PROFIBUS-DP

Operation Manual, Ninth Edition

Describes Model	
ACON	C/CG/CA/CB/CGB
PCON	C/CG/CA/CFA/ CB/CFB/CGB/CGFB
DCON	CA/CB/CGB
SCON	CA/CAL/CGAL/ CB/CGB (Servo Press)

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Operation Manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.
The DVD that comes with the product contains operation manuals for IAI products.
When using the product, refer to the necessary portions of the applicable operation manual by printing them out or displaying them on a PC.

After reading the Operation Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This Operation Manual is original.
- The product cannot be operated in any way unless expressly specified in this Operation Manual. IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Operation Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
- Using or copying all or part of this Operation Manual without permission is prohibited.
- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

⚠ Caution: The following functions are described in the separate operation manual.

	Title of operation manual/Overview	Control number
1	PROFIBUS-DP Operation Manual Refer to this operation manual if you are using an XSEL, TT, ASEL, PSEL, SSEL, SCON-C, RCS-C E-Con controller(s).	ME0153

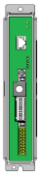
Construction of Instruction Manual for Each Controller Model and This Manual

ACON-CB/CGB
ACON-CA
ACON-C/CG
DCON-CB/CGB
DCON-CA



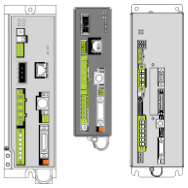
- ●Operation Patterns
  - ・Remote I/O Control Operation
  - ・Direct Number Indication Operation
  - → PROFIBUS (This Manual) ME0258
- ◎Basic Specifications and Patterns
  - → ACON-CB/CGB ME0343
  - → DCON-CB/CGB ME0343
  - → ACON-CA、DCON-CA ME0326
  - → ACON-C/CG ME0176
- ■Teaching Tool
  - ・PC Software → PC Software ME0155
  - ・Teachiong BOX (i) TB-01 → Touch Panel Teaching ME0324

PCON-CB/CFB/CGB/CGFB
PCON-CA/CFA
PCON-C/CG



- ●Operation Patterns
  - ・Remote I/O Control Operation
  - ・Direct Number Indication Operation
  - → PROFIBUS (This Manual) ME0258
- ◎Basic Specifications and Patterns
  - → PCON-CB/CFB/CGB/CGFB ME0342
  - → PCON-CA/CFA ME0289
  - → PCON-C/CG ME0170
- ■Teaching Tool
  - ・PC Software → PC Software ME0155
  - ・Teachiong BOX (i) TB-01 → Touch Panel Teaching ME0324

SCON-CB/CGB
SCON-CA
SCON-CAL/CGAL



- ●Operation Patterns
  - ・Remote I/O Control Operation
  - ・Direct Number Indication Operation
  - → PROFIBUS (This Manual) ME0258
- ◎Basic Specifications and Patterns
  - → SCON-CB/CGB ME0340
  - → SCON-CB (Servo Press Type) ME0345
  - → SCON-CA/CAL/CGAL ME0243
- ■Teaching Tool
  - ・PC Software → PC Software ME0155
  - ・Teachiong BOX (i) TB-01 → Touch Panel Teaching ME0324

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Safety Guide

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

Safety Precautions for Our Products

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

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

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

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

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

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

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

Alert Indication

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

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

Handling Precautions

1. Please see in the table below for the products explained in this instruction manual (and the chapter number explained in this manual).

○ : Applied, × : N/A, Slash : No applicable model (**) : Chapter number to describe in this manual

Type / Series	C/CG	CA/CB/CFA/CFB/ CGB/CGFB (Note 1)	CAL/CGAL	SE/PL/PO/CY	Servo Press Type
ACON	○ (Chapter 3)	○ (Chapter 4)		×	
PCON	○ (Chapter 3)	○ (Chapter 4)		×	
SCON	×	○ (Chapter 5)	○ (Chapter 5)		○ (Chapter 5)
DCON		○ (Chapter 4)			

Note 1 CFA, CFB, CGFB Type set to only PCON.

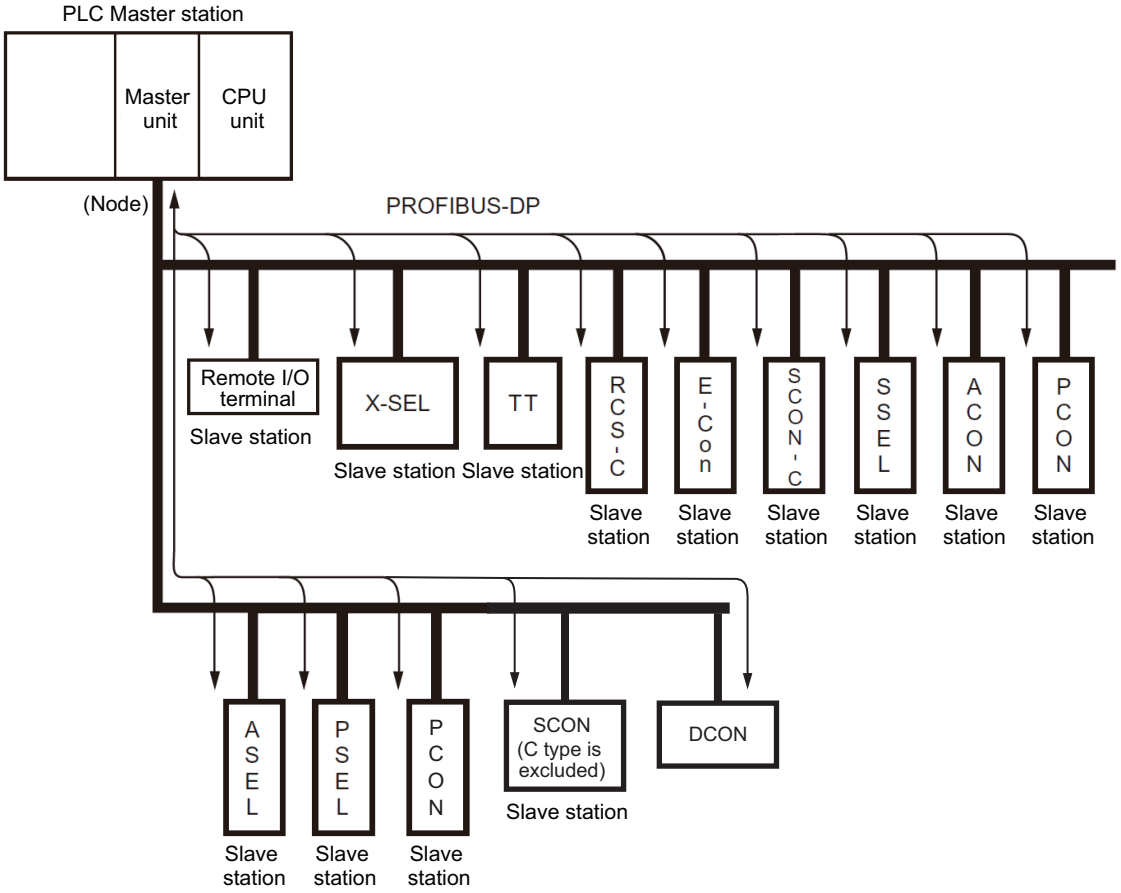
2. Servo press type, RC gateway function and ROBONET the extension I/O unit cannot be connected (control).

1. Overview

The open field network PROFIBUS-DP is a multi-bit, multi-vendor network for communication of both control and data signals of the machine/line control level.
A wire-saving system can be built by connecting IAI's X-SEL, TT, RCS-C, E-Con, SCON (C type is excluded), ASEL, PSEL, SSEL, ACON, PCON and DCON controllers (hereinafter collectively and individually referred to as "IAI controllers" or "Each Controller") to a PROFIBUS-DP network.

Each controller is treated as a slave station in PROFIBUS-DP and can be used to exchange I/O data. This Operation Manual covers the ACON, PCON, SCON (C type is excluded), and DCON series.

* For details on PROFIBUS-DP, refer to the operation manual for the programmable controller (hereinafter referred to as "PLC") in which the master unit is installed.
This operation manual should be used in conjunction with the operation manual for each controller.
You should also assume that any usage not specifically permitted in this operation manual is prohibited.



2. Specifications

2.1 Interface Specifications

The table below lists the specifications of the PROFIBUS-DP interface.

Item	Specification	Remarks	
Communication profile	PROFIBUS-DP		
Communication method	Hybrid method	Master/slave method with token passing	
Number of connectable stations	32 stations per segment	Up to 126 stations can be connected if a repeater is used.	
Communication data length	Maximum 244 bytes per frame		
Physical profile	RS485	* A general physical profile is RS485. * Use of a 9-pin D-sub connector is recommended for IP20 configurations.	
Baud rate (kbps)	9.6/19.2/93.75/187.5/500 1500/3000/6000/12000	*1	
Transmission distance	Maximum distance over the entire network	Baud rate	Cable type
	100 m	12,000/6,000/3,000 kbps	Type A cable
	200 m	1,500 kbps	
	400 m	500 kbps	
	1000 m	187.5 kbps	
	1200 m	9.6/19.2/93.75 kbps	
Topology	Bus/tree/star		
Cable	Single shielded twisted pair cable	Type A cable	

*1 The baud rate of a PROFIBUS-DP network can be specified only when the PROFIBUS-DP network is set up using a configurator (*2).

The baud rate of all PROFIBUS-DP slave modules is set with this configurator, and therefore a different baud rate cannot be set for an individual slave station.

*2 For the PROFIBUS-DP configurator, use the configurator recommended for the master unit.

3. ACON-C/CG, PCON-C/CG

3.1 Operation Modes and Functions

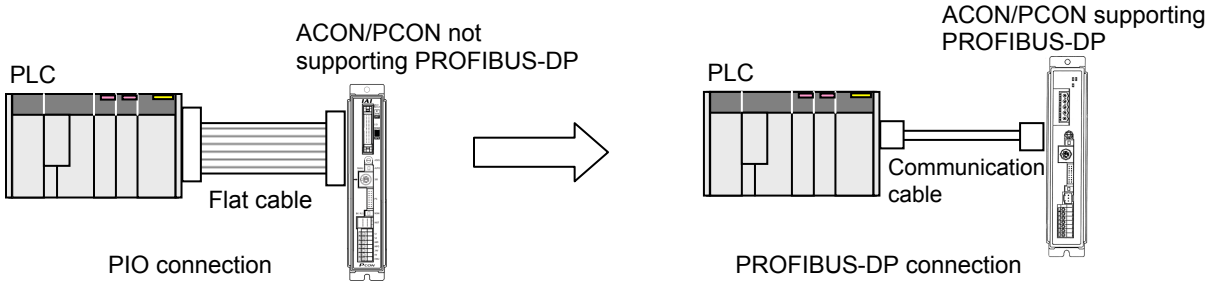
ACON and PCON controllers supporting PROFIBUS-DP can be operated in a desired operation mode selected from the following five modes.

Operation Modes and Key Functions

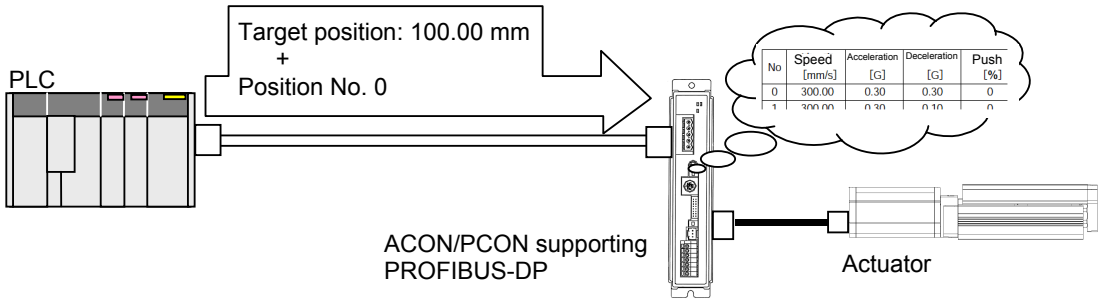
Key function	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
Number of occupied bytes	2	8	16	32	12
Operation by position data specification	x	○ (*1)	○	○	x
Direct speed/acceleration specification	x	x	○	○	x
Push-motion operation	○	○	○	○	○
Current position read	x	○	○	○	○
Current speed read	x	x	○	○	x
Operation by position number specification	○	○	x	x	○
Completed position number read	○	○	x	x	○
Maximum position table size	512	768	Not used	Not used	512

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

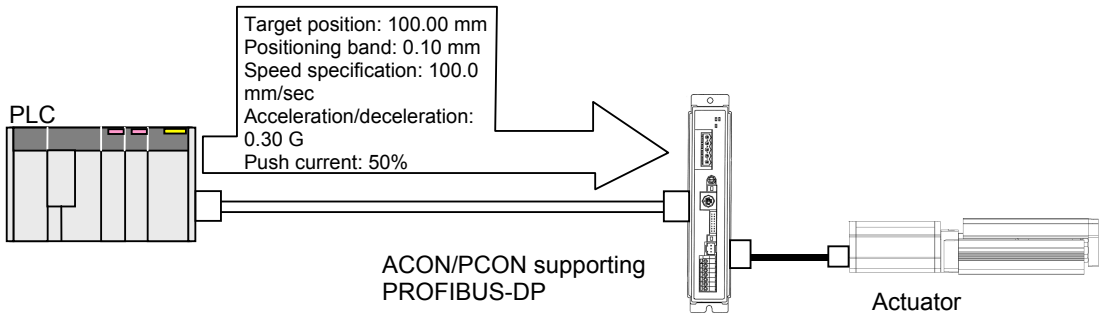
[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24 V I/Os) via PROFIBUS-DP communication.
Number of occupied bytes: 2 bytes (1 word)



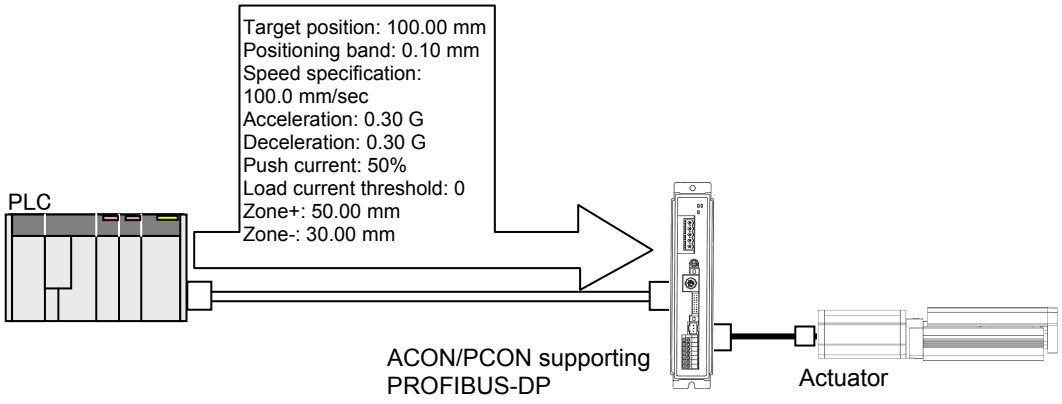
[2] Position/simple direct mode: In this mode, the actuator is operated by specifying position numbers.
You can select whether to specify the target position directly as a value, or use a value registered in the position data table, by switching a control signal.
For the speed, acceleration/deceleration, positioning band, etc., values preregistered in the position data table are used. Up to 768 position data points can be set.
Number of occupied bytes: 8 bytes (4 words)



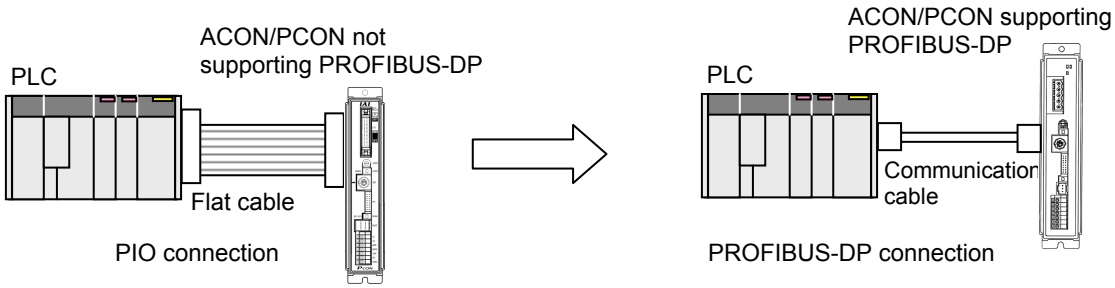
[3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.
Number of occupied bytes: 16 bytes (8 words)



[4] Full direct mode: In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, acceleration/deceleration, etc.) directly as values.
Number of occupied bytes: 32 bytes (16 words)



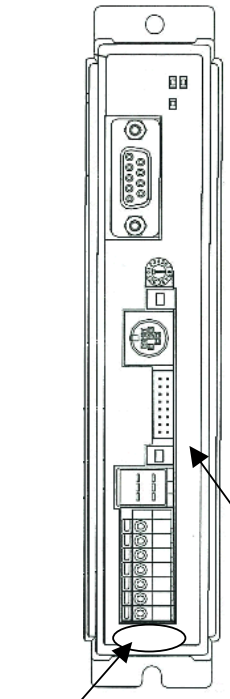
[5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication.
The current-position and command-current read functions are available in addition to the functions provided in mode [1].
Number of occupied bytes: 12 bytes (6 words)



3.2 Model Names

The model names of ACON and PCON controller supporting PROFIBUS-DP are indicated as follows, respectively:

- ACON-C/CG-☐-PR-☐
- PCON-C/CG-☐-PR-☐



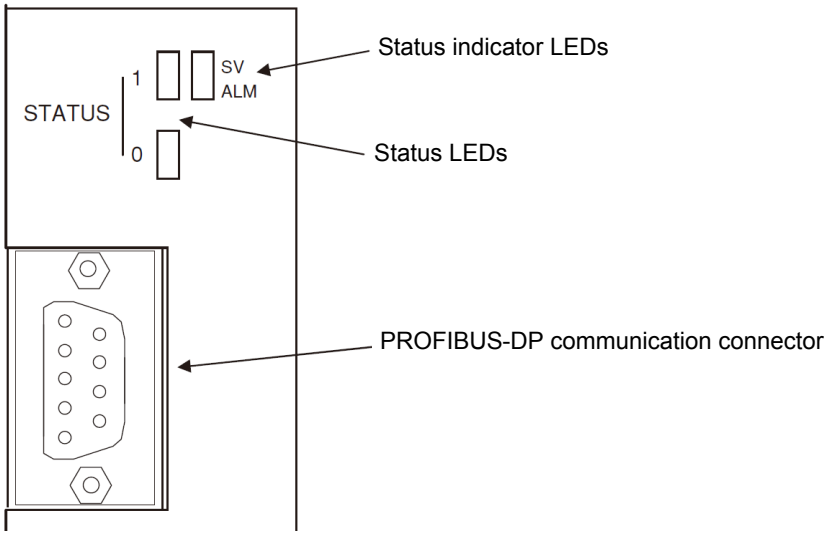
Printed series name
- ACON
- PCON

Front panel color
- ACON: Dark blue
- PCON: Dark green

3.3 PROFIBUS-DP (Slave Station) Settings

(1) Name of each part

The name of each part relating to PROFIBUS-DP is shown.



(2) PROFIBUS-DP communication connector interface specifications

This is a 9-pin, female D-sub connector recommended by the PROFIBUS-DP standard EN 50170.
Connector

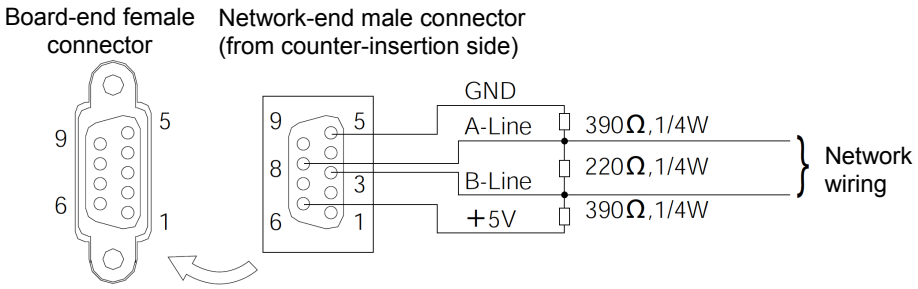
Pin No.	Description	Contents
3	B-Line	RxD, TxD (Positive signal line)
4	RTS	Request to send
5	GND	Signal ground (isolation)
6	+5V	+5-V output (isolation)
8	A-Line	/RxD, /TxD (Negative signal line)
Housing	Shield	Cable shield (enclosure and connection)

(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).
(Note 2) The cable-end connector is not supplied.

(3) Bus terminal processing

If the connector is to be connected to the network terminal node, connect the terminal resistor to the PROFIBUS-DP communication connector as shown below or use a connector with terminal resistor.

- Example of connector with terminal resistor: SUBCON-PLUS-PROFIB/AX/SC (Phoenix Contact)
- Connecting the terminal resistor



(4) Operation mode selection (setting)

Set a desired operation mode using a parameter.
Set the mode selector switch on the front side of the controller to the MANU position, and then set parameter No. 84, “FMOD: Fieldbus operation mode” using the RC PC software (V6.00.05.00 or later). (Refer to 3.7, “PROFIBUS-DP.”)

Set value	Operation mode	Number of occupied bytes
0 (factory setting)	Remote I/O mode	2
1	Position/simple direct mode	8
2	Half direct mode	16
3	Full direct mode	32
4	Remote I/O mode 2	12

* If a greater value is entered, an excessive input error will occur.

(5) Node address setting (Refer to 3.7.)

Set the node address using a parameter.
Set parameter No. 85, “NADR: Fieldbus node address” using the RC PC software.(Refer to 3.7, “PROFIBUS-DP Parameters.”)

Settable range: 0 to 125 (The parameter has been set to 1 at the factory.)

(Note 1) Pay attention to duplicate node address settings.
(Note 2) PROFIBUS-DP node addresses are set with the master station always having address 0. Accordingly, addresses of slave stations can be set between 1 and 125.

(6) Status LED indications

The board operating condition and network condition can be checked using the two LEDs provided on the front side of the controller.

○ : Lit, × : Off, ☆ : Blinking

LED	Color	Indicator condition	Description of indication (Meaning of indication)
STATUS1	Green	○	The board is online with the fieldbus network and communicating normally.
		☆	The board is offline from the fieldbus network.
	Orange	☆	A communication error is present.
		×	Offline / No power supply
STATUS0	Green	○	The board is operating properly.
		☆	The board is not yet ready.
	Orange	○	A communication hardware error was detected when the board was not yet ready.
		×	Initializing / No power supply

(Note 1) After the necessary parameters have been set, reconnect the controller power and return the mode selector switch on the front side of the controller to the AUTO position. If the switch remains in the MANU position, PLC operation cannot be performed.
(Note 2) The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

3.4 Communication with the Master Station

3.4.1 Operation Modes and Handling of PLC Addresses

The address assignments under each operation mode are shown below.

- PLC output → ACON/PCON input (* n indicates the initial output address for each axis.)

PLC output address (word address)	ACON/PCON DI and input data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Target position	Target position	Target position	Port number 0 to 15
n+1					Occupied area
n+2		Specified position number	Positioning band	Positioning band	
n+3		Control signal			
n+4			Speed	Speed specification	
n+5			Acceleration/ deceleration		
n+6			Push-current limiting value	Zone boundary+	
n+7			Control signal		
n+8				Zone boundary-	
n+9					
n+10				Acceleration	
n+11				Deceleration	
n+12				Push-current limiting value	
n+13				ACON: Occupied area / PCON: Load current threshold	
n+14				Control signal 1	
n+15				Control signal 2	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- ACON/PCON output → PLC input (* n indicates the initial input address for each axis.)

PLC input address (word address)	ACON/PCON DO and output data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Current position	Current position	Current position	Port number 0 to 15
n+1					Occupied area
n+2		Completed position number (simple alarm ID)	Command current	Command current	Current position
n+3		Status signal			
n+4			Current speed	Current speed	Command current
n+5					
n+6			Alarm code	Alarm code	
n+7			Status signal	Occupied area	
n+8					
n+9					
n+10					
n+11					
n+12					
n+13					
n+14					
n+15				Status signal	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- Reference: Example of PLC address assignment rules --- Fuji Electric
  The PLC address assignment rules are shown below.

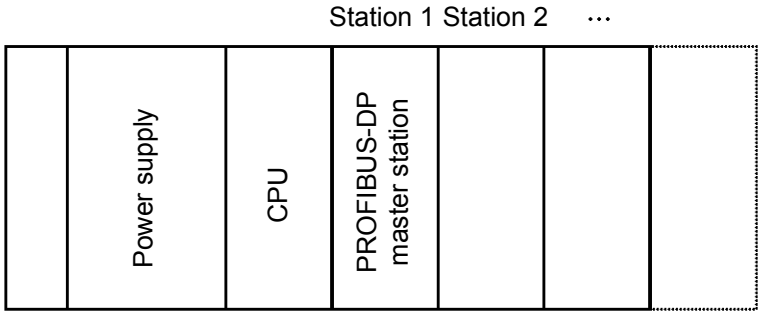
Prefix	Bus station number	.	Word number	.	Bit address

Prefix

%IX … Input bit address (address per bit)
%IW … Input word address (address per word)
%QX … Output bit address (address per bit)
%QW … Output word address (address per word)

Bus station number

This number indicates the installation position of the PROFIBUS-DP master unit within the PLC units is indicated.



Word address

Word addresses refer to addresses of DI/DOs and I/O data registers of an ACON or PCON assigned to the master station, being arranged sequentially in units of words.

Bit address

Bit addresses refer to addresses of DI/DOs and I/O data registers of an ACON or PCON assigned to a word address, being arranged sequentially in units of bits.

3.4.2 Remote I/O Mode (Number of Occupied Bytes: 2)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used. Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.

The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

○: Supported, x: Not supported

ROBO Cylinder function	PIO pattern					
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2
Home return operation	○	○	○	○	○	x
Positioning operation	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x
Speed change during movement	○	○	○	○	○	○
Operation at different acceleration and deceleration	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)
Zone signal output	○	○	○	x	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	ACON/PCON DI (port number)	PLC output address	ACON/PCON DO (port number)	PLC input address
0	0 to 15	n	0 to 15	n

Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 1 word (2 bytes) of I/O addresses.

