether the end condition of torque limit move meets and the output conditions of task load output, task limit output and task lock output meet.
  - If torque limit end (TE) is set to ON, when the state output torque is reaching torque limit value continues for more than torque limit judgement time (TM), next command is gone ahead to. (Condition ①)
  - If lock end (LE) is set to ON, when the lock is detected, next command is gone ahead to. (Condition of lock detection is motor stop and meeting condition ①)
  - If arrival end (AE) is set to ON, when the robot reaches target position, next command is executed.
  - If overflow detection (DD) is set to OFF, the detection of overflow error is not executed. When pushing a work, if overflow error occurs, set DD to OFF.

[Key operation]

**STEP 1** Press the **F1**, **CNT/3** and **JMP/5** keys in this order.  
NOP changes to TLMV.  
Next, press the **ENT** key.

```
[PRGM]
0001
NOP
```

---

**STEP 2** Every time you press the **ALT** key, "X", "Y", "Z" and "R" is displayed in this order. Select the axis to do torque limit move, and then press the **ENT** key

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

---

**STEP 3** Enter the torque limit table No. (TT) with the numeric keypad and press the **ENT** key.  
(Setting range: 1 to 8, Initial value: 8)  
Refer to section ■ 13.5.5 for torque limit table.

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

---

**STEP 4** Enter the torque limit judgement time (TM) with the numeric keypad and press the **ENT** key.  
(Setting range: 000.0 to 999.9, Initial value: 000.0)

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

---

**STEP 5** Press the **ALT** key and select either ON or OFF for torque limit end (TE) and press the **ENT** key.

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

**STEP 6**

Press the **ALT** key and select either ON or OFF for lock end (LE) and press the **ENT** key.

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

**STEP 7**

Press the **ALT** key and select either ON or OFF for arrival end (AE) and press the **ENT** key.

```
[PRGM] X TT=8
0001 TM=000.0
TLMV TE=OFF LE=OFF
      AE=OFF DD=ON
```

**STEP 8**

Press the **ALT** key and select either ON or OFF for overflow detection (DD) and press the **ENT** key.

**NOTE**

If an error occurs during torque limit move, the step goes ahead from the move command.

**CAUTION**

If a work is removed during pushing the work, the robot move to the target position. Pay enough attention not to cause damage to the workpiece or the hand, or cause your hand to be caught in.

# TRSA

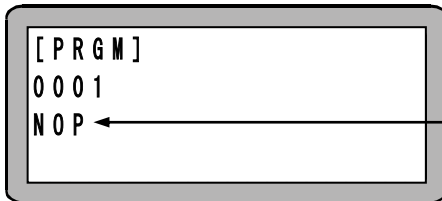
## Task Restart

[Function] The task is restarted.

[Explanation]

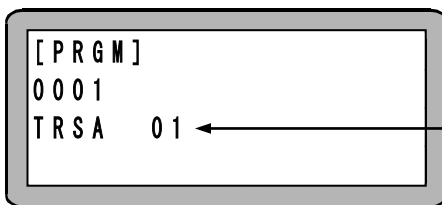
- The task that was started and then stopped with the STOP command or TSTO command will be restarted.
- If this command is executed to a task that has not been started once, an ER62 execution impossible error occurs.

[Key operation]



**STEP 1**

Press the **F 1**, **OUT**<sub>2</sub> and **CAL**<sub>4</sub> keys in this order.  
NOP changes to TRSA.  
Next, press the **ENT** key.



**STEP 2**

Enter the task No. with the numeric keypad and press the **ENT** key.  
(Setting range: 1 to 4)

**NOTE**

Refer to Chapter 6 for tasks.

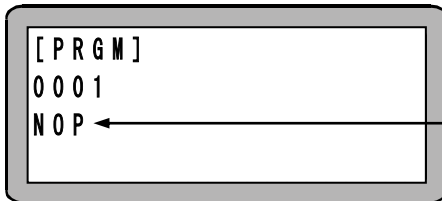
# TSTO

## Task Temporary Stop

[Function] The task is stopped temporarily.

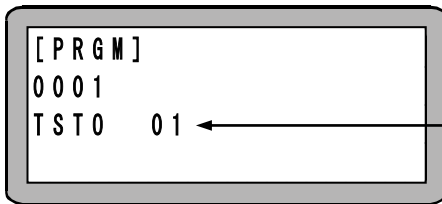
[Explanation] The designated task will be set in the same state as when that task executes the STOP command.

[Key operation]



**STEP 1**

Press the **F 1**, **OUT**<sub>2</sub> and **CAL**<sub>4</sub> keys in this order.  
NOP changes to TSTO.  
Next, press the **ENT** key.



**STEP 2**

Enter the task No. with the numeric keypad and press the **ENT** key.  
(Setting range: 1 to 4)

**NOTE** Refer to Chapter 6 for tasks.

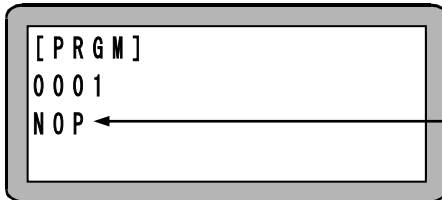
# TSTR

## Task Start

[Function] The task is started.

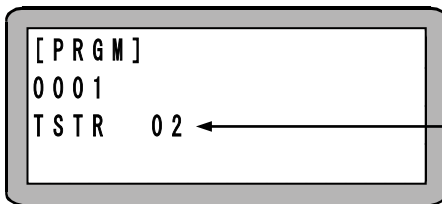
[Explanation] When this command is executed, the designated task will be started.  
Task 1 will start from the Teach Pendant or system input start, so it will not start with this command.

[Key operation]



**STEP 1**

Press the (F 1), ( $\frac{\text{OUT}}{2}$ ) and ( $\frac{\text{CNT}}{3}$ ) keys in this order.  
NOP changes to TSTR.  
Next, press the (ENT) key.



**STEP 2**

Enter the task No. with the numeric keypad and press the (ENT) key.  
(Setting range: 2 to 4)

**NOTE** Refer to Chapter 6 for tasks.



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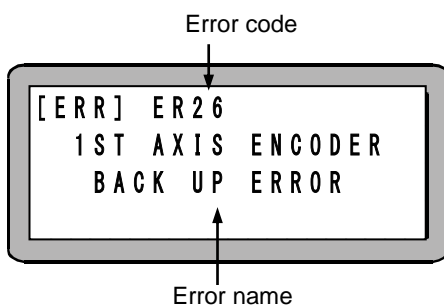
## Chapter 18 Error Messages

- When an error is generated, the status LED on the front panel of the controller will light in red (except for some cases) and the Teach Pendant will display error messages.
- If an error occurs during multitasking, the Teach Pendant display will automatically change to the task in which an error occurred, and an error message will display.
- There are four ways to clear an error.

When an error cannot be cleared with the following methods, the power must be turned OFF and then ON again.

1. Clear by teach Pendant	Press the <b>CLEAR</b> key on the Teach Pendant.
2. Clear by system input	Input a RESET signal to the system by setting pin No.31 ON. (Refer to section ■ 10.2.4)
3. Clear by fieldbus	Perform a reset input. (Refer to ■ *.2.1 List of *** I/O signals in the chapter of each fieldbus.)

### ■ 18.1 Error display



When an error occurs, the error code and error name are displayed on the Teach Pendant.

Check the meaning and cause of the error from the error list, and perform the remedy.



When multiple errors occur, the error that was detected first is displayed.

Although all errors are cleared by the error clear procedure, if these errors include an error that cannot be cleared, that error will be displayed, and the power must be turned OFF and then ON again.

## ■ 18.2 Error history display

The latest 99 errors (including power ON records) can be displayed.

```
[RUN] F1:AUTO/STEP
HELP  F2:OVERRIDE
      F3:RESET
      F4:PAGE ←
```

**STEP 1** In the RUN mode, press the **HELP** key to display the screen shown at the left. Then press the **F4** key.



In the external point designation mode, "AUTO/STEP" display does not appear.

```
[RUN] F1:MONITOR
      F2:OPTION ←
      F3:T/P ON
      F4:T/P OFF
```

**STEP 2** Then press the **F2** key.  
To return to the RUN mode, press the **ESC** key.

```
[OPT] F1:SYNC. UTL.
      F2:FIELD BUS
      F3:ERR. HISTORY ←
      F4:
```

**STEP 3** Then press the **F3** key.  
To return the STEP 2, press the **ESC** key.

```
[ERR] HISTORY   H M S
01 ER62AL*** 0000605
02 ER13AL*** 0000236
03 ***** *****
```

**STEP 4** The error history screen appears. Error codes and elapsed time from turning ON of the power are displayed. ("\*\*\*\*\*" represents turning ON of the power.)  
Press the **F1** key to proceed to the STEP 5A.  
Press the **F2** key to proceed to the STEP 5B.  
To scroll the error history, press the **NEXT** key or the **-NEXT** key.  
Press the **SEARCH** key and enter an error history No. to jump to the error history.  
To return to the STEP 3, press the **ESC** key.

```
[ERR] ER62
EXECUTION IMPOSSIBLE
```

**STEP 5A** The name of the error code displayed in the second line of the error history screen of the STEP 4 appears.  
To return to the STEP 4, press the **ESC** key.

```
[CLR]
ERROR HISTORY
      CLEAR ?
YES:ENT NO:ESC
```

**STEP 5B** The confirmation screen of clearing the error history appears.  
To clear all the error history, press the **ENT** key.  
To return to the STEP 4, press the **ESC** key.



The error codes ER02, ER14, ER80, and ERB8 are not recorded in the error history.

## ■ 18.3 Error table

Code	Error name	Meaning/cause	Remedy	State
ER02	Incompatible controller	An incompatible type of T/P was connected to the controller. Old version T/P was connected to the controller.	Check the T/P and controller model, and use the correct type. Update the version of the T/P.	L-G-0
ER12	Watchdog timer error	The CPU went out of control.	Turn the power off and then on again. The CPU may be overloaded due to noise. Refer to section ■ 2.5.3 for measures for reducing and preventing noise. * The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER13	Emergency stop	The emergency stop switch or emergency stop input was activated. Disconnection, breaking, or contact failure of the link cable or input/output connector occurred.	Clear the emergency stop switch or emergency stop input. Check that the link cables and input/output connectors are securely connected. Check if the link cable or input/output connector has a bad contact or a broken wire.	F-R-1
ER14	AC FAIL		Refer to section ■ 18.4-(5).	
ER20	Axis 1 driver communication error	An error occurred in communication with the slave unit.	Check if the link cable is disconnected, has a bad contact, or a broken wire. Also, check that the power supply is operating normally. Check if the robot type setting is correct. * The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER30	Axis 2 driver communication error			
ER40	Axis 3 driver communication error			
ER50	Axis 4 driver communication error			
ER21	Axis 1 driver overspeed error	The motor speed is abnormally high.	Check if the maximum speed setting is within the specification range. Check if the robot type setting is correct.	F-R-1
ER31	Axis 2 driver overspeed error			
ER41	Axis 3 driver driveroverspeed error			
ER51	Axis 4 driver overspeed error			
ER22	Axis 1 driver overcurrent error	A driver error occurred due to a low voltage, excessive current, or driver overheating.	Check if the input voltage has fallen below -10% of the voltage setting, the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the controller cable has a short-circuit or ground fault.	F-R-1
ER32	Axis 2 driver overcurrent error			
ER42	Axis 3 driver overcurrent error			
ER52	Axis 4 driver overcurrent error			
ER23	Axis 1 driver overload error	The motor load is large, or a current exceeding the rated current has flowed continuously. The power line or the brake line is breaking (unconnected).	Check if the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the power line or the brake line is breaking (unconnected). Check if the robot type setting is correct.	F-R-1
ER33	Axis 2 driver overload error			
ER43	Axis 3 driver overload error			
ER53	Axis 4 driver overload error			
ER24	Axis 1 driver overflow	The motor could not perform tracking for the command. The power line or the brake line is breaking (unconnected).	Check if the overflow data value is set correctly, the acceleration/deceleration time is normal, the transportable weight has been exceeded, the robot has contacted the mechanical stopper, the robot has contacted a foreign object, or the power line or the brake line is breaking (unconnected). Check if the robot type setting is correct.	F-R-1
ER34	Axis 2 driver overflow			
ER44	Axis 3 driver overflow			
ER54	Axis 4 driver overflow			
ER26	Axis 1 driver encoder error	The encoder signal line has a disconnected connector, broken wire, bad contact, or faulty encoder.	Check if the encoder signal line connector is connected securely and if there is a bad contact or broken wire in the cable. *The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER36	Axis 2 driver encoder error			
ER46	Axis 3 driver encoder error			
ER56	Axis 4 driver encoder error			

Code	Error name	Meaning/Cause	Remedy	State
ER28	Axis 1 + soft limit exceeded (during execution)	The coordinate value exceeded the software limit plus value during execution of the program.  The moving distance after PASS movement is shorter than the moving distance before PASS movement.	Check the soft limit positive value and the program.  Change to the POST movement or decrease the movement speed of the movement command after PASS movement.	F-R-1
ER38	Axis 2 + soft limit exceeded (during execution)			
ER48	Axis 3 + soft limit exceeded (during execution)			
ER58	Axis 4 + soft limit exceeded (during execution)			
ER29	Axis 1 - soft limit exceeded (during execution)	The coordinate value exceeded the software limit minus value during execution of the program.  The moving distance after PASS movement is shorter than the moving distance before PASS movement.	Check the soft limit negative value and the program.  Change to the POST movement or decrease the movement speed of the movement command after PASS movement.	F-R-1
ER39	Axis 2 - soft limit exceeded (during execution)			
ER49	Axis 3 - soft limit exceeded (during execution)			
ER59	Axis 4 - soft limit exceeded (during execution)			
ER2A	Axis 1 driver overvoltage error	The main power has risen to an abnormally high level (rise in power supply voltage or regenerative voltage).	Check if the input voltage is within +10% of the voltage setting, or the transportable weight has been exceeded.	F-R-1
ER3A	Axis 2 driver overvoltage error			
ER4A	Axis 3 driver overvoltage error			
ER5A	Axis 4 driver overvoltage error			
ER2C	Axis 1 encoder backup error	The absolute counter value of the encoder could not be backed up normally. Limit of the backup battery life. The encoder connector is temporarily disconnected during backup.	Check if the voltage of the backup battery power supply is less than 2.5 V.  Replace the backup battery. After this error occurs, the return to origin operation must be performed before executing any axis operations. This error occurs every time you turn ON the power unless return to origin is completed.	F-R-1
ER3C	Axis 2 encoder backup error			
ER4C	Axis 3 encoder backup error			
ER5C	Axis 4 encoder backup error			
ER2F	Axis 1 driver error	The brake-related interlock function is activated.	Inform our sales representative of your use conditions in detail. * The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER3F	Axis 2 driver error			
ER4F	Axis 3 driver error			
ER5F	Axis 4 driver error			
ER60	Continuous execution failure	This equipment is in a state where continuous execution cannot be performed. (The power was turned off during program execution (during operation).)	Set the continuous start input to OFF, and then turn the power off and then on again. After the power is turned OFF, continuous restart is enabled only when the power was turned OFF during program execution is stopped. * The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER61	Return to origin incomplete	An MOV command was executed while return to origin operation had not been performed after an encoder-related error occurred.	Perform return to origin operation.	F-R-1
ER62	Unexecutable	A movement command or return to origin was executed with the servo free. Start or return to origin was performed from the teach pendant with the stop input turned ON. A task to which the task step was not assigned was activated. A task other than the task 1 was executed in the palletizing mode. Other than sequential command is executed, pushing by torque limit move.	Turn the servo ON if the servo is OFF after clearing the error. Check that the stop input of system input is not turned ON.  Check if the step is assigned to the task to be executed. Check if a task other than the task 1 is executed in the palletizing mode. By progressing steps etc., change to the state not pushing by torque limit move.	F-R-1

Code	Error name	Meaning/Cause	Remedy	State
ER64	Synchronous axis origin search incomplete	This error occurs if the following action is performed when the synchronous axis origin search has not been performed or the origin search has been interrupted due to occurrence of an error. <ul style="list-style-type: none"> <li>• Execution of an axis movement command</li> <li>• External point designation mode operation, or</li> <li>• Return to origin</li> </ul>	Be sure to perform origin search after the following operation. <ul style="list-style-type: none"> <li>• Change of "K26: synchronous axis setting parameter"</li> <li>• Change of the parameter "K14: lead" of the axis that is set as the synchronous axis</li> <li>• Change of "K05: motor rotational direction" of the axis that is set as the synchronous axis, or</li> <li>• Change of the robot type</li> </ul>	L-R-1
ER65	Synchronization error is excessive	During synchronous operation, the positional error between the drive axis and the driven axis exceeds "P18: allowable synchronization error value" of the parameter 1. (This error does not occur until return to origin is completed.) The origin sensor of one axis is OFF when return to origin is completed.	Perform positional correction of the drive axis and the driven axis manually, and then clear the error.	F-R-1
ER66	Synchronous axis parameter error	The synchronized axes are set to an axis that does not exist. The tasks of the synchronized axes are different each other.	Set the synchronized axes only to an axis that actually exists. Set so that the tasks of the synchronized axes are same.	L-R-1
ER67	Synchronous axis origin search error	The origin sensor of one axis is OFF when synchronous axis origin search is completed. The synchronous axis offset amount measured by the synchronous axis origin search is larger than a quarter-rotation of the motor.	Perform positional correction of the drive axis and the driven axis manually, and then perform origin search again. Reconsider the axis installation conditions (installation error amount).	L-R-1
EP80	Teaching pendant communication error	Communication cannot be established using the teach pendant or RS-232C cable.	Check that the firmware update switch (refer to section ■ 2.4.1-(2) ⑤) is not turned ON. Check if the connector is connected securely, there is a bad contact, or the cable has a broken wire. * The error cannot be cleared by CLEAR or a reset. The power must be turned OFF and ON again.	F-R-1
ER90	ID error	The contents of the backup memory were corrupted by noise, fluctuations in the supply voltage, or other cause.	All the programs and parameters are initialized, and so re-enter the programs and parameters.	F-R-1
ERA0	Command error	The program tried to execute an impossible command.	Check the program.	F-R-1
ERA1	TAG undefined	An undefined tag number was found in a jump, call, BRAC, PSEL, or tag number search.	Check the program.	F-R-1
ERA2	TAG duplicate definition	A tag number was double-defined.	Correct the tag number.	F-R-1
ERA3	Stack overflow	Nesting was performed more than 10 times in the CAL system command.	Check the program.	F-R-1
ERA4	Stack underflow	An extra RET command was executed in the relationship between the CAL commands and RET commands.	Check the program.	F-R-1
ERA5	Circular interpolation data insufficient	The number of circular interpolation commands (MVC or MVCP) is odd number.	Check the program.	F-R-1

Code	Error name	Meaning/Cause	Remedy	State
ERA6	Circular interpolation radius too large	The radius set by circular interpolation commands (MVC or MVCP) exceeded 8388.607 mm (maximum value).	Check the program.	F-R-1
ERA7	Calculation error	Calculation with a movement command is impossible.	Check the program.	F-R-1
ERA8	Parameter error	Commands and other parameters are invalid.	Check the program.	F-R-1
ERB0	Step number error	A program was executed that exceeded the number of task steps (refer to section ■ 13.4.22) setting. In the external point designation mode with the expansion I/F unit not equipped, the program select input bit for mode designation is not designated.	Check the program. When the expansion I/F unit is not equipped in the external point designation mode, designate the program select input bit.	F-R-1
ERB1	Tag number error	The tag number is outside the range.	Check the program.	F-R-1
ERB2	Palletizing program No. error	The palletizing program No. is outside the range.	Check the palletizing program.	F-R-1
ERB5	Port No. error	The port No. is outside the range.	Check the program.	F-R-1
ERB6	Table No. error	The table No. is outside the range.	Check the program. Check if the coordinate table No. outside the range from 1 to 999 is designated in the external point designation mode.	F-R-1
ERB7	Group No. error	The group No. is outside the range.	Check the program.	F-R-1
ERB8	Robot number error	The robot type setting is incorrect or remains initial value or the version of the controller is not compatible with the robot.	Set the correct robot type. * If occurs when the T/P is turned ON, this error cannot be cleared by CLEAR or resetting. Turn OFF the power and turn ON again.	L-G-0 or F-R-1
ERBA	Task No. error	The task No. is outside the range.	Check the program.	F-R-1
ERC0	Axis 1 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 1 soft limit positive value and the program.	F-R-1
ERC1	Axis 1 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 1 soft limit negative value and the program.	F-R-1
ERC2	Axis 2 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 2 soft limit positive value and the program.	F-R-1
ERC3	Axis 2 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 2 soft limit negative value and the program.	F-R-1
ERC4	Axis 3 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 3 soft limit positive value and the program.	F-R-1
ERC5	Axis 3 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 3 soft limit negative value and the program.	F-R-1
ERC6	Axis 4 + soft limit exceeded	The designated coordinate value has exceeded the soft limit positive value.	Check the axis 4 soft limit positive value and the program.	F-R-1
ERC7	Axis 4 - soft limit exceeded	The designated coordinate value has exceeded the soft limit negative value.	Check the axis 4 soft limit negative value and the program.	F-R-1



The state column refers to the state of the controller when an error occurs (servo, LED state, error output).

- Servo                    L: Lock, F: Free
- LED state                R: Lit red, G: Lit green
- Error output            0: OFF, 1: ON

## ■ 18.4 Flashing of status display LED

This section describes conditions where the LED is flashing.

### (1) Waiting for establishment of slave communication

Screen display: No error display  
(Normal screen)

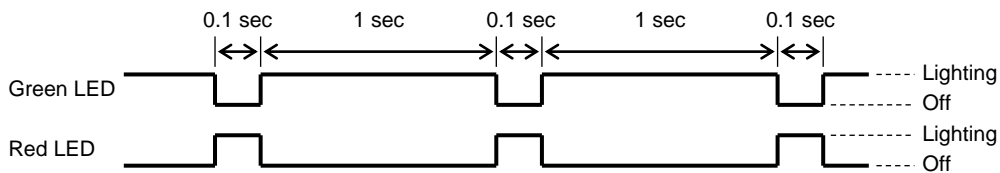
Servo condition: Servo free  
 Status display LED: Flashing (\*1)  
 System output: \_\_\_\_\_

Meaning/cause: In the case of a two or more axes specification, power is not supplied to the slave unit.  
 The link cable is not connected.  
 The station No. of the slave unit is out of the designated range, or overlapping.  
 The setting of terminal resistor is wrong.

Remedy: An incorrect robot type is set.  
 Supply power to the slave unit.  
 Connect the link cable correctly. (Refer to section ■ 2.5.4-(1))  
 Set the slave unit station No. setting switch correctly. (Refer to section ■ 2.5.4-(2))  
 Set the terminal resistor correctly. (Refer to section ■ 2.5.4-(4))  
 Set the correct robot type. (Refer to section ■ 4.2)

Note: The slave unit to witch communication is not established can be confirmed on the version display (refer to section ■ 16.4).

\*1: When waiting for establishment of slave communication, the status display LED is flashing repeatedly at intervals shown below.



### (2) Request for power OFF

Screen display: PLEASE POWER  
OFF !!

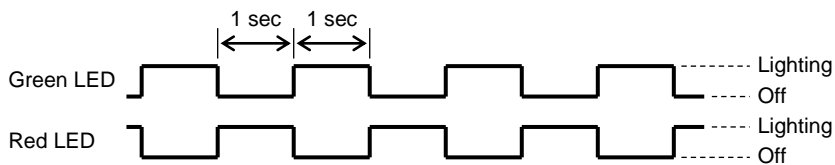
Servo condition: Servo free  
 Status display LED: Flashing (\*2)  
 System output: \_\_\_\_\_

Meaning/cause: The robot type, the number of axes, the parameter 2 or the mode setting is changed.  
 The slave unit is replaced, or a new slave unit is connected.