- I/O addresses are controlled by bit ON/OFF signals from the PLC.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignments

Which signals are assigned to controller I/O ports vary according to the setting of parameter No. 25.
(For details, refer to the operation manual for the controller.)

ACON

		Setting of parameter No. 25					
Category	Port No.	Positioning mode		Teaching mode		256-point mode	
		0		1		2	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → ACON input	0	PC1	Command position number	PC1	Command position number	PC1	Command position number
	1	PC2		PC2		PC2	
	2	PC4		PC4		PC4	
	3	PC8		PC8		PC8	
	4	PC16		PC16		PC16	
	5	PC32		PC32		PC32	
	6	-	Cannot be used.	MODE	Teaching mode command	PC64	
	7	-		JISL	Jog/inching switching	PC128	
	8	-		JOG+	+Jog	-	Cannot be used.
	9	BKRL	Forced brake release	JOG-	-Jog	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	CSTR/ PWRT	Positioning start / Positioning data read command	CSTR	Positioning start
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
ACON output → PLC input	0	PM1	Completed position number	PM1	Completed position number	PM1	Completed position number
	1	PM2		PM2		PM2	
	2	PM4		PM4		PM4	
	3	PM8		PM8		PM8	
	4	PM16		PM16		PM16	
	5	PM32		PM32		PM32	
	6	MOVE	Moving signal	MOVE	Moving signal	PM64	
	7	ZONE1	Zone 1	MODES	Teaching mode signal	PM128	
	8	PZONE	Position zone	PZONE	Position zone	PZONE	Position zone
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND/ WEND	Positioning complete signal/position data read complete	PEND	Positioning complete signal
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	-	Cannot be used.	-	Cannot be used.	-	Cannot be used.

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

ACON

		Setting of parameter No. 25					
Category	Port No.	512-point mode		Solenoid valve mode 1		Solenoid valve mode 2	
		3		4		5	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → ACON input	0	PC1	Command position number	ST0	Start position 0	ST0	Start position 0
	1	PC2		ST1	Start position 1	ST1	Start position 1
	2	PC4		ST2	Start position 2	ST2	Start position 2
	3	PC8		ST3	Start position 3	-	Cannot be used.
	4	PC16		ST4	Start position 4	-	
	5	PC32		ST5	Start position 5	-	
	6	PC64		ST6	Start position 6	-	
	7	PC128		-	Cannot be used.	-	
	8	PC256		-		-	
	9	BKRL	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	-	Cannot be used.
	12	*STP	Pause	*STP	Pause	-	
	13	CSTR	Positioning start	-	Cannot be used.	-	
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
ACON output → PLC input	0	PM1	Completed position number	PE0	Completed position 0	LS0	Rear end move command 0
	1	PM2		PE1	Completed position 1	LS1	Rear end move command 1
	2	PM4		PE2	Completed position 2	LS2	Rear end move command 2
	3	PM8		PE3	Completed position 3	-	Cannot be used.
	4	PM16		PE4	Completed position 4	-	
	5	PM32		PE5	Completed position 5	-	
	6	PM64		PE6	Completed position 6	-	
	7	PM128		ZONE1	Zone 1	ZONE1	Zone 1
	8	PM256		PZONE	Position zone	PZONE	Position zone
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND	Positioning complete signal	-	Cannot be used.
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	-	Cannot be used.	-	Cannot be used.	-	Cannot be used.

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

PCON

		Setting of parameter No. 25					
Category	Port No.	Positioning mode		Teaching mode		256-point mode	
		0		1		2	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → PCON input	0	PC1	Command position number	PC1	Command position number	PC1	Command position number
	1	PC2		PC2		PC2	
	2	PC4		PC4		PC4	
	3	PC8		PC8		PC8	
	4	PC16		PC16		PC16	
	5	PC32		PC32		PC32	
	6	-	Cannot be used.	MODE	Teaching mode command	PC64	
	7	-		JISL	Jog/inching switching	PC128	
	8	-		JOG+	+Jog	-	Cannot be used.
	9	BKRL	Forced brake release	JOG-	-Jog	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	CSTR/ PWRT	Positioning start / Positioning data read command	CSTR	Positioning start
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
PCON output → PLC input	0	PM1	Completed position number	PM1	Completed position number	PM1	Completed position number
	1	PM2		PM2		PM2	
	2	PM4		PM4		PM4	
	3	PM8		PM8		PM8	
	4	PM16		PM16		PM16	
	5	PM32		PM32		PM32	
	6	MOVE	Moving signal	MOVE	Moving signal	PM64	
	7	ZONE1	Zone 1	MODES	Teaching mode signal	PM128	
	8	PZONE	Position zone	PZONE	Position zone	PZONE	Position zone
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND/ WEND	Positioning complete signal/position data read complete	PEND	Positioning complete signal
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	LOAD/ TRQS	Load output judgment/torque level	-	Cannot be used.	LOAD/ TRQS	Load output judgment/torque level

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

PCON

Category	Port No.	Setting of parameter No. 25					
		512-point mode		Solenoid valve mode 1		Solenoid valve mode 2	
		3		4		5	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → PCON input	0	PC1	Command position number	ST0	Start position 0	ST0	Start position 0
	1	PC2		ST1	Start position 1	ST1	Start position 1
	2	PC4		ST2	Start position 2	ST2	Start position 2
	3	PC8		ST3	Start position 3	-	Cannot be used.
	4	PC16		ST4	Start position 4	-	
	5	PC32		ST5	Start position 5	-	
	6	PC64		ST6	Start position 6	-	
	7	PC128		-	Cannot be used.	-	
	8	PC256		-		-	
	9	BKRL	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	-	Cannot be used.
	12	*STP	Pause	*STP	Pause	-	
	13	CSTR	Positioning start	-	Cannot be used.	-	
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
PCON output → PLC input	0	PM1	Completed position number	PE0	Completed position 0	LS0	Rear end move command 0
	1	PM2		PE1	Completed position 1	LS1	Rear end move command 1
	2	PM4		PE2	Completed position 2	LS2	Rear end move command 2
	3	PM8		PE3	Completed position 3	-	Cannot be used.
	4	PM16		PE4	Completed position 4	-	
	5	PM32		PE5	Completed position 5	-	
	6	PM64		PE6	Completed position 6	-	
	7	PM128		ZONE1	Zone 1	ZONE1	Zone 1
	8	PM256		PZONE	Position zone	PZONE	Position zone
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete	PEND	Positioning complete	-	Cannot be used.
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	LOAD/ TRQS	Load output judgment/torque level	LOAD/ TRQS	Load output judgment/torque level	-	Cannot be used.

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

3.4.3 Position/Simple Direct Mode (Number of Occupied Bytes: 8)

In this mode, the actuator is operated by specifying position numbers. You can select whether to set the target position directly as a value or use a value registered in the position data table, by switching a control signal (PMOD signal).
For all data other than the target position, such as speed, acceleration/deceleration and positioning band, values in the controller's position table are used. Set desired position data by referring to the operation manual for the controller.
Up to 768 position data points can be set.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control Δ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	Δ	Position data must be set
Pitch feed (inching)	Δ	
Push-motion operation	Δ	
Speed change during movement	Δ	
Operation at different acceleration and deceleration	Δ	
Pause	○	
Zone signal output	Δ	Zones are set using parameters.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	ACON/PCON input register	PLC output address	ACON/PCON output register	PLC input address
1	Target position	n+0	Current position	n+0
		n+1		n+1
	Specified position number	n+2	Completed position number (simple alarm code)	n+2
	Control signal	n+3	Status signal	n+3

(Note) Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 4 words (8 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- The specified position number and completed position number are both a 1-word (16-bit) binary data. Although values from 0 to 767 can be handled by the PLC, use the PC software or teaching pendant to specify a position number for which operation conditions are already set.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (upper word)																

n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified position number	—	—	—	—	—	—	PC512	PC256	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD	—	—	PMOD	MODE	PWRT	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Complete position number	—	—	—	—	—	—	PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal	EMGS	PWR	ZONE2	ZONE1	PZONE	MODES	WEND	RMDS	—	—	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.40 mm, specify “2540.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	3.6 (1)
	Specified position number	16-bit data	PC1 ~ PC512	16-bit integer. To operate the actuator, position data is needed for which operation conditions have already been entered using the PC software or teaching tools. Use this register to specify the position number for which data has been entered. The specifiable range is 0 to 767. If an out-of-range value is specified or the specified position number is not yet set, an alarm will occur when the start signal is turned ON.	3.6 (1)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	3.4.7 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	3.4.7 (19)
		b13	-	Cannot be used.	-
		b12			
		b11	PMOD	Position/simple direct switching: Position mode when the signal is OFF, or simple direct mode when the signal is ON.	3.4.7 (20)
		b10	MODE	Teaching mode command: Normal mode when the signal is OFF, or teaching mode when the signal is ON.	3.4.7 (16)
		b9	PWRT	Position data read command: Position data is read when the signal is ON.	3.4.7 (17)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	3.4.7 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	3.4.7 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	3.4.7 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	3.4.7 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	3.4.7 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	3.4.7 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	3.4.7 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	3.4.7 (6)
		b0	CSTR	Positioning start: A move command is issued when the signal turns ON.	3.4.7 (7)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	3.6 (1)
	Completed position number (simple alarm code)	16 bit	PM1 ~ PM512	16-bit integer. After the actuator has moved to the target position and entered the positioning band, the position number corresponding to the completed positioning is output. “0” is output when no position movement has been performed yet or while the actuator is moving. If an alarm occurs (= the ALM status signal turns ON), a corresponding simple alarm code (refer to the operation manual for the controller) will be output.	3.6 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	3.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	3.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	3.4.7 (12)
		b10	MODES	Teaching mode signal: The signal is ON when the teaching mode is selected.	3.4.7 (16)
		b9	WEND	Position data read complete: The signal turns ON when the position data read is complete.	3.4.7 (17)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	3.4.7 (19)
		b7	-	Cannot be used.	-
		b6			
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	3.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	3.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	3.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	3.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	3.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	3.4.7 (10)

3.4.4 Half Direct Mode (Number of Occupied Bytes: 16)

In this mode, the actuator is operated by specifying the target position, positioning band, speed, acceleration/deceleration and push current directly as values from the PLC.
Set each value in an applicable I/O address. If the zone function is used, set parameter Nos. 1, 2, 23 and/or 24.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control △ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	○	
Pitch feed (inching)	○	
Push-motion operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

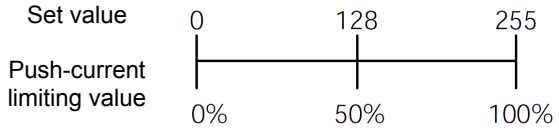
Parameter No. 84	ACON/PCON input register	PLC output address	ACON/PCON output register	PLC input address
2	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	n+6	Alarm code	n+6
	Control signal	n+7	Status signal	n+7

(Note) Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 8 words (16 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm) can be handled by the PLC.
- The speed is a 1-word (16-bit) binary data. Although values from 0 to +65535 (unit: 1.0 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator.
- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 300 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 255 (100%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1																
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3																
Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4																
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5																
Acceleration/ deceleration	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+6																
Push-current limiting value	—	—	—	—	—	—	—	—	128	64	32	16	8	4	2	1
n+7																
Control signal	BKRL	RMOD	DIR	PUSH	—	—	—	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3																
Command current (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4																
Current speed (upper word)																
n+5																
Current speed (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																
n+7																
Status signal	EMGS	PWR	ZONE2	ZONE1	—	—	—	RMDS	—	—	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	3.6 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm, while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	3.6 (2)
	Speed	16-bit data	-	16-bit integer. Specify the speed at which to move the actuator. The unit is 1.0 mm/sec, while the specifiable range is 0 to 65535. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. (Example) To set 254.0 mm/sec, specify “254.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	3.6 (2)
	Acceleration/ deceleration	16-bit data	-	16-bit integer. Specify the acceleration/deceleration at which to move the actuator. (The acceleration and deceleration become the same value.) The unit is 0.01 G, while the specifiable range is 1 to 300. (Example) To set 0.30 G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	3.6 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Push-current limiting value	16-bit data	-	16-bit integer. Specify the current-limiting value during push-motion operation. The specified range is 0 (0%) to 255 (100%). The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.) If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.	3.6 (2)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	3.4.7 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	3.4.7 (19)
		b13	DIR	Push direction specification: When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used. When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.	3.4.7 (22)
		b12	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	3.4.7 (21)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	3.4.7 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	3.4.7 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	3.4.7 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	3.4.7 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	3.4.7 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	3.4.7 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	3.4.7 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	3.4.7 (6)
		b0	DSTR	Positioning start command: A move command is issued when the signal turns ON.	3.4.7 (8)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	3.6 (2)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	3.6 (2)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	3.6 (2)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0H is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	3.6 (2)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	3.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	3.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	3.4.7 (19)
		b7	-	Cannot be used.	-
		b6			
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	3.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	3.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	3.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	3.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	3.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	3.4.7 (10)

3.4.5 Full Direct Mode (Number of Occupied Bytes: 32)

In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, etc.) directly as values from the PLC.
Set each value in an I/O address.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control x : Invalid
Home return operation	○
Positioning operation	○
Speed & acceleration/deceleration setting	○
Pitch feed (inching)	○
Push-motion operation	○
Speed change during movement	○
Operation at different acceleration and deceleration	○
Pause	○
Zone signal output	○
PIO pattern selection	x

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

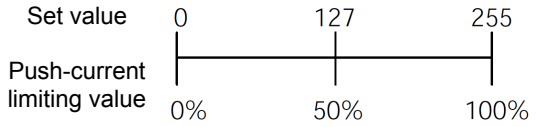
Parameter No. 84	ACON/PCON input register		PLC output address	ACON/PCON output register	PLC input address
3	Target position		n+0	Current position	n+0
			n+1		n+1
	Positioning band		n+2	Command current	n+2
			n+3		n+3
	Speed		n+4	Current speed	n+4
			n+5		n+5
	Zone boundary+		n+6	Alarm code	n+6
			n+7	Occupied area	n+7
	Zone boundary-		n+8		n+8
			n+9		n+9
	Acceleration		n+10		n+10
	Deceleration		n+11		n+11
	Push-current limiting value		n+12		n+12
	ACON	Occupied area	n+13		n+13
	PCON	Load current threshold			
	Control signal 1		n+14		n+14
	Control signal 2		n+15	Status signal	n+15

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 16 words (32 bytes) of I/O addresses.

- Control signals 1 and 2 and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm) can be handled by the PLC.
- The speed is a 2-word (32-bit) binary data. Although values from 0 to 999999 (unit: 0.01 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator.
- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 300 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 255 (100%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- Set a desired load current threshold. The load current threshold is a 1-word (16-bit) binary data. Values from 0 (0%) to 255 (100%) can be handled by the PLC. (Refer to the graph of push-current limiting value (upper graph).)
- The zone boundary+ and zone boundary- are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set values so that the zone boundary- becomes smaller than the zone boundary+.
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.

PLC output address

(* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary+ (upper word)																
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary+ (lower word)																

If the zone boundary+ is a negative value, it is expressed by a 2's complement.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+8 Zone boundary- (upper word)																
n+9 Zone boundary- (lower word)																

If the zone boundary- is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+10 Acceleration								256	128	64	32	16	8	4	2	1
n+11 Deceleration								256	128	64	32	16	8	4	2	1
n+12 Push-current limiting value								—	128	64	32	16	8	4	2	1
n+13 Load current threshold (*3)								—	128	64	32	16	8	4	2	1
n+14 Control signal 1						(※1)	ASO1	ASO0	(※2)		—	—	INC	DIR	PUSH	—
n+15 Control signal 2	BKRL	RMOD	—	—	—	—	—	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

(*1) b10 signal assignment for n+14

	Symbol	
Controller	ACON	PCON
b10	—	SMOD

(*2) b7 and b6 signal assignment for n+14

	Symbol	
Controller	ACON	PCON
b7	MOD1	—
b6	MOD0	—

(*3) Dedicated PCON function. Cannot be used on ACON.

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (upper word)																
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																
n+7~n+14	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																
n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal	EMGS	PWR	ZONE2	ZONE1	PZONE	(※1)		RMDS	GHMS	PUSH	PSFL	SV	ALM	MOVE	HEND	PEND

(*1) b10 and b9 signal assignment for n+15

	Symbol	
Controller	ACON	PCON
b10	—	LOAD
b9	—	TRQS

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Address		Bit	Symbol	Function	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	3.6 (3)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm, while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	3.6 (3)
	Speed	32-bit data	-	32-bit integer. Specify the speed at which to move the actuator. The unit is 0.01 mm/sec, while the specifiable range is 0 to 999999. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. (Example) To set 25.41 mm/sec, specify “2541.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	3.6 (3)
	Zone boundary+ / Zone boundary-	32-bit data	-	32-bit signed integer. A valid zone signal is output after the end of home return, separately from the zone boundaries specified by parameters. If the current position is inside these ± boundaries, the status signal PZONE turns ON. (Example) To set +25.40 mm, specify “2540.” The unit of specification is 0.01 mm, while the specifiable range is -999999 to 999999. Enter values satisfying the relationship of “Zone boundary+ > Zone boundary-.” If this function is not used, enter the same value for both ± boundaries. * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	3.6 (3)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Address</th><th>Bit</th><th colspan="2">Symbol</th><th>Function</th><th>Details</th></tr>
<tr><td rowspan="15">PLC output</td><td>Acceleration</td><td>16-bit data</td><td colspan="2">-</td><td rowspan="2">16-bit integer.
Specify the acceleration and deceleration at which to move the actuator.
The unit is 0.01 G, while the specifiable range is 1 to 300.
(Example) To set 0.30 G, specify “30.”
If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.</td><td rowspan="2">3.6 (3)</td></tr>
<tr><td>Deceleration</td><td>16-bit data</td><td colspan="2">-</td></tr>
<tr><td>Push-current limiting value</td><td>16-bit data</td><td colspan="2">-</td><td>16-bit integer.
Specify the current-limiting value during push-motion operation.
The specified range is 0 (0%) to 255 (100%).
The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.)
If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.</td><td>3.6 (3)</td></tr>
<tr><td>Load current threshold</td><td>16-bit data</td><td colspan="2">-</td><td>16-bit integer.
If judgment will be made as to whether or not the load current exceeded the set value, specify the threshold value for current using this register.
The specifiable range is 0 (0%) to 255 (100%).
If judgment is not performed, enter “0.”</td><td>3.6 (3)</td></tr>
<tr><td rowspan="13">Control signal 1</td><td>b15</td><td colspan="2" rowspan="5">-</td><td rowspan="5">Cannot be used.</td><td rowspan="5">-</td></tr>
<tr><td>b14</td></tr>
<tr><td>b13</td></tr>
<tr><td>b12</td></tr>
<tr><td>b11</td></tr>
<tr><td rowspan="2">b10</td><td>ACON</td><td>-</td><td>Cannot be used.</td><td>-</td></tr>
<tr><td>PCON</td><td>SMOD</td><td>Standstill control mode: When the signal is ON, servo control is performed at in a standstill state.</td><td>3.4.7 (28)</td></tr>
<tr><td>b9</td><td colspan="2">ASO1</td><td>Stop Mode 1</td><td rowspan="2">Select stop mode while standing by
<table><tr><th>ASO1</th><th>ASO0</th><th>Functions</th></tr><tr><td>OFF</td><td>OFF</td><td>Disable
(Servo is ON at all times)</td></tr><tr><td>OFF</td><td>ON</td><td>Sever turns OFF in time set in Parameter No. 36</td></tr><tr><td>ON</td><td>OFF</td><td>Sever turns OFF in time set in Parameter No. 37</td></tr><tr><td>ON</td><td>ON</td><td>Sever turns OFF in time set in Parameter No. 38</td></tr></table></td><td rowspan="2">3.4.7 (30)</td></tr>
<tr><td>b8</td><td colspan="2">ASO0</td><td>Stop Mode 0</td></tr>
<tr><td>b7</td><td rowspan="2">ACON</td><td>MOD1</td><td rowspan="2">Acceleration/deceleration mode:
<table><tr><th>MOD1</th><th>MOD0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Trapezoid pattern</td></tr><tr><td>OFF</td><td>ON</td><td>S-motion</td></tr><tr><td>ON</td><td>OFF</td><td>primary delay filter</td></tr></table></td><td rowspan="2">3.4.7 (29)</td></tr>
<tr><td>b6</td><td>MOD0</td></tr>
<tr><td>b7</td><td rowspan="2">PCON</td><td rowspan="2">-</td><td rowspan="2">Cannot be used.</td><td rowspan="2">-</td></tr>
<tr><td>b6</td></tr>
<tr><td>b5</td><td colspan="2" rowspan="2">-</td><td rowspan="2">Cannot be used.</td><td rowspan="2">-</td></tr>
<tr><td>b4</td></tr>
<tr><td>b3</td><td colspan="2">INC</td><td>Incremental specification:
Absolute position command when the signal is OFF, or incremental position command when the signal is ON.</td><td>3.4.7 (24)</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Address		Bit	Symbol	Function	Details
PLC output	Control signal 1	b2	DIR	Push direction specification: When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used. When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.	3.4.7 (22)
		b1	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	3.4.7 (21)
		b0	-	Cannot be used.	-
	Control signal 2	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	3.4.7 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	3.4.7 (19)
		b13	-	Cannot be used.	-
		b12			
		b11			
		b10			
		b9			
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	3.4.7 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	3.4.7 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	3.4.7 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	3.4.7 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	3.4.7 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	3.4.7 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	3.4.7 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	3.4.7 (6)
		b0	DSTR	Positioning start: A move command is issued when the signal turns ON.	3.4.7 (8)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	3.6 (3)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FFH = 1023 (decimal) = 1023 mA	3.6 (3)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	3.6 (3)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0 is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	3.6 (3)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	3.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	3.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	3.4.7 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	3.4.7 (12)
		b10	ACON -	Cannot be used. (ON/OFF statuses are indeterminable.)	-
			PCON LOAD	Load output judgment: Reached when the signal is ON, or not yet reached when the signal is OFF. (For details, refer to the operation manual for the controller.)	3.4.7 (26)
		b9	ACON -	Cannot be used. (ON/OFF statuses are indeterminable.)	-
			PCON TROS	Torque level: Reached when the signal is ON, or not yet reached when the signal is OFF. (For details, refer to the operation manual for the controller.)	3.4.7 (27)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	3.4.7 (19)
		b7	GHMS	Home return in progress: The signal is ON while the home return is in progress.	3.4.7 (6)
		b6	PUSHS	Push-motion operation in progress: The signal is ON while the push-motion operation is in progress.	3.4.7 (25)
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	3.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	3.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	3.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	3.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	3.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	3.4.7 (10)

3.4.6 Remote I/O Mode 2 (Number of Occupied Bytes: 12)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used. Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
This mode combines the functions available in the remote I/O mode and the current-position and command-current read functions.
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.

The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	PIO pattern					
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2
Home return operation	○	○	○	○	○	x
Positioning operation	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x
Speed change during movement	○	○	○	○	○	○
Operation at different acceleration and deceleration	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)
Zone signal output	○	○	○	x	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○

○: Supported, x: Not supported

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	ACON/PCON DI and input register	PLC output address	ACON/PCON DO and output register	PLC input address
4	Port number 0 to 15	n+0	Port number 0 to 15	n+0
	Occupied area	n+1	Occupied area	n+1
		n+2	Current position	n+2
		n+3		n+3
		n+4	Command current	n+4
		n+5		n+5

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 6 words (12 bytes) of I/O addresses.

- Addresses controlled by port numbers are controlled by bit ON/OFF signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm).
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																
n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (upper word)																
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+4																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (lower word)	I	I	I	I	I	I	I	I	I	I	I	I	524,288	262,144	131,072	65,536

(3) I/O signal assignments

For the signal assignments in each PIO pattern, refer to (3), “I/O signal assignments” under 7.4.2, “Remote I/O Mode.”

The signal assignments for command-current and current-position read functions are shown below.

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	-
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	-

3.4.7 I/O Signal Controls and Functions

* ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”
The following specifies the controls and functions of I/O signals used in the position/simple direct mode, half direct mode and full direct mode. For the I/O signals in the remote I/O mode and remote I/O mode 2, refer to the operation manual for the controller.

(1) Controller ready (PWR) PLC input signal

This signal turns ON when the controller has become ready to perform control after the power was turned on.

■ Function

This signal turns ON when the controller has been initialized successfully following a power on and become ready to perform control, regardless of the alarm condition, servo condition, etc.
The PWR signal turns ON as long as the controller is ready to perform control, even when an alarm is present.

(2) Emergency stop (EMGS) PLC input signal

This signal turns ON when the controller has entered an emergency stop mode.

■ Function

This signal turns ON when the control has entered an emergency stop mode (= the motor drive power has become cut off). It will turn OFF once the emergency stop mode is cancelled.

(3) Alarm (ALM) PLC input signal

This signal turns ON when the controller’s protective circuit (function) has detected an abnormality.

■ Function

This signal turns ON when a protective circuit (function) has actuated following a detection of abnormality.
When the cause of the alarm is removed and the reset (RES) signal is turned ON, the ALM signal will turn OFF if the applicable alarm is an operation-cancellation alarm. (In the case of a cold-start alarm, the power must be reconnected.)
Upon detection of an alarm, the status indicator LED (refer to (6) in 3.3) on the front side of the controller illuminates in red.

(4) Reset (RES) PLC output signal

This signal has two functions: it can be used to reset controller alarms or cancel the remaining travel during a pause.

■ Function

[1] If the cause of the present alarm is removed and then this signal is turned from OFF to ON, the alarm (ALM) signal will be reset. (In the case of a cold-start alarm, the power must be reconnected.)
[2] When this signal is turned from OFF to ON while the actuator is paused, the remaining travel will be cancelled.

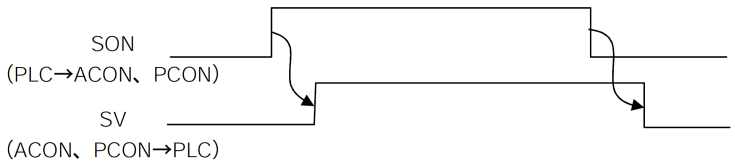
(5) Servo ON command (SON) PLC output signal

Ready (SV) PLC input signal

When the SON signal is turned ON, the servo turns ON.
When the servo turns ON, the status indicator LED (refer to (6) in 3.3) on the front side of the controller illuminates in green.
The SV signal is synchronized with this LED.

■ Function

The controller servo can be turned ON/OFF using the SON signal.
The controller servo remains ON to enable operation while the SV signal is ON.
The relationship of SON and SV signals is shown below.

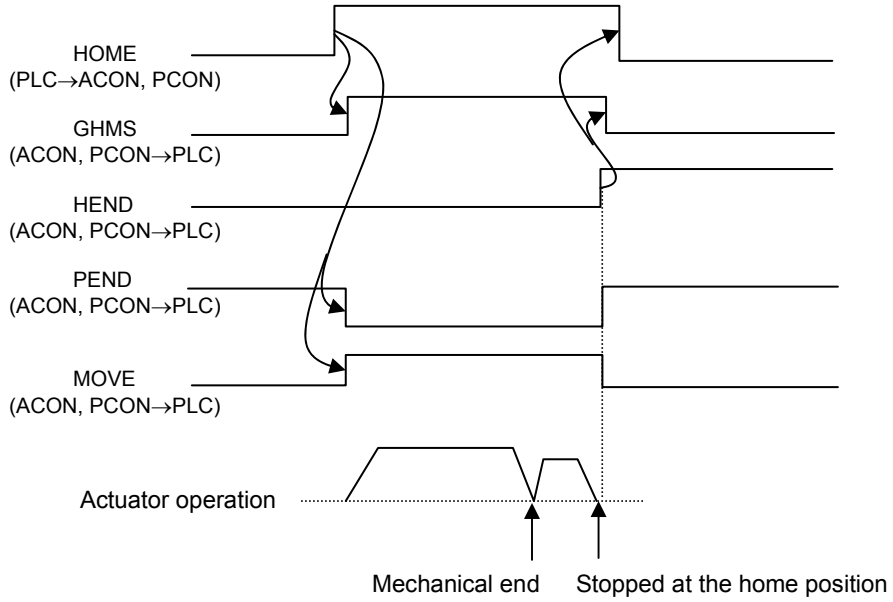


(6) Home return (HOME) PLC output signal

Home return complete (HEND) PLC input signal

Home return in progress (GHMS) PLC input signal

When the HOME signal is turned ON, the command will be processed at the leading (ON) edge of the signal and home return operation will be performed automatically. The GHMS signal turns ON while the home return is in progress.
When the home return is completed, the HEND signal turns ON while the GHMS signal turns OFF.
Turn the HOME signal OFF when the HEND signal turns ON. Once the HEND signal turns ON, it will not turn OFF until the power is turned OFF or the HOME signal is input again.
Even after home return has been completed once, another home return can be performed by turning the HOME signal ON.



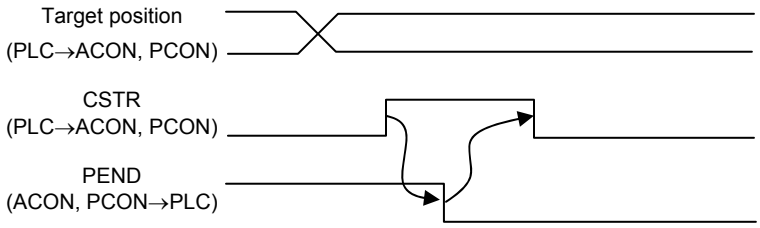
⚠ Caution: In the remote I/O mode, remote I/O mode 2 or position/simple direct mode, issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will cause the actuator to automatically return home and then perform positioning, provided that this is the first positioning command after the power on.
In the half direct mode or full direct mode, issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will generate an alarm (error code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed) (operation-cancellation alarm)). Exercise caution.

(7) Positioning start (CSTR): Used in the position/simple direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the position set by the target position corresponding to the specified position or the PLC's target position.
Whether to use the target position corresponding to the specified position number or PLC's target position is determined by the control signal b11 (position/simple direct switching (PMOD) signal).

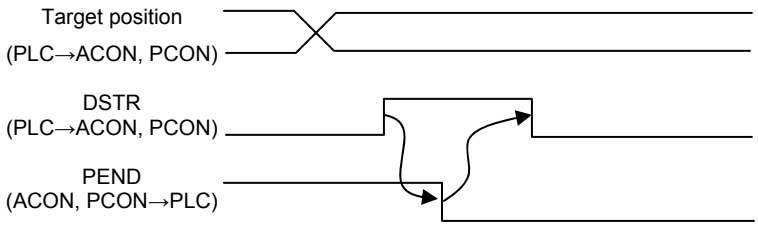
- PMOD = OFF: Use the target position data under the specified position number
- PMOD = ON: Use the set value of the PLC's target position

If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), the actuator will automatically perform home return operation and then move to the target position.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



(8) Positioning command (DSTR): Used in the half direct mode and full direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the target position entered as the PLC's target position (*). If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), an alarm (operation-cancellation alarm) will occur.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.

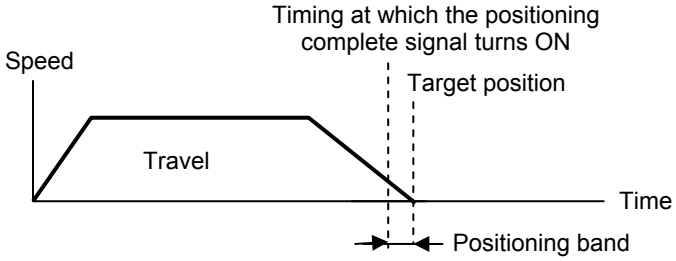


(9) Moving signal (MOVE) PLC input signal

This signal turns ON while the actuator slider or rod is moving (including cases where the actuator is performing home return operation, push-motion operation or jog operation).
The signal turns OFF after the positioning, home return or push-motion operation is completed or while the operation is paused.

(10) Positioning complete signal (PEND) PLC input signal

This signal turns ON when the actuator has moved to the target position and entered the positioning band or completed the push motion.



When the servo turns from OFF to ON, positioning is performed based on the current position being the target position. As a result, this signal turns ON and will turn OFF when another positioning operation is started subsequently using the home return (HOME) signal, positioning start (DSTR) signal or positioning command (CSTR) signal.

⚠ Caution: If the servo turns OFF or an emergency stop is actuated while the actuator is standing still at the target position, the PEND signal turns OFF.
When the servo turns ON again, the signal will turn ON if the actuator is inside the positioning band.
The PEND signal will not turn ON if the CSTR or DSTR signal is ON, even after the positioning is completed.

(11) Pause (STP) PLC output signal

When this signal is turned ON, the moving axis will decelerate to a stop. Turning it OFF will resume the axis movement.
The acceleration upon resumption of operation, and deceleration at stopping, conform to the acceleration/deceleration set by the specified position number (*) in the position/simple direct mode, or to the value of acceleration/deceleration (*) in the half direct mode.
In the full direct mode, the values of acceleration (*) and deceleration (*) are used.
(*) Refer to 3.4.1.

(12) Zone 1 (ZONE1) PLC input signal

Zone 2 (ZONE 2) PLC input signal

Position zone (PZONE) PLC input signal

Each signal turns ON when the current actuator position is inside the specified range, and turns OFF when the actuator is outside the range.

[1] Zones 1, 2

A desired zone is set using user parameters.

The ZONE1 signal is set using parameter Nos. 1, “Zone boundary 1+” and 2, “Zone boundary 1-.”

The ZONE2 signal is set using parameter Nos. 23, “Zone boundary 2+” and 24, “Zone boundary 2-.”

The ZONE1 and ZONE2 signals become valid upon completion of home return, after which they will remain valid even while the servo is turned OFF.

[2] Position zone

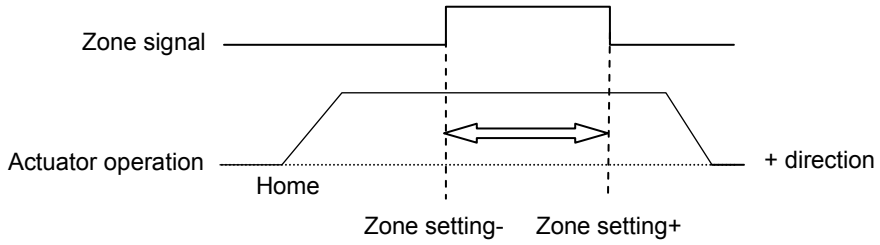
A desired zone is set using the position table or PLC.

In the position/simple direct mode, set the PZONE signal using the position table.

In the full direct mode, set the PZONE signal using the zone boundaries (refer to 3.4.1).

(*) The PZONE signal is not available in the half direct mode.

The PZONE signal becomes valid upon issuance of a move command after completion of home return, after which it will remain valid even while the servo is turned OFF.



(13) +Jog (JOG+) PLC output signal

-Jog (JOG-) PLC output signal

These signals are used as starting commands for jog operation or inching operation.
A + command starts the applicable operation in the direction opposite home, while a – command starts the applicable operation in the direction of home.

[1] Jog operation
Jog operation can be performed when the jog/inching switching (JISL) signal is OFF.
While JOG+ is ON, the actuator moves in the direction opposite home. When the signal turns OFF, the actuator will decelerate to a stop.
While JOG- is ON, the actuator moves in the direction of home. When the signal turns OFF, the actuator will decelerate to a stop.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the jog speed/inching distance switching (JVEL) signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals turn ON, the actuator will decelerate to a stop.

[2] Inching operation
Inching operation can be performed when the jog/inching switching (JISL) signal is ON.
The actuator moves by the inching distance with every ON input.
While JOG+ is ON, the actuator moves in the direction opposite home. While JOG- is ON, the actuator moves in the direction of home.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves by the travel corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves by the value of parameter No. 48, “PIO inching distance.”
  When the JVEL signal is ON, the actuator moves by the value of parameter No. 49, “PIO inching distance 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).

During normal operation, the actuator will continue with the normal operation even when the JOG+ or JOG- is turned ON (= the JOG signal will be ignored).
While paused, the actuator will not move even when the JOG+ or JOG- is turned ON.

(Note) Take note that before completion of home return, the actuator may collide with the mechanical end because the software stroke limits are not valid.

(14) Jog speed/inching distance switching (JVEL) PLC output signal

This signal switches between the parameter that specifies the jog speed to be used when the jog mode is selected, and one that specifies the inching distance to be used when the inching mode is selected.
The relationships of applicable parameters are shown below.

JVEL signal	Jog operation: JISL = OFF	Inching operation: JISL = ON
OFF	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed” Parameter No. 48, “Inching distance”
ON	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2” Parameter No. 49, “Inching distance 2”

(15) Jog/inching switching (JISL) PLC output signal

This signal switches between jog operation and inching operation.
JISL = OFF: Jog operation
JISL = ON: Inching operation
If the JISL signal switches to ON (inching) while the actuator is jogging, the actuator will decelerate to a stop and the inching function will become effective.
If the JISL signal switches to OFF (jog) while the actuator is inching, the jog function will become effective after the actuator completes its movement.
The table below specifies the relationship of the ON/OFF statuses of JISL signal and jog speed/inching distance switching (JVEL) signal.

		Jog operation	Inching operation
JISL		OFF	ON
JVEL=OFF	Speed	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed”
	Travel	-	Parameter No. 48, “Inching distance”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
JVEL=ON	Speed	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2”
	Travel	-	Parameter No. 49, “Inching distance 2”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
Operation		When JOG+/JOG- is ON	Upon detection of the leading (ON) edge of JOG+/JOG-

(16) Teaching mode command (MODE) PLC output signal

Teaching mode signal (MODES) PLC input signal

When the MODE signal is turned ON, the normal operation mode switches to the teaching mode.
When the mode switches to teaching, the controller of each axis turns ON the MODES signal.
The PLC should perform teaching operation after confirming that the MODES signal has turned ON.
(Note) For the normal operation mode to switch to the teaching mode, the following conditions must be satisfied:

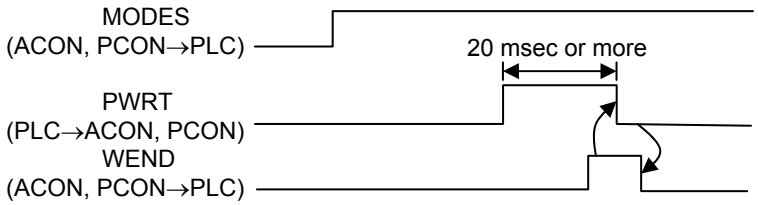
- The actuator (motor) is stopped.
- The +jog (JOG+) and -jog (JOG-) signals are OFF.
- The position data read command (PWRT) signal and positioning start (CSTR) signal are OFF.

(Note) The actuator will not return to the normal operation mode unless the PWRT signal is OFF.

(17) Position data read command (PWRT) PLC output signal

Position data read complete (WEND) PLC input signal

The PWRT signal is valid when the teaching mode signal (MODES) is ON.
Turn the PWRT signal ON (*1). This causes the current position data to be written to the Position field of the position number currently set under the position number specified by the PLC (refer to 3.4.1). (*2)
When the writing is completed, the WEND signal turns ON.
The host PLC should turn the PWRT signal OFF after the WEND signal has turned ON.
If the PWRT signal is turned OFF before the WEND signal turns ON, the WEND signal will not turn ON.
Turning the PWRT signal OFF causes the WEND signal to turn OFF.
(*1) Keep the signal ON for 20 msec or more. If the signal is turned on for less than 20 msec, the data may not be written.
(*2) If any data other than position is yet to be defined, the default value of the corresponding parameter is written. (Refer to the operation manual for the controller.)



(18) Forced brake release (BKRL) PLC output signal

The brake can be forcibly released by turning this signal ON.

(19) Operation mode (RMOD) PLC output signal

Operation mode status (RMDS) PLC input signal

A different operation mode is selected as follows based on the RMOD signal and the MODE switch on the front side of the controller.
Whether the current mode is AUTO or MANU can be checked using the RMDS signal.
RMOD signal and mode switch combinations, and corresponding operation modes, are shown below.

	Controller's MODE switch in AUTO position	Controller's MODE switch in MANU position
RMOD signal OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

(Note) Operation from the PLC is not supported in the MANU mode.

(20) Position/simple direct switching (PMOD) PLC output signal

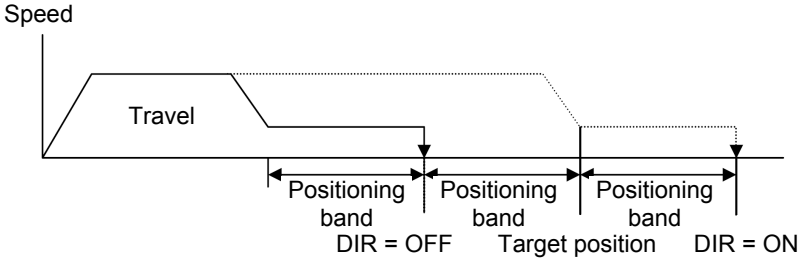
This signal switches between the mode where a value registered in the controller's position table is used as the target position for movement, and the mode where the PLC's target position (*) is used.
PMOD = OFF: Use the position table
PMOD = ON: Use the value of the PLC's target position(*)
(*) Refer to 3.4.1.

(21) Push specification (PUSH) PLC output signal

When a move command is issued after turning this signal ON, the actuator will perform push-motion operation.
If this signal is turned OFF, the actuator will perform normal positioning operation.
(Refer to (2), "Operation in the half direct mode" under 3.6, "Operation.")

(22) Push direction specification (DIR) PLC output signal

This signal specifies the direction in which the actuator will push the load.
When this signal is turned OFF, the actuator will push the load toward the position obtained by subtracting the positioning band from the target position.
When this signal is turned ON, the actuator will push the load toward the position obtained by adding the positioning band to the target position.
This signal is invalid during normal positioning operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 3.6, "Operation.")



(23) Missed load during push-motion operation (PSFL) PLC input signal

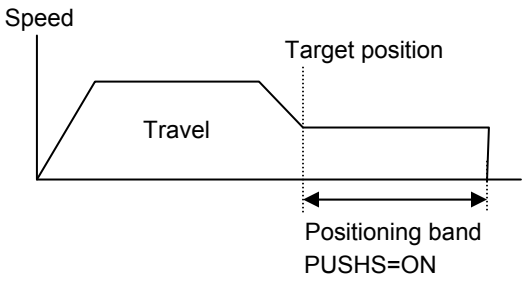
This signal turns ON when the actuator has not contacted the load after having travelled the distance set by the positioning band in the controller's position table or PLC's positioning band (refer to 3.4.1) during push-motion operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 3.6, "Operation.")

(24) Incremental specification (INC) PLC output signal

When a move command is issued while this signal is ON, the actuator will move by the value entered as the PLC's target position (*) with reference to the current position. (Incremental moves)
If this signal is OFF, the actuator will move to the value of the PLC's target position (*).
(*) Refer to 3.4.1.

(25) Push-motion operation in progress (PUSHS) PLC input signal

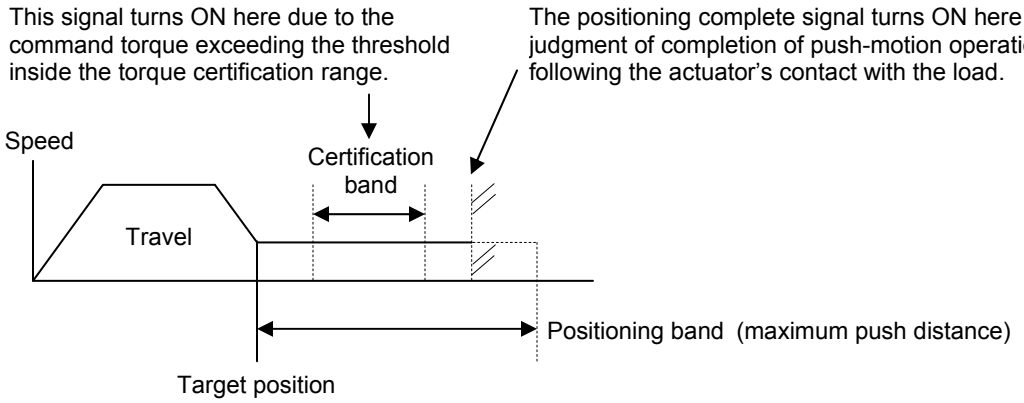
This signal turns ON while the push-motion operation is in progress.



This signal turns OFF if the actuator has missed the load in push-motion operation or paused, or the next move command has been issued, or the servo has been turned OFF.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 3.6, "Operation.")

(26) Load output judgment (LOAD) PLC input signal Dedicated PCON function

This signal is valid only during push-motion operation.
To use an actuator in a press-fit application, whether or not the specified load threshold has reached during the push-motion operation must be recognized.
The load threshold and certification band are set by the PLC, and this signal will turn ON when the command torque (motor current) exceeds the threshold inside the certification band.
For this signal, judgment is made based on whether the command torque has exceeded the threshold for the specified total time.
The specific procedure is the same as that for push judgment. The load output judgment time can be changed as desired using parameter No. 50, "Load output judgment time."
This signal will be retained until the next move command is received.

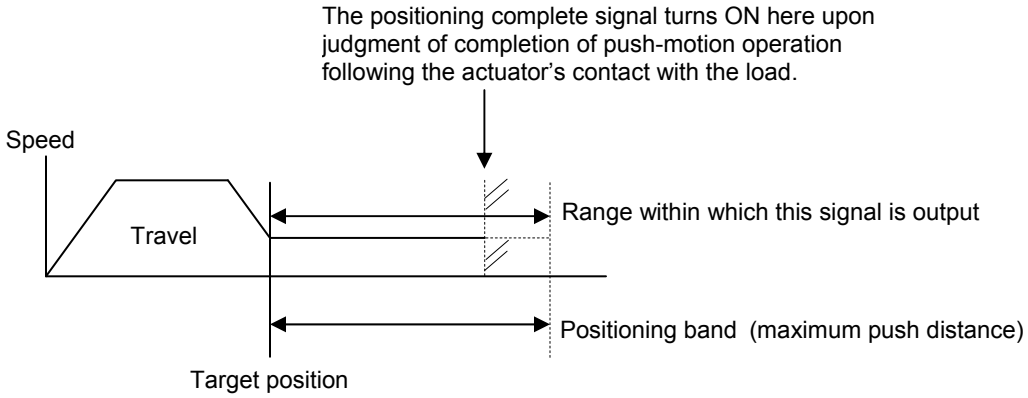


- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "0 [Enable]."
- Set the threshold certification band using the PLC's zone boundary+ and zone boundary- (*).
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 3.4.1.

⚠ Warning:
- If the actuator contacts the load before the target position is reached, a servo error will occur. Pay due attention to the position relationship of the target position and load.
- The actuator continues to push the load at the standstill push current determined by the current-limiting value.
  Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(27) Torque level (TRQS) PLC input signal Dedicated PCON function

This signal is valid only during push-motion operation.
This signal turns ON when the motor current has reached the load threshold during push-motion operation (while the actuator is moving inside the positioning band). Since the current is monitored by level, when the current changes the ON/OFF status of this signal will also change. The speeds that can be used for push-motion operation vary depending on the motor and lead. Accordingly, the applicable parameters must be adjusted.



- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "1 [Disable]."
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 3.4.1.

⚠ Warning:
- If the actuator contacts the load before the target position is reached, a servo error will occur. Pay due attention to the position relationship of the target position and load.
- The actuator continues to push the load at the standstill push current determined by the current-limiting value.
  Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(28) Standstill control mode (SMOD) PLC output signal Dedicated PCON function

One general characteristic of pulse motors is that their holding current in a standstill state is greater than that of AC servo motors. Accordingly, a means to reduce power consumption in a standstill state is provided as an energy-saving measure to address situations where the actuator remains standstill for a long period at a standby position.
SMOD = ON: Use the full-servo control mode during standby
SMOD = OFF: Normal standby mode

- Full-servo control mode
  The holding current can be reduced by servo-controlling the pulse motor.
  Although the specific level of reduction varies according to the actuator model, load condition, etc., the holding current will decrease to approx. 1/2 to 1/4.
  The actual holding current can be checked on the current monitor screen of the PC software.
  (Note) Micro-vibration or noises may occur in conditions where the actuator is subject to external forces or depending on the standstill position.

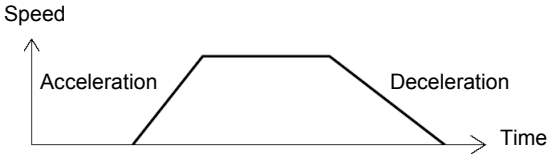
Before using this mode, confirm that the overall system will not be negatively affected.

(29) Acceleration/deceleration mode (MOD1, MOD0) PLC output signal Dedicated ACON function

This signal is used to select a desired acceleration/deceleration pattern characteristic. Select one characteristic before issuing an actuator move command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid pattern	Factory setting
OFF	ON	S-motion	
ON	OFF	Primary delay filter	
ON	ON	Cannot be used.	

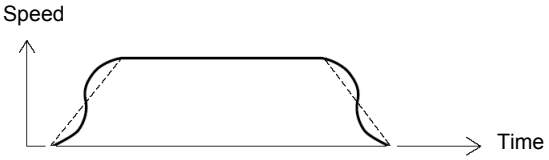
Trapezoid pattern



* The acceleration and deceleration are set in the “Acceleration” and “Deceleration” fields of the position data table.

S-motion

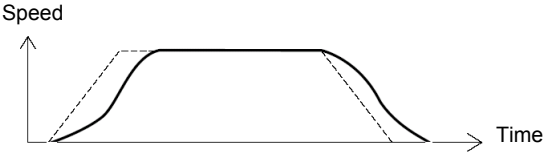
The acceleration/deceleration curve rises gradually at first and then draws a steep curve from a certain point. Use this mode if you want to set high acceleration/deceleration to meet the tact time requirement, but keep the acceleration/deceleration gradual at the start of movement or immediately before stopping.



* The S-motion level is set using parameter No. 56, “S-motion ratio setting.” The setting unit is %, while the setting range is 0 to 100.
(The above graph shows a curve assuming a 100% S-motion ratio.)
When “0” is set, the S-motion mode is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

Primary delay filter

A more gradual acceleration/deceleration curve than linear acceleration/deceleration (trapezoid pattern) is drawn. Use this mode if you don’t want the load to receive micro-vibration during acceleration/deceleration.

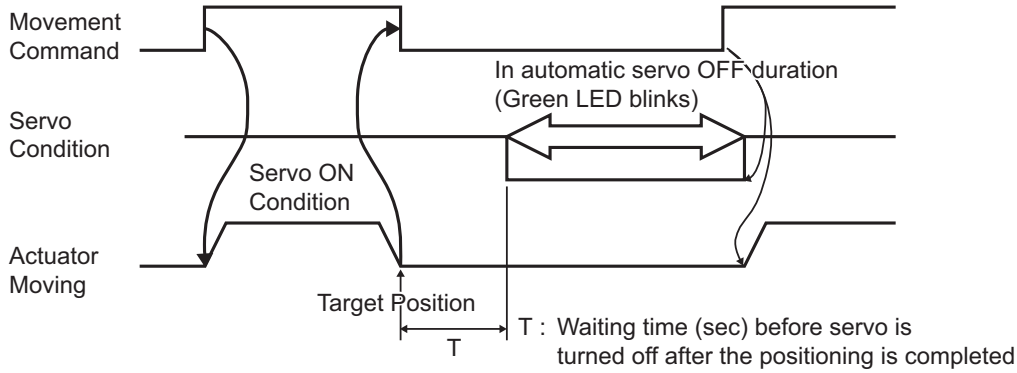


* The primary delay level is set using parameter No. 55, “Position-command primary filter time constant.” The minimum input unit is 0.1 msec, while the setting range is 0.0 to 100.0.
When “0” is set, the primary delay filter is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

(30) Stop Mode Selection (ASO1, ASO0) PLC Output Signal

Select the stop mode for the duration before the movement to the next position after a positioning is completed. If the duration for a stop is long, the system automatically turns the servo OFF to reduce the power consumption. Refer to the operation manual for the controller for more information.