Remedy: Turn OFF the power, and then turn ON the power.

Note: When the number of axes is changed or the slave unit is replaced or added, request for power OFF may occur twice.

\*2: When request for power OFF, the status display LED is flashing repeatedly at intervals shown below.





(3) Backup voltage drop

Screen display: 

No error display (Normal screen)
-------------------------------------

 Servo condition: 

Servo lock
------------

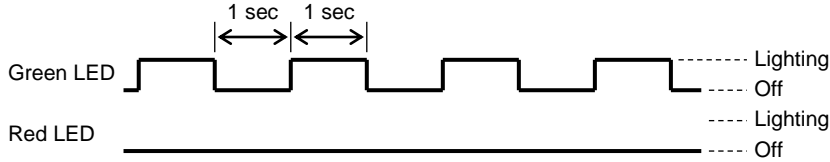
  
Status display LED: Flashing in green (\*3)  
System output: \_\_\_\_\_

Meaning/cause: Backup power voltage for the encoder drops to 3.1 V or lower.

Remedy: Replace the backup battery with a new one.

Note: After the battery is replaced, flashing in green on the controller CA25-M10/S10 will be cancelled, but flashing in green on the controller CA01-S05 will not be cancelled. Turn OFF the power and then turn ON the power.

\*3: When backup voltage drops, the status display LED is flashing repeatedly at intervals shown below.



(4) Firmware update mode

Screen display: 

T/P COMMUNICATION ERROR
----------------------------

 Servo condition: 

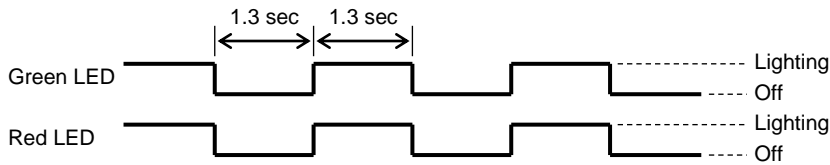
Servo free
------------

  
Status display LED: Flashing (\*4)  
System output: \_\_\_\_\_

Meaning/cause: The unit is in the firmware update mode.

Remedy: Return the firmware rewriting switch (refer to section ■ 2.4.1-(2)-(15)) to the original position, and then turn ON the power.

\*4: When firmware update mode, the status display LED is flashing repeatedly at intervals shown below.



(5) AC FAIL

Screen display: 

[ERR] ER14 AC FAIL ERROR
-----------------------------

 Servo condition: 

Servo free
------------

  
Status display LED: Flashing (\*5)  
System output: \_\_\_\_\_

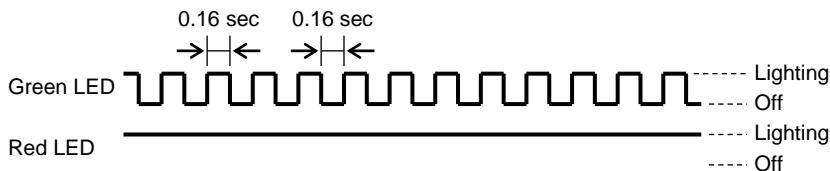
Meaning/cause: Power supply interrupts for 50 msec or more.

The power is turned ON before the power is turned OFF and then 10 seconds pass.

Remedy: Turn OFF the power and then turn ON the power. Check for contact failure of the power supply wiring and for insufficient power capacity.

If the power is turned OFF and then ON, Turn ON the power after the power is turned OFF and then 10 seconds pass. However, the controller whose version is 4.35 or more can be turned ON after expiration of 0.5 seconds from turning OFF the if the EtherNet/IP unit is not equipped.

\*5: When AC FAIL, the status display LED is flashing repeatedly at intervals shown below.



# Chapter 19 EtherNet/IP

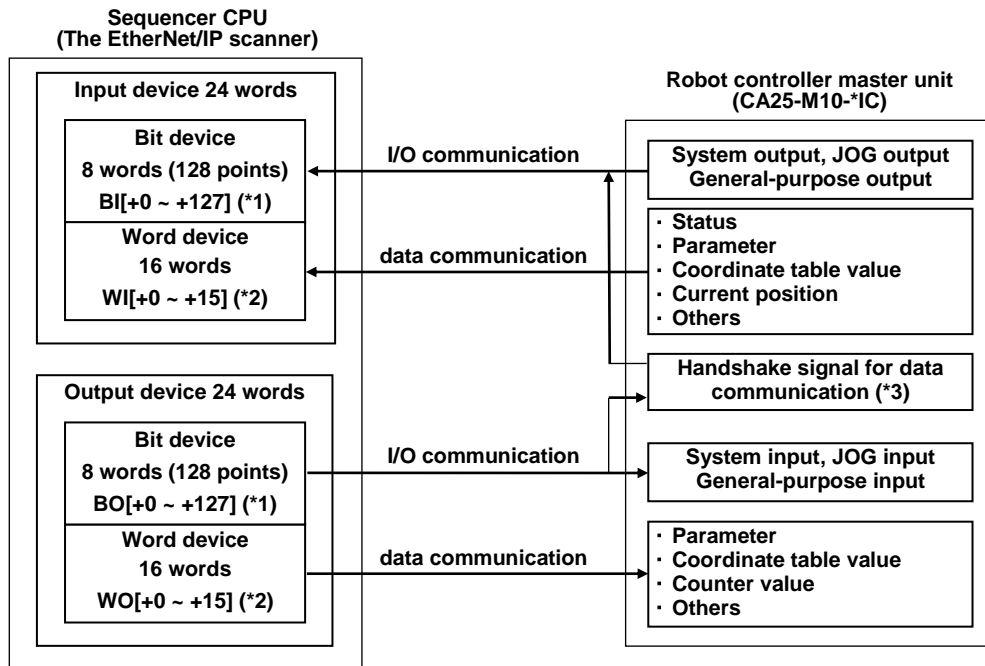
## 19.1 EtherNet/IP Function

A controller equipped with EtherNet/IP unit can use EtherNet/IP. This chapter describes the EtherNet/IP interface. EtherNet/IP is an open network using the ethernet and is managed like DeviceNet by ODVA (Open DeviceNet Vendor Association, Inc.). The EtherNet/IP interface allows data communication for various input/output, coordinate table, status, JOG operation, etc.

This function is supported only by CA25-M10 version 4.41 or later, TPH-4C version 2.40 or later, and SF-98D version 3.3.1 or later.

### 19.1.1 Overview

This controller can be handled as an EtherNet/IP adapter (slave) for enabling I/O communication and each kind of data communication. For details of the EtherNet/IP system specifications and various limitations, refer to the document published by ODVA (Open DeviceNet Vendor Association, Inc.) or the document supplied with the EtherNet/IP scanner (master).



\*1: The bit device's [+\*] is the offset amount from the start bit device. (unit: bits)

\*2: The word device's [+\*] is the offset amount from the start word device. (unit: words)

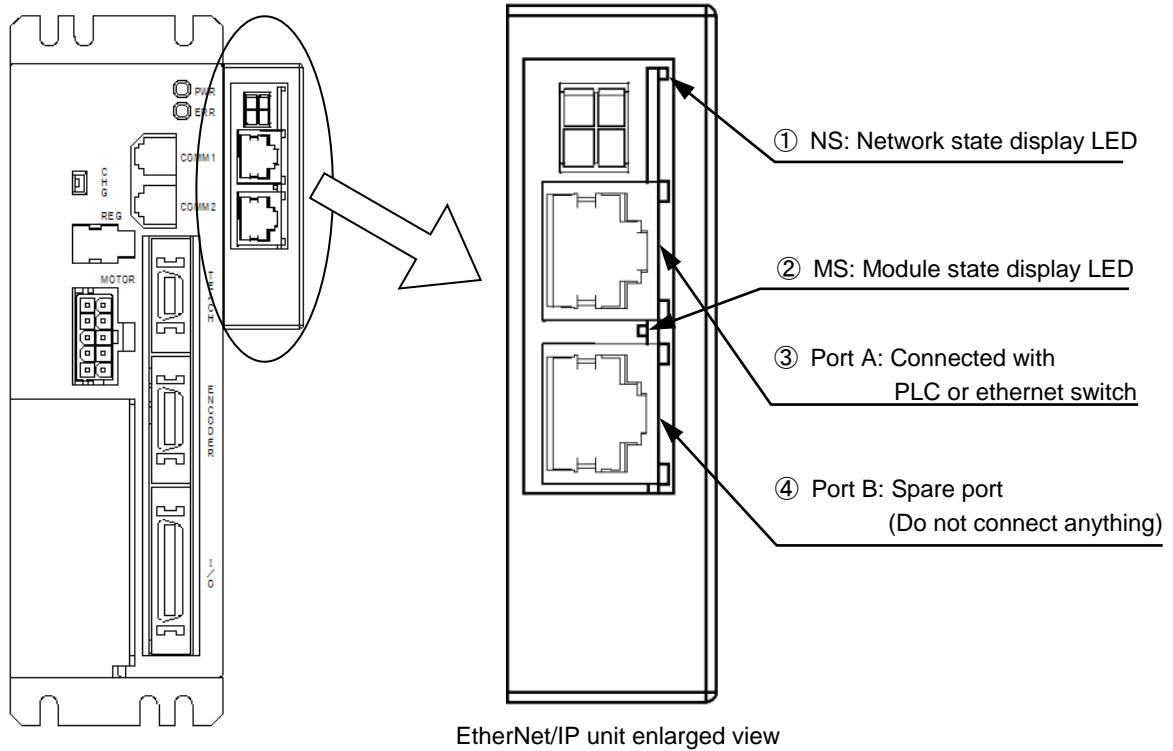
\*3: The data communication handshake signal on the robot controller side is created by the robot controller automatically.

### 19.1.2 EtherNet/IP specifications

Item	Specification
Transmission type	10BASE-T/100BASE-TX
Transmission speed	10M/100M bps
Communication distance	The distance between nodes: Less than 100m
Transmission cable	Straight cable with the shield, category 5, RJ45 connector
Number of input/output points	System input: 4 points, System output: 4 points
	General-purpose input: 64 points, General-purpose output: 64 points
	JOG input: 8 points, JOG output: 8 points
	Handshake input: 1 point, Handshake output: 2 points
	Data selection input: 4 points, Data selection check output: 4 points
Data communication functions	Coordinate table sending and receiving, current position monitor, error code request, status request, etc.
Vender code	1288

\*: The input and output are based on the direction viewed from the robot controller.

### ■ 19.1.3 Explanation of EtherNet/IP component



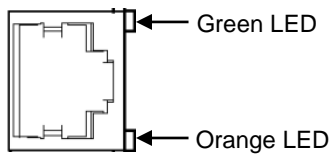
#### ① NS: Network state display LED

State	Description
Green on	The connection is established.
Green blinking	The connection is not established.
Red on	The IP address is overlapped. A fatal error is occurring.
Red blinking	The connection is timeout.
Off	The power is off. The IP address is not set.

#### ② MS: Module state display LED

State	Description
Green on	This module is running properly.
Green blinking	The parameters are not set. The scanner is idle.
Red on	A fatal error is occurring.
Red blinking	An error is occurring.
Green/ Red blinking	This module is Self-checking.
Off	The power is off.

#### ③ Port A, ④ Port B



#### LED

State	Description
Green on	Connecting with network
Orange on	Data is sent/received

#### Pin assignment

Pin No.	Signal name
1	TXD+
2	TXD-
3	RXD+
4	-
5	-
6	RXD-
7	-
8	-

## ■ 19.1.4 EtherNet/IP settings

(1) CA25-M10-\*IC settings

The IP address, the subnetmask and the default gateway for EtherNet/IP are specified by the mode setting. (Refer to section ■ 13.2.38, section ■ 13.2.39 and section ■ 13.2.40)

(2) EtherNet/IP scanner settings

Make the EtherNet/IP scanner settings by following the operating manual.  
Use the EDS file of this controller, which is put in the operation manual CD.

## ■ 19.2 Connection with External Devices

### ■ 19.2.1 List of master unit (CA25-M10-\*IC) I/O signals

EtherNet/IP scanner ← CA25-M10-*IC		EtherNet/IP scanner → CA25-M10-*IC (*1)	
Input bit device	Signal name	Output bit device	Signal name (*5)
BI[+0]	Running output	BO[+0]	Return to origin input
BI[+1]	Error output	BO[+1]	Start input
BI[+2]	Positioning complete output	BO[+2]	Stop input
BI[+3]	Return to origin complete output	BO[+3]	Reset input
BI[+4 ~ +7]	Use prohibited	BO[+4 ~ +7]	Use prohibited
BI[+8 ~ +15]	General output port 1-1 ~ 8	BO[+8 ~ +15]	General input port 1-1 ~ 8
BI[+16 ~ +23]	General output port 2-1 ~ 8	BO[+16 ~ +23]	General input port 2-1 ~ 8
BI[+24 ~ +31]	General output port 3-1 ~ 8	BO[+24 ~ +31]	General input port 3-1 ~ 8
BI[+32 ~ +39]	General output port 4-1 ~ 8	BO[+32 ~ +39]	General input port 4-1 ~ 8
BI[+40 ~ +47]	General output port 5-1 ~ 8	BO[+40 ~ +47]	General input port 5-1 ~ 8
BI[+48 ~ +55]	General output port 6-1 ~ 8	BO[+48 ~ +55]	General input port 6-1 ~ 8
BI[+56 ~ +63]	General output port 7-1 ~ 8	BO[+56 ~ +63]	General input port 7-1 ~ 8
BI[+64 ~ +71]	General output port 8-1 ~ 8	BO[+64 ~ +71]	General input port 8-1 ~ 8
BI[+72 ~ +79]	JOG output (*2)	BO[+72 ~ +79]	JOG input (*2)
BI[+80 ~ +103]	Reserved (*3)	BO[+80 ~ +103]	Reserved (*3)
BI[+104]	Command processing finish (*4)	BO[+104]	Request for command processing (*4)
BI[+105]	Command error (*4)	BO[+105]	Use prohibited
BI[+106 ~ +107]	Use prohibited	BO[+106 ~ +107]	Use prohibited
BI[+108 ~ +111]	Data selection check output	BO[+108 ~ +111]	Data selection input
BI[+112 ~ +127]	Use prohibited	BO[+112 ~ +127]	Use prohibited



\*1: When the EtherNet/IP communication is interrupted, the stop input is set to 1 and the others are cleared to zero. For the T/P operation, however, the stop input is also cleared to zero.

\*2: Refer to sections ■ 19.2.2 and ■ 19.2.4.

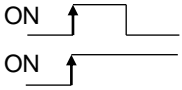
\*3: Area reserved for future extension of function.

\*4: Handshake signal for data communication.

\*5: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

## ■ 19.2.2 System I/O

### (1) System input (EtherNet/IP scanner → CA25-M10-\*IC)

Signal name	Output device	Normal mode	External point designation mode	Remarks
Return to origin	BO[+0]	ON: Start of return to origin operation.	Return to origin	Detection of leading edge 
Start	BO[+1]	ON: Restart from currently stopped step or from pausing.	ON: Starts moving based on currently specified table information.	
Stop	BO[+2]	ON: Stops after current step has been executed.	Invalid	When this input is ON, return to origin and start input are invalid.
Reset	BO[+3]	ON: Cancels an error status. (Valid while program execution is stopped.)	ON: Cancels an error status.	
JOG input	BO[+72 ~ +79]	A selected axis is moved by JOGGING after the motion mode (JOG, low-speed or high-speed) and travel direction are specified.		Refer to section ■ 19.2.4.



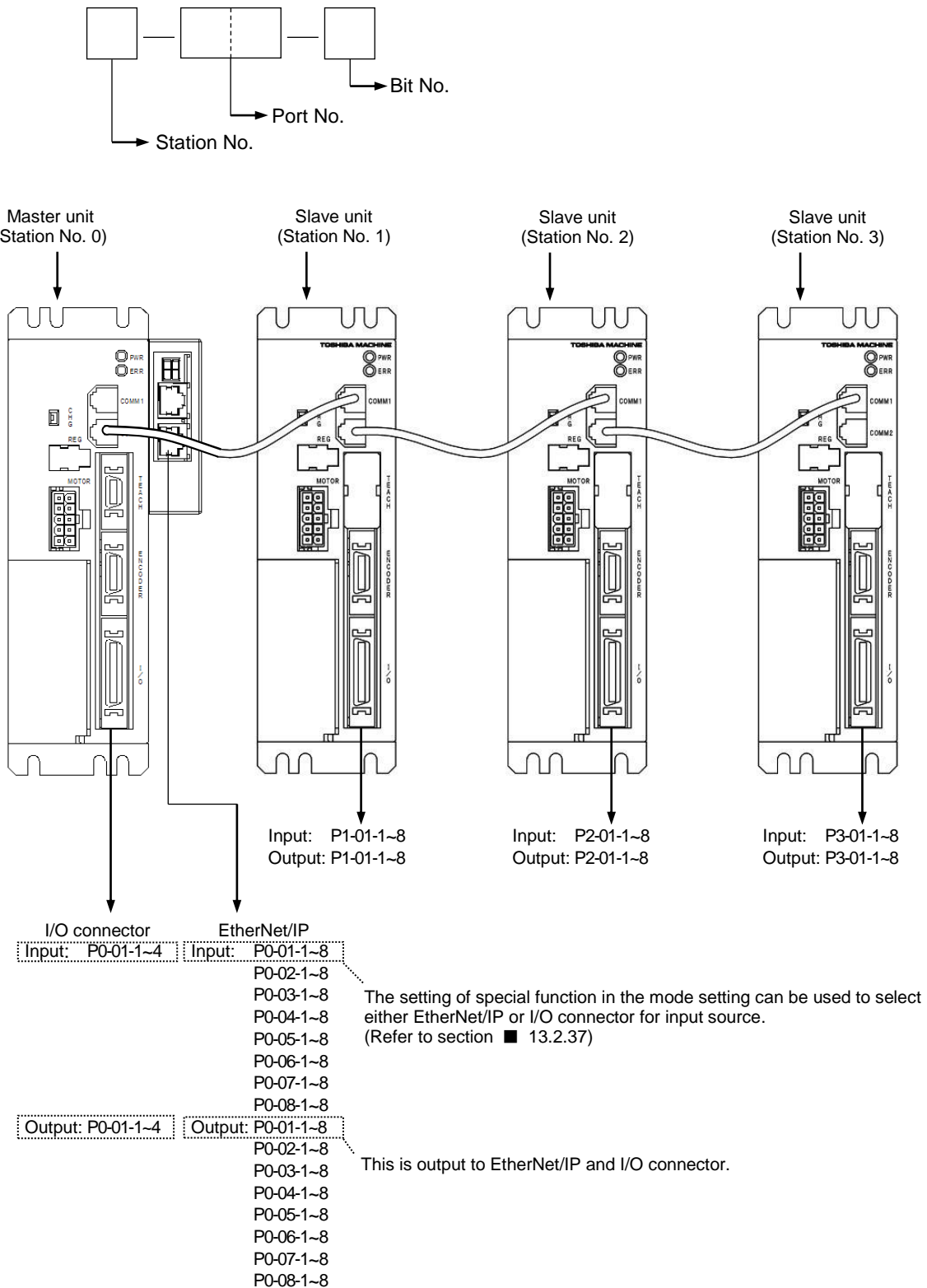
The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

### (2) System output (CA25-M10-\*IC → EtherNet/IP scanner)

Signal name	Input device	Normal mode	External point designation mode	Reference
Running	BI[+0]	ON during controller operation and during return to origin.	ON during robot operation.	Section ■ 10.2.13
Error	BI[+1]	ON at error generation.	Same as left	Section ■ 10.2.14
Positioning complete	BI[+2]	ON when the robot has been located at a predetermined position. OFF while the robot is moving. (Remains OFF when it is paused.)	Same as left	Section ■ 10.2.15
Return to origin complete	BI[+3]	ON when return to origin is completed.	Same as left	Section ■ 10.2.16
JOG output	BI[+72 ~ +79]	Acceptance or rejection of JOG, active status, etc. are displayed.		Section ■ 19.2.4

### ■ 19.2.3 Name of general-purpose I/O port and teach pendant display

In the controller's system configuration, there are master unit, slave unit and EtherNet/IP unit input/output ports. These input/output ports are displayed on the Teach Pendant as shown below.



● For the correspondence between the port numbers and input/output device, refer to section ■ 19.2.1.

## ■ 19.2.4 JOG input/output

### (1) List of JOG input/output signals

EtherNet/IP scanner ← CA25-M10-*IC		EtherNet/IP scanner → CA25-M10-*IC	
Input bit device	Signal name	Output bit device	Signal name (*1)
BI[+72]	"Axis 1 JOGGING" output (Station No. 0)	BO[+72]	"Request axis 1 JOG" input (Station No. 0)
BI[+73]	"Axis 2 JOGGING" output (Station No. 1)	BO[+73]	"Request axis 2 JOG" input (Station No. 1)
BI[+74]	"Axis 3 JOGGING" output (Station No. 2)	BO[+74]	"Request axis 3 JOG" input (Station No. 2)
BI[+75]	"Axis 4 JOGGING" output (Station No. 3)	BO[+75]	"Request axis 4 JOG" input (Station No. 3)
BI[+76]	JOG-ready output	BO[+76]	"Request inching" input
BI[+77]	Unused	BO[+77]	"Request low-speed JOG" input
BI[+78]	Unused	BO[+78]	"Request high-speed JOG" input
BI[+79]	Unused	BO[+79]	"Designate JOG direction" input OFF: + direction, ON: - direction



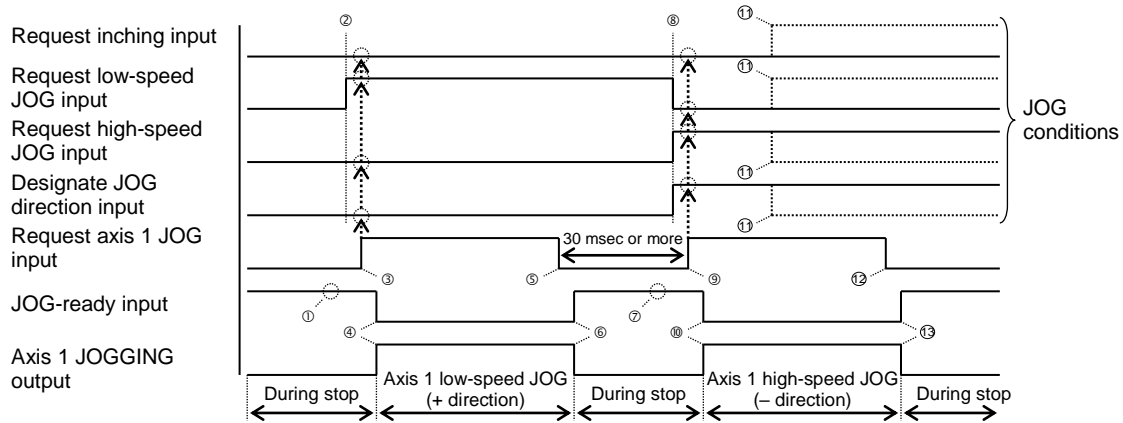
\*1: The controller recognizes the changes of the signals 10 msec later because the input signals are filtered. And the controller cannot recognize the pulse signals less than 10 msec, therefore when input signals are changed (OFF to ON or ON to OFF), keep more than 30 msec to leave some leeway until the next change.