ASO1	ASO0	Function	Reference
OFF	OFF	Disabled	Set in delivery
OFF	ON	Automatic Servo OFF Method Parameter No. 36 is valid for T	
ON	OFF	Automatic Servo OFF Method Parameter No. 37 is valid for T	
ON	ON	Automatic Servo OFF Method Parameter No. 38 is valid for T	



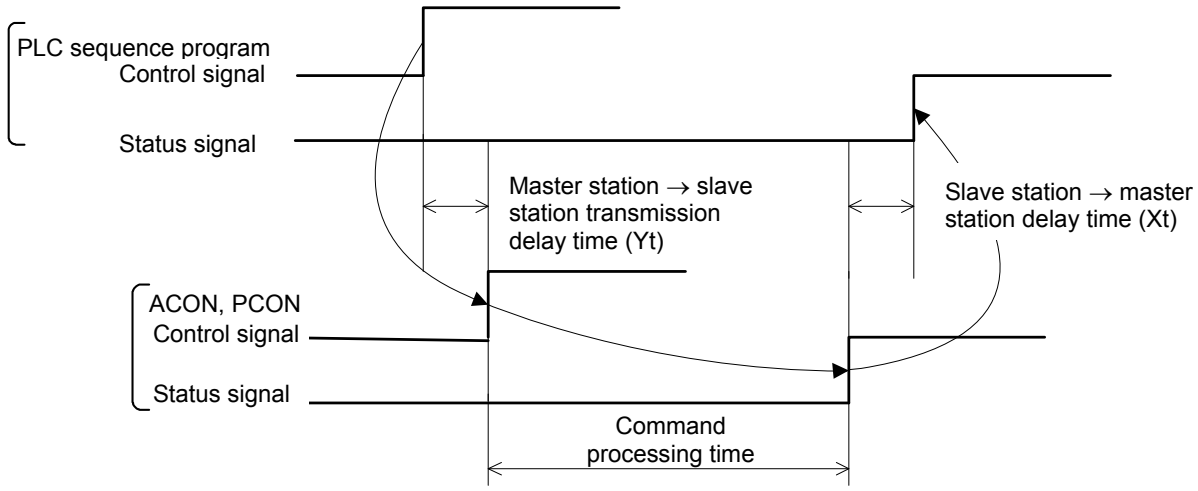
3.5 I/O Signal Timings

The maximum response time after a given control signal is turned ON to operate the ROBO Cylinder using the PLC's sequence program, until a response (status) signal is turned, is expressed by the formula below:

Maximum response time (msec) = Yt + Xt + 2 + Command processing time (operation time, etc.)

Yt: Master station → slave station transmission delay time
Xt: Slave station → master station delay time
} Field network transmission delay time

For the master station → slave station transmission delay time (Yt) and slave station → master station delay time (Xt), refer to the operation manuals for the PROFIBUS-DP master unit and the PLC in which the master unit is installed.



3.6 Operation

Next, timings in the position/simple direct mode, half direct mode and full direct mode are explained using examples of basic operations.
For the remote I/O mode and remote I/O mode 2, refer to the operation manual for the controller.
(In remote I/O mode 2, read the current position and current speed from the PLC as deemed necessary.)

(1) Operation in the position/simple direct mode

Operate the actuator by writing the position data to the PLC's target position, while specifying the speed, acceleration/deceleration, positioning band, push-current limiting value, etc., in the position table.

- Example of operation (normal positioning operation)

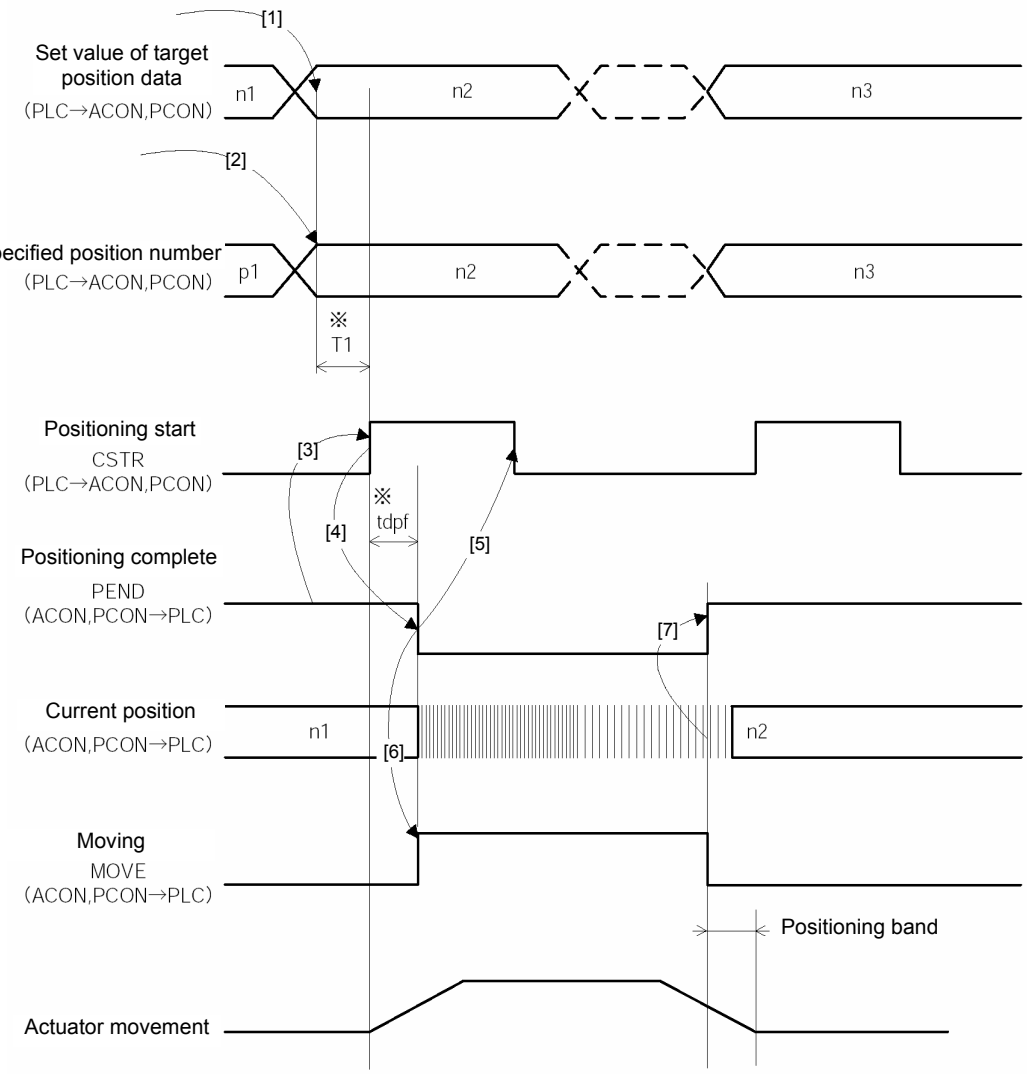
(Preparation) Set all position data other than the target position (speed, acceleration/deceleration, positioning band, etc.) in the position table.
Turn the position/simple direct switching (PMOD) signal ON.

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the position number for which the speed, acceleration/deceleration, etc., have been set for the specified position number corresponding to output address n+2 (*).
[3] Turn the positioning start (CSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] and [2] are read by the controller at the leading edge of the CSTR signal.
[4] The CSTR signal turns ON and PEND turns ON tpdf thereafter.
[5] Turn the CSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the target value (*) until the CSTR signal is turned OFF.
[6] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[7] The current position data (*) in input addresses n and n+1 are constantly updated. When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON if the CSTR signal is OFF, upon which the completed position number is output to the completed position number (*) corresponding to input address n+2.
Accordingly, wait until the PEND signal turns ON and an appropriate time (time to move the remaining travel) elapses before reading the completed position number (*) following the completion of positioning.
The current position data may vary slightly due to vibration, etc., even when the actuator is at standstill.
[8] The target position data can be changed while the actuator is moving.
To change the target position, change the target position data, wait until at least the PLC's scan time elapses, and then turn the CSTR signal ON.
Change the value of the CSTR signal after an elapse of at least the PLC's scan time.

- Example of operation (push-motion operation)

In push-motion operation, a current-limiting value is set in the Push field of the position data table in the "preparation" stage.
When positioning is started by specifying the position number for which the above value has been set in the Push field, push-motion operation is performed.

(*) Refer to 3.4.1.



*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※Yt+Xt≦tdpf≦Yt+Xt+2 (msec)

(2) Operation in the half direct mode

Operate the actuator by specifying data for the PLC's target position, positioning band, specified speed, acceleration/deceleration and push-current limiting specification.

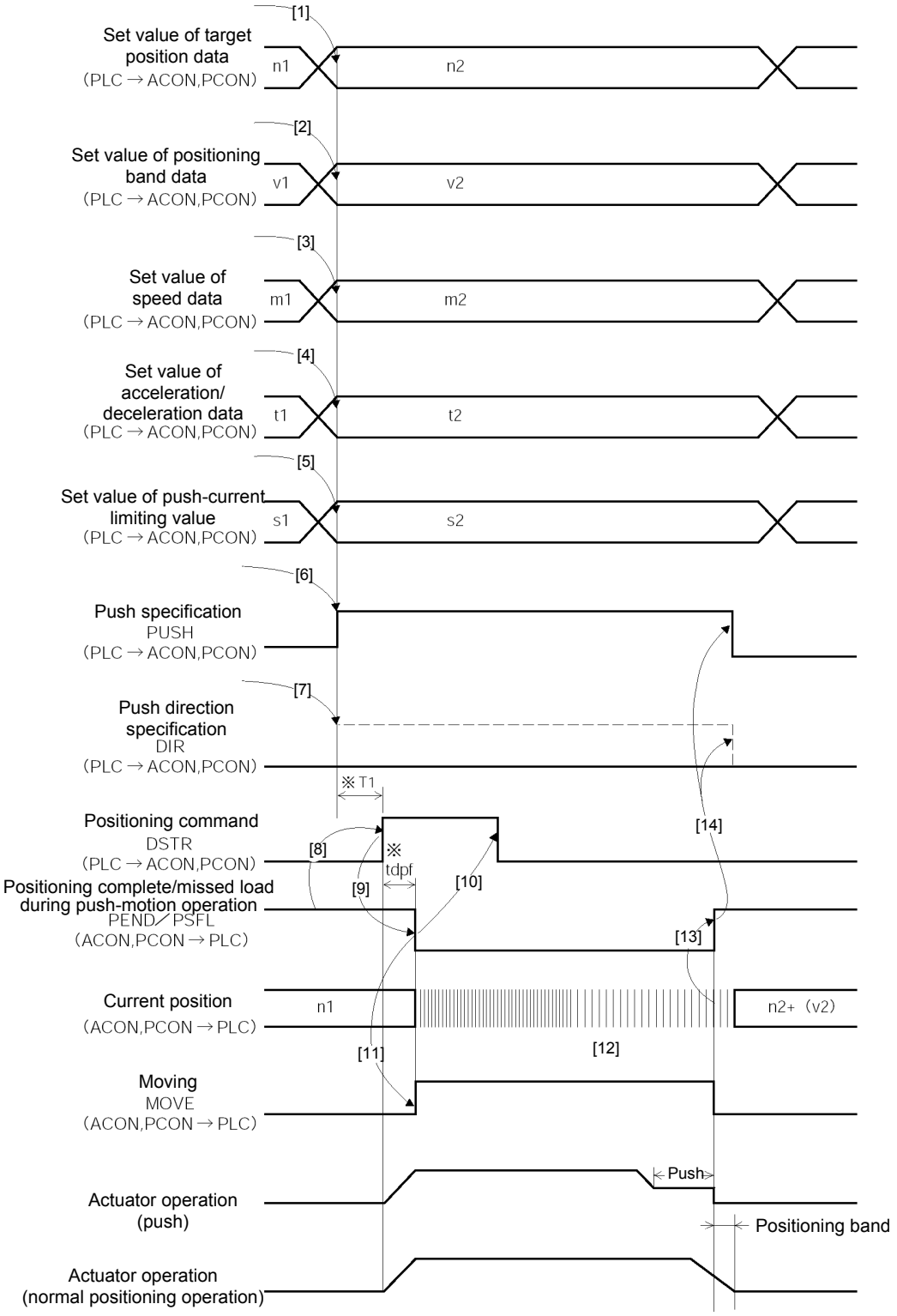
- Example of operation (push-motion operation)

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set the speed data for the speed (*) corresponding to output address n+4.
[4] Set the acceleration/deceleration data for the acceleration/deceleration (*) corresponding to output address n+5.
[5] Set the push-current limiting data for the push-current limiting value (*) corresponding to output address n+6.
[6] Turn the push specification (PUSH) signal ON.
[7] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 3.4.7.)
[8] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [5] are read by the controller at the leading edge of the DSTR signal.
[9] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[10] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [5] until the DSTR signal is turned OFF.
[11] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[12] The current position data (*) in input addresses n and n+1 are constantly updated.
[13] The PEND signal turns ON when the motor current reaches the current-limiting value set in [5] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [5] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[14] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [6] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 3.4.1.



*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※ Yt+Xt ≦ tdpf ≦ Yt+Xt+2 （msec）

(3) Operation in the full direct mode

Operate the actuator by specifying from the PLC all conditions required for positioning, such as the PLC's target position and positioning band.

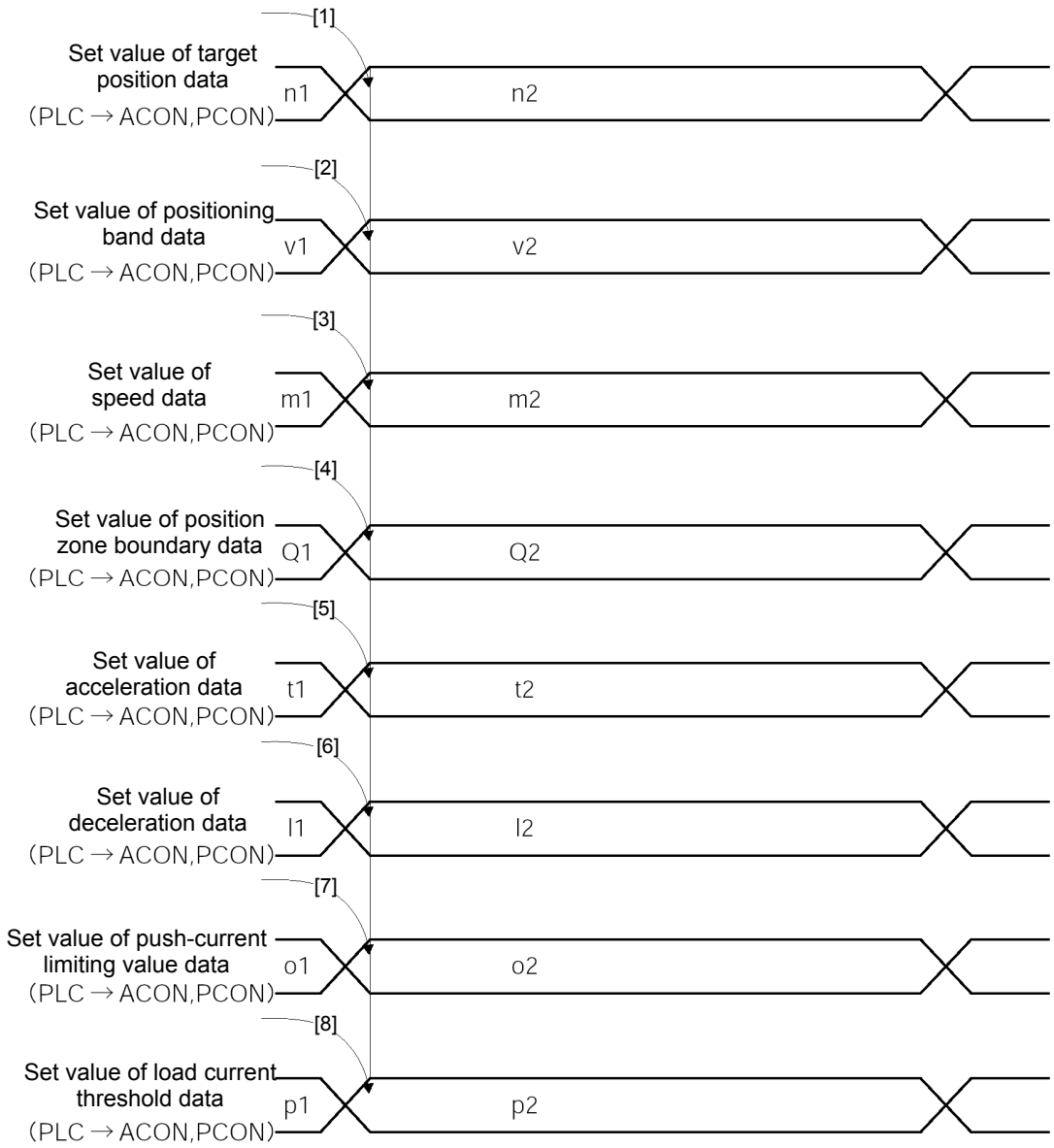
- Example of operation (push-motion operation)

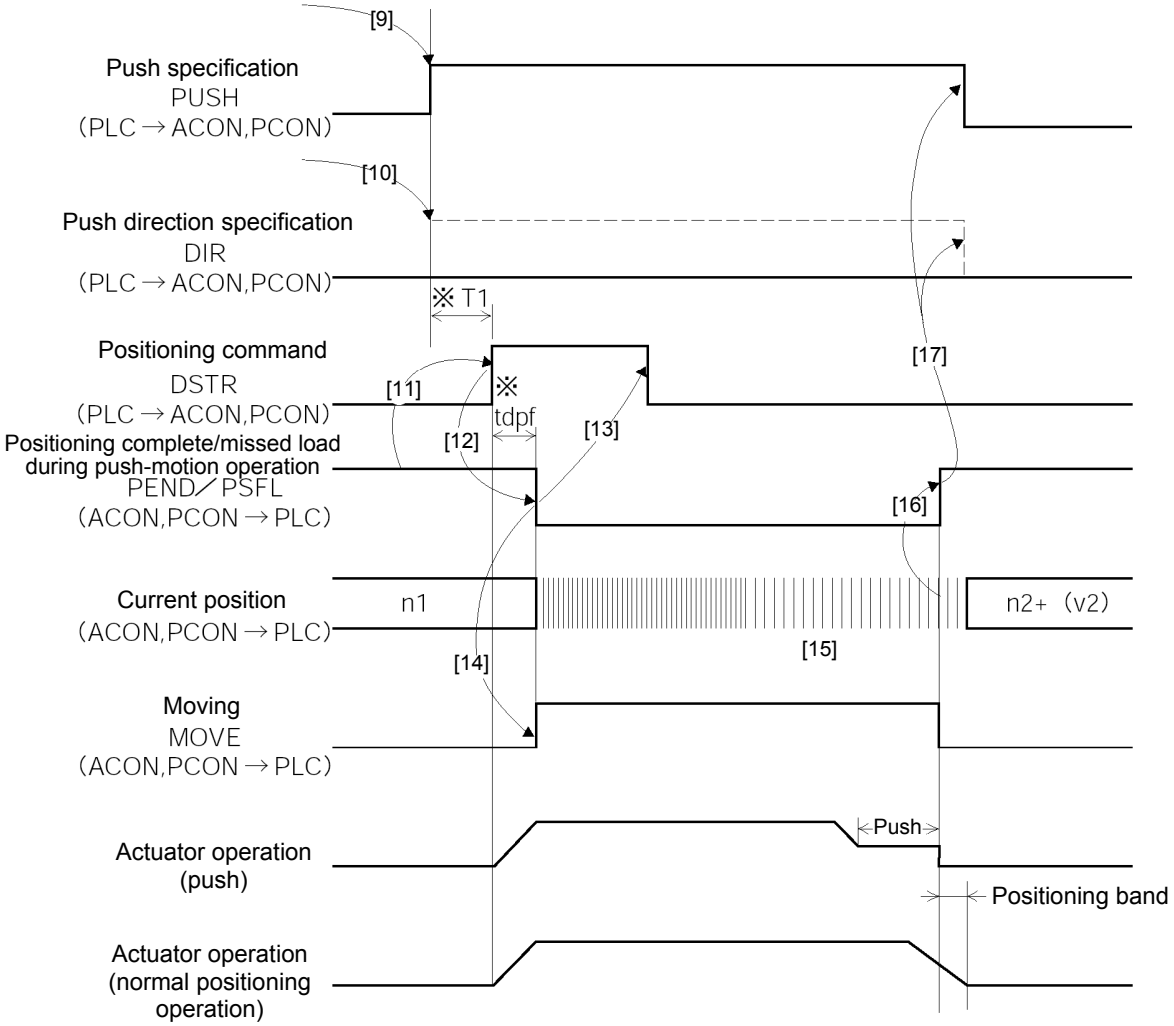
[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set speed data for the speeds (*) corresponding to output addresses n+4 and n+5.
[4] Set the position-zone output boundary data for the zone boundary+ and zone boundary- (*) corresponding to output addresses n+6 to n+9.
[5] Set the acceleration data for the acceleration (*) corresponding to output address n+10.
[6] Set the deceleration data for the deceleration (*) corresponding to output address n+11.
[7] Set the push-current limiting value data for the push-current limiting value (*) corresponding to output address n+12.
[8] Set the load current threshold data for the load current threshold (*) corresponding to output address n+13.
[9] Turn the push specification (PUSH) signal ON.
[10] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 3.4.7.)
[11] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [8] are read by the controller at the leading edge of the DSTR signal.
[12] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[13] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [8] until the DSTR signal is turned OFF.
[14] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[15] The current position data (*) in input addresses n and n+1 are constantly updated.
[16] The PEND signal turns ON when the motor current reaches the current-limiting value set in [7] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [7] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[17] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [9] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 3.4.1.


[1]
Set value of target position data
(PLC → ACON,PCON)
n1
n2
[2]
Set value of positioning band data
(PLC → ACON,PCON)
v1
v2
[3]
Set value of speed data
(PLC → ACON,PCON)
m1
m2
[4]
Set value of position zone boundary data
(PLC → ACON,PCON)
Q1
Q2
[5]
Set value of acceleration data
(PLC → ACON,PCON)
t1
t2
[6]
Set value of deceleration data
(PLC → ACON,PCON)
l1
l2
[7]
Set value of push-current limiting value data
(PLC → ACON,PCON)
o1
o2
[8]
Set value of load current threshold data
(PLC → ACON,PCON)
p1
p2

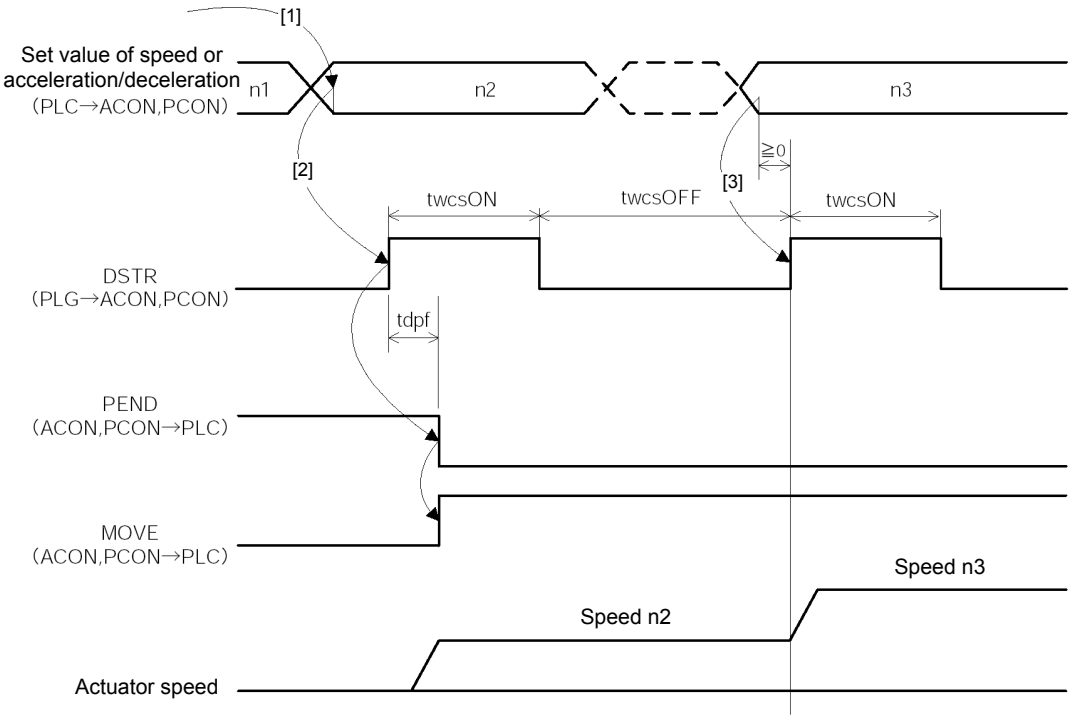


*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※ Yt+Xt ≦ tdpf ≦ Yt+Xt+2 （msec）

(4) Data change during movement

In the half direct mode and full direct mode, the values of target position data, acceleration/deceleration data, speed data, positioning band and push-current limiting value set by the PLC can be changed while the actuator is moving. After a desired data has been changed, turn the positioning command (DSTR) signal “ON” for tdpf or longer.
After the DSTR is turned “OFF,” wait for at least “twcsON + twcsOFF” before DSTR is turned “ON” again.
An example of changing the speed or acceleration/deceleration is given below.



twcsON≧Yt＋Xt＋2（msec）
twcsOFF≧Yt＋Xt＋2（msec）
※Yt＋Xt≦tpdf≦Yt＋Xt＋2（msec）

⚠ Caution:

1. If the speed is not yet set or set to “0,” the actuator will remain standstill and no alarm will generate.
2. If the speed is changed to “0” while the actuator is moving, the actuator will decelerate to a stop and no alarm will generate.
3. Even when the acceleration/deceleration or speed data alone is changed while the actuator is moving, the target position data must also be set.
4. Even when the target position alone is changed while the actuator is moving, the acceleration/deceleration and speed data must also be set.

3.7 PROFIBUS-DP Parameters

The parameters relating to PROFIBUS-DP are parameter Nos. 84 to 87 and 90.

Category: C: External interface parameter

No.	Category	Symbol	Name	Factory default
1			For parameter Nos. 1 to 83, refer to the operation manual for the controller.	
~				
83				
84	C	FMOD	Fieldbus operation mode	0
85	C	NADR	Fieldbus node address	1
86	C	FBRS	Fieldbus baud rate	0
87	C	NYTP	Network type	3
90	C	FMIO	Fieldbus I/O format	0

- Fieldbus operation mode (No. 84 FMOD)

Specify a desired operation mode in parameter No. 84 using a value between 0 and 4.