- When the JOG conditions (inching request, low-speed JOG request, high-speed JOG request) and JOG direction are specified, and the JOG request is ON, the corresponding axis performs the JOG operation. Refer to "(2) Example of axis 1 moving".
- JOGGING by I/O signal is not accepted as long as the JOG ready output signal is OFF. The JOG ready output signal is OFF under the following conditions.
  - While the T/P is turned ON or during execution operation or parameter transmission of SF-98D.
  - While the "running" output (BI[+0]) is ON.
  - While the error output (BI[+1]) is ON.
- When the multiple bits for the "request inching" input, "request low-speed JOG" input and "request high-speed JOG" input are ON, the motions are executed according to the following order.  
Inching > Low-speed JOG > High-speed JOG
- It is not possible to simultaneously move two (2) or more axes at JOGGING. Move each axis separately.
- The axis designated by the JOG move request signal corresponds to the station No.
- The axis stops if the communication through the EtherNet/IP has been severed during JOGGING.

### NOTE

- The JOG operation can be performed within the software limits when the controller understands the current position of the axis (when return to origin is unnecessary). When the BA-C axis is moved by JOG operation, however, the axis may stop at the position 0.01 mm in front of the software limits. (Refer to NOTE in ■ 3.2)
- The JOG operation can be performed even if the controller has lost the current position (return to origin is required). In this case, the software limit is not applied.
- The JOG operation speed can be set in the JOG speed setting in the parameter 1 (refer to sections ■ 13.3.8 to ■ 13.3.11).
- The distance of an inching movement can be set in the JOG increment of the parameter 1 (refer to section ■ 13.3.12). The inching JOG operation speed is the value set as the low speed in the JOG speed in the parameter 1.
- Each input signal is ORed with each signal of JOG input by I/O. Each signal of JOG output by I/O is also outputted. (Refer to section ■ 10.2.26)

(2) Example of axis 1 moving



- ① Make sure that the JOG-READY signal is ON.
- ② Set the JOG conditions. (In the above figure, low-speed JOG and plus "+" direction are specified.)
- ③ Turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ④ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at low speed in the plus "+" direction.
- ⑤ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑥ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at low speed in the plus "+" direction stops.
- ⑦ Make sure that the JOG-READY signal is ON.
- ⑧ Set the JOG conditions. (In the above figure, high-speed JOG and "-" direction are specified.)
- ⑨ 30 msec or more has passed after ⑤, then turn ON the "request axis 1 JOG" input. (With this timing, the JOG conditions are input.)
- ⑩ The JOG-READY output turns OFF and the "axis 1 JOGGING" output turns ON. Then the axis 1 starts JOGGING at high speed in the minus "-" direction.
- ⑪ Even if the JOG conditions have been changed during travel, they are neglected.
- ⑫ To stop the axis, turn OFF the "request axis 1 JOG" input signal.
- ⑬ The JOG-READY output turns ON and the "axis 1 JOGGING" output turns OFF. Then the axis 1 JOGGING at high speed in the minus "-" direction stops.



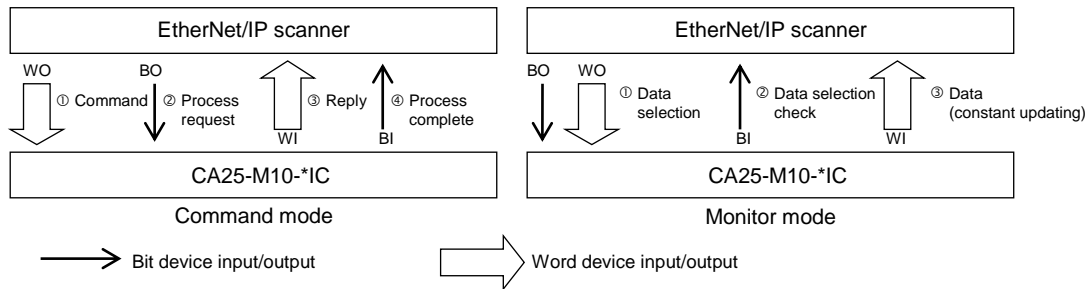
## ■ 19.3 Data Communication

### ■ 19.3.1 Overview of data communication

Two types of data communication are available: Command mode and Monitor mode.

In Command mode, the CA25-M10-\*IC returns reply to commands from the EtherNet/IP scanner. Although this enables complex data communication, its characteristic of returning replies to commands requires a certain amount of time for the data updating cycle.

In Monitor mode, the data selected by data selection input (BO[+108 ~ +111]) and WO[+0] is constantly updated. This eliminates the need for complex handshake signals for realizing high-speed updating cycles.



In Command mode, set all the data selection input (BO[+108 ~ +111]) to 0. In Monitor mode, set from 0001 ~ 1111 based on the monitoring content.

No	BO[+111]	BO[+110]	BO[+109]	BO[+108]	Mode	Description
1	0	0	0	0	Command mode (section ■ 19.3.2)	Status request Writing/reading of coordinate table Current position request (monitor) Current offset value request (monitor) Counter value request (monitor) Counter set Writing/reading of speed table Writing/reading of acceleration/deceleration table Writing/reading of override Torque monitor Writing/reading of torque limit table
2	0	0	0	1	Monitor mode (section ■ 19.3.3)	Status monitor
3	0	0	1	0		Current position monitor
4	0	0	1	1		Counter monitor ① Arbitrary selection mode (WO[+0] = 0000h) ② Designated sequence number mode (WO[+0] = 0001h)
5	0	1	0	0		Torque monitor
:	:	:	:	:		Reserved
16	1	1	1	1		Reserved

The value of the data selection input (BO[+108 ~ +111]) is output unchangedly to the data selection check output (BI[+108 ~ +111]). During this output, a time difference ( $t = \text{several } 10 \text{ mSEC}$ ) occurs, and so pay attention to the timing when changing.

Signal name	Device	Timing
Data selection input signal (*)	BO[+108 ~ +111]	
Data selection check output signal(*)	BI[+108 ~ +111]	

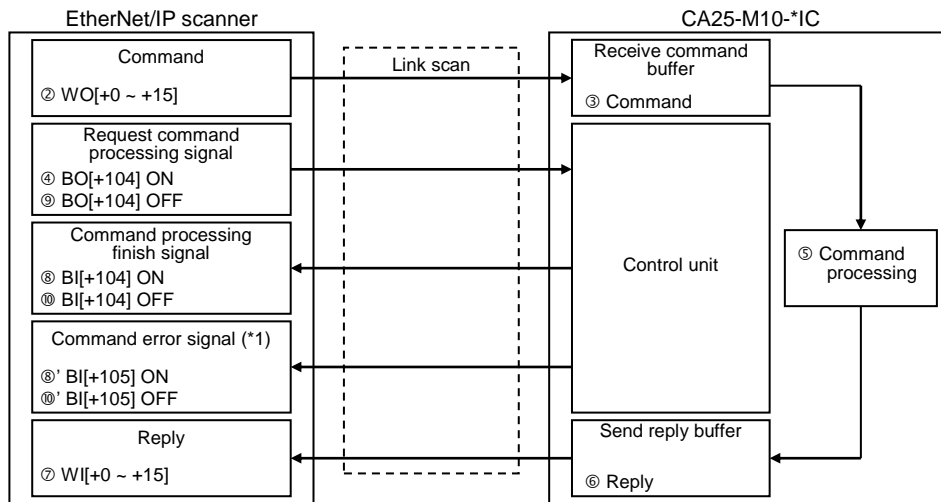
\*: The input and output are based on the direction viewed from the robot controller.

## ■ 19.3.2 Command mode

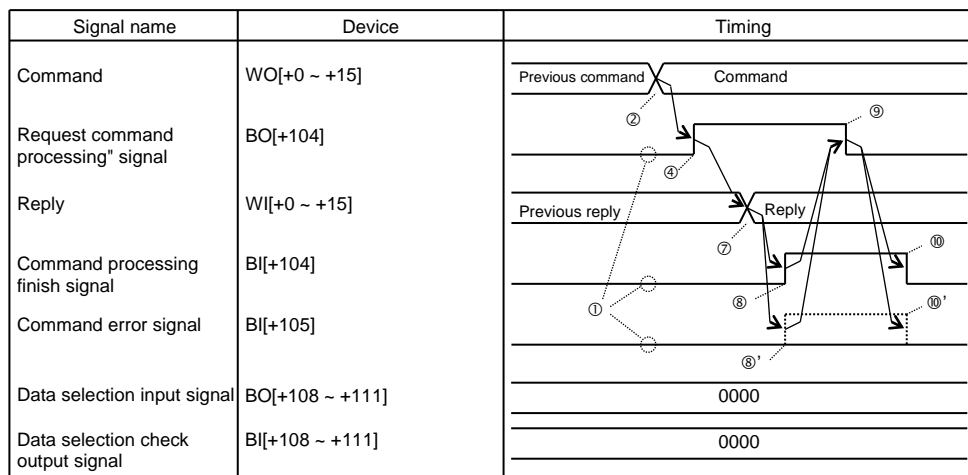
In the relationship between the CA25-M10-\*IC and EtherNet/IP scanner, the EtherNet/IP scanner is always the master, and the CA25-M10-\*IC is the slave. Communication uses a half-duplex system where the EtherNet/IP scanner issues commands and the CA25-M10-\*IC sends back a reply.

When the CA25-M10-\*IC receives a command that can be processed, an affirmative response or the necessary data is returned. If the process is not possible because the CA25-M10-\*IC is busy or other reasons, an error reply is returned.

The method of data transmission and reception (data flow and timing) is shown in the following figure.



\*1: Only when an error has occurred.



Set the data selection input (BO[+108 ~ +111]) to 0000.

- ① Before sending a command, make sure that all handshake signals (request command processing signal, command processing finish signal and command error signal) are set OFF.
- ② Set the command in the word device.
- ③ The command set in the word device is transferred to the CA25-M10-\*IC "receive command" buffer via the link scan of the EtherNet/IP.
- ④ The request command processing signal is turned ON.
- ⑤ The command is processed based on the data in the "receive command" buffer in Step ③ above.
- ⑥ The results are set in the "send reply" buffer.
- ⑦ The response set in the "send reply" buffer is transferred to the word device of the EtherNet/IP scanner via the link scan of the EtherNet/IP.
- ⑧ The command processing finish signal turns ON.
- ⑧' If an error has occurred, the command error signal turns ON at the same time.
- ⑨ The request command processing signal turns OFF.
- ⑩ The command processing finish signal turns OFF.
- ⑩' If the command error signal is ON, it turns OFF at the same time.

● Command table

No.	Description	Command/ reply	Word device (Command = WO[+*], Reply = WI[+*])					
			[+0]	[+1]	[+2]	[+3]	[+4 ~ +11]	[+12 ~ +15]
1	Request status	Command	B900H	Status No.	Reserved (0 fixed)			
		Reply			Status value	Error code	Reserved (0 fixed)	
2	Write coordinate table	Command	C2C1H	Table No.	Task No.	0 fixed	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
3	Read coordinate table	Command	C3C1H	Table No.	Task No.	Reserved (0 fixed)		
		Reply				Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
4	Request current position (monitor)	Command	E300H	Task No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
5	Request current offset value (monitor)	Command	E400H	Task No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Axis 1 ~ Axis 4 coordinates	Reserved (0 fixed)
6	Request counter value (monitor)	Command	E500H	Counter No.	Reserved (0 fixed)			
		Reply			Counter value	Error code	Reserved (0 fixed)	
7	Set counter	Command	E700H	Counter No.	Counter value	Reserved (0 fixed)		
		Reply			0 fixed	Error code	Reserved (0 fixed)	
8	Write speed table	Command	C2C2H	Table No.	0 fixed	0 fixed	Speed	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
9	Read speed table	Command	C3C2H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Speed	Reserved (0 fixed)
10	Write acceleration/deceleration table	Command	C2C3H	Table No.	0 fixed	0 fixed	Time to set speed	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
11	Read acceleration/deceleration table	Command	C3C3H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Time to set speed	Reserved (0 fixed)
12	Write override	Command	D900H	Override value	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Reserved (0 fixed)	
13	Read override	Command	DA00H	Reserved (0 fixed)				
		Reply		Override	0 fixed	Error code	Reserved (0 fixed)	
14	Torque monitor	Command	EE08 H	Reserved (0 fixed)				
		Reply		0 fixed	0 fixed	Error code	Axis 1 torque	Reserved (0 fixed)
15	Writing of torque limit table	Command	C2C5H	Table No.	0 fixed	0 fixed	Torque limit value Load output reference value	Reserved (0 fixed)
		Reply				Error code	Reserved (0 fixed)	
16	Reading of torque limit table	Command	C3C5H	Table No.	Reserved (0 fixed)			
		Reply			0 fixed	Error code	Torque limit value Load output reference value	Reserved (0 fixed)



- Error code 0000H Normal
- 1000H Command analysis error (An error is found in the command.)
- 20\*\*H Command cannot be executed. (See the explanation of each command.)

● Descriptions on each command

(1) "Request Status" command (B900H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	B9H	00H	Command	WI[+0]	B9H	00H	Same value as command
WO[+1]	0-2		Status number	WI[+1]	0-2		Status number
WO[+2]	00		Use prohibited	WI[+2]	00	**H	Status value (*1)
WO[+3]	Fixed at 0			WI[+3]	Error code		
WO[+4 ~ +15]	Fixed at 0			WI[+4 ~ +15]	Fixed at 0		Unused



\*1: The status value is saved in the lower byte. The upper byte is always fixed at "00".

- Error code 0000H Normal
- 1000H Command analysis error (An error is found in the command)

Details of each status

Status 0		Status 1		Status 2	
BIT	Description	BIT	Description	BIT	Description
0	1: Error is found.	0	Error code (See Chapter 18)	0	00: Sequential mode
1	1: During execution	1		01: Palletizing mode	
2	1: During pause	2		10: External point designation mode	
3	1: During return to origin	3		00: Auto mode	
4	1: Return to origin complete	4		01: Step mode	
5	1: Positioning complete	5		10: Program mode	
6		6		1: Single operation mode	
7	1: Change in Parameter 2.	7		5	6
			6	7	1: Host computer ON

(2) "Write coordinate table" command (C2C1H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C2H	C1H	Command	WI[+0]	C2H	C1H	Same value as command
WO[+1]	1-999		Table number	WI[+1]	1-999		Table number
WO[+2]	1-4		Task number	WI[+2]	1-4		Task number
WO[+3]	Fixed at 0		Use prohibited	WI[+3]	Error code		
WO[+4]	-800000~+800000		Axis 1 coordinate	WI[+4 ~ +15]	Fixed at 0	Unused	
WO[+5]							
WO[+6]	-800000~+800000		Axis 2 coordinate				
WO[+7]							
WO[+8]	-800000~+800000		Axis 3 coordinate				
WO[+9]							
WO[+10]	-800000~+800000		Axis 4 coordinate				
WO[+11]							
WO[+12 ~ +15]	Fixed at 0		Use prohibited				



- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → +10000)
- When writing "\*\*\*\*\*", specify H7FFFFFFF.
- Error code 0000H Normal
- 1000H Command analysis error (An error is found in the command.)

(3) "Read coordinate table" command (C3C1H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C3H	C1H	Command	WI[+0]	C3H	C1H	Same value as command
WO[+1]	1-999		Table number	WI[+1]	1-999		Table number
WO[+2]	1-4		Task number	WI[+2]	1-4		Task number
WO [+3 ~ +15]	Fixed at 0		Use prohibited	WI[+3]	Error code		
				WI[+4]	-800000~+800000		Axis 1 coordinate
				WI[+5]			
				WI[+6]	-800000~+800000		Axis 2 coordinate
				WI[+7]			
				WI[+8]	-800000~+800000		Axis 3 coordinate
				WI[+9]			
				WI[+10]	-800000~+800000		Axis 4 coordinate
				WI[+11]			
				WI [+12 ~ +15]	Fixed at 0		Unused



- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → +10000)
- When writing "\*\*\*\*\*", reply H7FFFFFFF.
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(4) "Request current position" (monitor) command (E300H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	E3H	00H	Command	WI[+0]	E3H	00H	Same value as command
WO[+1]	1-4		Task number	WI[+1]	1-4		Task number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	-800000~+800000		Axis 1 coordinate
				WI[+5]			
				WI[+6]	-800000~+800000		Axis 2 coordinate
				WI[+7]			
				WI[+8]	-800000~+800000		Axis 3 coordinate
				WI[+9]			
				WI[+10]	-800000~+800000		Axis 4 coordinate
				WI[+11]			
WI [+12 ~ +15]	Fixed at 0		Unused				



- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → +10000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(5) "Request current offset value" (monitor) command (E400H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	E4H	00H	Command	WI[+0]	E4H	00H	Same value as command
WO[+1]	1-4		Task number	WI[+1]	1-4		Task number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	-800000~+800000		Axis 1 coordinate
				WI[+5]			Axis 2 coordinate
				WI[+6]	-800000~+800000		Axis 3 coordinate
				WI[+7]			Axis 4 coordinate
				WI[+8]	-800000~+800000		Axis 4 coordinate
				WI[+9]			
				WI[+10]	-800000~+800000		Axis 4 coordinate
				WI[+11]			
WI [+12 ~ +15]	Fixed at 0		Unused				



- Data length of coordinate value: 32 bits
- Unit of coordinate value: 0.01 [mm] (Ex.: +100.00 [mm] → +10000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(6) "Request counter value" (monitor) command (E500H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	E5H	00H	Command	WI[+0]	E5H	00H	Same value as command
WO[+1]	1-99		Counter number	WI[+1]	1-99		Counter number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	0-9999		Counter value
				WI[+3]	Error code		
				WI [+4 ~ +15]	Fixed at 0		Unused



- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(7) "Set counter" command (E700H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	E7H	00H	Command	WI[+0]	E7H	00H	Same value as command
WO[+1]	1-99		Counter number	WI[+1]	1-99		Counter number
WO[+2]	0-9999		Counter value	WI[+2]	Fixed at 0		Unused
WO [+3 ~ +15]	Fixed at 0		Use prohibited	WI[+3]	Error code		
				WI [+4 ~ +15]	Fixed at 0		Unused



- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(8) " Write speed table " command (C2C2H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C2H	C2H	Command	WI[+0]	C2H	C2H	Same value as command
WO[+1]	1-20		Table number	WI[+1]	1-20		Table number
WO[+2]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
WO[+3]	Fixed at 0		Use prohibited	WI[+3]	Error code		
WO[+4]	10~99999		Speed	WI [+4 ~ +15]	Fixed at 0		Unused
WO[+5]							
WO [+6 ~ +15]	Fixed at 0		Use prohibited				



- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00 [mm/SEC] → +1000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(9) " Read speed table " command (C3C2H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C3H	C2H	Command	WI[+0]	C3H	C2H	Same value as command
WO[+1]	1-20		Table number	WI[+1]	1-20		Table number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	10~99999		Speed
				WI[+5]			
				WI [+6 ~ +15]	Fixed at 0		Unused



- Data length of speed value: 32 bits
- Unit of speed value: 0.1 [mm/SEC] (Ex.: +100.00 [mm/SEC] → +1000)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(10) " Write acceleration/deceleration table " command (C2C3H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C2H	C3H	Command	WI[+0]	C2H	C3H	Same value as command
WO[+1]	1-20		Table number	WI[+1]	1-20		Table number
WO[+2]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
WO[+3]	Fixed at 0		Use prohibited	WI[+3]	Error code		
WO[+4]	1~999		Time to set speed	WI [+4 ~ +15]	Fixed at 0		Unused
WO[+5]							
WO [+6 ~ +15]	Fixed at 0		Use prohibited				



- Data length of "time to set speed" value: 32 bits
- Unit of "time to set speed" value: 0.01 [SEC] (Ex.: +0.30 [SEC] → +30)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(11) " Read acceleration/deceleration table " command (C3C3H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C3H	C3H	Command	WI[+0]	C3H	C3H	Same value as command
WO[+1]	1-20		Table number	WI[+1]	1-20		Table number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	1~999		Time to set speed
				WI[+5]			
				WI [+6 ~ +15]	Fixed at 0		Unused



- Data length of "time to set speed" value: 32 bits
- Unit of "time to set speed" value: 0.01 [SEC] (Ex.: +0.30 [SEC] → +30)
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(12) " Write override " command (D900H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	D9H	00H	Command	WI[+0]	D9H	00H	Same value as command
WO[+1]	1-100		Override	WI[+1]	1-100		Override
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI [+4 ~ +15]	Fixed at 0		Unused



- Unit of override value: [%]
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)  
2000H Controller error state

(13) " Read override " command (DA00H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	DAH	00H	Command	WI[+0]	DAH	00H	Same value as command
WO [+1 ~ +15]	Fixed at 0		Use prohibited	WI[+1]	1-100		Override
				WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI [+4 ~ +15]	Fixed at 0		Unused



- Unit of override value: [%]
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)  
2000H Controller error state



(14) " Torque monitor " command (EE08H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	EEH	08H	Command	WI[+0]	EEH	08H	Same value as command
WO [+1 ~ +15]	Fixed at 0		Use prohibited	WI[+1]	Fixed at 0		Unused
				WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	-999~+999		Task 1
				WI[+5]			Axis 1 torque
				WI [+6 ~ +15]	Fixed at 0		Unused



- Data length of torque value: 32 bits
- Unit of torque value: 0.01 [T] (Ex.: +2.00 [T] → +200)
- T: Rating torque
- Torque of axes 2 and larger numbers in task 1 cannot be monitored.
- Torque of axes in tasks 2 to 4 cannot be monitored.
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(15) " Writing of torque limit table " command (C2C5H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C2H	C5H	Command	WI[+0]	C2H	C5H	Same value as command
WO[+1]	1-8		Table number	WI[+1]	1-8		Table number
WO[+2]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
WO[+3]	Fixed at 0		Use prohibited	WI[+3]	Error code		
WO[+4]	1~999		Torque limit value	WI [+4 ~ +15]	Fixed at 0		Unused
WO[+5]							
WO[+6]	1~999		Load output reference value				
WO[+7]							
WO [+8 ~ +15]	Fixed at 0		Use prohibited				



- Torque limit value data length: 32 bits
- Load output reference value data length: 32 bits
- Unit: 0.01 [T] (Ex.: 3.00 [T] → +300)
- T: Rating torque
- Error code 0000H Normal  
1000H Command analysis error (An error is found in the command.)

(16) " Reading of torque limit table " command (C3C5H)

Command (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	C3H	C5H	Command	WI[+0]	C3H	C5H	Same value as command
WO[+1]	1-8		Table number	WI[+1]	1-8		Table number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Error code		
				WI[+4]	1-999		Torque limit value
				WI[+5]			
				WI[+6]	1-999		Load output reference value
				WI[+7]			
				WI [+8 ~ +15]	Fixed at 0		Use prohibited

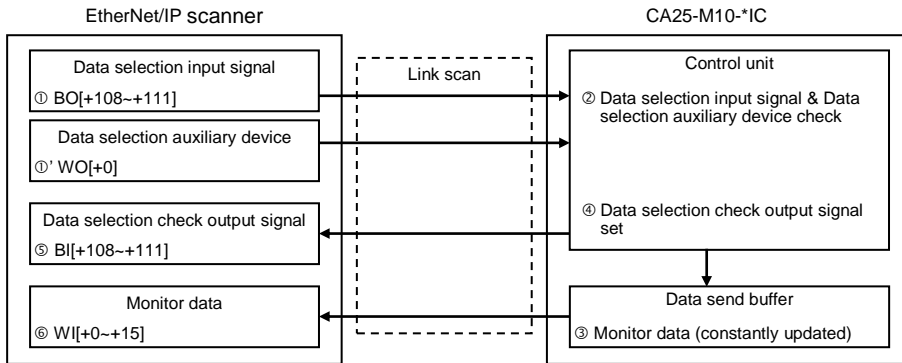


- Torque limit value data length: 32 bits
- Load output reference value data length: 32 bits
- Unit: 0.01 [T] (Ex.: 3.00 [T] → +300)
- T: Rating torque
- Error code   0000H   Normal
- 1000H   Command analysis error (An error is found in the command.)

### 19.3.3 Monitor mode

In Monitor mode, the data selected by data selection input (BO[+108~+111]) is constantly updated for realizing high-speed updating cycles.

The method of data transmission and reception (data flow and timing) is shown in the following figure.



Signal name	Device	Timing
Data selection input signal	BO[+108~+111]	A
Data selection auxiliary device	WO[+0]	A'
Monitor data	WI[+0~+15]	Previous data / Monitor data (constantly updated)
Data selection check output signal	BI[+108~+111]	B

- The data selection auxiliary device may not be used depending on a selected monitor.

- ① Set the data selection signal and data selection auxiliary device.
- ② The data selection signal is transferred to CA25-M10-\*IC by the link scan.
- ③ The data selected by the data selection signal and data selection auxiliary device is set to the data send buffer. The data send buffer is updated at 1-ms cycles.
- ④ Set the data selection check output signal. Set the value of the data selection check output signal to the same value as the data selection signal.
- ⑤ The data selection check output signal that was set in step ④ is transferred to the bit device of the EtherNet/IP scanner by the link scan.
- ⑥ The data that was set in step ③ is transferred to the word device of the EtherNet/IP scanner by the link scan.

#### List of monitors

No.	Description	Data selection input signal				Auxiliary device	Remarks
		BO[+111]	BO[+110]	BO[+109]	BO[+108]	WO[+0]	
1	Status monitor	0	0	0	1	Unused	
2	Current position monitor	0	0	1	0	Used	Task number
3	Counter monitor	0	0	1	1	0000h	Arbitrary selection mode
						0001h	Designated sequence number mode
4	Torque monitor	0	1	0	0	Unused	
5	Reserved	0	1	0	1	-	
:	Reserved	...	...	...	...	-	
15	Reserved	1	1	1	1	-	

● Explanation of monitors



- The same value as the data selection check output signal BI[+108~+111] is stored to the lower byte. The upper byte is constantly fixed at 00.

(1) Status monitor

Word device	b15-----b8	b7-----b0	Remarks
WI[+0]	00H	01H	Data selection check
WI[+1]	Fixed at 0		Use prohibited
WI[+2]	Fixed at 0		Use prohibited
WI[+3]	Fixed at 0		Use prohibited
WI[+4]	00H	**H	Status 0 (*1)
WI[+5]	00H	**H	Status 1 (*1)
WI[+6]	00H	**H	Status 2 (*1)
WI[+7]	00H	**H	Status 3 (*1)
WI [+8 ~ +15]	Fixed at 0		Use prohibited



- \*1: The status value is stored to the lower byte. The upper byte is constantly fixed at 00.

Status descriptions

Status 0		Status 1		Status 2		Status 3	
BIT	Description	BIT	Description	BIT	Description	BIT	Description
0	1: Error occurred	0	Error code (Refer to Chapter 18)	0	00: Sequential mode 01: Palletizing mode	0	1: Servo ON
1	1: Execution in progress	1		10: External point designation mode	1		
2	1: Pause in progress	2		00: Auto mode	2		
3	1: Return to origin in progress	3		01: Step mode	3		
4	1: Return to origin complete	4		10: Program mode	4		
5	1: Positioning complete	5		1: Single operation mode	5		
6		6		1: Teach pendant ON	6		
7	1: Parameter 2 modified	7		1: Host computer ON	7		

(2) Current position monitor

Monitor (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15-----b8	b7-----b0	Remarks	Word device	b15-----b8	b7-----b0	Remarks
WO[+0]	Fixed at 0		Use prohibited	WI[+0]	00H	02H	Data selection check
WO[+1]	1-4		Task number	WI[+1]	1-4		Task number
WO [+2 ~ +15]	Fixed at 0		Use prohibited	WI[+2]	Fixed at 0		Unused
				WI[+3]	Fixed at 0		Unused
				WI[+4]	-800000~+800000		Axis 1 coordinate
				WI[+5]	-800000~+800000		Axis 2 coordinate
				WI[+6]	-800000~+800000		Axis 3 coordinate
				WI[+7]	-800000~+800000		Axis 4 coordinate
				WI[+8]	-800000~+800000		Axis 3 coordinate
				WI[+9]	-800000~+800000		Axis 4 coordinate
				WI[+10]	-800000~+800000		Axis 4 coordinate
				WI[+11]	-800000~+800000		Axis 4 coordinate
				WI[+12]	00H	**H	Status 0 (*1)
				WI[+13]	00H	**H	Status 1 (*1)
				WI[+14]	00H	**H	Status 2 (*1)
				WI[+15]	00H	**H	Status 3 (*1)



- Coordinate data length: 32 bits
- Coordinate units: 0.01 mm (Ex.: +100.00 mm → +10000)

\*1: The status values are stored at lower byte. Upper byte are always fixed at 00.  
Refer to section (1) Status monitor for the status description.

(3) Counter monitor

The counter monitor can be operated in two modes: "arbitrary selection mode" for monitoring arbitrary seven counters; and "designated subsequent number mode" for monitoring subsequent 14 counters. Either of two modes can be selected using the data selection auxiliary device WO[+0].

① Arbitrary selection mode (WO[+0] = 0000H)

Monitoring up to seven arbitrary counters set to WO[+2, +4, +6, +8, +A, +C, +E]

Monitor (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15----b8	b7----b0	Remarks	Word device	b15----b8	b7----b0	Remarks
WO[+0]	00H	00H	Mode selection	WI[+0]	00H	03H	Arbitrary selection mode
WO[+1]	Fixed at 0		Use prohibited	WI[+1]	Fixed at 0		Unused
WO[+2]	1-99 (*1)		Counter number 1	WI[+2]	1-99		Counter number 1
WO[+3]	Fixed at 0		Use prohibited	WI[+3]	0-9999		Value of counter number 1
WO[+4]	1-99 (*1)		Counter number 2	WI[+4]	1-99		Counter number 2
WO[+5]	Fixed at 0		Use prohibited	WI[+5]	0-9999		Value of counter number 2
WO[+6]	1-99 (*1)		Counter number 3	WI[+6]	1-99		Counter number 3
WO[+7]	Fixed at 0		Use prohibited	WI[+7]	0-9999		Value of counter number 3
WO[+8]	1-99 (*1)		Counter number 4	WI[+8]	1-99		Counter number 4
WO[+9]	Fixed at 0		Use prohibited	WI[+9]	0-9999		Value of counter number 4
WO[+10]	1-99 (*1)		Counter number 5	WI[+10]	1-99		Counter number 5
WO[+11]	Fixed at 0		Use prohibited	WI[+11]	0-9999		Value of counter number 5
WO[+12]	1-99 (*1)		Counter number 6	WI[+12]	1-99		Counter number 6
WO[+13]	Fixed at 0		Use prohibited	WI[+13]	0-9999		Value of counter number 6
WO[+14]	1-99 (*1)		Counter number 7	WI[+14]	1-99		Counter number 7
WO[+15]	Fixed at 0		Use prohibited	WI[+15]	0-9999		Value of counter number 7



\*1: In the case where a number other than "1 to 99" is designated for counter number, 0 will be returned to that counter number.

② Designated subsequent mode (WO[+0] = 0001H)

Monitoring subsequent counters (up to 14) starting with the counter number set to WO[+1].

Monitor (EtherNet/IP scanner → CA25-M10-*IC)				Response (EtherNet/IP scanner ← CA25-M10-*IC)			
Word device	b15----b8	b7----b0	Remarks	Word device	b15----b8	b7----b0	Remarks
WO[+0]	00H	01H	Mode selection	WI[+0]	01H	03H	Designated subsequent mode
WO[+1]	1-99 (*1)		First counter number	WI[+1]	1-99		First counter number
WO[+2]	Fixed at 0		Use prohibited	WI[+2]	0-9999		Value of first counter
WO[+3]				WI[+3]	0-9999		Value of first counter + 1
WO[+4]				WI[+4]	0-9999		Value of first counter + 2
WO[+5]				WI[+5]	0-9999		Value of first counter + 3
WO[+6]				WI[+6]	0-9999		Value of first counter + 4
WO[+7]				WI[+7]	0-9999		Value of first counter + 5
WO[+8]				WI[+8]	0-9999		Value of first counter + 6
WO[+9]				WI[+9]	0-9999		Value of first counter + 7
WO[+10]				WI[+10]	0-9999		Value of first counter + 8
WO[+11]				WI[+11]	0-9999		Value of first counter + 9
WO[+12]				WI[+12]	0-9999		Value of first counter + 10
WO[+13]				WI[+13]	0-9999		Value of first counter + 11
WO[+14]				WI[+14]	0-9999		Value of first counter + 12
WO[+15]				WI[+15]	0-9999		Value of first counter + 13



\*1: In the case where a number other than "1 to 99" is designated for counter number, 0 will be returned to that counter number. In the case where a number 87 or larger is designated for the first counter number, 0 will be returned to the values after counter number 99.

(4) Torque monitor

Word device	b15-----b8	b7-----b0	Remarks
WI[+0]	00H	04H	Data selection check
WI[+1]	Fixed at 0		Unused
WI[+2]	Fixed at 0		Unused
WI[+3]	Fixed at 0		Unused
WI[+4]	-999~+999		Task 1 Axis 1 torque
WI[+5]			
WI[+6]	Fixed at 0		Unused
WI[+7]			
WI[+8]	Fixed at 0		Unused
WI[+9]			
WI[+10]	Fixed at 0		Unused
WI[+11]			
WI[+12]	00H	**H	Status 0 (*1)
WI[+13]	00H	**H	Status 1 (*1)
WI[+14]	00H	**H	Status 2 (*1)
WI[+15]	00H	**H	Status 3 (*1)



- Data length of torque value: 32 bits
  - Unit of torque value: 0.01 [T] (Ex.: +2.00 [T] → +200)
  - T: Rating torque
  - Torque of axes 2 and larger numbers in task 1 cannot be monitored.
  - Torque of axes in tasks 2 to 4 cannot be monitored.
- \*1: The status values are stored at lower byte. Upper bytes are always fixed at 00.  
Refer to section (1) Status monitor for the status description.

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# Chapter 20 Appendix

## ■ 20.1 Performance difference between CA25-M10 and CA20-M00

CA25-M10 employs newly-developed hardware high-performance servo engine for speed and electric current control and attains significant improvement of positional distribution cycle, slave communication cycle, and various control cycle in comparison to CA20-M00. CA25-M10 can deal with constant speed operation at the lower speed range with use of pass movement and sealing process of workpieces having complex shape, which were difficult for CA20-M00.

Also CA25-M10 enables smoother jointing of the acceleration/deceleration curve and the pass movement, and significantly decreases speed fluctuation.

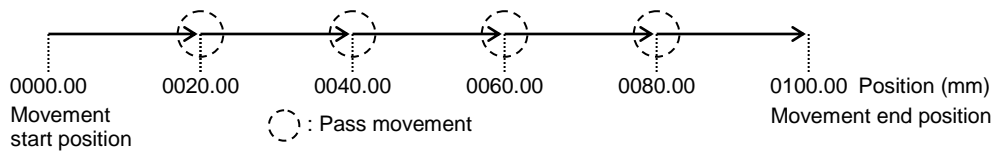
Comparison table of positional distribution cycle, communication cycle, and various control cycle

No	Item	CA25-M10	CA20-M00 (conventional series)	Cycle improvement
1	Positional distribution cycle	4 msec	24 msec	6 times
2	Slave communication cycle	5 msec	10 msec	2 times
3	Position control cycle	100 μsec	1 msec	10 times
4	Speed control cycle	25 μsec	500 μsec	20 times
5	Current control cycle	4 μsec	100 μsec	25 times

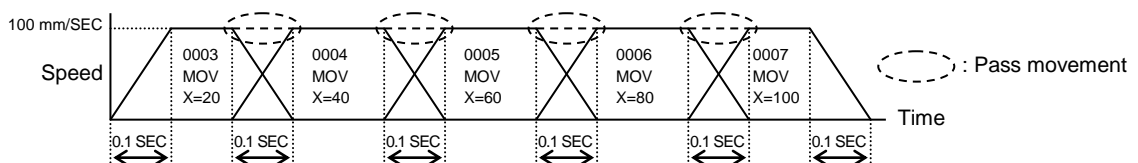
### ■ 20.1.1 Comparison of constant speed operation at the lower speed range with use of pass movement

Constant speed operation was compared while moving one axis from the position 0 mm to the position 100 mm in increments of 20 mm that were joined by pass movement. The speed was 100 mm/sec and the acceleration/deceleration time was 0.1 sec.

- Movement pattern



- Speed pattern



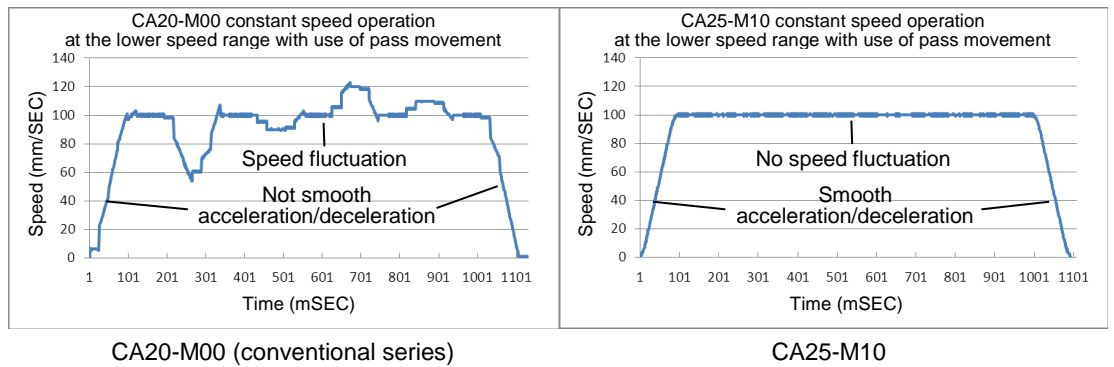
- Sequential program

```

0001 ACC 01(0.1SEC)
0002 SPD V=01(100mm/SEC)
0003 MOV X= 20, Y=0, Z=0, R=0 PASS
0004 MOV X= 40, Y=0, Z=0, R=0 PASS
0005 MOV X= 60, Y=0, Z=0, R=0 PASS
0006 MOV X= 80, Y=0, Z=0, R=0 PASS
0007 MOV X=100, Y=0, Z=0, R=0 POST
    
```



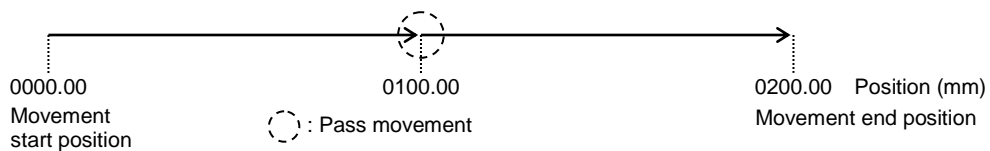
- Comparison result



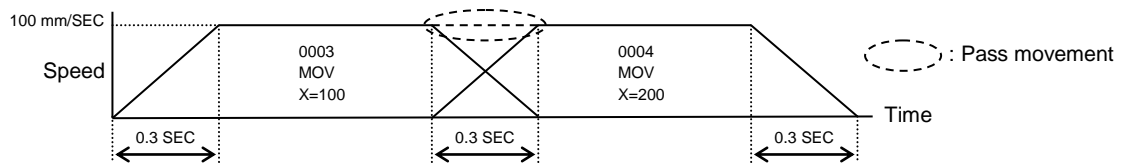
## ■ 20.1.2 Comparison of pass movement speed at joint

Pass movement speed at joint was compared while moving one axis from the position 0 mm to the position 100 mm and from the position 100 mm to the position 200 mm and joining these two travels with use of pass movement. The speed was 100 mm/sec and the acceleration/deceleration time was 0.3 sec.

- Movement pattern



- Speed pattern



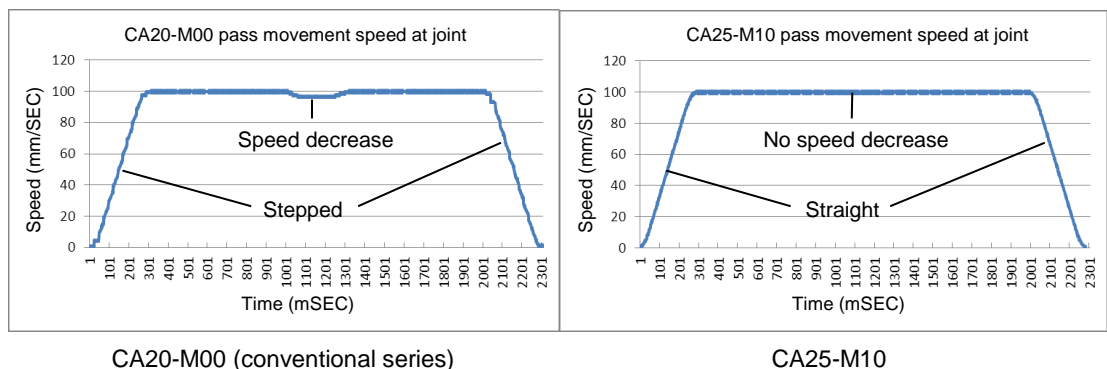
- Sequential program

```

0001 ACC 05(0.3Sec)
0002 SPD V=01(100mm/SEC)
0003 MOV X=100, Y=0, Z=0, R=0 PASS
0004 MOV X=200, Y=0, Z=0, R=0 POST

```

- Comparison result



## ■ 20.2 Functions added for CA25-M10

List of functions added for CA25-M10

Function	Description	Reference
Individual setting of acceleration/deceleration time	The DEC command (deceleration setting command) is newly provided. Therefore acceleration time and deceleration time can be set independently.	Chapter 17- ACC and DEC Command
Movement from coordinate table	The conventional models cannot move the robot on the coordinate table screen in all modes except for the external point designation mode. However, CA25-M10 can move the robot on the coordinate table screen in all modes. This improves efficiency of teaching work.	Section ■ 16.6
Axis control with multiple tasks	The conventional model (CA20-M00) can perform axis control only with the task 1. However, CA25-M10 can perform axis control with multiple tasks, and therefore a flexible system configuration such as 2 axes + 1 axis + 1 axis can be established.	Section ■ 13.4.19
External point designation mode coordinate table No. output	After positioning is completed, external output to a coordinate table number can be performed. This enables to inform the host controller of reach to target position more surely than ever before.	Chapter 8
Maximum torque limit	The conventional models can use the maximum torque limit function only when connected to a host controller through CC-Link. However, CA25-M10 can use the maximum torque limit function also when connected through DIO connection or DeviceNet connection. In addition, the number of selection of the maximum torque limit function is expanded from four to eight.	Section ■ 16.11
New torque limit table	The conventional models uses values of the acceleration/ deceleration table for torque limiting. However, a dedicated torque limit table that allows intuitive and easy understanding is newly provided for CA25-M10.	Section ■ 13.5.5
Pass movement from designated coordinate	The PASS command (pass rate setting command) is newly provided. For linear movement commands, the timing to shift to the next command can be set by percentage of the movement amount. This allows earlier execution of the next command than the conventional models, and therefore tact time can be reduced.	Chapter 17- PASS Command
Offset designation with coordinate table	The OFSP command (coordinate table designation offset command) is newly provided. Therefore offset can be set indirectly with the coordinate table.	Chapter 17- OFSP Command
Coordinate table base designation in external point designation mode	The conventional models interpreted the input port value as a binary, and the value obtained by adding 1 to that value was the coordinate table number to which the robot moved. However, CA25-M10 series can move to the coordinate table number to which 1 has not been added, in addition to the conventional method. Whether 1 is added or not is switched by the parameter.	Chapter 8 Section ■ 13.2.23
Expansion of number of speed table	The number of speed tables is expanded from 10 to 20.	Section ■ 13.5.2
Jumping from JOG operation screen to JOG speed setting screen	When the [SEARCH] key is pressed on the JOG operation screen, the procedure jumps to the JOG speed (A0) setting screen of the parameter 1. When the [ESC] key is pressed, the procedure returns to the JOG operation screen. This is convenient for frequent change of JOG speed.	Section ■ 16.5
Torque limit move	1 axis which is specified arbitrarily for each task can move with torque limit move. The torque limit value and the specification of move conditions are set by the new command of TLMV beforehand and actual move is executed by MOV command or MOVVP command.	Section ■ 5.1.7
Expansion of the number of steps in total for all tasks	The number of steps in total for all tasks tables is expanded from 2500 to 5000.	Section ■ 13.4.22
Return to origin torque limit	Torque can be limited, returning to origin. Torque limit value is the value of the torque limit table No. designated in the parameter 2.	Section ■ 13.4.27
Logic selection of system input/output	Positive logic/negative logic of each system input/output can be selected in the mode setting.	Sections ■ 13.2.27 to ■ 13.2.34
JOG operation by I/O	Bits of JOG inout/output are designated in the mode setting. JOG operation can be executed by I/O in the same way as the conventional operation by CC-Link, DeviceNet.	Section ■ 10.2.26

Function	Description	Reference
Start input delay	The time from the start input is ON to the robot starts can be delayed.	Section ■ 10.2.2
EtherNet/IP is supported	I/O communication and data communication are available.	Chapter 19

## ■ 20.3 Replacement of conventional models

This section describes notes for replacement of conventional models with CA25-M10 and difference between their specifications. But CA25-M10 cannot be substituted from CA20-M01 because it cannot support safety Category 3.

- (1) CA20-M00 (2) CA10-M00B (3) CA10-M01B-CC (4) CA20-M10  
(5) CA10-M00 (6) CA10-M01-CC (7) CA10-M10

### ■ 20.3.1 Notes for replacement of conventional models

#### (1) Replacement of CA20-M00 with CA25-M10

##### ① Robot type

The robot type of the BA III series is different from that of the BA II series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.6 Robot type correspondence table between BA II series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

##### ② Number of units

CA25-M10 has the servo driver function, in contrast to CA20-M00 having no servo driver function. Therefore necessary number of units of CA25-M10 is one less than that of CA20-M00.

For example, CA20-M00 needs five units for four-axis construction, including one master unit and four slave units.

On the other hand, CA25-M10 needs four units for the same construction, including one master unit and three slave units.

##### ③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

##### ④ Power supply voltage

The power supply voltage of the master unit is changed from 24 VDC to 100/200 VAC (refer to Table 20.1 in section ■ 20.3.2). The power supply voltage of the slave unit is unchanged (refer to Table 20.2 in section ■ 20.3.2).

##### ⑤ Compatible slave unit

The compatible slave unit differs between CA20-M00 and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

##### ⑥ Emergency stop input/output

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.3 and Figure 20.2 in section ■ 20.3.2.)

##### ⑦ I/O wiring of master unit

A different type of connector is used and therefore wiring needs to be changed (Refer to Table 20.3 in section ■ 20.3.2).

The number of general-purpose input/output decreases from 20/12 to 4/4 (Refer to Table 20.1 in section ■ 20.3.2) and may be insufficient depending on use conditions. In the case of insufficient number of general-purpose input/output, add the expansion input/output unit to CA25-M10 or use input/output connectors of the slave unit. After that, port designation of input/output commands needs to be corrected.

##### ⑧ Wiring of CC-Link cable

The same type of terminal block connection is used and therefore the conventional wiring can be used without change. However, the top and bottom of the terminal block is reversed in comparison to the conventional one, and naturally the arrangement of the wiring is reversed. (Refer to Figure 20.3 in section ■ 20.3.2.)

##### ⑨ Wiring of DeviceNet cable

The same type of connector is used and therefore the conventional wiring can be used without change. However, the top and bottom of the connector is reversed in comparison to the conventional one. (Refer to Figure 20.4 in section ■ 20.3.2.)