Set value of parameter No. 84	Mode name	Number of occupied bytes	Description
0 (factory setting)	Remote I/O mode	2	The actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP.
1	Position/simple direct mode	8	The target position can be specified directly as a value or using a value in the position data table. Other values required for operation are set in the position data table.
2	Half direct mode	16	Operate the actuator by specifying the speed, acceleration/deceleration and push-current value, in addition to the target position, directly using values.
3	Full direct mode	32	Operate the actuator by specifying all values relating to position control directly using values.
4	Remote I/O mode 2	12	The current-position and current-speed read functions are added to the functions available in the remote I/O mode.

- Fieldbus node address (No. 85 NADR)

Specify the slave number of the remote station in parameter No. 85.

Setting range: 0 to 125 (The factory setting is 1.)

- Fieldbus baud rate (No. 86 FBRS)

The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

- Network type (No. 87 NTYP)

Specify the network module in parameter No. 87. Do not change the default value.

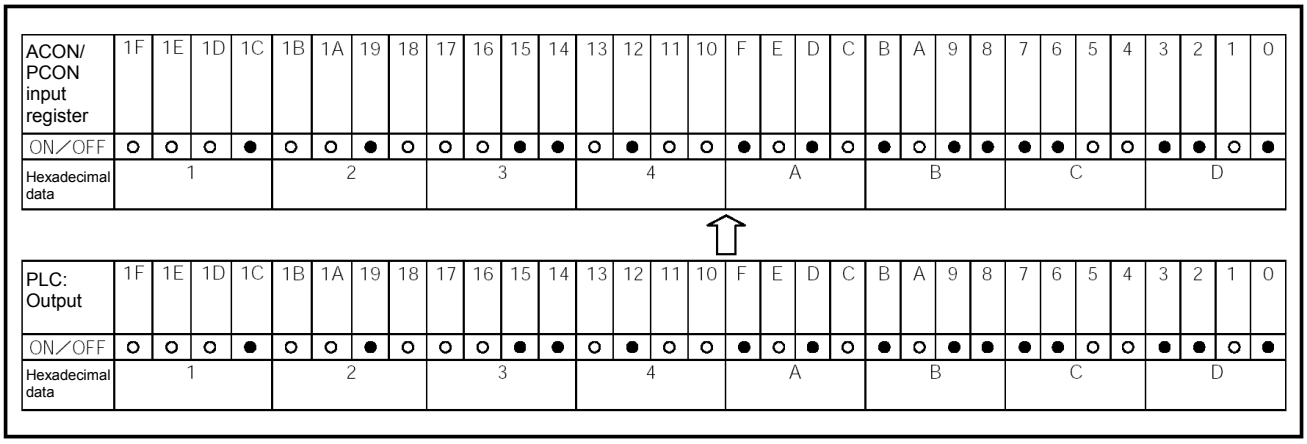
- Fieldbus I/O format (No. 90 FMIO)

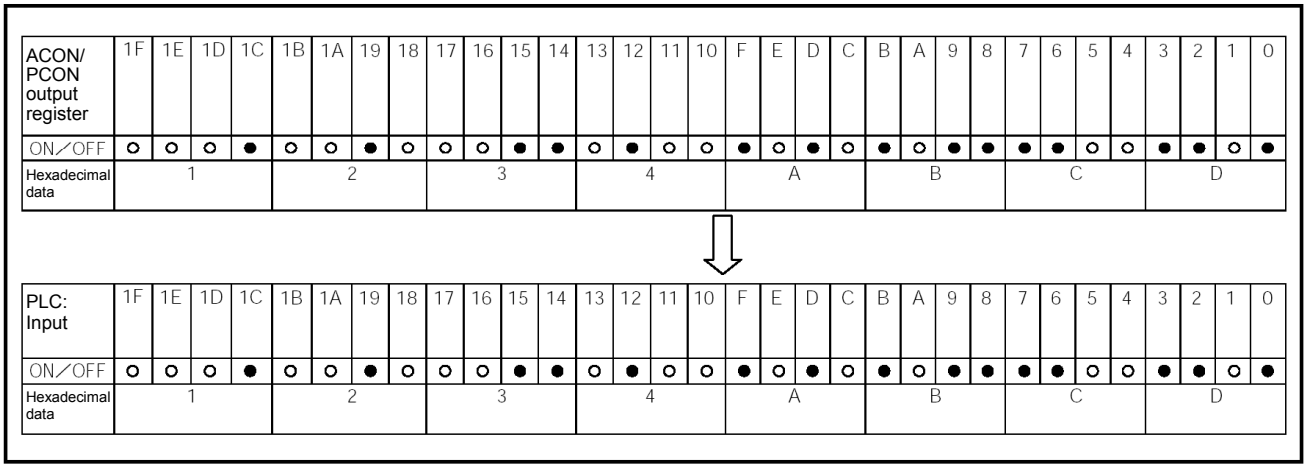
PLC addresses are assigned in units of 16 points (units of words) based on the I/O addresses set to the controller and number of occupied addresses in each mode.
By changing the setting of parameter No. 90, data of up to 2 words can be swapped in units of bytes before transmission within the range of communication with the PLC's I/O addresses.

Set value of parameter No. 90	Description
0 (factory setting)	Data is not swapped and sent as is to the PLC. (Refer to Example i.)
1	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. (Refer to Example ii.)
2	In the case of a word register, the upper word and lower word are swapped. (Refer to Example iii.)
3	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. In the case of a word register, the upper word and lower word are also swapped. (Refer to Example iv.)

(Example i) Set value = "0"

● indicates ON, while O indicates OFF.





(Example ii) Set value = “1”

● indicates ON, while O indicates OFF.

ACON/ PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

ACON/ PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iii) Set value = “2”

● indicates ON, while O indicates OFF.

ACON/ PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

ACON/ PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iv) Set value = “3”

● indicates ON, while O indicates OFF.

ACON/ PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O
Hexadecimal data	C				D				A				B				3				4				1				2			

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

ACON/ PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O
Hexadecimal data	C				D				A				B				3				4				1				2			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

3.8 Troubleshooting

3.8.1 Status LED Indicators

The illumination patterns of status LEDs (STATUS0/1) indicate the operating condition of the PROFIBUS-DP module as well as the network condition.
Should you encounter a problem, check the current conditions based on the illumination patterns of the status LEDs.
The illumination patterns of status LEDs, and corresponding communication conditions, are shown below.

○ : Lit, × : Off, ☆ : Blinking

LED	Color	Indicator condition	Description of indication (Meaning of indication)
STATUS1	Green	○	The board is online with the fieldbus network and communicating normally.
		☆	The board is offline from the fieldbus network.
	Orange	☆	A communication error is present.
STATUS0	Green	○	The board is operating properly.
		☆	The board is not yet ready.
	Orange	○	A communication hardware error was detected when the board was not yet ready.

3.8.2 Alarm Details and Causes/Actions

If an alarm occurs, the completed position number (four bits of PM1 to PM8) indicates a corresponding simple alarm code in the remote I/O mode or remote I/O mode 2.
In the position/simple direct mode, a simple alarm code is output to input address n+2.
In the half direct mode or full direct mode, an alarm code is output to input address n+6.

[1] Check the alarm code using the PLC's monitor function, etc., or connect the RC PC software or teaching pendant and check the code on the status monitor screen.
[2] Use the identified alarm code as the key to search the alarm list provided in the operation manual for the controller.
[3] Take an appropriate action according to the description provided under the applicable alarm code.
For the alarm codes listed below, take the actions specified in the following table.

Code	Error name	ID (*1)	RES (*2)	Cause/action
0F2	Fieldbus module error	05	x	Cause: A fieldbus module error was detected. Action: Check the applicable parameters.
0F3	Fieldbus module non-detection error	04	x	Cause: The module could not be detected. Action: Reconnect the power. If the problem persists, contact IAI.

(*1) ID → Simple alarm code
(*2) RES → Whether or not the alarm can be reset ○: Alarm can be reset / X: Alarm cannot be reset

3.9 CE Marking

If a compliance with the CE Marking is required, please follow Overseas Standards Compliance Manual (ME0287) that is provided separately.

4. ACON-CA/CB/CGB, PCON-CA/CB/CFA/CFB/CGB/CGFB, DCON-CA/CB/CGB

4.1 Operation Modes and Functions

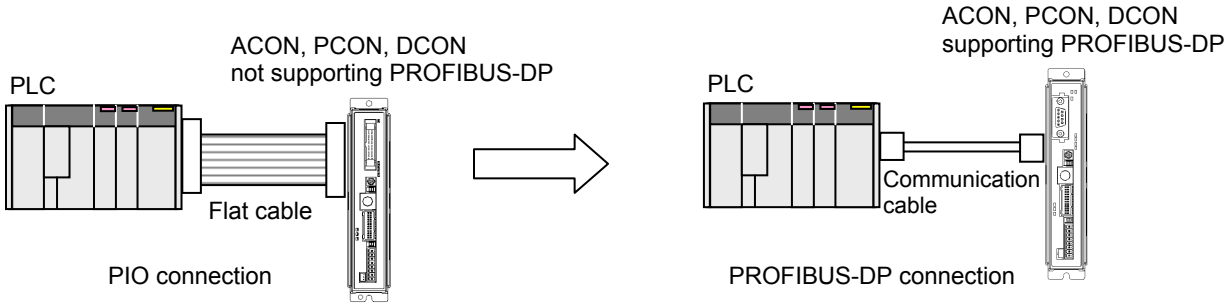
ACON, PCON, DCON controllers (hereinafter referred to as “IAI controllers”) supporting PROFIBUS-DP can be operated in a desired operation mode selected from the following five modes.

Operation Modes and Key Functions

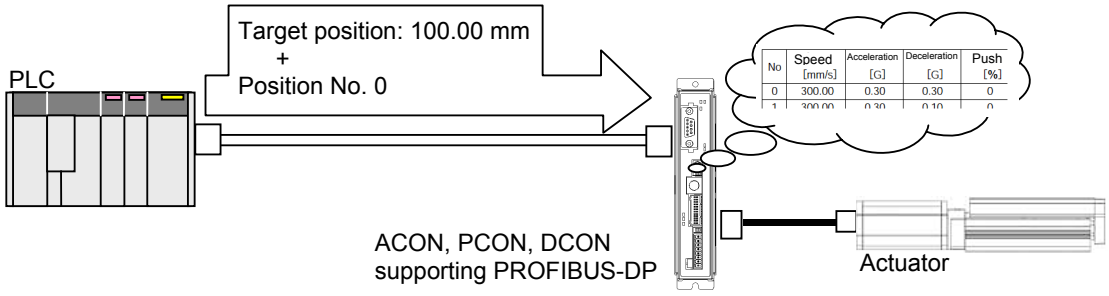
Key function	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
Number of occupied bytes	2	8	16	32	12
Operation by position data specification	x	○ (*1)	○	○	x
Direct speed/acceleration specification	x	x	○	○	x
Push-motion operation	○	○	○	○	○
Current position read	x	○	○	○	○
Current speed read	x	x	○	○	x
Operation by position number specification	○	○	x	x	○
Completed position number read	○	○	x	x	○
Maximum position table size	512	768	Not used	Not used	512

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

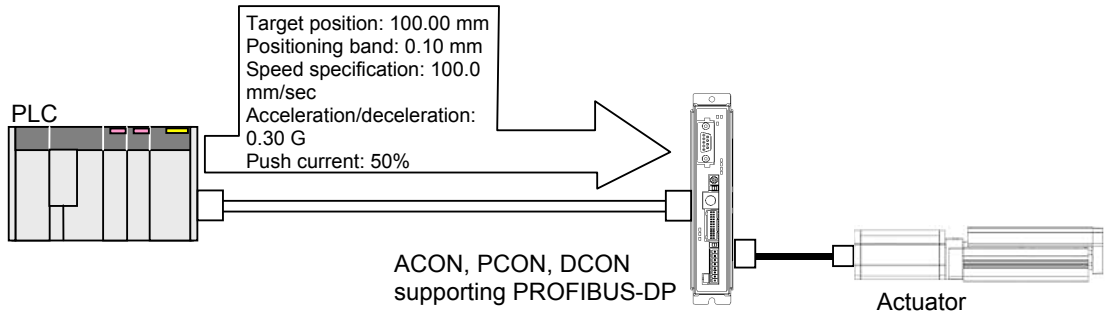
[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24 V I/Os) via PROFIBUS-DP communication.
Number of occupied bytes: 2 bytes (1 word)



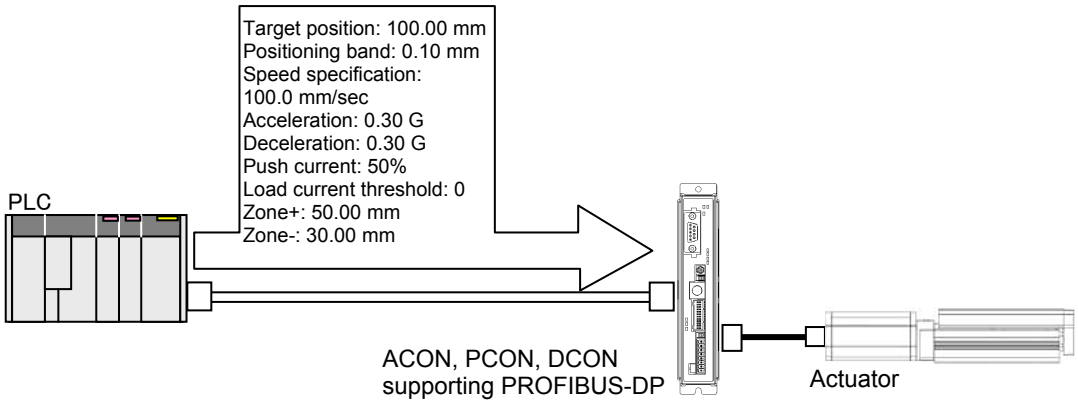
[2] Position/simple direct mode: In this mode, the actuator is operated by specifying position numbers.
You can select whether to specify the target position directly as a value, or use a value registered in the position data table, by switching a control signal.
For the speed, acceleration/deceleration, positioning band, etc., values preregistered in the position data table are used. Up to 768 position data points can be set.
Number of occupied bytes: 8 bytes (4 words)



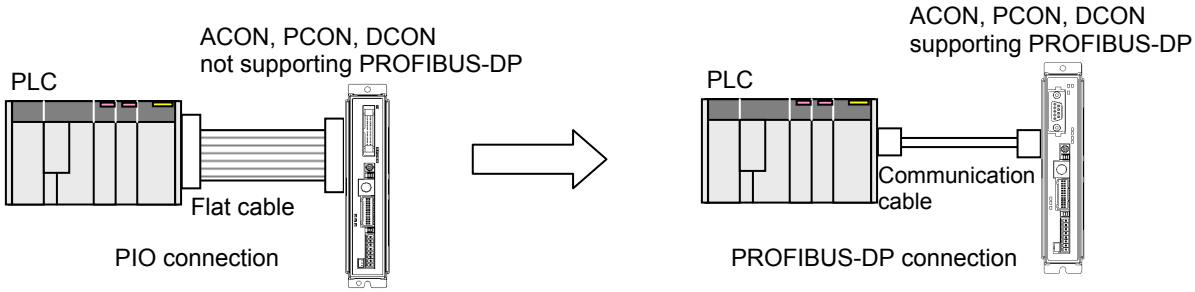
[3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.
Number of occupied bytes: 16 bytes (8 words)



[4] Full direct mode: In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, acceleration/deceleration, etc.) directly as values.
Number of occupied bytes: 32 bytes (16 words)



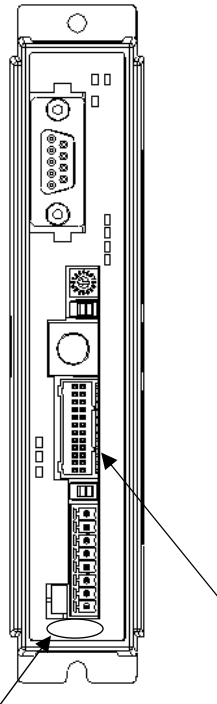
[5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication.
The current-position and command-current read functions are available in addition to the functions provided in mode [1].
Number of occupied bytes: 12 bytes (6 words)



4.2 Model Names

The model names of IAI controllers controller supporting PROFIBUS-DP are indicated as follows, respectively:

- ACON-CA/CB-☐-PR-☐
- PCON-CA/CB/CGB-☐-PR-☐
- PCON-CFA/CFB/CGFB-☐-PR-☐
- DCON-CA/CB-☐-PR-☐



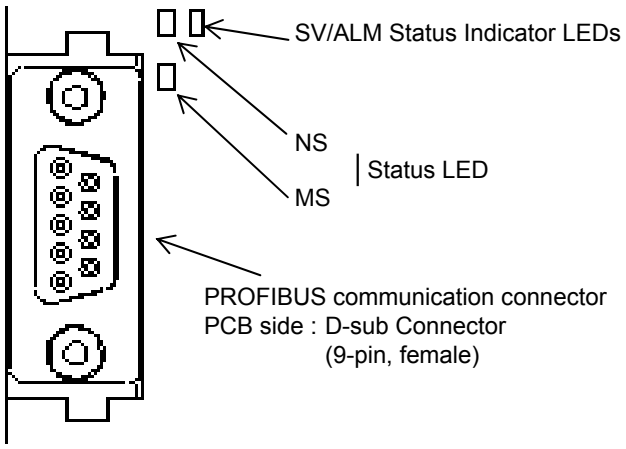
Printed series name
- ACON, PCON or DCON

Front panel color
- ACON-CA/CB : Dark blue
- PCON-CA/CB/CGB : Dark green
- PCON-CFA/CFB/CGFB : Light green
- DCON-CA/CB : Dark orange

4.3 PROFIBUS-DP (Slave Station) Settings

(1) Name of each part

The name of each part relating to PROFIBUS-DP is shown.



(2) PROFIBUS-DP communication connector interface specifications

This is a 9-pin, female D-sub connector recommended by the PROFIBUS-DP standard EN 50170.

Connector

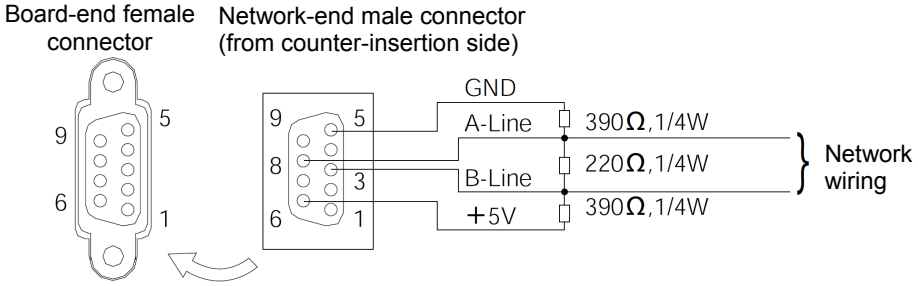
Pin No.	Description	Contents
3	B-Line	RxD, TxD (Positive signal line)
4	RTS	Request to send
5	GND	Signal ground (isolation)
6	+5V	+5-V output (isolation)
8	A-Line	/RxD, /TxD (Negative signal line)
Housing	Shield	Cable shield (enclosure and connection)

(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).
(Note 2) The cable-end connector is not supplied.

(3) Bus terminal processing

If the connector is to be connected to the network terminal node, connect the terminal resistor to the PROFIBUS-DP communication connector as shown below or use a connector with terminal resistor.

- Example of connector with terminal resistor: SUBCON-PLUS-PROFIB/AX/SC (Phoenix Contact)
- Connecting the terminal resistor



(4) Operation mode selection (setting)

Set a desired operation mode using a parameter.
Set the mode selector switch on the front side of the controller to the MANU position, and then set parameter No. 84, “FMOD: Fieldbus operation mode” using the RC PC software (V6.00.05.00 or later). (Refer to 4.7, “PROFIBUS-DP.”)
Note Refer to operation manual of RC PC Software for the applicable version.

Set value	Operation mode	Number of occupied bytes
0 (factory setting)	Remote I/O mode	2
1	Position/simple direct mode	8
2	Half direct mode	16
3	Full direct mode	32
4	Remote I/O mode 2	12

* If a greater value is entered, an excessive input error will occur.

(5) Node address setting (Refer to 4.7)

Set the node address using a parameter.
Set parameter No. 85, “NADR: Fieldbus node address” using the RC PC software.(Refer to 4.7, “PROFIBUS-DP Parameters.”)

Settable range: 0 to 125 (The parameter has been set to 1 at the factory.)

(Note 1) Pay attention to duplicate node address settings.
(Note 2) PROFIBUS-DP node addresses are set with the master station always having address 0. Accordingly, addresses of slave stations can be set between 1 and 125.

(6) Status LED indications

The board operating condition and network condition can be checked using the two LEDs provided on the front side of the controller.

LED	Color	Indicator condition	Description of indication (Meaning of indication)
STATUS1	Green	Lit	The board is online with the fieldbus network and communicating normally.
		Blinking	The board is offline from the fieldbus network.
	Orange	Blinking	A communication error is present.
STATUS0	Green	Lit	The board is operating properly.
		Blinking	The board is not yet ready.
	Orange	Lit	A communication hardware error was detected when the board was not yet ready.

(Note 1) After the necessary parameters have been set, reconnect the controller power and return the mode selector switch on the front side of the controller to the AUTO position. If the switch remains in the MANU position, PLC operation cannot be performed.
(Note 2) The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

4.4 Communication with the Master Station

4.4.1 Operation Modes and Handling of PLC Addresses

The address assignments under each operation mode are shown below.

- PLC output → IAI controllers input (* n indicates the initial output address for each axis.)

PLC output address (word address)	ACON, PCON, DCON DI and input data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Target position	Target position	Target position	Port number 0 to 15
n+1					Occupied area
n+2		Specified position number	Positioning band	Positioning band	
n+3		Control signal			
n+4			Speed	Speed specification	
n+5			Acceleration/ deceleration		
n+6			Push-current limiting value	Zone boundary+	
n+7			Control signal		
n+8				Zone boundary-	
n+9					
n+10				Acceleration	
n+11				Deceleration	
n+12				Push-current limiting value	
n+13				Load current threshold	
n+14				Control signal 1	
n+15				Control signal 2	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- IAI controllers output → PLC input (* n indicates the initial input address for each axis.)

PLC input address (word address)	ACON, PCON, DCON DO and output data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Current position	Current position	Current position	Port number 0 to 15
n+1					Occupied area
n+2		Completed position number (simple alarm ID)	Command current	Command current	Current position
n+3		Status signal			
n+4			Current speed	Current speed	Command current
n+5					
n+6			Alarm code	Alarm code	
n+7			Status signal	Occupied area	
n+8					
n+9					
n+10				Total moving count	
n+11					
n+12				Total moving distance	
n+13					
n+14				Status Signal 1	
n+15				Status Signal 2	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- Reference: Example of PLC address assignment rules --- Fuji Electric
  The PLC address assignment rules are shown below.

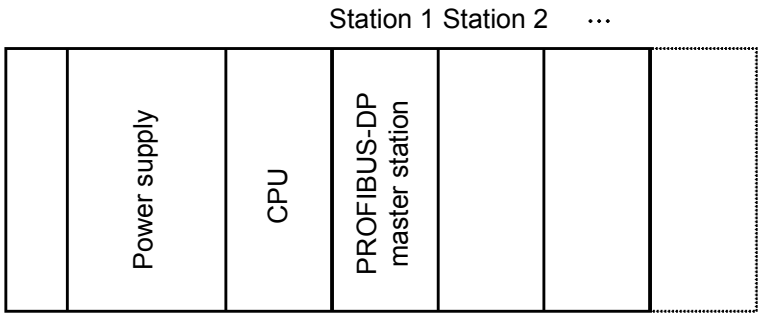
Prefix	Bus station number	.	Word number	.	Bit address

Prefix

%IX … Input bit address (address per bit)
%IW … Input word address (address per word)
%QX … Output bit address (address per bit)
%QW … Output word address (address per word)

Bus station number

This number indicates the installation position of the PROFIBUS-DP master unit within the PLC units is indicated.



Word address

Word addresses refer to addresses of DI/DOs and I/O data registers of an IAI controllers assigned to the master station, being arranged sequentially in units of words.

Bit address

Bit addresses refer to addresses of DI/DOs and I/O data registers of an IAI controllers assigned to a word address, being arranged sequentially in units of bits.

4.4.2 Remote I/O Mode (Number of Occupied Bytes: 2)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used. Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.

The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

○: Supported, x: Not supported

ROBO Cylinder function	PIO pattern					
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2
Home return operation	○	○	○	○	○	x
Positioning operation	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x
Speed change during movement	○	○	○	○	○	○
Operation at different acceleration and deceleration	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)
Zone signal output	○	○	○	x	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	IAI controllers DI (port number)	PLC output address	IAI controllers DO (port number)	PLC input address
0	0 to 15	n	0 to 15	n

Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 1 word (2 bytes) of I/O addresses.

- I/O addresses are controlled by bit ON/OFF signals from the PLC.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignments

Which signals are assigned to controller I/O ports vary according to the setting of parameter No. 25.
(For details, refer to the operation manual for the controller.)

		Setting of parameter No. 25					
Category	Port No.	Positioning mode		Teaching mode		256-point mode	
		0		1		2	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → ACON, PCON, DCON input	0	PC1	Command position number	PC1	Command position number	PC1	Command position number
	1	PC2		PC2		PC2	
	2	PC4		PC4		PC4	
	3	PC8		PC8		PC8	
	4	PC16		PC16		PC16	
	5	PC32		PC32		PC32	
	6	-	Cannot be used.	MODE	Teaching mode command	PC64	
	7	-		JISL	Jog/inching switching	PC128	
	8	-		JOG+	+Jog	-	Cannot be used.
	9	BKRL	Forced brake release	JOG-	-Jog	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	CSTR/ PWRT	Positioning start / Positioning data read command	CSTR	Positioning start
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
ACON, PCON, DCON output → PLC input	0	PM1	Completed position number	PM1	Completed position number	PM1	Completed position number
	1	PM2		PM2		PM2	
	2	PM4		PM4		PM4	
	3	PM8		PM8		PM8	
	4	PM16		PM16		PM16	
	5	PM32		PM32		PM32	
	6	MOVE	Moving signal	MOVE	Moving signal	PM64	
	7	ZONE1	Zone 1	MODES	Teaching mode signal	PM128	
	8	PZONE/ ZONE2	Position zone/ Zone2	PZONE/ ZONE1	Position zone/ Zone1	PZONE/ ZONE1	Position zone/ Zone1
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND/ WEND	Positioning complete signal/position data read complete	PEND	Positioning complete signal
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15 (Note 1)	LOAD/ TRQS/ *ALML	Load output judgment/ torque level/ Light error status	*ALML	Light error status	LOAD/ TRQS/ *ALML	Load output judgment/ torque level/ Light error status

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

Note 1 For ACON and DCON, the signals change as explained below;
ACON : *BALM (Battery Alarm) / *ALML (Light error status)
DCON : *ALML(Light error status)

		Setting of parameter No. 25					
Category	Port No.	512-point mode		Solenoid valve mode 1		Solenoid valve mode 2	
		3		4		5	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → ACON, PCON, DCON input	0	PC1	Command position number	ST0	Start position 0	ST0	Start position 0
	1	PC2		ST1	Start position 1	ST1	Start position 1
	2	PC4		ST2	Start position 2	ST2	Start position 2
	3	PC8		ST3	Start position 3	-	Cannot be used.
	4	PC16		ST4	Start position 4	-	
	5	PC32		ST5	Start position 5	-	
	6	PC64		ST6	Start position 6	-	
	7	PC128		-	Cannot be used.	-	
	8	PC256		-		-	
	9	BKRL	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	-	Cannot be used.
	12	*STP	Pause	*STP	Pause	-	
	13	CSTR	Positioning start	-	Cannot be used.	-	
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
ACON, PCON, DCON output → PLC input	0	PM1	Completed position number	PE0	Completed position 0	LS0	Rear end move command 0
	1	PM2		PE1	Completed position 1	LS1	Rear end move command 1
	2	PM4		PE2	Completed position 2	LS2	Rear end move command 2
	3	PM8		PE3	Completed position 3	-	Cannot be used.
	4	PM16		PE4	Completed position 4	-	
	5	PM32		PE5	Completed position 5	-	
	6	PM64		PE6	Completed position 6	-	
	7	PM128		ZONE1	Zone 1	ZONE1	Zone 1
	8	PM256		PZONE/ ZONE2	Position zone/ Zone2	PZONE/ ZONE2	Position zone/ Zone2
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete	PEND	Positioning complete	-	Cannot be used.
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15 (Note 1)	LOAD/ TRQS/ *ALML	Load output judgment/ torque level/ Light error status	LOAD/ TRQS/ *ALML	Load output judgment/ torque level/ Light error status	*ALML	Light error status

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

Note 1 For ACON and DCON, the signals change as explained below;
ACON : *BALM (Battery Alarm) / *ALML (Light error status)
DCON : *ALML(Light error status)

4.4.3 Position/Simple Direct Mode (Number of Occupied Bytes: 8)

In this mode, the actuator is operated by specifying position numbers. You can select whether to set the target position directly as a value or use a value registered in the position data table, by switching a control signal (PMOD signal).
For all data other than the target position, such as speed, acceleration/deceleration and positioning band, values in the controller's position table are used. Set desired position data by referring to the operation manual for the controller.
Up to 768 position data points can be set.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control △ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	△	Position data must be set
Pitch feed (inching)	△	
Push-motion operation	△	
Speed change during movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using parameters.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	IAI controllers input register	PLC output address	IAI controllers output register	PLC input address
1	Target position	n+0	Current position	n+0
		n+1		n+1
	Specified position number	n+2	Completed position number (simple alarm code)	n+2
	Control signal	n+3	Status signal	n+3

(Note) Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 4 words (8 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- The specified position number and completed position number are both a 1-word (16-bit) binary data. Although values from 0 to 767 can be handled by the PLC, use the PC software or teaching pendant to specify a position number for which operation conditions are already set.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Specified position number	—	—	—	—	—	—	PC512	PC256	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD	—	—	PMOD	MODE	PWRT	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Complete position number							PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1
n+3																
Status signal	EMGS	PWR	ZONE2	ZONE1	PZONE	MODES	WEND	RMDS	ALML (Note 1)	—	PSFL	SV	ALM	MOVE	HEND	PEND

Note 1 For ACON, it can be changed to BALM by the setting in Parameter No. 151.

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.40 mm, specify “2540.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	4.6 (1)
	Specified position number	16-bit data	PC1 ~ PC512	16-bit integer. To operate the actuator, position data is needed for which operation conditions have already been entered using the PC software or teaching tools. Use this register to specify the position number for which data has been entered. The specifiable range is 0 to 767. If an out-of-range value is specified or the specified position number is not yet set, an alarm will occur when the start signal is turned ON.	4.6 (1)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	4.4.7 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.7 (19)
		b13	-	Cannot be used.	-
		b12			
		b11	PMOD	Position/simple direct switching: Position mode when the signal is OFF, or simple direct mode when the signal is ON.	4.4.7 (20)
		b10	MODE	Teaching mode command: Normal mode when the signal is OFF, or teaching mode when the signal is ON.	4.4.7 (16)
		b9	PWRT	Position data read command: Position data is read when the signal is ON.	4.4.7 (17)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	4.4.7 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	4.4.7 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	4.4.7 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.7 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	4.4.7 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	4.4.7 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	4.4.7 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	4.4.7 (6)
		b0	CSTR	Positioning start: A move command is issued when the signal turns ON.	4.4.7 (7)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	4.6 (1)
	Completed position number (simple alarm code)	16 bit	PM1 ~ PM512	16-bit integer. After the actuator has moved to the target position and entered the positioning band, the position number corresponding to the completed positioning is output. “0” is output when no position movement has been performed yet or while the actuator is moving. If an alarm occurs (= the ALM status signal turns ON), a corresponding simple alarm code (refer to the operation manual for the controller) will be output.	4.6 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	4.4.7 (12)
		b10	MODES	Teaching mode signal: The signal is ON when the teaching mode is selected.	4.4.7 (16)
		b9	WEND	Position data read complete: The signal turns ON when the position data read is complete.	4.4.7 (17)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.7 (19)
		b7	ALML	Light error status: Turns ON when light alarm (threshold exceeded for number of movement, etc.) that the operation can be continued with is issued. Note: ALM LED would not turn ON with a light error.	4.4.7 (31)
			BALM	☆When Parameter No. 151 is set to 1 in ACON, absolute battery voltage drop warning turns ON when the voltage is dropped.	4.4.7 (32)
		b6	-	Unavailable	—
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	4.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	4.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.7 (10)

4.4.4 Half Direct Mode (Number of Occupied Bytes: 16)

In this mode, the actuator is operated by specifying the target position, positioning band, speed, acceleration/deceleration and push current directly as values from the PLC.
Set each value in an applicable I/O address. If the zone function is used, set parameter Nos. 1, 2, 23 and/or 24.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control △ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	○	
Pitch feed (inching)	○	
Push-motion operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	IAI controllers input register	PLC output address	IAI controllers output register	PLC input address
2	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	n+6	Alarm code	n+6
	Control signal	n+7	Status signal	n+7

(Note) Pay attention to use of duplicate addresses.

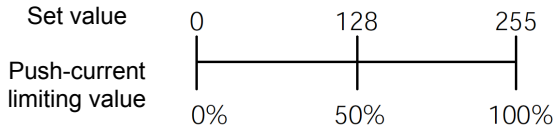
(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 8 words (16 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm) can be handled by the PLC.
- The speed is a 1-word (16-bit) binary data. Although values from 0 to +65535 (unit: 1.0 mm/sec or 0.1mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator.
  The setting of unit can be established in Parameter No. 159 FB Half Direct Mode Speed Unit.

Parameter No.159 Setting Value	Indicated Speed Unit
0	1.0mm/sec
1	0.1mm/sec

- The acceleration/deceleration is a 1-word (16-bit) binary data. For the acceleration/deceleration, the PLC can handle values from 1 to 300 (unit: 0.01 G). Take note, however, that the set value should not exceed the maximum acceleration or maximum deceleration supported by the applicable actuator.
- The push-motion current-limiting value is a 1-word (16-bit) binary data. For the push-motion current-limiting value, the PLC can handle values from 0 (0%) to 255 (100%). Take note, however, that the setting should be inside the allowable specification range of push-motion current-limiting values supported by the applicable actuator (refer to the catalog or operation manual for the actuator).



- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1																
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3																
Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4																
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5																
Acceleration/ deceleration	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+6																
Push-current limiting value	—	—	—	—	—	—	—	—	128	64	32	16	8	4	2	1
n+7																
Control signal	BKRL	RMOD	DIR	PUSH	—	—	—	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0 Current position (upper word)																
n+1 Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2 Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3 Command current (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4 Current speed (upper word)																
n+5 Current speed (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6 Alarm code																
n+7 Status signal	EMGS	PWR	ZONE2	ZONE1	—	—	—	RMDS	ALML (Note 1)	—	PSFL	SV	ALM	MOVE	HEND	PEND

Note 1 For ACON, it can be changed to BALM by the setting in Parameter No. 151.

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	4.6 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm, while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	4.6 (2)
	Speed	16-bit data	-	16-bit integer. Specify the speed at which to move the actuator. The unit is 1.0 mm/sec or 0.1mm/sec, while the specifiable range is 0 to 65535. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. The change of unit is to be conducted in Parameter No. 159 FB Half Direct Mode Speed Unit. (Example) To set 254.0 mm/sec, specify “254.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	4.6 (2)
	Acceleration/ deceleration	16-bit data	-	16-bit integer. Specify the acceleration/deceleration at which to move the actuator. (The acceleration and deceleration become the same value.) The unit is 0.01 G, while the specifiable range is 1 to 300. (Example) To set 0.30 G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	4.6 (2)
	Push-current limiting value	16-bit data	-	16-bit integer. Specify the current-limiting value during push-motion operation. The specified range is 0 (0%) to 255 (100%). The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.) If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.	4.6 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	4.4.7 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.7 (19)
		b13	DIR	Push direction specification: When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used. When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.	4.4.7 (22)
		b12	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	4.4.7 (21)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	4.4.7 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	4.4.7 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	4.4.7 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.7 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	4.4.7 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	4.4.7 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	4.4.7 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	4.4.7 (6)
		b0	DSTR	Positioning start command: A move command is issued when the signal turns ON.	4.4.7 (8)
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	4.6 (2)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FFH = 1023 (decimal) = 1023 mA	4.6 (2)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	4.6 (2)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0H is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	4.6 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.7 (19)
		b7	ALML	Light error status: Turns ON when light alarm (threshold exceeded for number of movement, etc.) that the operation can be continued with is issued. Note: ALM LED would not turn ON with a light error.	4.4.7 (31)
			BALM	☆When Parameter No. 151 is set to 1 in ACON, absolute battery voltage drop warning turns ON when the voltage is dropped.	4.4.7 (32)
		b6	-	Cannot be used	-
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	4.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	4.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.7 (10)

4.4.5 Full Direct Mode (Number of Occupied Bytes: 32)

In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, etc.) directly as values from the PLC.
Set each value in an I/O address.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control x : Invalid
Home return operation	○
Positioning operation	○
Speed & acceleration/deceleration setting	○
Pitch feed (inching)	○
Push-motion operation	○
Speed change during movement	○
Operation at different acceleration and deceleration	○
Pause	○
Zone signal output	○
PIO pattern selection	x

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

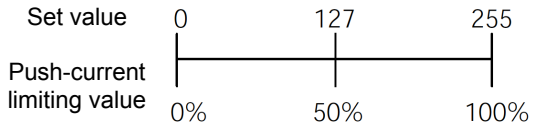
Parameter No. 84	IAI controllers input register	PLC output address	IAI controllers output register	PLC input address
3	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
		n+5		n+5
	Zone boundary+	n+6	Alarm code	n+6
		n+7	Occupied area	n+7
	Zone boundary-	n+8		n+8
		n+9		n+9
	Acceleration	n+10	Total moving count	n+10
	Deceleration	n+11		n+11
	Push-current limiting value	n+12	Total moving distance	n+12
	Load current threshold	Status Signal 1		n+13
	Control signal 1	n+14	Status Signal 1	n+14
	Control signal 2	n+15	Status Signal 2	n+15

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 16 words (32 bytes) of I/O addresses.

- Control signals 1 and 2 and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm) can be handled by the PLC.
- The speed is a 2-word (32-bit) binary data. Although values from 0 to 999999 (unit: 0.01 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator.
- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 300 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 255 (100%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- Set a desired load current threshold. The load current threshold is a 1-word (16-bit) binary data. Values from 0 (0%) to 255 (100%) can be handled by the PLC. (Refer to the graph of push-current limiting value (upper graph).)
- The zone boundary+ and zone boundary- are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm) can be handled by the PLC, set values so that the zone boundary- becomes smaller than the zone boundary+.
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.
- The total moving count is a 2-word (32-bit) binary data (Unit: times).
- The total moving distance is a 2-word (32-bit) binary data (Unit: m).

PLC output address

(* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0 Target position (upper word)																
n+1 Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2 Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3 Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4 Speed (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5 Speed (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+6 Zone boundary+ (upper word)																
n+7 Zone boundary+ (lower word)																

If the zone boundary+ is a negative value, it is expressed by a 2's complement.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+8																
Zone boundary- (upper word)																
n+9																
Zone boundary- (lower word)																

If the zone boundary- is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+10																
Acceleration	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+11																
Deceleration	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+12																
Push-current limiting value	—	—	—	—	—	—	—	—	128	64	32	16	8	4	2	1
n+13																
Load current threshold (Note 1)	—	—	—	—	—	—	—	—	128	64	32	16	8	4	2	1
n+14																
Control signal 1	—	—	NTC1 (Note 2)	NTC0 (Note 2)	—	SMOD (Note 1)	ASO1	ASO0	MOD1	MOD0	GSL1 (Note 2)	GSL0 (Note 2)	INC	DIR	PUSH	—
n+15																
Control signal 2	BKRL	RMOD	—	—	—	—	—	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

Note 1 It can be used only in PCON.
Note 2 It can be used only in ACON.

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (lower word)													524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (upper word)																
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																
n+7~n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

Address (* “n” shows the head register address per each axis).

one word = 16 bits

n+10	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving count (Slave Word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving count (Host Word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536

n+12	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving distance (Slave Word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving distance (Host Word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536

n+14	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal 1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ALML (Note 2)

n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status Signal 2	EMGS	PWR	ZONE2	ZONE1	PZONE	LOAD (Note 1)	TRQS (Note 1)	RMDS	GHMS	PUSH	PSFL	SV	ALM	MOVE	HEND	PEND

Note 1 It can be used only in PCON.
Note 2 For ACON, it can be changed to BALM by the setting in Parameter No. 151.

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Address		Bit	Symbol	Function	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm, while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	4.6 (3)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm, while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	4.6 (3)
	Speed	32-bit data	-	32-bit integer. Specify the speed at which to move the actuator. The unit is 0.01 mm/sec, while the specifiable range is 0 to 999999. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. (Example) To set 25.41 mm/sec, specify “2541.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	4.6 (3)
	Zone boundary+ / Zone boundary-	32-bit data	-	32-bit signed integer. A valid zone signal is output after the end of home return, separately from the zone boundaries specified by parameters. If the current position is inside these ± boundaries, the status signal PZONE turns ON. (Example) To set +25.40 mm, specify “2540.” The unit of specification is 0.01 mm, while the specifiable range is -999999 to 999999. Enter values satisfying the relationship of “Zone boundary+ > Zone boundary-.” If this function is not used, enter the same value for both ± boundaries. * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	4.6 (3)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Address</th><th>Bit</th><th>Symbol</th><th>Function</th><th>Details</th></tr>
<tr><td rowspan="14">PLC output</td><td>Acceleration</td><td>16-bit data</td><td>-</td><td rowspan="2">16-bit integer.
Specify the acceleration and deceleration at which to move the actuator.
The unit is 0.01 G, while the specifiable range is 1 to 300.
(Example) To set 0.30 G, specify “30.”
If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.</td><td rowspan="2">4.6 (3)</td></tr>
<tr><td>Deceleration</td><td>16-bit data</td><td>-</td></tr>
<tr><td>Push-current limiting value</td><td>16-bit data</td><td>-</td><td>16-bit integer.
Specify the current-limiting value during push-motion operation.
The specified range is 0 (0%) to 255 (100%).
The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.)
If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.</td><td>4.6 (3)</td></tr>
<tr><td>Load current threshold (PCON only)</td><td>16-bit data</td><td>-</td><td>16-bit integer.
If judgment will be made as to whether or not the load current exceeded the set value, specify the threshold value for current using this register.
The specifiable range is 0 (0%) to 255 (100%).
If judgment is not performed, enter “0.”</td><td>4.6 (3)</td></tr>
<tr><td rowspan="12">Control signal 1</td><td>b15</td><td rowspan="2">-</td><td rowspan="4">Select the servo gain parameter set to be used.
<table><tr><th>NTC1</th><th>NTC0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Do not use vibration damping control.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="4">4.4.7 (33)</td></tr>
<tr><td>b14</td></tr>
<tr><td>b13</td><td>NTC1 (ACON only)</td></tr>
<tr><td>b12</td><td>NTC0 (ACON only)</td></tr>
<tr><td>b11</td><td>-</td><td>Not available.</td><td></td></tr>
<tr><td>b10</td><td>SMOD (PCON only)</td><td>Standstill control mode: When the signal is ON, servo control is performed at in a standstill state.</td><td>4.4.7 (28)</td></tr>
<tr><td>b9</td><td>ASO1</td><td>Stop Mode 1</td><td rowspan="2">Select stop mode while standing by
<table><tr><th>ASO1</th><th>ASO0</th><th>Functions</th></tr><tr><td>OFF</td><td>OFF</td><td>Disable
(Servo is ON at all times)</td></tr><tr><td>OFF</td><td>ON</td><td>Sever turns OFF in time set in Parameter No. 36</td></tr><tr><td>ON</td><td>OFF</td><td>Sever turns OFF in time set in Parameter No. 37</td></tr><tr><td>ON</td><td>ON</td><td>Sever turns OFF in time set in Parameter No. 38</td></tr></table></td><td rowspan="2">4.4.7(30)</td></tr>
<tr><td>b8</td><td>ASO0</td><td>Stop Mode 0</td></tr>
<tr><td>b7</td><td>MOD1</td><td rowspan="2">Acceleration/deceleration mode:
<table><tr><th>MOD1</th><th>MOD0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Trapezoid pattern</td></tr><tr><td>OFF</td><td>ON</td><td>S-motion</td></tr><tr><td>ON</td><td>OFF</td><td>primary delay filter</td></tr></table></td><td rowspan="2">4.4.7 (29)</td></tr>
<tr><td>b6</td><td>MOD0</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Address</th><th>Bit</th><th>Symbol</th><th>Function</th><th>Details</th></tr>
<tr><td rowspan="25">PLC output</td><td rowspan="6">Control signal 1</td><td>b5</td><td>GSL1 (ACON only)</td><td>Servo gain parameter set selection 1</td><td rowspan="2">Select the servo gain parameter set to be used.
<table><tr><th>GSL1</th><th>GSL0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Select parameter set 0.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">4.4.7 (34)</td></tr>
<tr><td>b4</td><td>GSL0 (ACON only)</td><td>Servo gain parameter set selection 0</td></tr>
<tr><td>b3</td><td>INC</td><td colspan="2">Incremental specification:
Absolute position command when the signal is OFF, or incremental position command when the signal is ON.</td><td>4.4.7 (24)</td></tr>
<tr><td>b2</td><td>DIR</td><td colspan="2">Push direction specification:
When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used.
When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.</td><td>4.4.7 (22)</td></tr>
<tr><td>b1</td><td>PUSH</td><td colspan="2">Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.</td><td>4.4.7 (21)</td></tr>
<tr><td>b0</td><td>-</td><td colspan="2">Cannot be used.</td><td>-</td></tr>
<tr><td rowspan="19">Control signal 2</td><td>b15</td><td>BKRL</td><td colspan="2">Forced brake release: The brake is released when the signal turns ON.</td><td>4.4.7 (18)</td></tr>
<tr><td>b14</td><td>RMOD</td><td colspan="2">Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.</td><td>4.4.7 (19)</td></tr>
<tr><td>b13</td><td rowspan="5">-</td><td colspan="2" rowspan="5">Cannot be used.</td><td rowspan="5">-</td></tr>
<tr><td>b12</td></tr>
<tr><td>b11</td></tr>
<tr><td>b10</td></tr>
<tr><td>b9</td></tr>
<tr><td>b8</td><td>JOG+</td><td colspan="2">+Jog: The actuator moves in the direction opposite home when the signal is ON.</td><td>4.4.7 (13)</td></tr>
<tr><td>b7</td><td>JOG-</td><td colspan="2">-Jog: The actuator moves in the direction of home when the signal is ON.</td><td>4.4.7 (13)</td></tr>
<tr><td>b6</td><td>JVEL</td><td colspan="2">Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.</td><td>4.4.7 (14)</td></tr>
<tr><td>b5</td><td>JISL</td><td colspan="2">Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.</td><td>4.4.7 (15)</td></tr>
<tr><td>b4</td><td>SON</td><td colspan="2">Servo ON command: The servo is ON when the signal is ON.</td><td>4.4.7 (5)</td></tr>
<tr><td>b3</td><td>RES</td><td colspan="2">Reset: A reset is performed when the signal turns ON.</td><td>4.4.7 (4)</td></tr>
<tr><td>b2</td><td>STP</td><td colspan="2">Pause: A pause command is issued when the signal turns ON.</td><td>4.4.7 (11)</td></tr>
<tr><td>b1</td><td>HOME</td><td colspan="2">Home return: A home return command is issued when the signal turns ON.</td><td>4.4.7 (6)</td></tr>
<tr><td>b0</td><td>DSTR</td><td colspan="2">Positioning start: A move command is issued when the signal turns ON.</td><td>4.4.7 (8)</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	4.6 (3)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FFH = 1023 (decimal) = 1023 mA	4.6 (3)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	4.6 (3)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0 is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	4.6 (3)
	Total moving count	32bits data	-	32-bit integer (unit: times)	-
	Total moving distance	32bits data	-	32-bit integer (unit: m)	-
	Status signal 1	b15	-	Unavailable	-
		b14			
		b13			
		b12			
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0	ALML	Light error status: Turns ON when light alarm (threshold exceeded for number of movement, etc.) that the operation can be continued with is issued. Note: ALM LED would not turn ON with a light error.	4.4.7 (31)
			BALM	☆When Parameter No. 151 is set to 1 in ACON, absolute battery voltage drop warning turns ON when the voltage is dropped.	4.4.7 (32)

Signal type		Bit	Symbol	Description	Details
PLC input	Status signal 2	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.7 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.7 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.7 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	4.4.7 (12)
		b10	LOAD (Note 1)	Load Output Judgment: "ON" for Reached "OFF" for Not reached [Refer to the instruction manual for the controller main body for more information.]	4.4.7 (26)
		b9	TRQS (Note 1)	Torque Level: "ON" for Reached "OFF" for Not Reached [Refer to the instruction manual for the controller main body for more information.]	4.4.7 (27)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.7 (19)
		b7	GHMS	Home return in progress: The signal is ON while the home return is in progress.	4.4.7 (6)
		b6	PUSHS	Push-motion operation in progress: The signal is ON while the push-motion operation is in progress.	4.4.7 (25)
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	4.4.7 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	4.4.7 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.7 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.7 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.7 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.7 (10)

Note 1 It can be used only in PCON.

4.4.6 Remote I/O Mode 2 (Number of Occupied Bytes: 12)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used. Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
This mode combines the functions available in the remote I/O mode and the current-position and command-current read functions.
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.

The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

○: Supported, x: Not supported

ROBO Cylinder function	PIO pattern					
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2
Home return operation	○	○	○	○	○	x
Positioning operation	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x
Speed change during movement	○	○	○	○	○	○
Operation at different acceleration and deceleration	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)
Zone signal output	○	○	○	x	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	IAI controllers DI and input register	PLC output address	IAI controllers DO and output register	PLC input address
4	Port number 0 to 15	n+0	Port number 0 to 15	n+0
	Occupied area	n+1	Occupied area	n+1
		n+2	Current position	n+2
		n+3		n+3
		n+4	Command current	n+4
		n+5		n+5

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 6 words (12 bytes) of I/O addresses.

- Addresses controlled by port numbers are controlled by bit ON/OFF signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm).
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+1																
Cannot be used.																
n+2																
Current position (upper word)																
n+3																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+4																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5																
Command current (lower word)	I	I	I	I	I	I	I	I	I	I	I	I	524,288	262,144	131,072	65,536

(3) I/O signal assignments

For the signal assignments in each PIO pattern, refer to (3), “I/O signal assignments” under 4.4.2, “Remote I/O Mode.”

The signal assignments for command-current and current-position read functions are shown below.

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	-
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	-

4.4.7 I/O Signal Controls and Functions

* ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”
The following specifies the controls and functions of I/O signals used in the position/simple direct mode, half direct mode and full direct mode. For the I/O signals in the remote I/O mode and remote I/O mode 2, refer to the operation manual for the controller.

(1) Controller ready (PWR) PLC input signal

This signal turns ON when the controller has become ready to perform control after the power was turned on.

■ Function

This signal turns ON when the controller has been initialized successfully following a power on and become ready to perform control, regardless of the alarm condition, servo condition, etc.
The PWR signal turns ON as long as the controller is ready to perform control, even when an alarm is present.

(2) Emergency stop (EMGS) PLC input signal

This signal turns ON when the controller has entered an emergency stop mode.

■ Function

This signal turns ON when the control has entered an emergency stop mode (= the motor drive power has become cut off). It will turn OFF once the emergency stop mode is cancelled.

(3) Alarm (ALM) PLC input signal

This signal turns ON when the controller’s protective circuit (function) has detected an abnormality.

■ Function

This signal turns ON when a protective circuit (function) has actuated following a detection of abnormality.
When the cause of the alarm is removed and the reset (RES) signal is turned ON, the ALM signal will turn OFF if the applicable alarm is an operation-cancellation alarm. (In the case of a cold-start alarm, the power must be reconnected.)
Upon detection of an alarm, the status indicator LED (refer to (6) in 4.3) on the front side of the controller illuminates in red.

(4) Reset (RES) PLC output signal

This signal has two functions: it can be used to reset controller alarms or cancel the remaining travel during a pause.