- ⑩ Wiring of slave unit I/O  
If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.)  
If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.
- ⑪ Program and parameter  
Backward compatibility is maintained. To convert data from CA20-M00 to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.
- ⑫ External point designation mode  
The number of general-purpose input/output decreases from 20/12 to 4/4 and therefore port assignment needs to be changed. The method for assignment of a port varies depending on existence or type of the expansion I/F unit. For details, refer to Chapter 8.
- ⑬ Teach pendant  
TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.
- ⑭ PC software  
SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.
- ⑮ Easy mode  
If the easy mode was used with CA20-M00, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.
- ⑯ The timing output port turns on after the power is turned on  
The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)
- ⑰ Waiting time until the power is turned on again  
Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)
- ⑱ Defaults of servo gain (position) and servo gain (speed)  
Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA II series, set them to the values corresponding to the axis type in Table 20.6 in section ■ 20.3.2.  
When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

## (2) Replacement of CA10-M00B with CA25-M10

### ① Robot type

The robot type of the BA III series is different from that of the BA II series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.6 Robot type correspondence table between BA II series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

### ② Number of units

CA25-M10 has the servo driver function, in contrast to CA10-M00B having no servo driver function. Therefore necessary number of units of CA25-M10 is one less than that of CA10-M00B.

For example, CA10-M00B needs five units for four-axis construction, including one master unit and four slave units. On the other hand, CA25-M10 needs four units for the same construction, including one master unit and three slave units.

### ③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

### ④ Power supply voltage

The power supply voltage of the master unit is changed from 24 VDC to 100/200 VAC (refer to Table 20.1 in section ■ 20.3.2). The power supply voltage of the slave unit is unchanged (refer to Table 20.2 in section ■ 20.3.2).

### ⑤ Compatible slave unit

The compatible slave unit differs between CA10-M00B and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

### ⑥ Emergency stop input/output

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.3 and Figure 20.2 in section ■ 20.3.2.)

### ⑦ I/O wiring of master unit

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.3 in section ■ 20.3.2.)

The number of general-purpose input/output decreases from 20/12 to 4/4 (Refer to Table 20.1 in section ■ 20.3.2) and may be insufficient depending on use conditions. In the case of insufficient number of general-purpose input/output, add the expansion input/output unit to CA25-M10 or use input/output connectors of the slave unit. After that, port designation of input/output commands needs to be corrected.

### ⑧ Wiring of expansion input/output unit I/O

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.4 in section ■ 20.3.2.)

The number of expansion input/output decreases from 24/16 to 24/8 (refer to Table 20.1 in section ■ 20.3.2) and may be insufficient depending on use conditions. In the case of insufficient number of expansion input/output, use input/output connectors of the slave unit. After that, port designation of input/output commands needs to be corrected.

### ⑨ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.)

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

### ⑩ Program and parameter

Backward compatibility is maintained. To convert data from CA10-M00B to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.

### ⑪ External point designation mode

The number of general-purpose input/output decreases from 20/12 to 4/4 and therefore port assignment needs to

be changed. The method for assignment of a port varies depending on existence or type of the expansion I/F unit. For details, refer to Chapter 8.

⑫ Teach pendant

TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.

⑬ PC software

SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.

⑭ Memory card unit

If the memory card unit (CA10-MC-B20) was used with CA10-M00B, the corresponding memory card unit is not available with CA25-M10. Perform backup of programs and parameters with PC software (SF-98D).

⑮ Easy mode

If the easy mode was used with CA10-M00B, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.

⑯ The timing output port turns on after the power is turned on

The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)

⑰ Waiting time until the power is turned on again

Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)

⑱ Defaults of servo gain (position) and servo gain (speed)

Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA II series, set them to the values corresponding to the axis type in Table 20.6 in section ■ 20.3.2.

When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

### (3) Replacement of CA10-M01B-CC with CA25-M10

#### ① Robot type

The robot type of the BA III series is different from that of the BA II series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.6 Robot type correspondence table between BA II series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

#### ② Number of units

CA25-M10 has the servo driver function, in contrast to CA10-M01B-CC having no servo driver function. Therefore necessary number of units of CA25-M10 is one less than that of CA10-M01B-CC.

For example, CA10-M01B-CC needs five units for four-axis construction, including one master unit and four slave units. On the other hand, CA25-M10 needs four units for the same construction, including one master unit and three slave units.

#### ③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

#### ④ Power supply voltage

The power supply voltage of the master unit is changed from 24 VDC to 100/200 VAC (Refer to Table 20.1 in section ■ 20.3.2). The power supply voltage of the slave unit is unchanged (refer to Table 20.2 in section ■ 20.3.2).

#### ⑤ Compatible slave unit

The compatible slave unit differs between CA10-M01B-CC and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

#### ⑥ Emergency stop input/output

A different type of connector is used and therefore wiring needs to be changed. (Refer to Figure 20.2 in section ■ 20.3.2.)

#### ⑦ Wiring of CC-Link cable

CA10-M01B-CC uses connector connection, but CA25-M10 uses terminal block connection. Therefore wiring needs to be changed. (Refer to Figure 20.3 in section ■ 20.3.2.)

#### ⑧ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.)

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

#### ⑨ Program and parameter

Backward compatibility is maintained. To convert data from CA10-M01B-CC to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.

#### ⑩ External point designation mode

The method for port assignment differs. For details, refer to Chapter 8.

#### ⑪ Teach pendant

TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.



⑫ PC software

SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.

⑬ Easy mode

If the easy mode was used with CA10-M01B-CC, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.

⑭ The timing output port turns on after the power is turned on

The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)

⑮ Waiting time until the power is turned on again

Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)

⑯ Defaults of servo gain (position) and servo gain (speed)

Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA II series, set them to the values corresponding to the axis type in Table 20.6 in section ■ 20.3.2.

When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

#### (4) Replacement of CA20-M10 with CA25-M10

##### ① Robot type

The robot type of the BA III series is different from that of the BA II series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.6 Robot type correspondence table between BA II series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

##### ② Number of units

Necessary number of units of CA25-M10 is same as that of CA20-M10.

For example, both the two need four units for four-axis construction, including one master unit and three slave units.

##### ③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

##### ④ Power supply voltage

The power supply voltage of both the master unit and the slave unit is unchanged. (Refer to Table 20.1 and Table 20.2 in section ■ 20.3.2.)

##### ⑤ Compatible slave unit

The compatible slave unit differs between CA20-M10 and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

##### ⑥ Emergency stop input/output

The same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.3 and Figure 20.2 in section ■ 20.3.2.)

##### ⑦ I/O wiring of master unit

If the input/output of CA25-M10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.3 in section ■ 20.3.2.) However, CA25-M10 does not support the pulse train mode, and therefore signals for the pulse train mode (pins 15, 16, 33, 34, 35, and 36) are N.C.

If the input/output of CA25-M10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

##### ⑧ Wiring of expansion input/output unit I/O

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.4 in section ■ 20.3.2.)

##### ⑨ Wiring of CC-Link cable

The same type of terminal block connection is used and therefore the conventional wiring can be used without change. (Refer to Figure 20.3 in section ■ 20.3.2.)

##### ⑩ Wiring of DeviceNet cable

The same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Figure 20.4 in section ■ 20.3.2.)

##### ⑪ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.)

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

- ⑫ Program and parameter  
Backward compatibility is maintained. To convert data from CA20-M10 to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.
- ⑬ External point designation mode  
The method for assignment of a port varies depending on existence or type of the expansion I/F unit. For details, refer to Chapter 8.
- ⑭ Continuous start  
The operation differs between CA20-M10 and CA25-M10. For details, refer to section ■ 10.2.6.
- ⑮ Teach pendant  
TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.
- ⑯ PC software  
SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.
- ⑰ Easy mode  
If the easy mode was used with CA20-M10, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.
- ⑱ Pulse train mode  
If the pulse train mode was used with CA20-M10, the corresponding mode is not available with CA25-M10.
- ⑲ The timing output port turns on after the power is turned on  
The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)
- ⑳ Waiting time until the power is turned on again  
Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)
- ㉑ Defaults of servo gain (position) and servo gain (speed)  
Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA II series, set them to the values corresponding to the axis type in Table 20.6 in section ■ 20.3.2.  
When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

(5) Replacement of CA10-M00 with CA25-M10

① Robot type

The robot type of the BA III series is different from that of the BA series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.7 Robot type correspondence table between BA series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

② Number of units

CA25-M10 has the servo driver function, in contrast to CA10-M00 having no servo driver function. Therefore necessary number of units of CA25-M10 is one less than that of CA10-M00.

For example, CA10-M00 needs five units for four-axis construction, including one master unit and four slave units. On the other hand, CA25-M10 needs four units for the same construction, including one master unit and three slave units.

③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

④ Power supply voltage

The power supply voltage of the master unit is changed from 24 VDC to 100/200 VAC (refer to Table 20.1 in section ■ 20.3.2). The power supply voltage of the slave unit is unchanged (refer to Table 20.2 in section ■ 20.3.2).

⑤ Compatible slave unit

The compatible slave unit differs between CA10-M00 and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

⑥ Emergency stop input/output

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.3 and Figure 20.2 in section ■ 20.3.2.)

⑦ I/O wiring of master unit

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.3 in section ■ 20.3.2.)

The number of general-purpose input/output decreases from 20/12 to 4/4 (Refer to Table 20.1 in section ■ 20.3.2) and may be insufficient depending on use conditions. In the case of insufficient number of general-purpose input/output, add the expansion input/output unit to CA25-M10 or use input/output connectors of the slave unit. After that, port designation of input/output commands needs to be corrected.

⑧ Wiring of expansion input/output unit I/O

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.4 in section ■ 20.3.2.)

The number of expansion input/output decreases from 24/16 to 24/8 (refer to Table 20.1 in section ■ 20.3.2) and may be insufficient depending on use conditions. In the case of insufficient number of expansion input/output, use input/output connectors of the slave unit. After that, port designation of input/output commands needs to be corrected.

⑨ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.) However, the general-purpose output ports 1-5 to 1-8 (pins 11, 12, 13, and 14) are changed from the conventional photocoupler output (rated current of 20 mA per point) to the transistor output (rated current of 300 mA per point). Therefore use of this output needs 24 VDC connected to +COM1 (pin 1). If 24 VDC is not connected to +COM1, additional wiring is needed.

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

⑩ Program and parameter

Backward compatibility is maintained. To convert data from CA10-M00 to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.

- ① External point designation mode  
The number of general-purpose input/output decreases from 20/12 to 4/4 and therefore port assignment needs to be changed. The method for assignment of a port varies depending on existence or type of the expansion I/F unit. For details, refer to Chapter 8.
- ② Teach pendant  
TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.
- ③ PC software  
SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.
- ④ Memory card unit  
If the memory card unit (CA10-MC-B20) was used with CA10-M00, the corresponding memory card unit is not available with CA25-M10. Perform backup of programs and parameters with PC software (SF-98D).
- ⑤ Easy mode  
If the easy mode was used with CA10-M00, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.
- ⑥ Encoder type setting  
The axis unit of all models among BA III series is equipped with the absolute encoder as standard. Therefore the initial value of "encoder type setting" of the parameter 2 is changed from "i: incremental encoder" for BA series to "a: absolute encoder". (Refer to section ■ 13.4.17.)  
~~Because of this, an "encoder backup error" occurs when the power is turned ON for the first time or when the power is turned OFF and then ON without a backup battery attached.~~ Clear the error with reset input or the [CLEAR] key of the teach pendant and then perform return to origin. For details of absolute encoder backup, refer to section ■ 2.4.2.  
Incremental encoder operation of BA series can be selected by changing the encoder type setting to "i: incremental encoder".
- ⑦ Change of activation specification of return to origin complete output  
BA series: The return to origin complete output turns ON upon completion of return to origin and remains ON unless the axis moves from that position (turns OFF when the axis moves).  
BA III series: The return to origin complete output is ON while the robot understands the current position and execution of movement commands does not require return to origin.  
When return to origin is required, for example after occurrence of an encoder-related error, the return to origin complete output turns OFF.  
The operation of BA series can be selected by changing the selection of BA I/O compatible mode of the parameter 2 (refer to section ■ 13.4.23) to "valid".
- ⑧ Change of servo gain input range  
The setting range of the servo gain (position and speed) of the parameter 1 is changed from 16 levels (0 to 15) of BA series to 99 levels (0 to 98) of BA III series in order to deal with all axes that is expected to be developed in the future.
- ⑨ The timing output port turns on after the power is turned on  
The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)
- ⑩ Waiting time until the power is turned on again  
Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)
- ⑪ Defaults of servo gain (position) and servo gain (speed)  
Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA series, set them to the values corresponding to the axis type in Table 20.7 in section ■ 20.3.2.  
When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

(6) Replacement of CA10-M01-CC with CA25-M10

① Robot type

The robot type of the BA III series is different from that of the BA series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.7 Robot type correspondence table between BA series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

② Number of units

CA25-M10 has the servo driver function, in contrast to CA10-M01-CC having no servo driver function. Therefore necessary number of units of CA25-M10 is one less than that of CA10-M01-CC.

For example, CA10-M01-CC needs five units for four-axis construction, including one master unit and four slave units. On the other hand, CA25-M10 needs four units for the same construction, including one master unit and three slave units.

③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

④ Power supply voltage

The power supply voltage of the master unit is changed from 24 VDC to 100/200 VAC (refer to Table 20.1 in section ■ 20.3.2). The power supply voltage of the slave unit is unchanged (refer to Table 20.2 in section ■ 20.3.2).

⑤ Compatible slave unit

The compatible slave unit differs between CA10-M01-CC and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

⑥ Emergency stop input/output

A different type of connector is used and therefore wiring needs to be changed. (Refer to Figure 20.2 in section ■ 20.3.2.)

⑦ Wiring of CC-Link cable

CA10-M01-CC uses connector connection, but CA25-M10 uses terminal block connection. Therefore wiring needs to be changed. (Refer to Figure 20.3 in section ■ 20.3.2.)

⑧ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change (refer to Table 20.5 in section ■ 20.3.2). However, the general-purpose output ports 1-5 to 1-8 (pins 11, 12, 13, and 14) are changed from the conventional photocoupler output (rated current of 20 mA per point) to the transistor output (rated current of 300 mA per point). Therefore use of this output needs 24 VDC connected to +COM1 (pin 1). If 24 VDC is not connected to +COM1, additional wiring is needed.

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

⑨ Program and parameter

Backward compatibility is maintained. To convert data from CA10-M01-CC to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.

⑩ External point designation mode

The method for port assignment differs. For details, refer to Chapter 8.

⑪ Teach pendant

TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.

- ⑫ PC software  
SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.
- ⑬ Easy mode  
If the easy mode was used with CA10-M01-CC, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.
- ⑭ Encoder type setting  
The axis unit of all models among BA III series is equipped with the absolute encoder as standard. Therefore the initial value of "encoder type setting" of the parameter 2 is changed from "i: incremental encoder" for BA series to "a: absolute encoder". (Refer to section ■ 13.4.17.)  
~~Because of this, an "encoder backup error" occurs when the power is turned ON for the first time or when the power is turned OFF and then ON without a backup battery attached.~~ Clear the error with reset input or the [CLEAR] key of the teach pendant and then perform return to origin. For details of absolute encoder backup, refer to section ■ 2.4.2.  
Incremental encoder operation of BA series can be selected by changing the encoder type setting to "i: incremental encoder".
- ⑮ Change of activation specification of return to origin complete output  
BA series: The return to origin complete output turns ON upon completion of return to origin and remains ON unless the axis moves from that position (turns OFF when the axis moves).  
BA III series: The return to origin complete output is ON while the robot understands the current position and execution of movement commands does not require return to origin.  
When return to origin is required, for example after occurrence of an encoder-related error, the return to origin complete output turns OFF.  
The operation of BA series can be selected by changing the selection of BA I/O compatible mode of the parameter 2 (refer to section ■ 13.4.23) to "valid".
- ⑯ Change of servo gain input range  
The setting range of the servo gain (position and speed) of the parameter 1 is changed from 16 levels (0 to 15) of BA series to 99 levels (0 to 98) of BA III series in order to deal with all axes that is expected to be developed in the future.
- ⑰ The timing output port turns on after the power is turned on  
The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)
- ⑱ Waiting time until the power is turned on again  
Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)
- ⑲ Defaults of servo gain (position) and servo gain (speed)  
Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA series, set them to the values corresponding to the axis type in Table 20.7 in section ■ 20.3.2.  
When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

(7) Replacement of CA10-M10 with CA25-M10

① Robot type

The robot type of the BA III series is different from that of the BA series, and therefore it cannot be used without any change. If used without any change, a robot No. error occurs.

Change the robot type according to Table 20.7 Robot type correspondence table between BA series and BA III series in section ■ 20.3.2.

When the PC software (SF-98D) is used, use the file convert function to change the robot type.

② Number of units

Necessary number of units of CA25-M10 is same as that of CA10-M10.

For example, both the two need four units for four-axis construction, including one master unit and three slave units.

③ External dimensions

For external dimensions, refer to Table 20.1 and Table 20.2 in section ■ 20.3.2. For mounting hole dimension, refer to Figure 20.1 in section ■ 20.3.2.

④ Power supply voltage

The power supply voltage of both the master unit and the slave unit is unchanged. (Refer to Table 20.1 and Table 20.2 in section ■ 20.3.2.)

⑤ Compatible slave unit

The compatible slave unit differs between CA10-M10 and CA25-M10. For details, refer to Table 20.12 in section ■ 20.3.2.

⑥ Emergency stop input/output

The same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.3 and Figure 20.2 in section ■ 20.3.2.)

⑦ I/O wiring of master unit

If the input/output of CA25-M10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.3 in section ■ 20.3.2.) However, CA25-M10 does not support the pulse train mode, and therefore signals for the pulse train mode (pins 15, 16, 33, 34, 35, and 36) are N.C. The system output ports (pins 11, 12, 13, and 14) are changed from the conventional photocoupler output (rated current of 20 mA per point) to the transistor output (rated current of 300 mA per point). Therefore use of this output needs 24 VDC connected to +COM1 (pin 1). If 24 VDC is not connected to +COM1, additional wiring is needed.

If the input/output of CA25-M10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

⑧ Wiring of expansion input/output unit I/O

A different type of connector is used and therefore wiring needs to be changed. (Refer to Table 20.4 in section ■ 20.3.2.)

⑨ Wiring of slave unit I/O

If the input/output of CA25-S10 is NPN specification, the same type of connector is used and therefore the conventional wiring can be used without change. (Refer to Table 20.5 in section ■ 20.3.2.) However, the general-purpose output ports 1-5 to 1-8 (pins 11, 12, 13, and 14) are changed from the conventional photocoupler output (rated current of 20 mA per point) to the transistor output (rated current of 300 mA per point). Therefore use of this output needs 24 VDC connected to +COM1 (pin 1). If 24 VDC is not connected to +COM1, additional wiring is needed.

If the input/output of CA25-S10 is PNP specification, the polarity of COM is changed and then the external devices and wiring need to be changed.

⑩ Program and parameter

Backward compatibility is maintained. To convert data from CA10-M10 to CA25-M10, use the file conversion function of the PC software (SF-98D). Data should be transferred according to procedure of section ■ 20.3.3.

⑪ External point designation mode

The method for assignment of a port varies depending on existence or type of the expansion I/F unit. For details, refer to Chapter 8.



- ⑫ Continuous start  
The operation differs between CA10-M10 and CA25-M10. For details, refer to section ■ 10.2.6.
- ⑬ Teach pendant  
TPH-4C can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, TPH-4C version 2.28 or later is needed. For compatibility between TPH-4C version and controller type, refer to Table 20.9 in section ■ 20.3.2.
- ⑭ PC software  
SF-98D can be used for both CA25-M10 and the conventional models. For use for CA25-M10, however, SF-98D version 3.1.2 or later is needed. For compatibility between SF-98D version and controller type, refer to Table 20.11 in section ■ 20.3.2.
- ⑮ Easy mode  
If the easy mode was used with CA10-M10, the corresponding mode is not available with CA25-M10. Substitute sequential programs for the easy mode.
- ⑯ Pulse train mode  
If the pulse train mode was used with CA10-M10, the corresponding mode is not available with CA25-M10.
- ⑰ Encoder type setting  
The axis unit of all models among BA III series is equipped with the absolute encoder as standard. Therefore the initial value of "encoder type setting" of the parameter 2 is changed from "i: incremental encoder" for BA series to "a: absolute encoder". (Refer to section ■ 13.4.17.)  
~~Because of this, an "encoder backup error" occurs when the power is turned ON for the first time or when the power is turned OFF and then ON without a backup battery attached. Clear the error with reset input or the [CLEAR] key of the teach pendant and then perform return to origin. For details of absolute encoder backup, refer to section ■ 2.4.2.~~  
Incremental encoder operation of BA series can be selected by changing the encoder type setting to "i: incremental encoder".
- ⑱ Change of activation specification of return to origin complete output  
BA series: The return to origin complete output turns ON upon completion of return to origin and remains ON unless the axis moves from that position (turns OFF when the axis moves).  
BA III series: The return to origin complete output is ON while the robot understands the current position and execution of movement commands does not require return to origin.  
When return to origin is required, for example after occurrence of an encoder-related error, the return to origin complete output turns OFF.  
The operation of BA series can be selected by changing the selection of BA I/O compatible mode of the parameter 2 (refer to section ■ 13.4.23) to "valid".
- ⑲ Change of servo gain input range  
The setting range of the servo gain (position and speed) of the parameter 1 is changed from 16 levels (0 to 15) of BA series to 99 levels (0 to 98) of BA III series in order to deal with all axes that is expected to be developed in the future.
- ⑳ The timing output port turns on after the power is turned on  
The timing output port turns on after the power is turned on varies because of the difference of internal processing. (Refer to Table 20.13 in section ■ 20.3.2)
- ㉑ Waiting time until the power is turned on again  
Waiting time until the power is turned on again varies because of the difference of internal processing. In case the power is turned on again within this time, the controller may not operate properly. (Refer to Table 20.14 in section ■ 20.3.2)
- ㉒ Defaults of servo gain (position) and servo gain (speed)  
Because defaults of servo gain (position) and servo gain (speed) of the BA III series are different from those of the BA series, set them to the values corresponding to the axis type in Table 20.7 in section ■ 20.3.2.  
When the data of parameter 1 which contains servo gain (position) and servo gain (speed) is transferred with the file conversion function of the PC software (SF-98D), refer to section ■ 20.3.3.