■ Function

[1] If the cause of the present alarm is removed and then this signal is turned from OFF to ON, the alarm (ALM) signal will be reset. (In the case of a cold-start alarm, the power must be reconnected.)
[2] When this signal is turned from OFF to ON while the actuator is paused, the remaining travel will be cancelled.

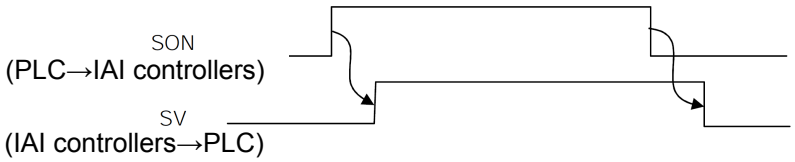
(5) Servo ON command (SON) PLC output signal

Ready (SV) PLC input signal

When the SON signal is turned ON, the servo turns ON.
When the servo turns ON, the status indicator LED (refer to (6) in 4.3) on the front side of the controller illuminates in green.
The SV signal is synchronized with this LED.

■ Function

The controller servo can be turned ON/OFF using the SON signal.
The controller servo remains ON to enable operation while the SV signal is ON.
The relationship of SON and SV signals is shown below.

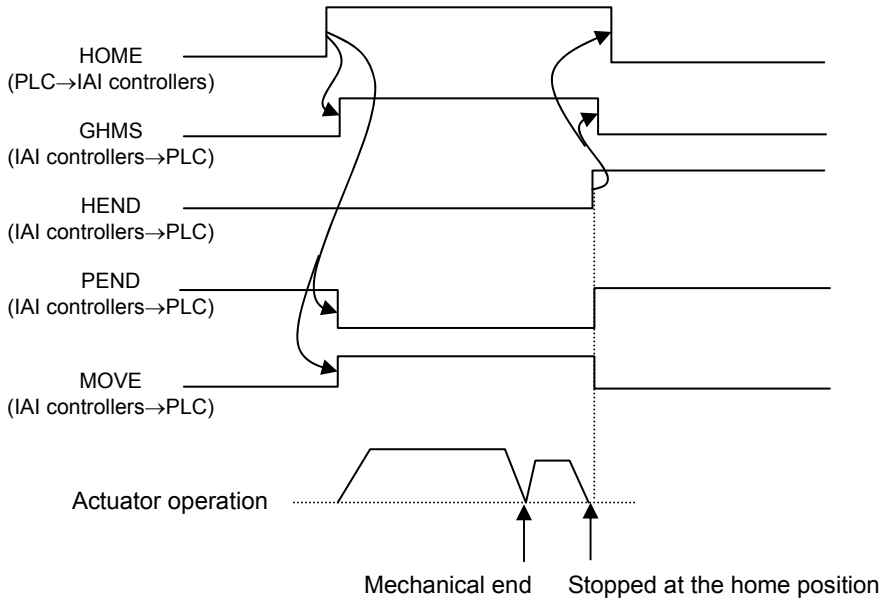


(6) Home return (HOME) PLC output signal

Home return complete (HEND) PLC input signal

Home return in progress (GHMS) PLC input signal

When the HOME signal is turned ON, the command will be processed at the leading (ON) edge of the signal and home return operation will be performed automatically. The GHMS signal turns ON while the home return is in progress.
When the home return is completed, the HEND signal turns ON while the GHMS signal turns OFF.
Turn the HOME signal OFF when the HEND signal turns ON. Once the HEND signal turns ON, it will not turn OFF until the power is turned OFF or the HOME signal is input again.
Even after home return has been completed once, another home return can be performed by turning the HOME signal ON.



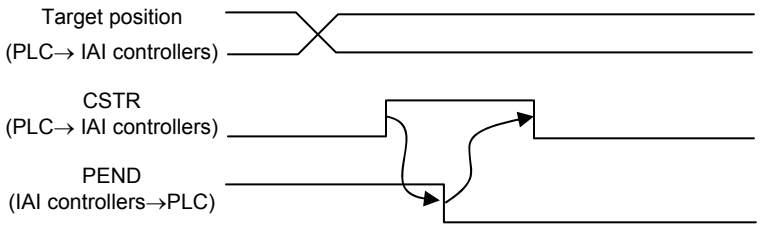
⚠ Caution: In the remote I/O mode, remote I/O mode 2 or position/simple direct mode, issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will cause the actuator to automatically return home and then perform positioning, provided that this is the first positioning command after the power on.
In the half direct mode or full direct mode, issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will generate an alarm (error code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed) (operation-cancellation alarm)). Exercise caution.

(7) Positioning start (CSTR): Used in the position/simple direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the position set by the target position corresponding to the specified position or the PLC's target position.
Whether to use the target position corresponding to the specified position number or PLC's target position is determined by the control signal b11 (position/simple direct switching (PMOD) signal).

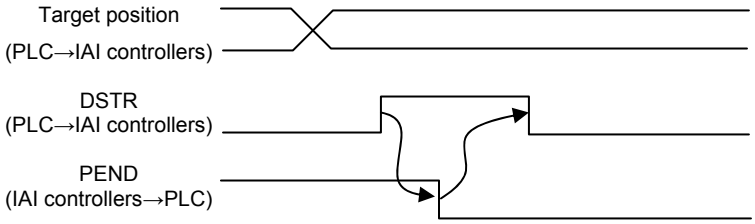
- PMOD = OFF: Use the target position data under the specified position number
- PMOD = ON: Use the set value of the PLC's target position

If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), the actuator will automatically perform home return operation and then move to the target position.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



(8) Positioning command (DSTR): Used in the half direct mode and full direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the target position entered as the PLC's target position (*). If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), an alarm (operation-cancellation alarm) will occur.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.

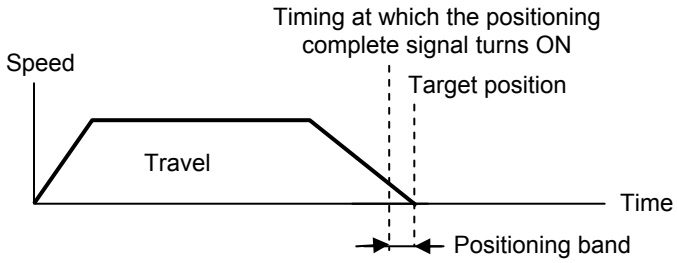


(9) Moving signal (MOVE) PLC input signal

This signal turns ON while the actuator slider or rod is moving (including cases where the actuator is performing home return operation, push-motion operation or jog operation).
The signal turns OFF after the positioning, home return or push-motion operation is completed or while the operation is paused.

(10) Positioning complete signal (PEND) PLC input signal

This signal turns ON when the actuator has moved to the target position and entered the positioning band or completed the push motion.



When the servo turns from OFF to ON, positioning is performed based on the current position being the target position. As a result, this signal turns ON and will turn OFF when another positioning operation is started subsequently using the home return (HOME) signal, positioning start (DSTR) signal or positioning command (CSTR) signal.

⚠ Caution: If the servo turns OFF or an emergency stop is actuated while the actuator is standing still at the target position, the PEND signal turns OFF.
When the servo turns ON again, the signal will turn ON if the actuator is inside the positioning band.
The PEND signal will not turn ON if the CSTR or DSTR signal is ON, even after the positioning is completed.

(11) Pause (STP) PLC output signal

When this signal is turned ON, the moving axis will decelerate to a stop. Turning it OFF will resume the axis movement.
The acceleration upon resumption of operation, and deceleration at stopping, conform to the acceleration/deceleration set by the specified position number (*) in the position/simple direct mode, or to the value of acceleration/deceleration (*) in the half direct mode.
In the full direct mode, the values of acceleration (*) and deceleration (*) are used.
(*) Refer to 4.4.1.

(12) Zone 1 (ZONE1) PLC input signal

Zone 2 (ZONE 2) PLC input signal

Position zone (PZONE) PLC input signal

Each signal turns ON when the current actuator position is inside the specified range, and turns OFF when the actuator is outside the range.

[1] Zones 1, 2

A desired zone is set using user parameters.

The ZONE1 signal is set using parameter Nos. 1, “Zone boundary 1+” and 2, “Zone boundary 1-.”

The ZONE2 signal is set using parameter Nos. 23, “Zone boundary 2+” and 24, “Zone boundary 2-.”

The ZONE1 and ZONE2 signals become valid upon completion of home return, after which they will remain valid even while the servo is turned OFF.

[2] Position zone

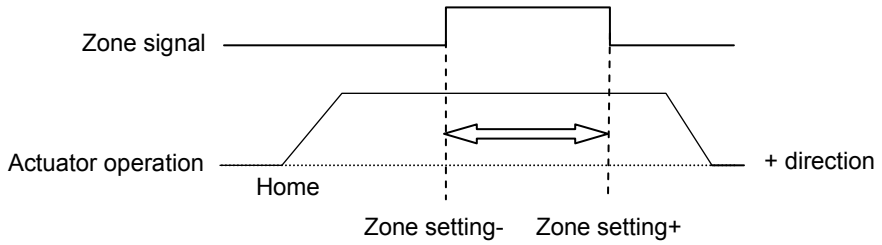
A desired zone is set using the position table or PLC.

In the position/simple direct mode, set the PZONE signal using the position table.

In the full direct mode, set the PZONE signal using the zone boundaries (refer to 4.4.1).

(*) The PZONE signal is not available in the half direct mode.

The PZONE signal becomes valid upon issuance of a move command after completion of home return, after which it will remain valid even while the servo is turned OFF.



(13) +Jog (JOG+) PLC output signal

-Jog (JOG-) PLC output signal

These signals are used as starting commands for jog operation or inching operation.
A + command starts the applicable operation in the direction opposite home, while a – command starts the applicable operation in the direction of home.

[1] Jog operation
Jog operation can be performed when the jog/inching switching (JISL) signal is OFF.
While JOG+ is ON, the actuator moves in the direction opposite home. When the signal turns OFF, the actuator will decelerate to a stop.
While JOG- is ON, the actuator moves in the direction of home. When the signal turns OFF, the actuator will decelerate to a stop.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the jog speed/inching distance switching (JVEL) signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals turn ON, the actuator will decelerate to a stop.

[2] Inching operation
Inching operation can be performed when the jog/inching switching (JISL) signal is ON.
The actuator moves by the inching distance with every ON input.
While JOG+ is ON, the actuator moves in the direction opposite home. While JOG- is ON, the actuator moves in the direction of home.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves by the travel corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves by the value of parameter No. 48, “PIO inching distance.”
  When the JVEL signal is ON, the actuator moves by the value of parameter No. 49, “PIO inching distance 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).

During normal operation, the actuator will continue with the normal operation even when the JOG+ or JOG- is turned ON (= the JOG signal will be ignored).
While paused, the actuator will not move even when the JOG+ or JOG- is turned ON.

(Note) Take note that before completion of home return, the actuator may collide with the mechanical end because the software stroke limits are not valid.

(14) Jog speed/inching distance switching (JVEL) PLC output signal

This signal switches between the parameter that specifies the jog speed to be used when the jog mode is selected, and one that specifies the inching distance to be used when the inching mode is selected.
The relationships of applicable parameters are shown below.

JVEL signal	Jog operation: JISL = OFF	Inching operation: JISL = ON
OFF	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed” Parameter No. 48, “Inching distance”
ON	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2” Parameter No. 49, “Inching distance 2”

(15) Jog/inching switching (JISL) PLC output signal

This signal switches between jog operation and inching operation.
JISL = OFF: Jog operation
JISL = ON: Inching operation
If the JISL signal switches to ON (inching) while the actuator is jogging, the actuator will decelerate to a stop and the inching function will become effective.
If the JISL signal switches to OFF (jog) while the actuator is inching, the jog function will become effective after the actuator completes its movement.
The table below specifies the relationship of the ON/OFF statuses of JISL signal and jog speed/inching distance switching (JVEL) signal.

		Jog operation	Inching operation
JISL		OFF	ON
JVEL=OFF	Speed	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed”
	Travel	-	Parameter No. 48, “Inching distance”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
JVEL=ON	Speed	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2”
	Travel	-	Parameter No. 49, “Inching distance 2”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
Operation		When JOG+/JOG- is ON	Upon detection of the leading (ON) edge of JOG+/JOG-

(16) Teaching mode command (MODE) PLC output signal

Teaching mode signal (MODES) PLC input signal

When the MODE signal is turned ON, the normal operation mode switches to the teaching mode.
When the mode switches to teaching, the controller of each axis turns ON the MODES signal.
The PLC should perform teaching operation after confirming that the MODES signal has turned ON.
(Note) For the normal operation mode to switch to the teaching mode, the following conditions must be satisfied:

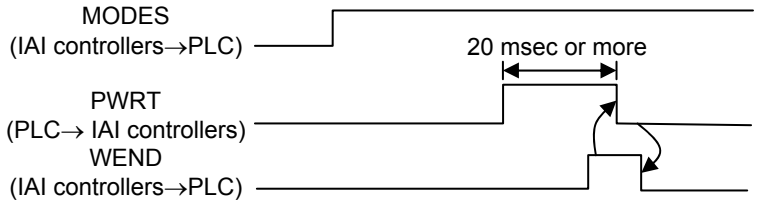
- The actuator (motor) is stopped.
- The +jog (JOG+) and -jog (JOG-) signals are OFF.
- The position data read command (PWRT) signal and positioning start (CSTR) signal are OFF.

(Note) The actuator will not return to the normal operation mode unless the PWRT signal is OFF.

(17) Position data read command (PWRT) PLC output signal

Position data read complete (WEND) PLC input signal

The PWRT signal is valid when the teaching mode signal (MODES) is ON.
Turn the PWRT signal ON (*1). This causes the current position data to be written to the Position field of the position number currently set under the position number specified by the PLC (refer to 4.4.1). (*2)
When the writing is completed, the WEND signal turns ON.
The host PLC should turn the PWRT signal OFF after the WEND signal has turned ON.
If the PWRT signal is turned OFF before the WEND signal turns ON, the WEND signal will not turn ON.
Turning the PWRT signal OFF causes the WEND signal to turn OFF.
(*1) Keep the signal ON for 20 msec or more. If the signal is turned on for less than 20 msec, the data may not be written.
(*2) If any data other than position is yet to be defined, the default value of the corresponding parameter is written. (Refer to the operation manual for the controller.)



(18) Forced brake release (BKRL) PLC output signal

The brake can be forcibly released by turning this signal ON.

(19) Operation mode (RMOD) PLC output signal

Operation mode status (RMDS) PLC input signal

A different operation mode is selected as follows based on the RMOD signal and the MODE switch on the front side of the controller.
Whether the current mode is AUTO or MANU can be checked using the RMDS signal.
RMOD signal and mode switch combinations, and corresponding operation modes, are shown below.

	Controller's MODE switch in AUTO position	Controller's MODE switch in MANU position
RMOD signal OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

(Note) Operation from the PLC is not supported in the MANU mode.

(20) Position/simple direct switching (PMOD) PLC output signal

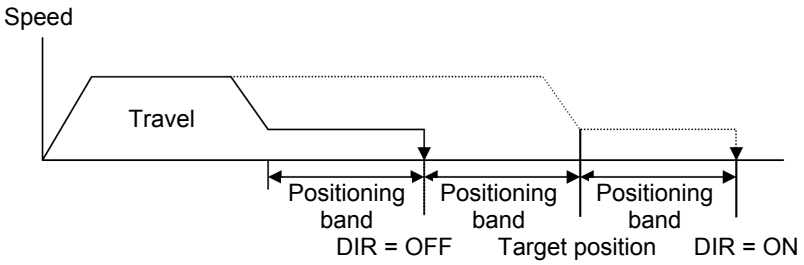
This signal switches between the mode where a value registered in the controller's position table is used as the target position for movement, and the mode where the PLC's target position (*) is used.
PMOD = OFF: Use the position table
PMOD = ON: Use the value of the PLC's target position(*)
(*) Refer to 4.4.1.

(21) Push specification (PUSH) PLC output signal

When a move command is issued after turning this signal ON, the actuator will perform push-motion operation.
If this signal is turned OFF, the actuator will perform normal positioning operation.
(Refer to (2), "Operation in the half direct mode" under 4.6, "Operation.")

(22) Push direction specification (DIR) PLC output signal

This signal specifies the direction in which the actuator will push the load.
When this signal is turned OFF, the actuator will push the load toward the position obtained by subtracting the positioning band from the target position.
When this signal is turned ON, the actuator will push the load toward the position obtained by adding the positioning band to the target position.
This signal is invalid during normal positioning operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 4.6, "Operation.")



(23) Missed load during push-motion operation (PSFL) PLC input signal

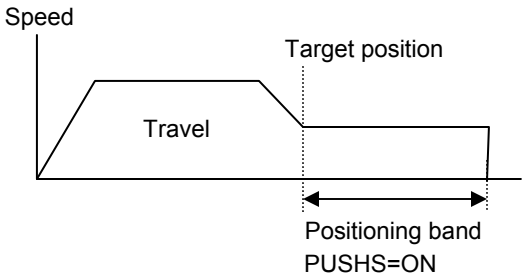
This signal turns ON when the actuator has not contacted the load after having travelled the distance set by the positioning band in the controller's position table or PLC's positioning band (refer to 4.4.1) during push-motion operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 4.6, "Operation.")

(24) Incremental specification (INC) PLC output signal

When a move command is issued while this signal is ON, the actuator will move by the value entered as the PLC's target position (*) with reference to the current position. (Incremental moves)
If this signal is OFF, the actuator will move to the value of the PLC's target position (*).
(*) Refer to 4.4.1.

(25) Push-motion operation in progress (PUSHS) PLC input signal

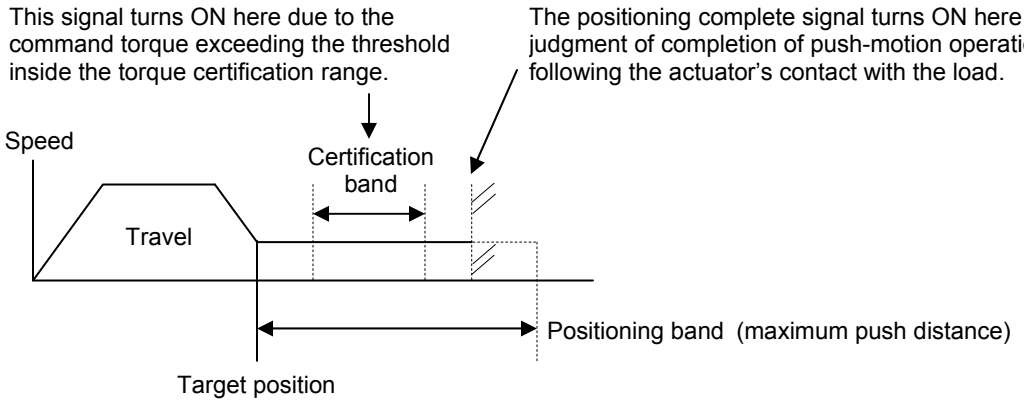
This signal turns ON while the push-motion operation is in progress.



This signal turns OFF if the actuator has missed the load in push-motion operation or paused, or the next move command has been issued, or the servo has been turned OFF.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 4.6, "Operation.")

(26) Load output judgment (LOAD) PLC input signal PCON only

This signal is valid only during push-motion operation.
To use an actuator in a press-fit application, whether or not the specified load threshold has reached during the push-motion operation must be recognized.
The load threshold and certification band are set by the PLC, and this signal will turn ON when the command torque (motor current) exceeds the threshold inside the certification band.
For this signal, judgment is made based on whether the command torque has exceeded the threshold for the specified total time.
The specific procedure is the same as that for push judgment. The load output judgment time can be changed as desired using parameter No. 50, "Load output judgment time."
This signal will be retained until the next move command is received.

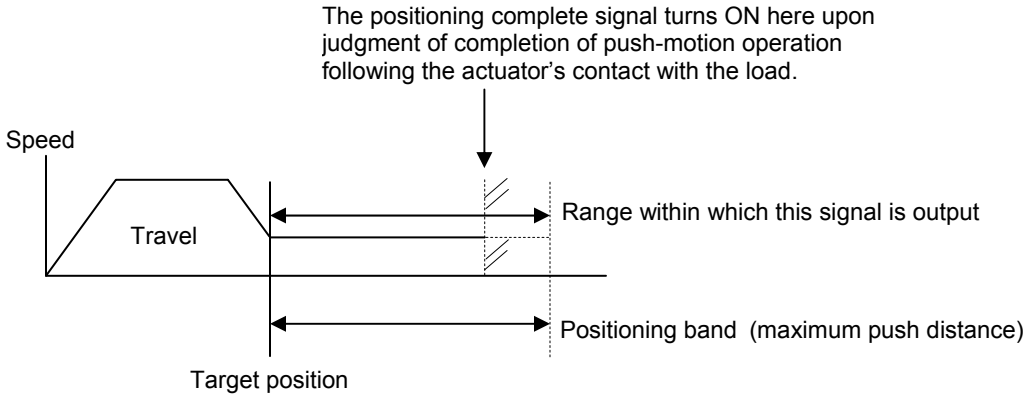


- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "0 [Enable]."
- Set the threshold certification band using the PLC's zone boundary+ and zone boundary- (*).
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 4.4.1.

⚠ Warning:
- If the actuator contacts the load before the target position is reached, a servo error will occur. Pay due attention to the position relationship of the target position and load.
- The actuator continues to push the load at the standstill push current determined by the current-limiting value.
  Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(27) Torque level (TRQS) PLC input signal PCON only

This signal is valid only during push-motion operation.
This signal turns ON when the motor current has reached the load threshold during push-motion operation (while the actuator is moving inside the positioning band). Since the current is monitored by level, when the current changes the ON/OFF status of this signal will also change. The speeds that can be used for push-motion operation vary depending on the motor and lead. Accordingly, the applicable parameters must be adjusted.



- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "1 [Disable]."
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 4.4.1.

⚠ Warning:
- If the actuator contacts the load before the target position is reached, a servo error will occur. Pay due attention to the position relationship of the target position and load.
- The actuator continues to push the load at the standstill push current determined by the current-limiting value.
  Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(28) Standstill control mode (SMOD) PLC output signal PCON only

One general characteristic of pulse motors is that their holding current in a standstill state is greater than that of AC servo motors. Accordingly, a means to reduce power consumption in a standstill state is provided as an energy-saving measure to address situations where the actuator remains standstill for a long period at a standby position.
SMOD = ON: Use the full-servo control mode during standby
SMOD = OFF: Normal standby mode

- Full-servo control mode
  The holding current can be reduced by servo-controlling the pulse motor.
  Although the specific level of reduction varies according to the actuator model, load condition, etc., the holding current will decrease to approx. 1/2 to 1/4.
  The actual holding current can be checked on the current monitor screen of the PC software.
  (Note) Micro-vibration or noises may occur in conditions where the actuator is subject to external forces or depending on the standstill position.

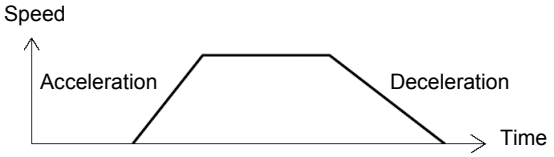
Before using this mode, confirm that the overall system will not be negatively affected.

(29) Acceleration/deceleration mode (MOD1, MOD0) PLC output signal

This signal is used to select a desired acceleration/deceleration pattern characteristic. Select one characteristic before issuing an actuator move command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid pattern	Factory setting
OFF	ON	S-motion	
ON	OFF	Primary delay filter	
ON	ON	Cannot be used.	

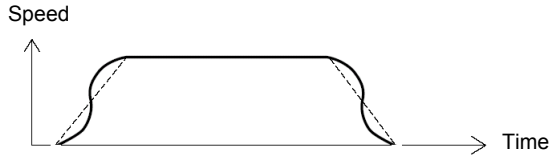
Trapezoid pattern



* The acceleration and deceleration are set in the “Acceleration” and “Deceleration” fields of the position data table.

S-motion

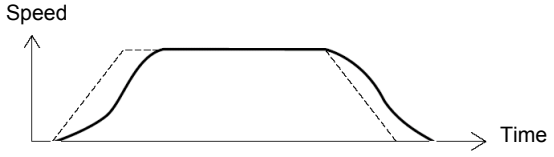
The acceleration/deceleration curve rises gradually at first and then draws a steep curve from a certain point. Use this mode if you want to set high acceleration/deceleration to meet the tact time requirement, but keep the acceleration/deceleration gradual at the start of movement or immediately before stopping.



* The S-motion level is set using parameter No. 56, “S-motion ratio setting.” The setting unit is %, while the setting range is 0 to 100.
(The above graph shows a curve assuming a 100% S-motion ratio.)
When “0” is set, the S-motion mode is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

Primary delay filter

A more gradual acceleration/deceleration curve than linear acceleration/deceleration (trapezoid pattern) is drawn. Use this mode if you don’t want the load to receive micro-vibration during acceleration/deceleration.

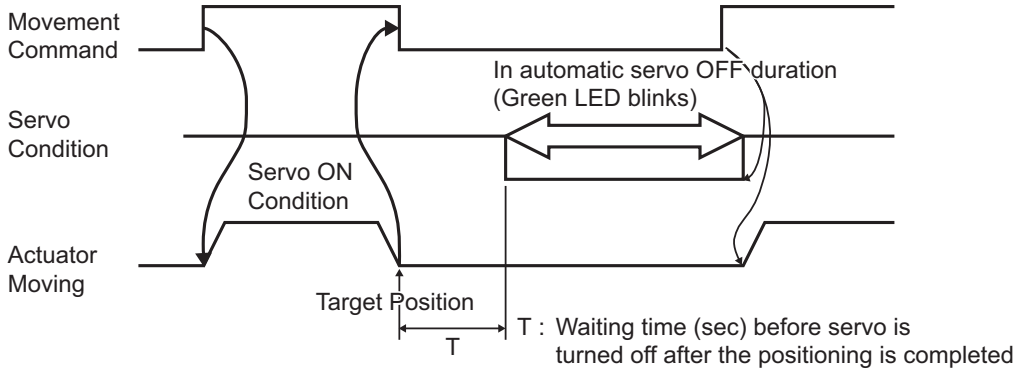


* The primary delay level is set using parameter No. 55, “Position-command primary filter time constant.” The minimum input unit is 0.1 msec, while the setting range is 0.0 to 100.0.
When “0” is set, the primary delay filter is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

(30) Stop Mode Selection (ASO1, ASO0) PLC Output Signal

Select the stop mode for the duration before the movement to the next position after a positioning is completed.
If the duration for a stop is long, the system automatically turns the servo OFF to reduce the power consumption.
Refer to the operation manual for the controller for more information.