## ■ 20.3.2 Specifications comparison table and drawings

Table 20.1 Master unit specifications comparison table (1/2)

Item	CA25-M10 CA25-M40 CA25-M80	CA20-M00 CA20-M01	CA10-M00B	CA10-M01B- CC	CA20-M10 CA20-M40	
Applicable robot	BA III series	×	×	×	BA II series	
Maximum number of task	4	4 (*1)	←	←	4	
Maximum number of controllable axis	4	←	←	←	←	
Maximum number of controllable axis per one task	4	←	←	←	2	
Three dimension linear/circular interpolation	○	○	○	○	×	
Position command distribution cycle	4 mSEC	24 mSEC	←	←	10 mSEC	
Slave communication cycle	5 mSEC	10 mSEC	←	←	←	
Two axes synchronization control	×	○	×	×	×	
Simple torque control function	○	×	×	×	○	
Torque limit function	To be added	×	×	×	×	
Pass movement from designated coordinate	○	×	×	×	×	
External point mode Output expansion function	○	×	×	×	×	
Acceleration/deceleration time individual setting	○	×	×	×	×	
Number of speed and acceleration/deceleration tables	20/20 (variable)	10/20 (variable)	←	←	←	
Operation mode	Step / continuous / single	←	←	←	←	
Sequential mode	○	○	○	○	○	
Maximum number of program step	5000 (*8)	2500	←	←	2000	
Palletizing mode (number of program)	○ (16)	○ (16)	○ (16)	○ (16)	○ (8)	
External point designation mode	○	○	○	○	○	
Easy mode (number of program)	×	○ (8)	○ (8)	○ (8)	○ (8)	
Pulse train mode	×	×	×	×	○	
Number of counter / timer	99/9	←	←	←	←	
Number of coordinate tables	999 for each task	←	←	←	←	
Communication function (RS-232C)	1CH	1CH (OP: 1CH)	1CH	2CH	1CH	
Communication cable type	PCBL-31	←	←	←	←	
Servo driver function	○	×	×	×	○	
Number of system input/output	4/4	4/4	4/4	4/4	4/4	
Number of general-purpose input/output	4/4	20/12	20/12	64/64	4/4	
I/O type	NPN, PNP	NPN	NPN	None (*2)	NPN	
Option	Number of expansion input/output	24/8	None	24/16	None	12/8
	CC-Link	○	○	×	○	○
	DeviceNet	○	○	×	×	○
	EtherNet/IP	○	×	×	×	×
	Memory card unit	×	×	○	×	×
Regenerative discharge unit	ABSU-2000 ABSU-4000 ABSU-8000	×	×	×	ABSU-2000 ABSU-4000	
Battery type for ABS (life duration)	CA25-EB-05 (Approximately 3 years)	×	×	×	CA20-EB-05 (Approximately 5 years)	
Power source	100/200 VAC (*3)	24 VDC	24 VDC	24 VDC	100/200 VAC (*4)	
External dimensions (W x H x D) (mm)	M10: 55×160×150 M40: 85×160×150 M80: Equal to M40	65×170×150	25×160×130	47×160×130	M10: 55×160×134 M40: 85×160×134	
Mounting hole dimension	Refer to figure 20.1 in section ■ 20.3.2.	←	←	←	←	
Weight (kg)	M10: 0.92 M40: 1.58 M80: Equal to M40	1.2	0.4	0.8	M10: 0.93 M40: 1.36	

### NOTE

\*1: Axis movement can be used with task 1

\*2: No I/O connector because of controller exclusive for CC-Link

\*3: Only 200 V for CA25-M40/M80

\*4: Only 200 V for CA20-M40

\*8: Supported only by CA25-M10 version 4.30 or later, and SF-98D version 3.1.7 or later. For other than the above, 2500.

Table 20.1 Master unit specifications comparison table (2/2)

Item	CA10-M00	CA10-M01-CC	CA10-M10 CA10-M40
Applicable robot	×	×	BA series
Maximum number of task	4 (*5)	←	4
Maximum number of controllable axis	4	←	←
Maximum number of controllable axis per one task	4	←	2
Three dimension linear/circular interpolation	○	○	×
Position command distribution cycle	24 mSEC	←	10 mSEC
Slave communication cycle	10 mSEC	←	←
Two axes synchronization control	×	×	×
Simple torque control function	×	×	×
Torque limit function	×	×	×
Pass movement from designated coordinate	×	×	×
External point mode Output expansion function	×	×	×
Acceleration/deceleration time individual setting	×	×	×
Number of speed and acceleration/deceleration tables	10/20 (variable)	←	←
Operation mode	Step / continuous / single	←	←
Sequential mode	○	○	○
Maximum number of program step	2500	←	2000
Palletizing mode (number of program)	○ (16)	○ (16)	○ (8)
External point designation mode	○	○	○
Easy mode (number of program)	○ (8)	○ (8)	○ (8)
Pulse train mode	×	×	○
Number of counter / timer	99/9	←	←
Number of coordinate tables	999 for each task	←	←
Communication function (RS-232C)	1CH	2CH	1CH
Communication cable type	PCBL-31	←	←
Servo driver function	×	×	○
Number of system input/output	4/4	4/4	4/4
Number of general-purpose input/output	20/12	64/64	4/4
I/O type	NPN	None (*6)	NPN
Option	Number of expansion input/output	24/16	None
	CC-Link	×	○
	DeviceNet	×	×
	EtherNet/IP	×	×
	Memory card unit	○	×
Regenerative discharge unit	×	×	ABSU-2000 ABSU-4000
Battery type for ABS (life duration)	×	×	ECBU-4.5 (approximately 1 year)
Power source	24 VDC	24 VDC	100/200 VAC (*7)
External dimensions (W × H × D) (mm)	25×160×130	47×160×130	M10: 55×160×134 M40: 85×160×134
Mounting hole dimension	Refer to figure 20.1 in section ■ 20.3.2.	←	←
Weight (kg)	0.4	0.8	M10: 0.93 M40: 1.36

**NOTE**

\*5: Axis movement can be used with task 1

\*6: No I/O connector because of controller exclusive for CC-Link

\*7: Only 200 V for CA10-M40

Table 20.2 Slave unit specifications comparison table

Item		CA25-S10 CA25-S40 CA25-S80	CA20-S10 CA20-S40	VLASX-025P2	CA10-S10 CA10-S40	CA01-S05
Applicable robot		BA III series	BA II series	←	BA series	BA-C series
Number of general-purpose input/output		8/8	8/8	×	8/8	×
I/O type		NPN, PNP	NPN	×	NPN	×
Option	Number of expansion input/output	×	12/8	×	12/8	×
	Regenerative discharge unit (regenerative discharge resistor)	ABSU-2000 ABSU-4000 ABSU-8000	ABSU-2000 ABSU-4000	(RGH200A 30 Ω) (RGH400A 30 Ω)	ABSU-2000 ABSU-4000	CAR-UN50 (CAR-0500)
Battery type for ABS (life duration)		CA25-EB-05 (Approximately 3 years)	CA20-EB-05 (Approximately 5 years)	LRV03 (Approximately 1.5 years)	ECBU-4.5 (Approximately 1 year)	CA10-EB-05 (Approximately 1 year)
Power source		100/200 VAC (*1)	100/200 VAC (*2)	200 VAC	100/200 VAC (*3)	24 VDC
External dimensions (W × H × D) (mm)		S10: 55×160×150 S40: 85×160×150 S80: Equal to S40	S10: 55×160×134 S40: 85×160×134	110×170×180	S10: 55×160×134 S40: 85×160×134	31×146×89
Mounting hole dimension		Refer to figure 20.1 in section ■ 20.3.2.	←	←	←	←
Weight (kg)		S10: 0.92 S40: 1.58 S80: Equal to S40	S10: 0.91 S40: 1.34	2.3	S10: 0.91 S40: 1.34	0.25

**NOTE**

\*1: Only 200 V for CA25-S40/S80

\*2: Only 200 V for CA20-S40

\*3: Only 200 V for CA10-S40

Table 20.3 Master unit I/O connector comparison table

Pin No.	CA25-M10-P*C CA25-M40-P*C CA25-M80-P*C (PNP specification)	CA25-M10-N*C CA25-M40-N*C CA25-M80-N*C (NPN specification)	CA10-M10 CA10-M40 CA20-M10 CA20-M40 (NPN specification)	CA10-M00 CA10-M00B CA20-M00 CA20-M01 (NPN specification)
1	-COM5	+COM1	←	+COM1 (*5)
2	General-purpose output port 1-1	←	←	General-purpose output port 1-1
3	General-purpose output port 1-2	←	←	General-purpose output port 1-2
4	General-purpose output port 1-3	←	←	General-purpose output port 1-3
5	General-purpose output port 1-4	←	←	General-purpose output port 1-4
6	+COM5 (*1)	-COM1 (*3)	-COM1 (*4)	General-purpose output port 1-5
7	Emergency stop output (NO)	←	←	General-purpose output port 1-6
8	Emergency stop output (COM)	←	←	General-purpose output port 1-7
9	Emergency stop output (NC)	←	←	General-purpose output port 1-8
10	N.C	←	←	General-purpose output port 2-1
11	Running output	←	←	General-purpose output port 2-2
12	Error output	←	←	General-purpose output port 2-3
13	Positioning complete output	←	←	General-purpose output port 2-4
14	Return to origin complete output	←	←	-COM1 (*6)
15	N.C	←	Origin LS output	-COM1 (*6)
16	N.C	←	φZ output	+COM2 (*5)
17	+COM6 (*1)	-COM2 (*3)	-COM2 (*4)	Running output
18	N.C	←	←	Error output
19	COM3 (*2)	←	←	Positioning complete output
20	General-purpose input port 1-1	←	←	Return to origin complete output
21	General-purpose input port 1-2	←	←	Return to origin input
22	General-purpose input port 1-3	←	←	Start input
23	General-purpose input port 1-4	←	←	Stop input
24	N.C	←	←	Reset input
25	Emergency stop input	←	←	-COM2 (*6)
26	Emergency stop input	←	←	General-purpose input port 1-1
27	COM4 (*2)	←	←	General-purpose input port 1-2
28	Return to origin input	←	←	General-purpose input port 1-3
29	Start input	←	←	General-purpose input port 1-4
30	Stop input	←	←	General-purpose input port 1-5
31	Reset input	←	←	General-purpose input port 1-6
32	N.C	←	←	General-purpose input port 1-7
33	N.C	←	+CLK / CLK (P)	General-purpose input port 1-8
34	N.C	←	+CLK / CLK (N)	General-purpose input port 2-1
35	N.C	←	-CLK / SIGN (P)	General-purpose input port 2-2
36	N.C	←	-CLK / SIGN (N)	General-purpose input port 2-3
37				General-purpose input port 2-4
38				General-purpose input port 2-5
39				General-purpose input port 2-6
40				General-purpose input port 2-7
41				General-purpose input port 2-8
42				General-purpose input port 3-1
43				General-purpose input port 3-2
44				General-purpose input port 3-3
45				General-purpose input port 3-4
46				Emergency stop input
47				Emergency stop input
48				Emergency stop output (NO)
49				Emergency stop output (COM)
50				Emergency stop output (NC)

**NOTE**

- \*1: +COM5 and +COM6 are connected to each other internally.
- \*2: COM3 and COM4 are not connected to each other internally.
- \*3: -COM1 and -COM2 are connected to each other internally.
- \*4: -COM1 and -COM2 are not connected to each other internally.
- \*5: +COM1 and +COM2 are not connected to each other internally.
- \*6: -COM1 and -COM2 are not connected to each other internally.

Table 20.4 Expansion input/output unit I/O connector comparison table (expansion input/output unit type is shown in [ ].)

Pin No.	CA25-M10-*BC CA25-M40-*BC CA25-M80-*BC (Common for NPN and PNP)	CA20-M10 CA20-M40 CA20-S10 CA20-S40 (NPN specification) [CA20-EX-A20]	CA10-M10 CA10-M40 CA10-S10 CA10-S40 (NPN specification) [CA10-EX-A20]	CA10-M00 CA10-M00B (NPN specification) [CA10-EX-B40]
1	General-purpose input port 2-1	+COM5 (*3)	←	+COM3
2	General-purpose input port 2-2	General-purpose output port 2-1	←	General-purpose output port 3-1
3	General-purpose input port 2-3	General-purpose output port 2-2	←	General-purpose output port 3-2
4	General-purpose input port 2-4	General-purpose output port 2-3	←	General-purpose output port 3-3
5	General-purpose input port 2-5	General-purpose output port 2-4	←	General-purpose output port 3-4
6	General-purpose input port 2-6	General-purpose output port 2-5	←	General-purpose output port 3-5
7	General-purpose input port 2-7	General-purpose output port 2-6	←	General-purpose output port 3-6
8	General-purpose input port 2-8	General-purpose output port 2-7	←	General-purpose output port 3-7
9	General-purpose input port 3-1	General-purpose output port 2-8	←	General-purpose output port 3-8
10	COM7 (*1)	N.C	←	General-purpose output port 4-1
11	General-purpose input port 3-2	N.C	←	General-purpose output port 4-2
12	General-purpose input port 3-3	N.C	←	General-purpose output port 4-3
13	COM8 (*2)	-COM5	←	General-purpose output port 4-4
14	General-purpose input port 3-4	COM6 (*3)	←	-COM3
15	General-purpose input port 3-5	General-purpose input port 2-1	←	-COM3
16	General-purpose input port 3-6	General-purpose input port 2-2	←	+COM3
17	General-purpose input port 3-7	General-purpose input port 2-3	←	General-purpose output port 4-5
18	General-purpose input port 3-8	General-purpose input port 2-4	←	General-purpose output port 4-6
19	General-purpose input port 4-1	General-purpose input port 2-5	←	General-purpose output port 4-7
20	General-purpose input port 4-2	General-purpose input port 2-6	←	General-purpose output port 4-8
21	General-purpose input port 4-3	General-purpose input port 2-7	←	General-purpose input port 6-5
22	General-purpose input port 4-4	General-purpose input port 2-8	←	General-purpose input port 6-6
23	General-purpose input port 4-5	General-purpose input port 3-1	←	General-purpose input port 6-7
24	General-purpose input port 4-6	General-purpose input port 3-2	←	General-purpose input port 6-8
25	General-purpose input port 4-7	General-purpose input port 3-3	←	-COM3
26	General-purpose input port 4-8	General-purpose input port 3-4	←	General-purpose input port 4-1
27	General-purpose output port 2-1			General-purpose input port 4-2
28	General-purpose output port 2-2			General-purpose input port 4-3
29	COM9 (*2)			General-purpose input port 4-4
30	General-purpose output port 2-3			General-purpose input port 4-5
31	General-purpose output port 2-4			General-purpose input port 4-6
32	General-purpose output port 2-5			General-purpose input port 4-7
33	General-purpose output port 2-6			General-purpose input port 4-8
34	General-purpose output port 2-7			General-purpose input port 5-1
35	General-purpose output port 2-8			General-purpose input port 5-2
36	N.C			General-purpose input port 5-3
37				General-purpose input port 5-4
38				General-purpose input port 5-5
39				General-purpose input port 5-6
40				General-purpose input port 5-7
41				General-purpose input port 5-8
42				General-purpose input port 6-1
43				General-purpose input port 6-2
44				General-purpose input port 6-3
45				General-purpose input port 6-4
46				N.C
47				N.C
48				N.C
49				N.C
50				N.C

- NOTE**
- \*1: COM7 and COM8/COM9 are not connected to each other internally.
  - \*2: COM8 and COM9 are connected to each other internally.
  - \*3: +COM5 and COM6 are not connected to each other internally.

Table 20.5 Slave unit I/O connector comparison table

Pin No.	CA25-S10-P*X CA25-S40-P*X CA25-S80-P*X (PNP specification)	CA25-S10-N*X CA25-S40-N*X CA25-S80-N*X (NPN specification)	CA10-S10 CA10-S40 CA20-S10 CA20-S40 (NPN specification)
1	-COM5	+COM1	←
2	General-purpose output port 1-1	←	←
3	General-purpose output port 1-2	←	←
4	General-purpose output port 1-3	←	←
5	General-purpose output port 1-4	←	←
6	+COM5 (*1)	-COM1 (*3)	-COM1 (*4)
7	N.C	←	Emergency stop output (NO)
8	N.C	←	Emergency stop output (COM)
9	N.C	←	Emergency stop output (NC)
10	N.C	←	←
11	General-purpose output port 1-5	←	←
12	General-purpose output port 1-6	←	←
13	General-purpose output port 1-7	←	←
14	General-purpose output port 1-8	←	←
15	N.C	←	←
16	N.C	←	←
17	+COM6 (*1)	-COM2 (*3)	-COM2 (*4)
18	N.C	←	←
19	COM3 (*2)	←	←
20	General-purpose input port 1-1	←	←
21	General-purpose input port 1-2	←	←
22	General-purpose input port 1-3	←	←
23	General-purpose input port 1-4	←	←
24	N.C	←	←
25	N.C	←	←
26	N.C	←	←
27	COM4 (*2)	←	←
28	General-purpose input port 1-5	←	←
29	General-purpose input port 1-6	←	←
30	General-purpose input port 1-7	←	←
31	General-purpose input port 1-8	←	←
32	N.C	←	←
33	N.C	←	←
34	N.C	←	←
35	N.C	←	←
36	N.C	←	←

**NOTE**

\*1: +COM5 and +COM6 are connected to each other internally.

\*2: COM3 and COM4 are not connected to each other internally.

\*3: -COM1 and -COM2 are connected to each other internally.

\*4: -COM1 and -COM2 are not connected to each other internally.

Table 20.6 Robot type correspondence table between BA II series and BA III series

Motor capacity	No.	BA II series (*1)				BA III series (*2)				Remarks
		Axis type	Robot type	Servo gain default		Axis type	Robot type	Servo gain default		
				Position	Speed			Position	Speed	
50 W	1	BB00D-RH-*	510130	7	6	BE00D-RH-*	600810	35	38	Rotation axis (harmonic gear)
	2	BB00D-RP-*	510040	7	6	BE00D-RP-*	600820	24	38	Rotation axis (planetary gear)
	3	BB05D-ST-M06*~**	520170	7	6	BE05D-ST-M06*~**	600300	20	20	Ball screw drive
	4	BB05D-ST-M12*~**	520180	7	6	BE05D-ST-M12*~**	600310	20	20	Ball screw drive
	5	BB07D-ST-M06*~**	520170	7	6	BE07D-ST-M06*~**	600320	20	20	Ball screw drive
	6	BB07D-ST-M12*~**	520180	7	6	BE07D-ST-M12*~**	600330	20	20	Ball screw drive
	7	BBT5D-ST-M06*~**	521170	7	6	BET5D-ST-M06*~**	600200	31	22	Ball screw drive
	8	BBT5D-ST-M12*~**	521180	7	1	BET5D-ST-M12*~**	600210	31	22	Ball screw drive
	9	BBT7D-ST-M06*~**	522170	7	6	BET7D-ST-M06*~**	600220	29	28	Ball screw drive
	10	BBT7D-ST-M12*~**	522180	7	20	BET7D-ST-M12*~**	600230	30	30	Ball screw drive
	11	BBT3D-ST-C12*~**	530080	7	6	BET3D-ST-C12*~**	600240	30	25	Push rod
	12	BBT4D-ST-C12*~**	530180	7	6	BET4D-ST-C12*~**	600250	30	25	Push rod
100 W	1	BBT5E-ST-C12*~**	531080	6	2	BET5E-ST-C12*~**	601900	24	38	Push rod
	2	BB10E-ST-*20*~**	510100	7	6	BE10E-ST-*20*~**	601020	26	33	Ball screw drive
	3	BB10E-ST-*20*~**	510800	7	6	BE10E-ST-*20*~**	601020	26	33	Ball screw drive
	4	BB10E-U-*20*~**	510000	7	6	BE10E-U-*20*~**	601030	26	33	Ball screw drive
	5	BB10E-ST-*10*~**	510110	7	6	BE10E-ST-*10*~**	601040	26	33	Ball screw drive
	6	BB10E-U-*10*~**	510010	7	6	BE10E-U-*10*~**	601050	26	33	Ball screw drive
	7	BB10E-ST-*05*~**	510120	7	6	BE10E-ST-*05*~**	601060	26	33	Ball screw drive
	8	BB10E-U-*05*~**	510020	7	6	BE10E-U-*05*~**	601070	26	33	Ball screw drive
	9	BB10E-B-*21N~**	596120	6	7	BE10E-B-*21N~**	601090	32	35	Belt drive
	10	BB30E-ST-*20*~**	520100	3	13	BE30E-ST-*20*~**	601220	15	40	Ball screw drive
	11	BB30E-U-*20*~**	520000	3	13	BE30E-U-*20*~**	601230	17	65	Ball screw drive
	12	BB30E-ST-*10*~**	520110	3	13	BE30E-ST-*10*~**	601240	15	40	Ball screw drive
	13	BB30E-U-*10*~**	520010	3	13	BE30E-U-*10*~**	601250	17	65	Ball screw drive
	14	BB30E-ST-*05*~**	520120	3	13	BE30E-ST-*05*~**	601260	15	40	Ball screw drive
	15	BB30E-U-*05*~**	520020	3	13	BE30E-U-*05*~**	601270	17	65	Ball screw drive
	16	BB30E-B-*21N~**	596120	6	7	BE30E-B-*21N~**	601290	32	35	Belt drive
200 W	1	BB10F-B-*42*~**	596130	4	10	BE10F-B-*42*~**	602280	31	50	Belt drive
	2	BB10F-B-*21*~**	586120	6	7	BE10F-B-*21*~**	602290	27	30	Belt drive
	3	BB30F-ST-*20*~**	510100	7	6	BE30F-ST-*20*~**	602020	12	30	Ball screw drive
	4	BB30F-U-*20*~**	510000	7	6	BE30F-U-*20*~**	602030	12	30	Ball screw drive
	5	BB30F-ST-*10*~**	510110	7	6	BE30F-ST-*10*~**	602040	12	30	Ball screw drive
	6	BB30F-U-*10*~**	510010	7	6	BE30F-U-*10*~**	602050	12	30	Ball screw drive
	7	BB30F-ST-*05*~**	510120	7	6	BE30F-ST-*05*~**	602060	12	30	Ball screw drive
	8	BB30F-U-*05*~**	510020	7	6	BE30F-U-*05*~**	602070	12	30	Ball screw drive
	9	BB30F-B-*42*~**	586140	4	4	BE30F-B-*42*~**	602080	34	50	Belt drive
	10	BB30F-B-*21*~**	596120	6	7	BE30F-B-*21*~**	602090	19	30	Belt drive
	11	BB50F-ST-*20*~**	520100	3	13	BE50F-ST-*20*~**	602320	13	40	Ball screw drive
	12	BB50F-U-*20*~**	520000	3	13	BE50F-U-*20*~**	602330	13	40	Ball screw drive
	13	BB50F-ST-*10*~**	520110	3	13	BE50F-ST-*10*~**	602340	13	40	Ball screw drive
	14	BB50F-U-*10*~**	520010	3	13	BE50F-U-*10*~**	602350	13	40	Ball screw drive
	15	BB50F-ST-*05*~**	520120	3	13	BE50F-ST-*05*~**	602360	13	40	Ball screw drive
	16	BB50F-U-*05*~**	520020	3	13	BE50F-U-*05*~**	602370	13	40	Ball screw drive
	17	BB50F-B-*21*~**	596120	6	7	BE50F-B-*21*~**	602390	19	30	Belt drive
400 W	1	BB50G-ST-*20*~**	510100	7	6	BE50G-ST-*20*~**	603020	17	30	Ball screw drive
	2	BB50G-U-*20*~**	510000	7	6	BE50G-U-*20*~**	603030	17	30	Ball screw drive
	3	BB50G-ST-*10*~**	510110	7	6	BE50G-ST-*10*~**	603040	17	30	Ball screw drive
	4	BB50G-U-*10*~**	510010	7	6	BE50G-U-*10*~**	603050	17	30	Ball screw drive
	5	BB50G-ST-*05*~**	510120	7	6	BE50G-ST-*05*~**	603060	17	25	Ball screw drive
	6	BB50G-U-*05*~**	510020	7	6	BE50G-U-*05*~**	603070	17	25	Ball screw drive
	7	BB50G-B-*42*~**	576140	4	10	BE50G-B-*42*~**	603080	20	30	Belt drive
	8	BB50G-BT-L19N~**	576150	8	30	BE50G-BT-L19N~**	603280	20	61	Belt drive
	9	BB50G-BT-L19N~**	576250	7	28	BE50G-BT-L19N~**	603280	20	61	Belt drive (long stroke)
	10	BB50G-LT-*20*~**	510100	7	6	BE50G-LT-*20*~**	603020	17	30	Ball screw drive (self-run)
	11	BB60G-ST-*20*~**	512100	7	6	BE60G-ST-*20*~**	603520	22	55	Ball screw drive
	12	BB60G-ST-*10*~**	512110	7	6	BE60G-ST-*10*~**	603540	22	55	Ball screw drive
	13	BB60G-LT-*20*~**	512100	7	6	BE60G-LT-*20*~**	603520	22	55	Ball screw drive (self-run)
750 W	1					BE60J-ST-*50*~**	605080	12	75	Ball screw drive
	2					BE60J-ST-*20*~**	605020	12	60	Ball screw drive
	3					BE60J-ST-*10*~**	605040	12	30	Ball screw drive
	4					BE60J-BT-*19*~**	605180	10	80	Ball screw drive
	5					BE60J-LT-*20*~**	605120	30	80	Ball screw drive (self-run)



Table 20.7 Robot type correspondence table between BA series and BA III series

Motor capacity	No.	BA series (*1)				BA III series (*2)				Remarks
		Axis type	Robot type	Servo gain default		Servo gain default	Robot type	Servo gain default		
				Position	Speed			Position	Speed	
50 W	1	BA00D-RH-*	510130	7	6	BE00D-RH-*	600810	35	38	Rotation axis (harmonic gear)
	2	BA00D-RP-*	510040	7	6	BE00D-RP-*	600820	24	38	Rotation axis (planetary gear)
	3	BA05D-ST-M06*~**	520170	7	6	BE05D-ST-M06*~**	600300	20	20	Ball screw drive
	4	BA05D-ST-M12*~**	520180	7	6	BE05D-ST-M12*~**	600310	20	20	Ball screw drive
	5	BA07D-ST-M06*~**	520170	7	6	BE07D-ST-M06*~**	600320	20	20	Ball screw drive
	6	BA07D-ST-M12*~**	520180	7	6	BE07D-ST-M12*~**	600330	20	20	Ball screw drive
100 W	1	BA10*-ST-*20*~**	510100	7	6	BE10E-ST-*20*~**	601020	26	33	Ball screw drive
	2	BA10*-U*-*20*~**	510000	7	6	BE10E-U*-*20*~**	601030	26	33	Ball screw drive
	3	BA10*-ST-*10*~**	510110	7	6	BE10E-ST-*10*~**	601040	26	33	Ball screw drive
	4	BA10*-U*-*10*~**	510010	7	6	BE10E-U*-*10*~**	601050	26	33	Ball screw drive
	5	BA10*-ST-*05*~**	510120	7	6	BE10E-ST-*05*~**	601060	26	33	Ball screw drive
	6	BA10*-U*-*05*~**	510020	7	6	BE10E-U*-*05*~**	601070	26	33	Ball screw drive
	7	BA10E-B*-*21N~**	596120	6	7	BE10E-B*-*21N~**	601090	32	35	Belt drive
	8	BA30E-ST-*20*~**	520100	3	13	BE30E-ST-*20*~**	601220	15	40	Ball screw drive
	9	BA30E-U*-*20*~**	520000	3	13	BE30E-U*-*20*~**	601230	17	65	Ball screw drive
	10	BA30E-ST-*10*~**	520110	3	13	BE30E-ST-*10*~**	601240	15	40	Ball screw drive
	11	BA30E-U*-*10*~**	520010	3	13	BE30E-U*-*10*~**	601250	17	65	Ball screw drive
	12	BA30E-ST-*05*~**	520120	3	13	BE30E-ST-*05*~**	601260	15	40	Ball screw drive
	13	BA30E-U*-*05*~**	520020	3	13	BE30E-U*-*05*~**	601270	17	65	Ball screw drive
	14	BA30E-B*-*21N~**	596120	6	7	BE30E-B*-*21N~**	601290	32	35	Belt drive
200 W	1	BA10F-B*-*42*~**	596130	4	10	BE10F-B*-*42*~**	602280	31	50	Belt drive
	2	BA10F-B*-*21*~**	586120	6	7	BE10F-B*-*21*~**	602290	27	30	Belt drive
	3	BA30F-ST-*20*~**	510100	7	6	BE30F-ST-*20*~**	602020	12	30	Ball screw drive
	4	BA30F-U*-*20*~**	510000	7	6	BE30F-U*-*20*~**	602030	12	30	Ball screw drive
	5	BA30F-ST-*10*~**	510110	7	6	BE30F-ST-*10*~**	602040	12	30	Ball screw drive
	6	BA30F-U*-*10*~**	510010	7	6	BE30F-U*-*10*~**	602050	12	30	Ball screw drive
	7	BA30F-ST-*05*~**	510120	7	6	BE30F-ST-*05*~**	602060	12	30	Ball screw drive
	8	BA30F-U*-*05*~**	510020	7	6	BE30F-U*-*05*~**	602070	12	30	Ball screw drive
	9	BA30F-B*-*42*~**	586140	4	4	BE30F-B*-*42*~**	602080	34	50	Belt drive
	10	BA30F-B*-*21*~**	596120	6	7	BE30F-B*-*21*~**	602090	19	30	Belt drive
	11	BA50F-ST-*20*~**	520100	3	13	BE50F-ST-*20*~**	602320	13	40	Ball screw drive
	12	BA50F-U*-*20*~**	520000	3	13	BE50F-U*-*20*~**	602330	13	40	Ball screw drive
	13	BA50F-ST-*10*~**	520110	3	13	BE50F-ST-*10*~**	602340	13	40	Ball screw drive
	14	BA50F-U*-*10*~**	520010	3	13	BE50F-U*-*10*~**	602350	13	40	Ball screw drive
	15	BA50F-ST-*05*~**	520120	3	13	BE50F-ST-*05*~**	602360	13	40	Ball screw drive
	16	BA50F-U*-*05*~**	520020	3	13	BE50F-U*-*05*~**	602370	13	40	Ball screw drive
	17	BA50F-B*-*21*~**	596120	6	7	BE50F-B*-*21*~**	602390	19	30	Belt drive
400 W	1	BA50G-ST-*20*~**	510100	7	6	BE50G-ST-*20*~**	603020	17	30	Ball screw drive
	2	BA50G-U*-*20*~**	510000	7	6	BE50G-U*-*20*~**	603030	17	30	Ball screw drive
	3	BA50G-ST-*10*~**	510110	7	6	BE50G-ST-*10*~**	603040	17	30	Ball screw drive
	4	BA50G-U*-*10*~**	510010	7	6	BE50G-U*-*10*~**	603050	17	30	Ball screw drive
	5	BA50G-ST-*05*~**	510120	7	6	BE50G-ST-*05*~**	603060	17	25	Ball screw drive
	6	BA50G-U*-*05*~**	510020	7	6	BE50G-U*-*05*~**	603070	17	25	Ball screw drive
	7	BA50G-B*-*42*~**	576140	4	10	BE50G-B*-*42*~**	603080	20	30	Belt drive

Table 20.8 Operation command comparison table

Command		CA25-M10 CA25-M40 CA25-M80	CA20-M00 CA20-M01	CA10-M00 CA10-M01-CC CA10-M00B CA10-M01B-CC	CA10-M10 CA10-M40 CA20-M10 CA20-M40
Movement	MOV	○	○	○	×
	MOVP	○	○	○	○
	MVC	○	○	○	×
	MVCP	○	○	○	×
	MVB	○	○	○	○
	MVE	○	○	○	○
	RSMV	○	○	○	×
	TLMV	○	×	×	×
	HOME	○	○	○	○
Parameter	SPD	○	○	○	○
	ACC	○	○	○	○
	DEC	○	×	×	×
	PASS	○	×	×	×
	OFS	○	○	○	○
	OFSP	○	×	×	×
MVM	MINI	○	○	○	○
	MVM	○	○	○	○
	LOOP	○	○	○	○
Servo control	SVON	○	○	○	○
	SVOF	○	○	○	○
Input/output port control	OUT	○	○	○	○
	OUTP	○	○	○	○
	OUTC	○	○	○	○
	OUTS	○	○	○	×
	CANS	○	○	○	×
	IOUT	○	○	○	×
	IN	○	○	○	○
	INPC	○	○	○	○
	INSP	○	○	○	×
Timer/counter control	TIM	○	○	○	○
	TIMP	○	○	○	○
	CNT	○	○	○	○
	CNT+	○	○	○	○
	CNT-	○	○	○	○
	CNTC	○	○	○	○
	CWIT	○	○	○	×
Jump	JMP	○	○	○	○
	JMPI	○	○	○	○
	JMPC	○	○	○	○
	JMPT	○	○	○	○
	BRAC	○	○	○	○
Sub routine call	CAL	○	○	○	○
	CALI	○	○	○	○
	CALC	○	○	○	○
	CALT	○	○	○	○
Program control	NOP	○	○	○	○
	RET	○	○	○	○
	STOP	○	○	○	○
	END	○	○	○	○
	TAG	○	○	○	○
	PSEL	○	○	○	○
Task control	TSTR	○	○	○	○
	TSTO	○	○	○	○
	TRSA	○	○	○	○
	TCAN	○	○	○	○

Table 20.9 Compatible start version of teach pendant for each controller type

Controller type	TPH-4C	TPX-4A	TPH-2A (discontinued)
CA25-M10	Ver. 2.28	×	×
CA20-M00	Ver. 2.03	×	×
CA20-M01	×	Ver. 1.00	×
CA10-M00 CA10-M01-CC CA10-M00B CA10-M01B-CC	Ver. 2.03	×	×
CA20-M10	Ver. 2.10	×	Ver. 2.40
CA01-M05	Ver. 2.25	×	×
CA10-M10	Ver. 2.10	×	Ver. 2.20

Table 20.10 PC software (SF-98D) extension list

File type	CA25-M10 CA25-M40 CA25-M80	CA20-M00 CA20-M01	CA10-M00 CA10-M01-CC CA10-M00B CA10-M01B-CC	CA10-M10 CA10-M40 CA20-M10 CA20-M40	CA01-M05
Group file	DCY	DCN	←	DCB	DC7
Sequential program	DSY	DSN	←	DSB	–
Palletizing program	DPY	DPN	←	DPB	–
Easy program	–	DEN	←	DEB	–
Coordinate table	DTY	DTN	←	DTB	DT7
MVM table	DMY	DMN	←	DMB	–
Speed and acceleration/deceleration table	DAY	DAN	←	DAB	DA7
Robot type	DRY	DRN	←	DRB	DR7
Parameter 1	D1Y	D1N	←	D1B	D17
Parameter 2	D2Y	D2N	←	D2B	D27
Parameter 3	–	D3N	–	–	–
Torque limit table	DQY	–	–	–	DQ7

Table 20.11 Compatible start version of PC software for each controller type

Controller type	SF-98D
CA25-M10	Ver. 3.1.2
CA20-M00 CA20-M01	Ver. 2.2.2
CA10-M00 CA10-M01-CC CA10-M00B CA10-M01B-CC CA10-M10	Ver. 1.0.0
CA20-M10	Ver. 2.0.1
CA01-M05	Ver. 3.0.0

Table 20.12 Possibility of combination between CA25 series and other series

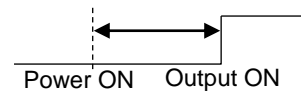
		Slave unit				
		CA25-S10	CA20-S10	VLASX-025P2	CA01-S05	CA10-S10
Master unit	CA25-M10	○	○	×	○	×
	CA20-M00/M01	○	○	○	○	×
	CA10-M00B CA10-M01B-CC	×	○	×	×	×
	CA20-M10	×	○	×	○	×
	CA01-M05	×	×	×	×	×
	CA10-M00 CA10-M01-CC	×	×	×	×	○
	CA10-M10	×	×	×	×	○

○: Possible combination

×: Impossible combination

Table 20.13 The timing output port turns on after the power is turned on

Controller type	Positioning complete output	Return to origine complete output
CA25-M10	5 seconds (*1)	5 seconds (*1)
CA20-M00/M01	2 seconds	2 seconds
CA10-M00B CA10-M01B-CC	2 seconds	2 seconds
CA20-M10	2 seconds	2 seconds
CA01-M05	2 seconds	-
CA10-M00 CA10-M01-CC	2 seconds	2 seconds
CA10-M10	2 seconds	2 seconds



\*1: It is 3 seconds in the case of the CA25-M10 whose version is 4.45 or more.

Table 20.14 Waiting time until the power is turned on again

Controller type	Waiting time
CA25-M10	10 seconds (*1)
CA20-M00/M01	1 second
CA10-M00B CA10-M01B-CC	1 second
CA20-M10	0.1 seconds
CA01-M05	1 second
CA10-M00 CA10-M01-CC	1 second
CA10-M10	0.1 seconds



\*1: It is 0.5 seconds in the case of the CA25-M10 whose version is 4.41 or more if the EtherNet/IP unit is not equipped.

Figure 20.1 Mounting hole dimension

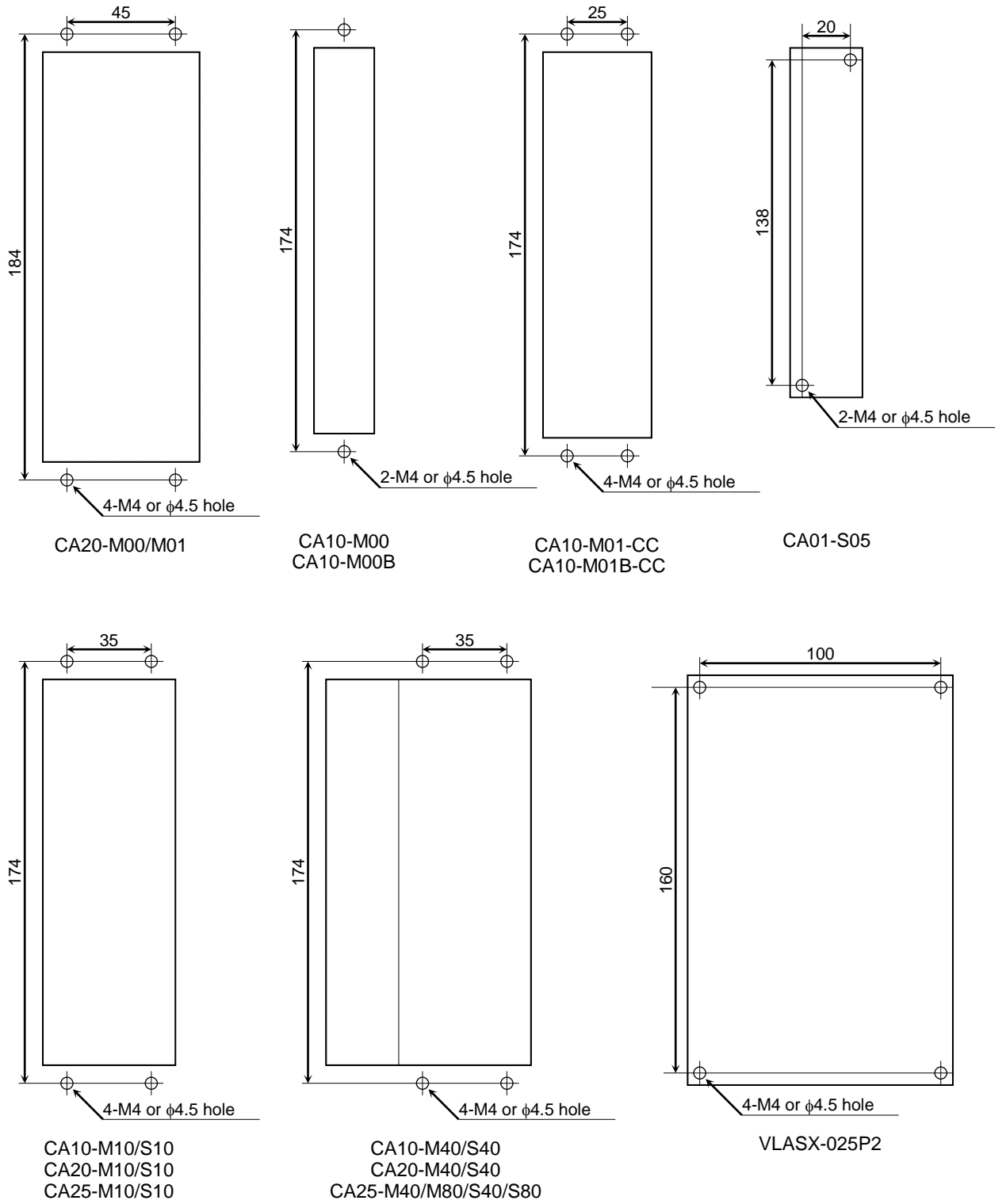
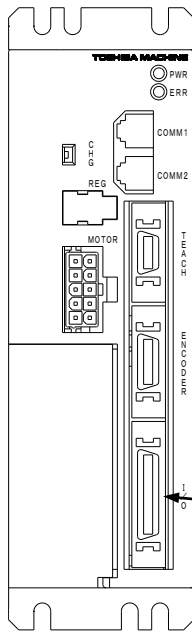


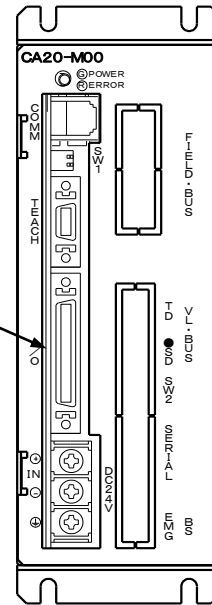
Figure 20.2 Emergency stop connector and input/output assignment



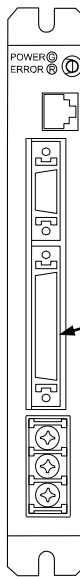
CA10-M10  
CA20-M10  
CA25-M10

Pin No.	Signal name
46	Emergency stop input
47	Emergency stop input
48	Emergency stop output (NO)
49	Emergency stop output (COM)
50	Emergency stop output (NC)

Pin No.	Signal name
25	Emergency stop input
26	Emergency stop input
7	Emergency stop output (NO)
8	Emergency stop output (COM)
9	Emergency stop output (NC)



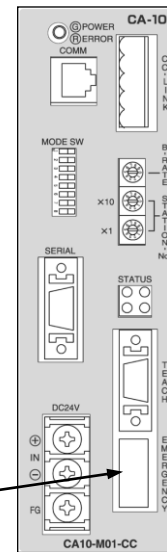
CA20-M00



CA10-M00  
CA10-M00B

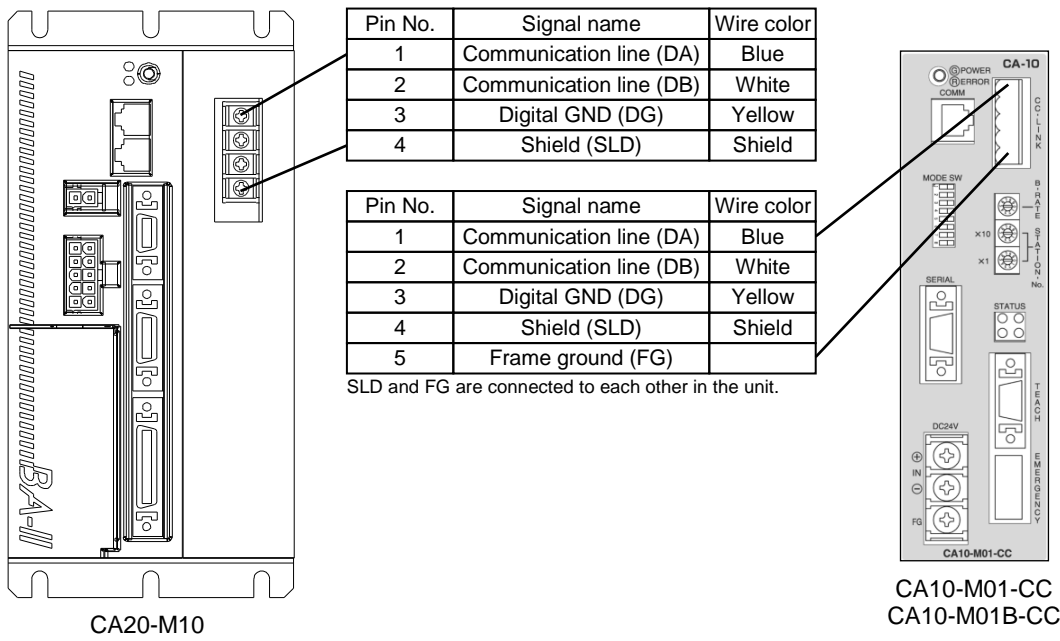
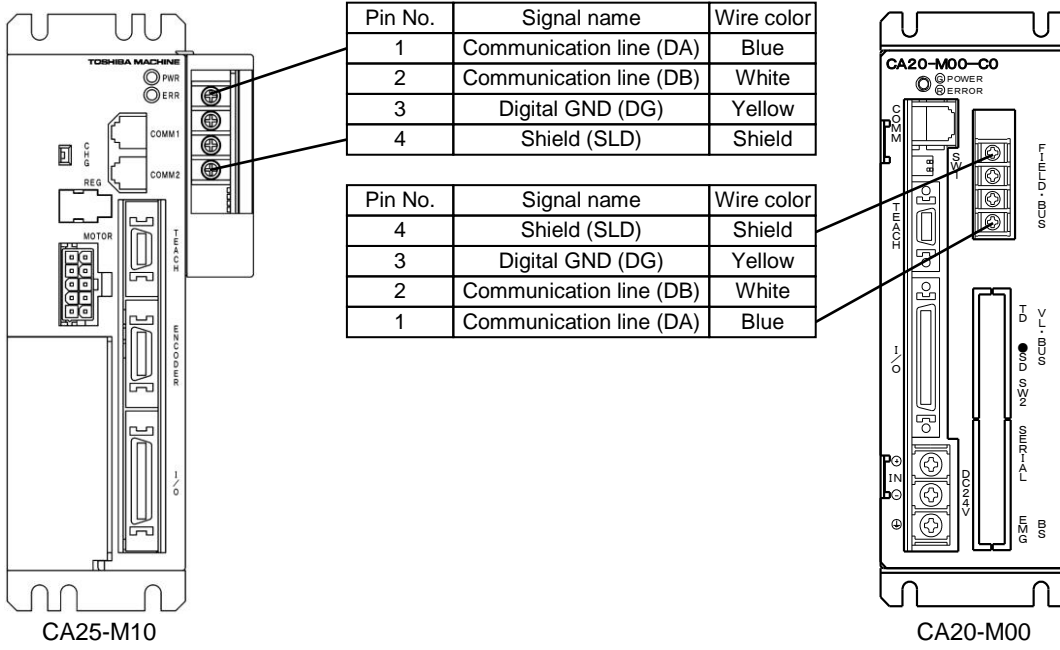
Pin No.	Signal name
46	Emergency stop input
47	Emergency stop input
48	Emergency stop output (NO)
49	Emergency stop output (COM)
50	Emergency stop output (NC)

Pin No.	Signal name
1	Emergency stop output (NC)
2	Emergency stop output (COM)
3	Emergency stop output (NO)
4	Emergency stop input
5	Emergency stop input



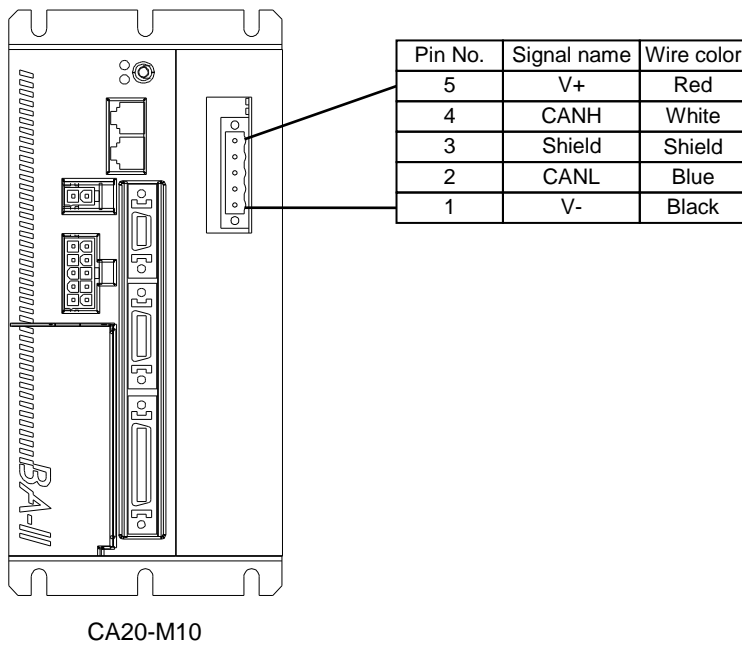
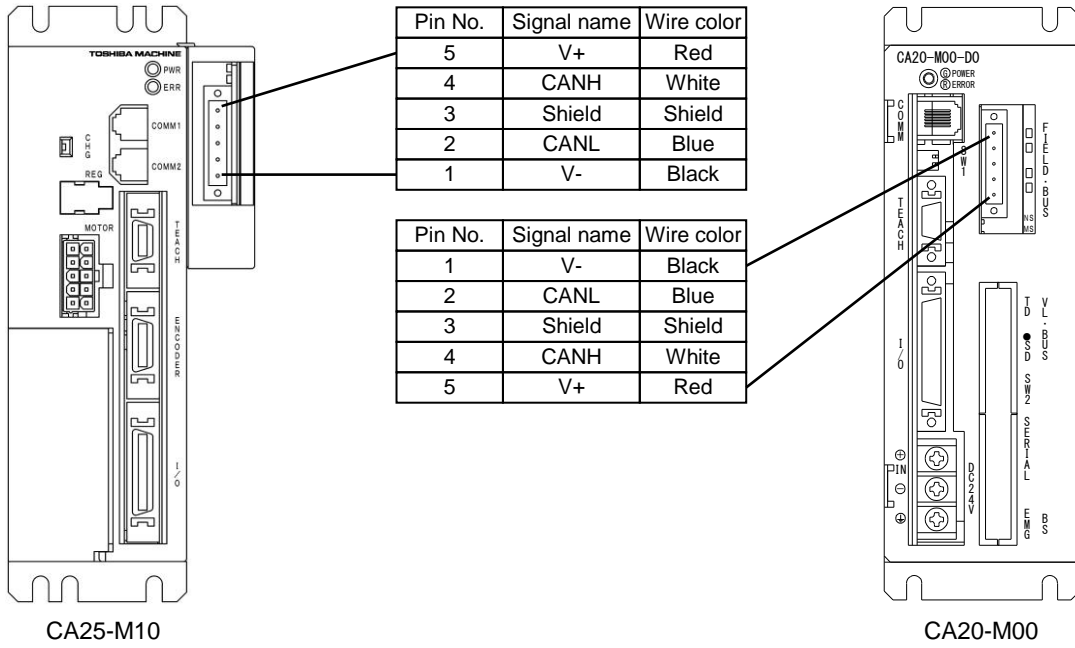
CA10-M01-CC  
CA10-M01B-CC

Figure 20.3 CC-Link wiring and pin assignment



CA10-M01-CC  
CA10-M01B-CC

Figure 20.4 DeviceNet wiring and pin assignment





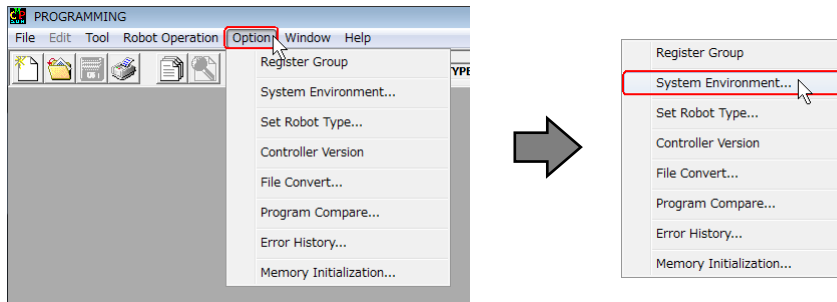
### ■ 20.3.3 Procedure of data transfer from conventional models

The conventional models which are possible to transfer data are CA20-M00/M01, CA10-M00(B)/M01(B), CA20-M10, CA10-M10, CRL/CRLAC, CM1, CM2/CM2AC, CM3 and CRH.

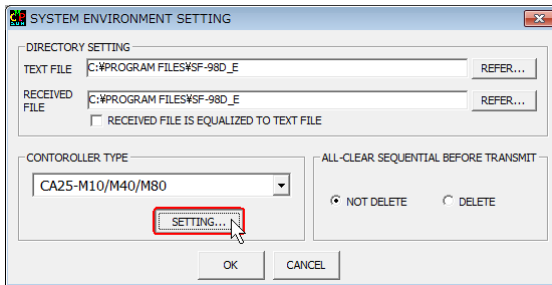
Data should be transferred according to the following procedure. In this section, the old controller is defined as the conventional controller which was used so far and the new controller is defined as CA25-M10 which will be used in future.

① Receive data from the old controller

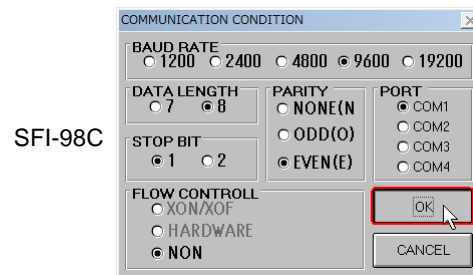
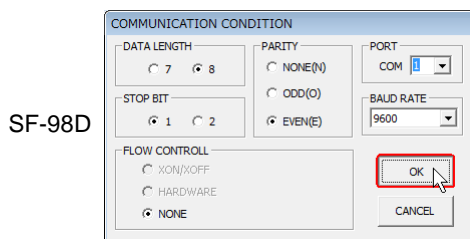
1. Connect the old controller to personal computer with communication cable (PCBL-31 or PCB-31).
2. Start SF-98D in case the old controller is CA20-M00/M01, CA10-M00(B)/M01(B), CA20-M10, CA10-M10, SFI-98C in case the old controller is CRL/CRLAC, CM1, CM2/CM2AC, CM3 and CRH.
3. Click [Option], then click [System Environment].



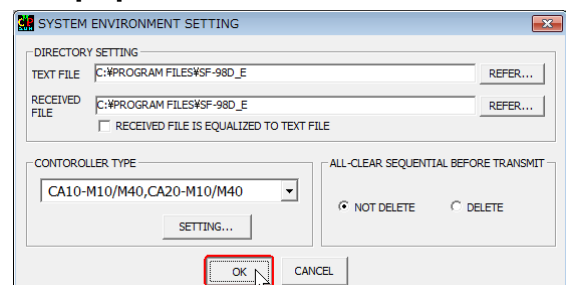
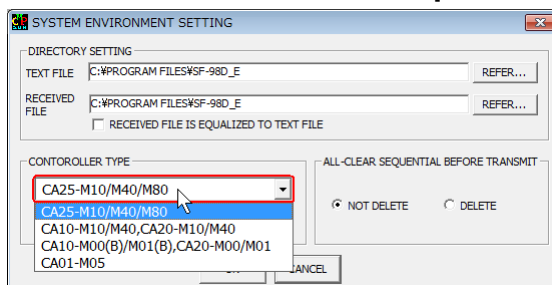
4. Click [Setting].



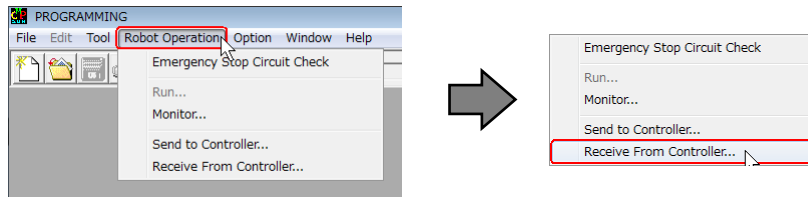
5. Set as the below screen and set [PORT] to the port connected with the communication cable, then click [OK].



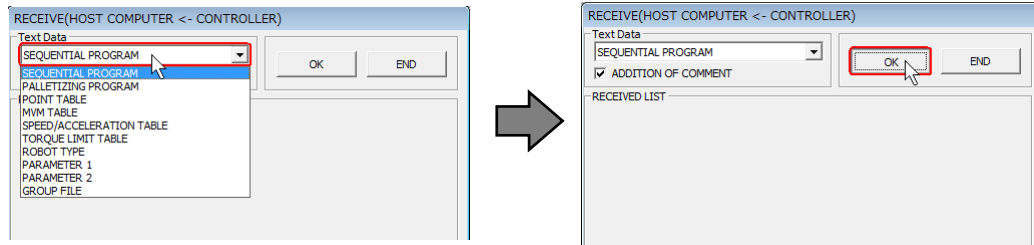
6. Select the model of the old controller in [CONTROLLER], then click [OK].



7. Click [Robot Operation], then click [Receive from Controller].



8. Select the kind of the file to transfer data, then click [OK]. Then, receive data according to the instruction of the screen.

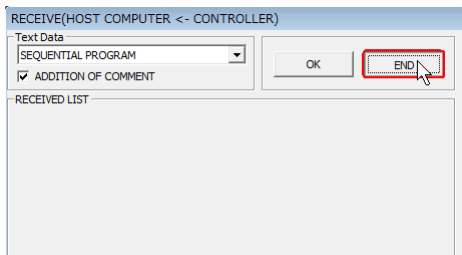


- Group file can be also selected in case the old controller is CA20-M00/M01, CA10-M00(B)/M01(B), CA20-M10, CA10-M10.
- Only the data of sequential program and point table can be transferred in case the old controller is CRL/CRLAC, CM1, CM2/CM2AC, CM3 and CRH.

9. When receiving finished, [Receiving complete.] is displayed.

10. If several files are received, repeat 8. and 9.

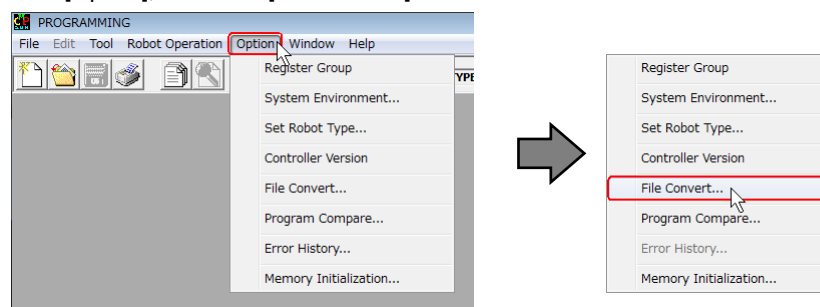
11. Click [END] after receiving all data.



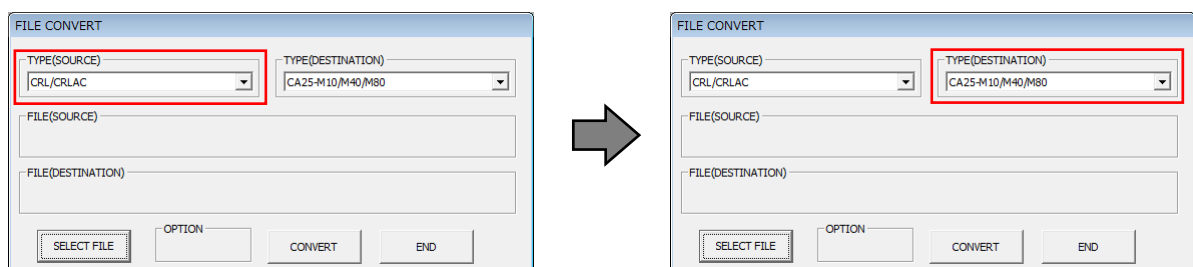
② Convert the data of the old controller to the data of the new controller.

1. Start SF-98D

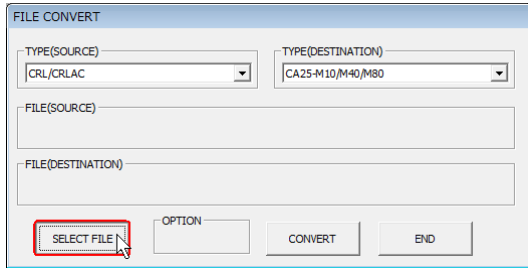
2. Click [Option], then click [File Convert].



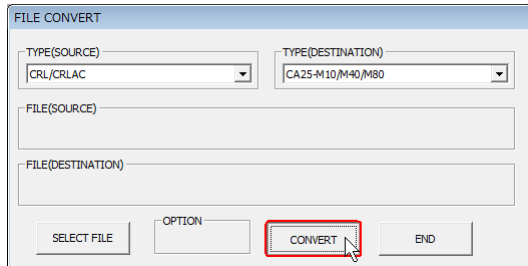
3. Select the old controller model in [TYPE(SOURCE)] and [CA25-M10/M40/M80] in [TYPE(DESTINATION)].



4. Click [SELECT FILE]. Then, select the kind and the name of the file to convert data.



5. Click [CONVERT]. Then, convert data according to the instruction of the screen.

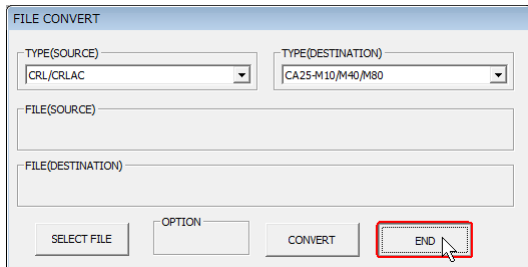


When group file is selected in case the old controller is CA20-M00/M01, CA10-M00(B)/M01(B), CA20-M10, CA10-M10, all files set valid to in the group file can be converted.

6. When file conversion succeeded, [File Convert complete.] is displayed.

7. If several files are converted, repeat from 4. to 6.

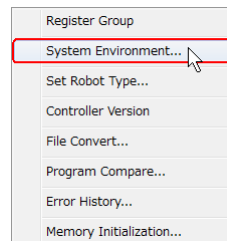
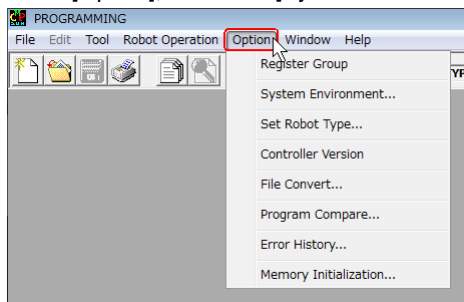
8. Click [END] after converting all data.



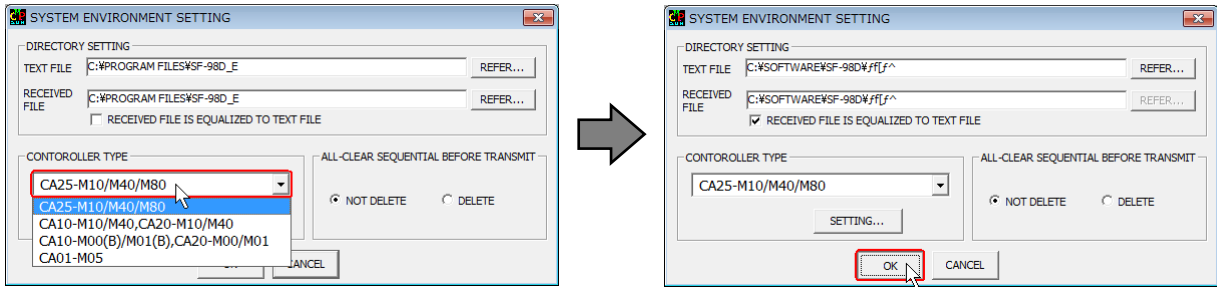
③ Reset servo gain (position) and servo gain (speed) in PARAMETER 1.  
(Because the default of servo gain varies according to the series.)

1. Start SF-98D

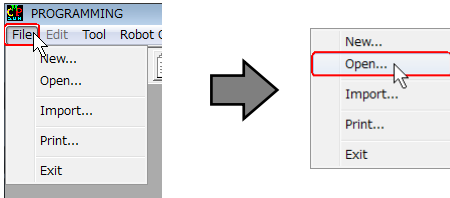
2. Click [Option], then click [System Environment].



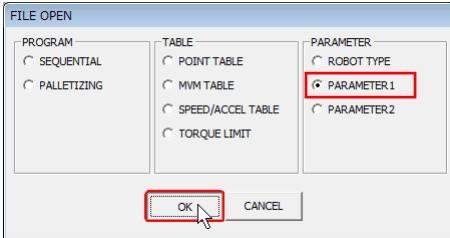
3. Select [CA25-M10/M40/M80] in [CONTROLLER], then click [OK].



4. Click [File], then click [Open].



5. Click [PARAMETER 1], then click [OK]. Then, select the file converted in ②.



6. Reset servo gain (position) and servo gain (speed) to the value corresponding to the axis type in Table 20.6 in section 20.3.2.

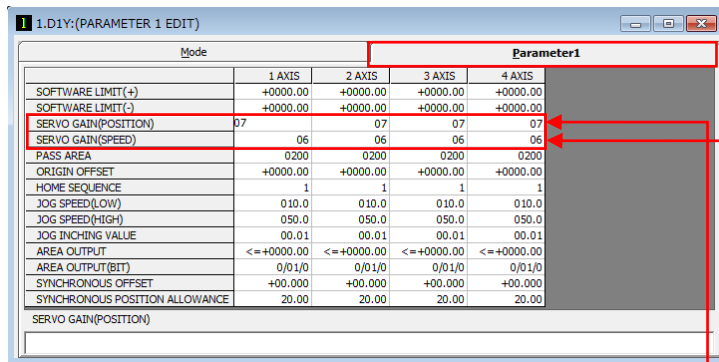
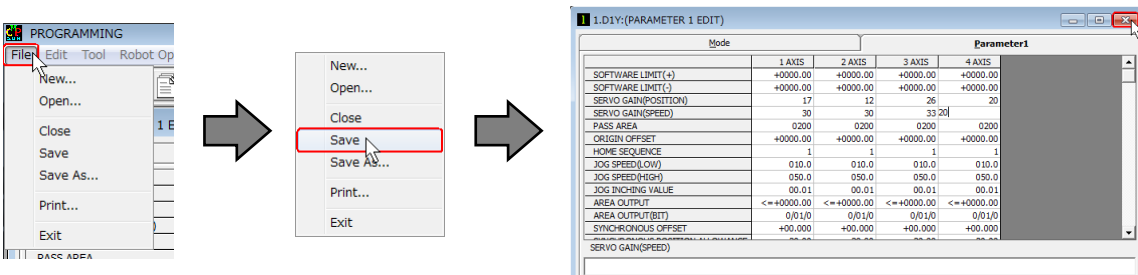


Table 20.6 Robot type correspondence table between BA II series (\*1) and BA III series (\*2)

Motor capacity	No.	BA II series (*1)				BA III series (*2)				Remarks
		Axis type	Robot type	Servo gain default		Axis type	Robot type	Servo gain default		
				Position	Speed			Position	Speed	
	1	BB00D-RH-*	510130	7	6	BE00D-RH-*	600810	35	38	Rotation axis (harmonic gear)
	2	BB00D-RP-*	510040	7	6	BE00D-RP-*	600820	24	38	Rotation axis (planetary gear)
	3	BB05D-ST-M06**	520170	7	6	BE05D-ST-M06**	600300	20	20	Ball screw drive
	4	BB05D-ST-M12**	520180	7	6	BE05D-ST-M12**	600310	20	20	Ball screw drive

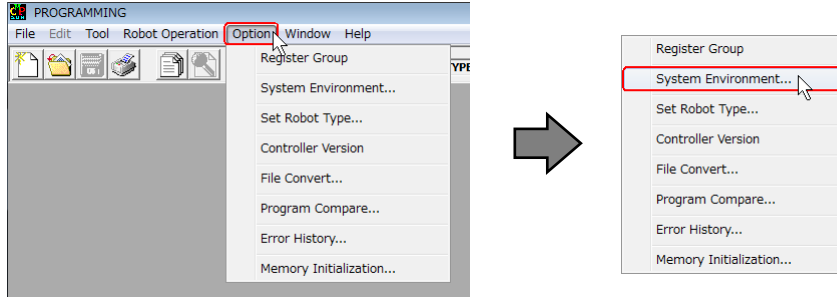
7. Click [File], then click [Save]. Then, close the screen.



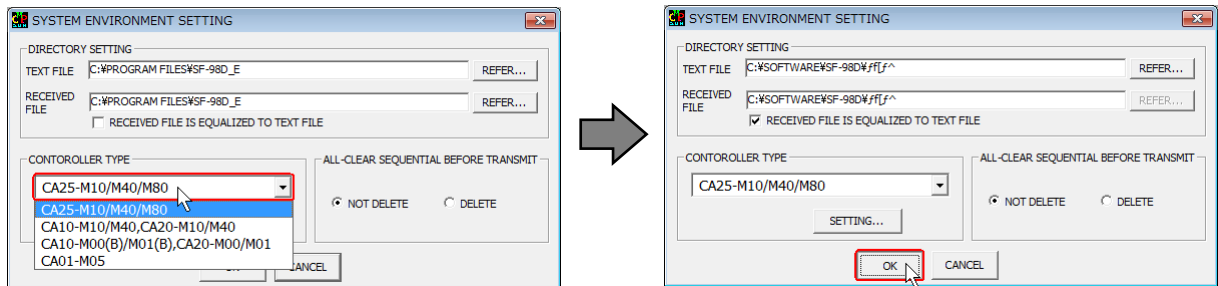
**CAUTION** Unless servo gain (position) and servo gain (speed) are reset, positioning complete time may be long or vibration and noise occur.

④ Send data to the new controller

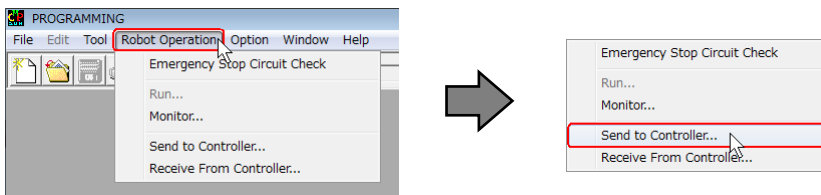
1. Connect the new controller to personal computer with communication cable (PCBL-31).
2. Start SF-98D.
3. Click [Option], then click [System Environment].



4. Select [CA25-M10/M40/M80] in [CONTROLLER TYPE], then click [OK].



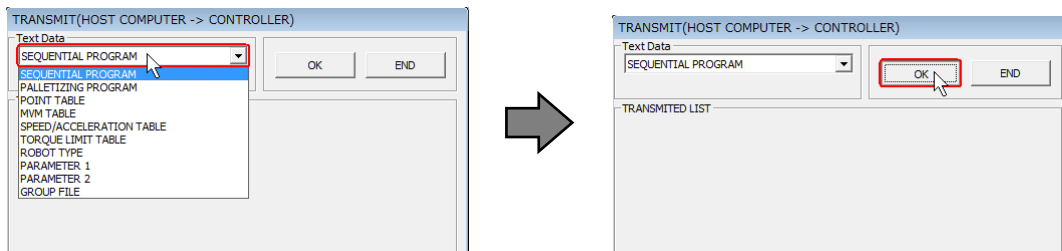
5. Click [Robot Operation], then click [Send to Controller].



6. Send converted data in the following order.

ROBOT TYPE → PARAMETER 1 → PARAMETER 2 → Other files

Select the kind of the file to transfer data, then click [OK]. Then, send data according to the instruction of the screen.

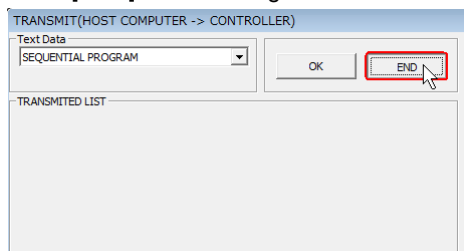


When group file is selected in case the old controller is CA20-M00/M01, CA10-M00(B)/M01(B), CA20-M10, CA10-M10, files are sent in above order.

**CAUTION** Unless files are sent in above order, a part of parameters may become to be default.

7. When sending finished, [Sending complete.] is displayed.
8. If several files are sent, repeat 6. and 7, paying attention to the sending order.

9. Click [END] after sending all data.



⑤ Confirm the motion.

Confirm the motion being ready for pushing the emergency stop button immediately because the robot may move unexpectedly.



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