ASO1	ASO0	Function	Reference
OFF	OFF	Disabled	Set in delivery
OFF	ON	Automatic Servo OFF Method Parameter No. 36 is valid for T	
ON	OFF	Automatic Servo OFF Method Parameter No. 37 is valid for T	
ON	ON	Automatic Servo OFF Method Parameter No. 38 is valid for T	



(31) Light error status (ALML) PLC Input Signal

This becomes 1 when a message level (light alarm that the operation can be kept on) is generated.
This signal is not linked with ALM_LED on the front panel of the controller.
[Refer to the instruction manual for the controller main body for the details of the alarms.]

(32) Absolute Battery Voltage Low Warning (BALM) PLC Input Signal ACON only

With an serial absolute system, this signal is OFF when the absolute battery voltage is normal. It remains OFF with an incremental system.
This BALM signal turns ON when the absolute battery voltage drops to 3.1 V. If the controller is operated continuously and the voltage drops further to 2.5 V, the controller can no longer retain position information. (If you are using an absolute system and this signal turns ON, replace the battery at the earliest opportunity.)

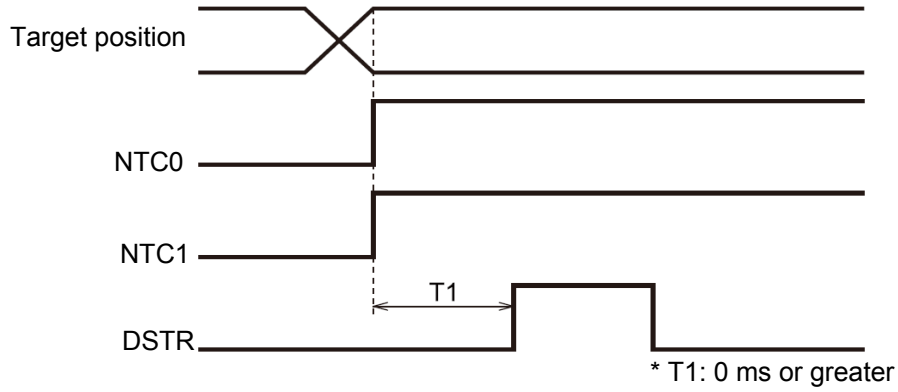
(33) Vibration Damping Mode Selection 0, 1 (NTC0, NTC1) PLC Output Signals ACON only

The vibration damping control function suppresses the load vibration induced by IAI's actuator. Measure the vibration frequency and set it in a parameter. In another parameter, select and set an appropriate option based on a combination of these signals.
For details, refer to the operation manual for your controller.

NTC1	NTC0	Function	Remarks
OFF	OFF	Do not use vibration damping control.	Factory setting
OFF	ON	Select parameter set 1	
ON	OFF	Select parameter set 2	
ON	ON	Select parameter set 3	

Input timing

An input timing chart of NTC0/NTC1 signals is shown below.



⚠ Caution: Since the statuses of NTC0/NTC1 signals are loaded when a movement command (DSTR) is recognized, nothing happens when the NTC0/NTC1 signals are turned ON/OFF while the actuator is moving.

(34) Servo Gain Parameter Set Selection (GSL0, GSL1) PLC Output Signals ACON only

The actuator can be operated by selecting, for each position movement, any one of the following four pre-defined sets of servo gain parameters (six different parameters).
For details, refer to the operation manual for your controller.

GSL1	GSL0	Function	Remarks
OFF	OFF	Select parameter set 0	Factory setting
OFF	ON	Select parameter set 1	
ON	OFF	Select parameter set 2	
ON	ON	Select parameter set 3	

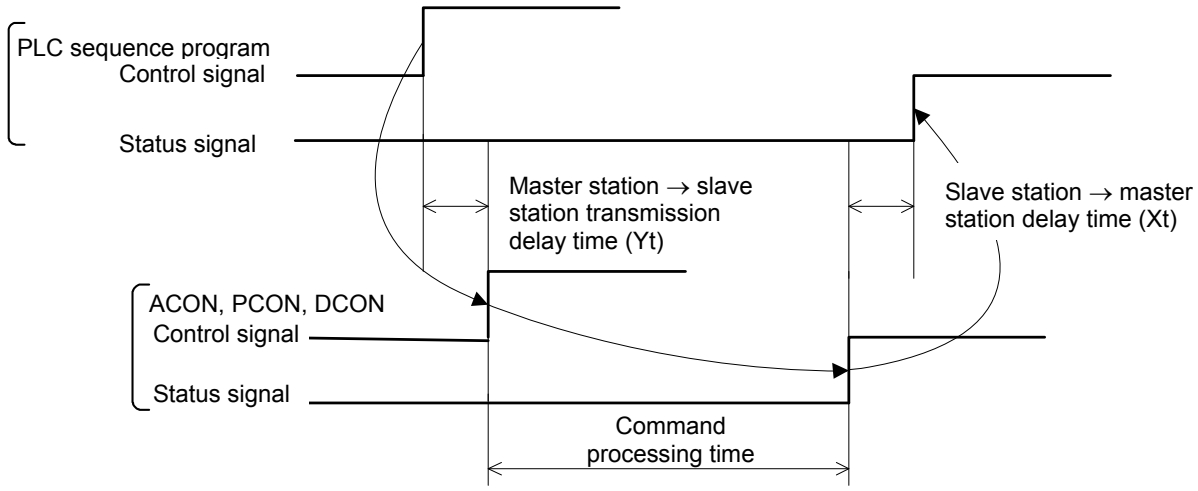
4.5 I/O Signal Timings

The maximum response time after a given control signal is turned ON to operate the ROBO Cylinder using the PLC's sequence program, until a response (status) signal is turned, is expressed by the formula below:

Maximum response time (msec) = Yt + Xt + 2 + Command processing time (operation time, etc.)

Yt: Master station → slave station transmission delay time
Xt: Slave station → master station delay time
} Field network transmission delay time

For the master station → slave station transmission delay time (Yt) and slave station → master station delay time (Xt), refer to the operation manuals for the PROFIBUS-DP master unit and the PLC in which the master unit is installed.



4.6 Operation

Next, timings in the position/simple direct mode, half direct mode and full direct mode are explained using examples of basic operations.
For the remote I/O mode and remote I/O mode 2, refer to the operation manual for the controller.
(In remote I/O mode 2, read the current position and current speed from the PLC as deemed necessary.)

(1) Operation in the position/simple direct mode

Operate the actuator by writing the position data to the PLC's target position, while specifying the speed, acceleration/deceleration, positioning band, push-current limiting value, etc., in the position table.

- Example of operation (normal positioning operation)

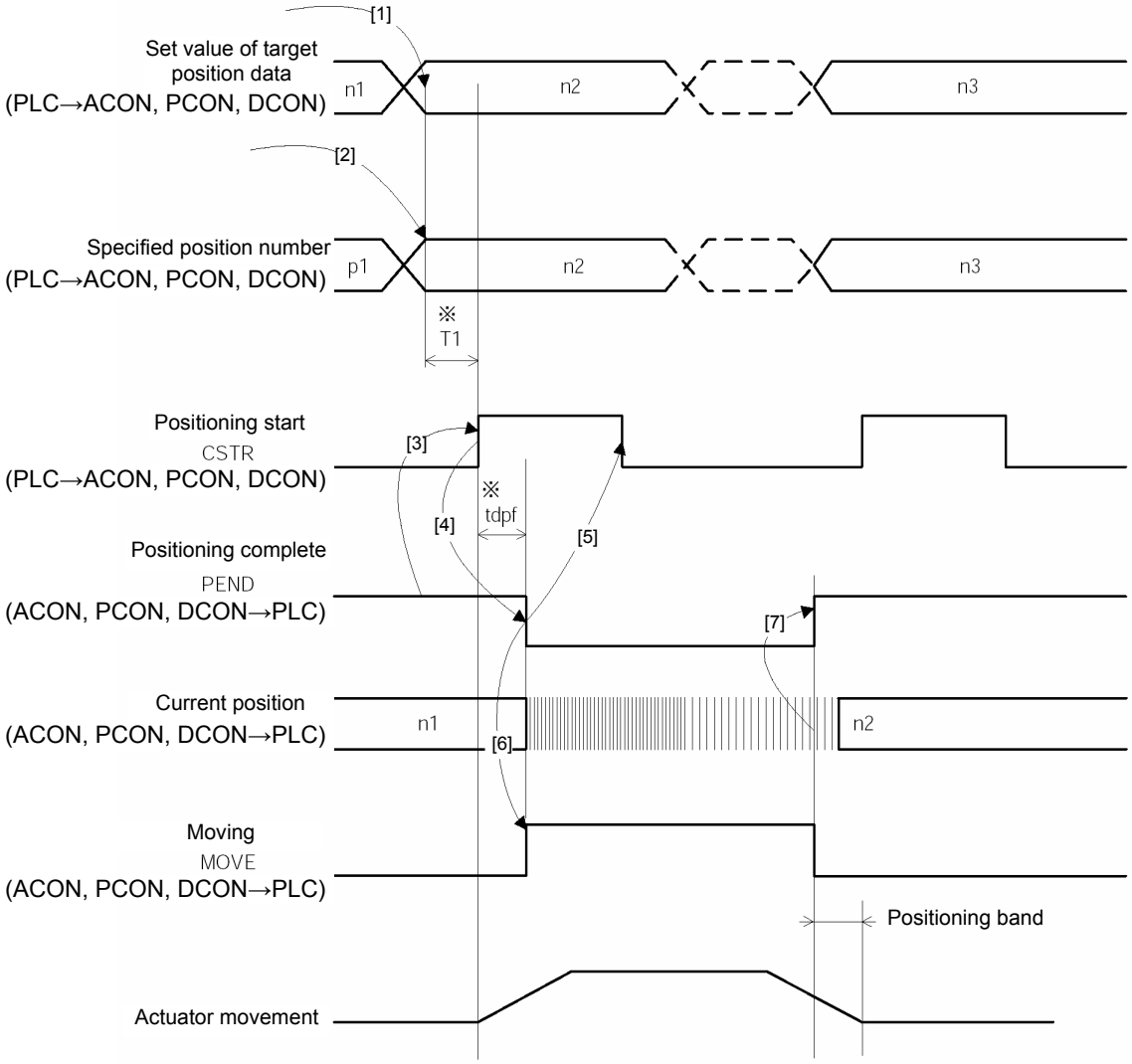
(Preparation) Set all position data other than the target position (speed, acceleration/deceleration, positioning band, etc.) in the position table.
Turn the position/simple direct switching (PMOD) signal ON.

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the position number for which the speed, acceleration/deceleration, etc., have been set for the specified position number corresponding to output address n+2 (*).
[3] Turn the positioning start (CSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] and [2] are read by the controller at the leading edge of the CSTR signal.
[4] The CSTR signal turns ON and PEND turns ON tpdf thereafter.
[5] Turn the CSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the target value (*) until the CSTR signal is turned OFF.
[6] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[7] The current position data (*) in input addresses n and n+1 are constantly updated. When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON if the CSTR signal is OFF, upon which the completed position number is output to the completed position number (*) corresponding to input address n+2.
Accordingly, wait until the PEND signal turns ON and an appropriate time (time to move the remaining travel) elapses before reading the completed position number (*) following the completion of positioning.
The current position data may vary slightly due to vibration, etc., even when the actuator is at standstill.
[8] The target position data can be changed while the actuator is moving.
To change the target position, change the target position data, wait until at least the PLC's scan time elapses, and then turn the CSTR signal ON.
Change the value of the CSTR signal after an elapse of at least the PLC's scan time.

- Example of operation (push-motion operation)

In push-motion operation, a current-limiting value is set in the Push field of the position data table in the "preparation" stage.
When positioning is started by specifying the position number for which the above value has been set in the Push field, push-motion operation is performed.

(*) Refer to 4.4.1.



*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※Yt+Xt≦tdpf≦Yt+Xt+2 (msec)

(2) Operation in the half direct mode

Operate the actuator by specifying data for the PLC's target position, positioning band, specified speed, acceleration/deceleration and push-current limiting specification.

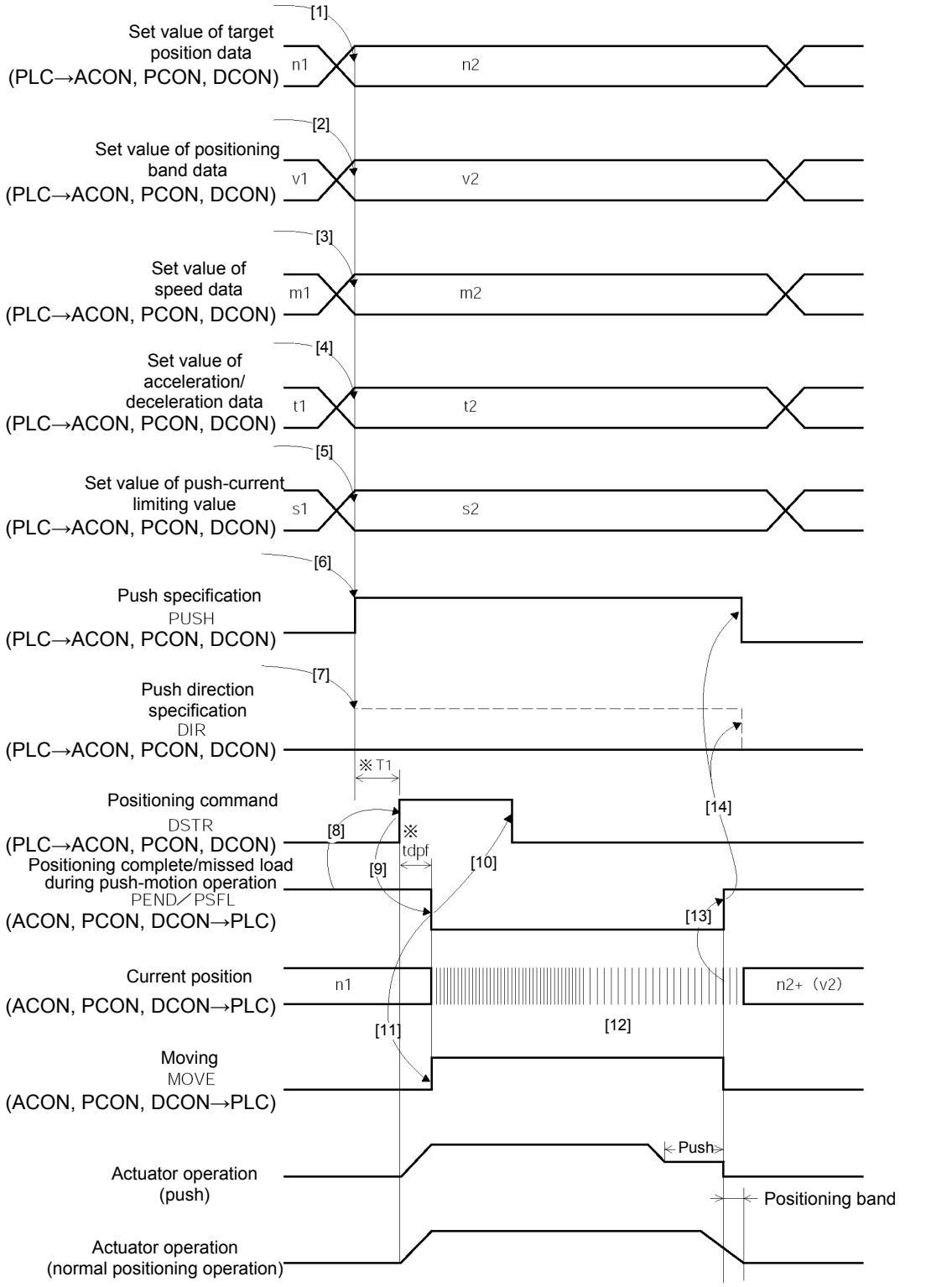
- Example of operation (push-motion operation)

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set the speed data for the speed (*) corresponding to output address n+4.
[4] Set the acceleration/deceleration data for the acceleration/deceleration (*) corresponding to output address n+5.
[5] Set the push-current limiting data for the push-current limiting value (*) corresponding to output address n+6.
[6] Turn the push specification (PUSH) signal ON.
[7] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 4.4.7.)
[8] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [5] are read by the controller at the leading edge of the DSTR signal.
[9] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[10] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [5] until the DSTR signal is turned OFF.
[11] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[12] The current position data (*) in input addresses n and n+1 are constantly updated.
[13] The PEND signal turns ON when the motor current reaches the current-limiting value set in [5] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [5] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[14] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [6] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 4.4.1.



*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※ Yt+Xt ≦ tdpf ≦ Yt+Xt+2 （msec）

(3) Operation in the full direct mode

Operate the actuator by specifying from the PLC all conditions required for positioning, such as the PLC's target position and positioning band.

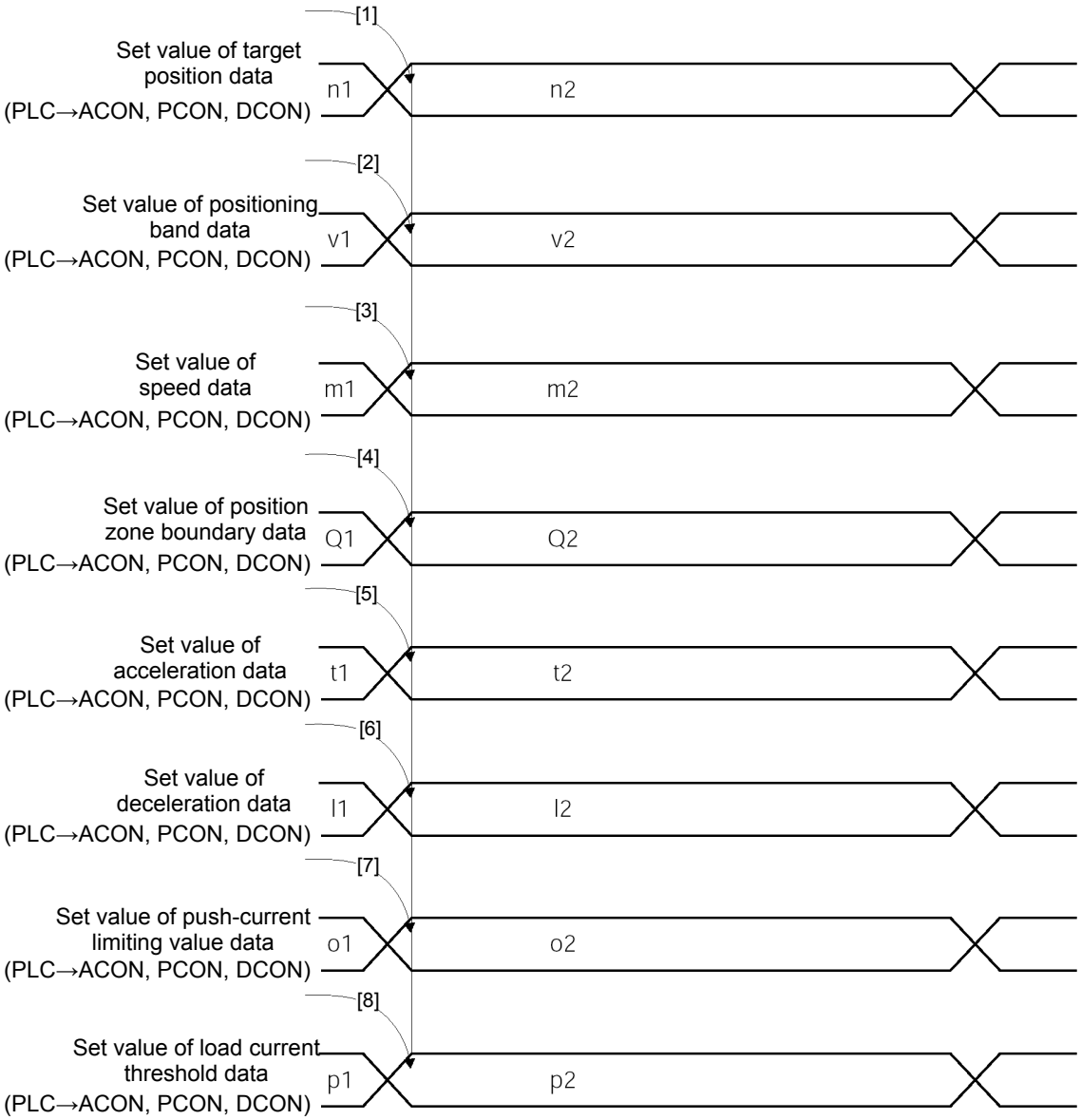
- Example of operation (push-motion operation)

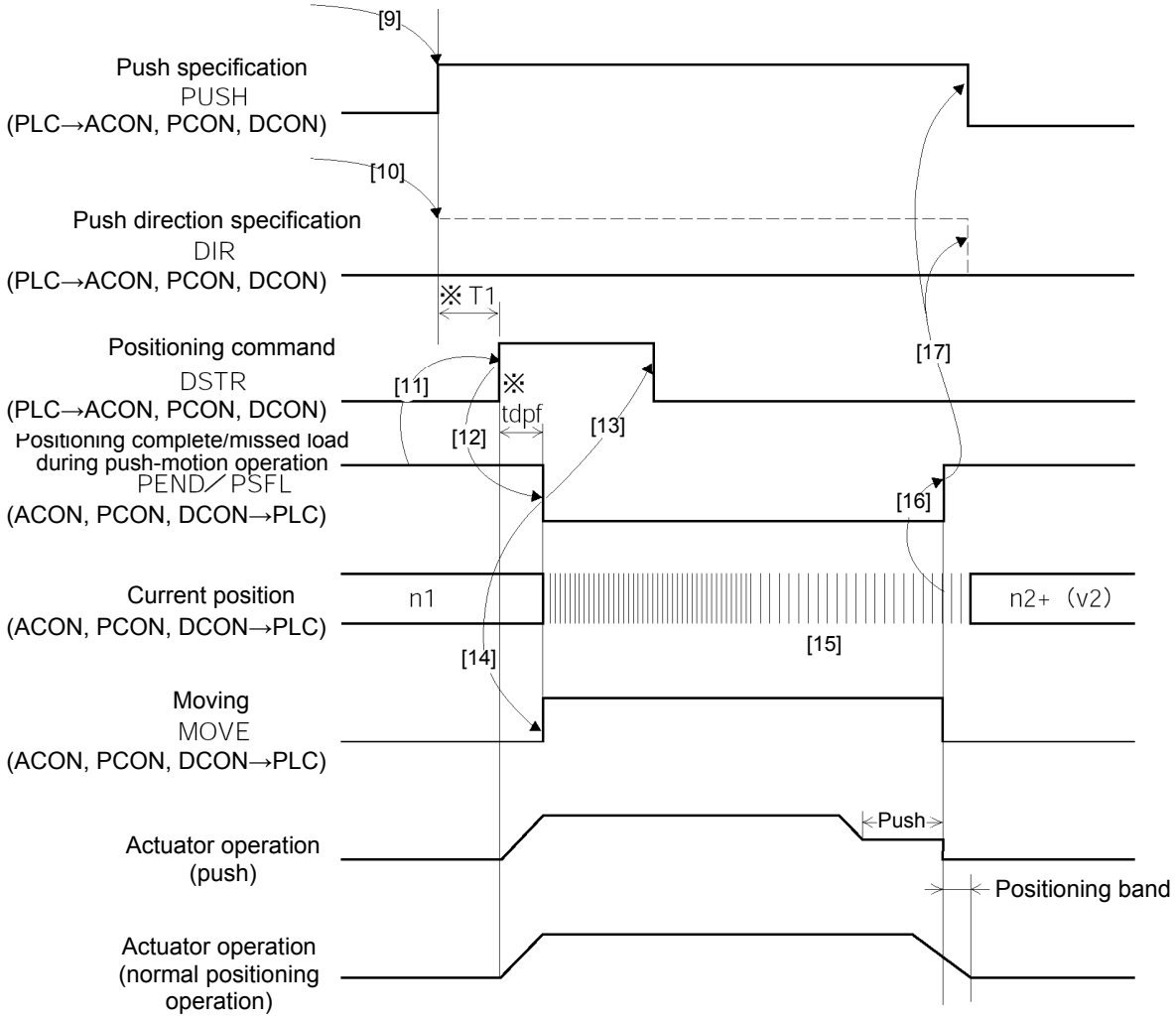
[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set speed data for the speeds (*) corresponding to output addresses n+4 and n+5.
[4] Set the position-zone output boundary data for the zone boundary+ and zone boundary- (*) corresponding to output addresses n+6 to n+9.
[5] Set the acceleration data for the acceleration (*) corresponding to output address n+10.
[6] Set the deceleration data for the deceleration (*) corresponding to output address n+11.
[7] Set the push-current limiting value data for the push-current limiting value (*) corresponding to output address n+12.
[8] Set the load current threshold data for the load current threshold (*) corresponding to output address n+13.
[9] Turn the push specification (PUSH) signal ON.
[10] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 4.4.7.)
[11] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [8] are read by the controller at the leading edge of the DSTR signal.
[12] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[13] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [8] until the DSTR signal is turned OFF.
[14] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[15] The current position data (*) in input addresses n and n+1 are constantly updated.
[16] The PEND signal turns ON when the motor current reaches the current-limiting value set in [7] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [7] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[17] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [9] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 4.4.1.


[1]
Set value of target position data (PLC→ACON, PCON, DCON)
n1
n2
[2]
Set value of positioning band data (PLC→ACON, PCON, DCON)
v1
v2
[3]
Set value of speed data (PLC→ACON, PCON, DCON)
m1
m2
[4]
Set value of position zone boundary data (PLC→ACON, PCON, DCON)
Q1
Q2
[5]
Set value of acceleration data (PLC→ACON, PCON, DCON)
t1
t2
[6]
Set value of deceleration data (PLC→ACON, PCON, DCON)
l1
l2
[7]
Set value of push-current limiting value data (PLC→ACON, PCON, DCON)
o1
o2
[8]
Set value of load current threshold data (PLC→ACON, PCON, DCON)
p1
p2

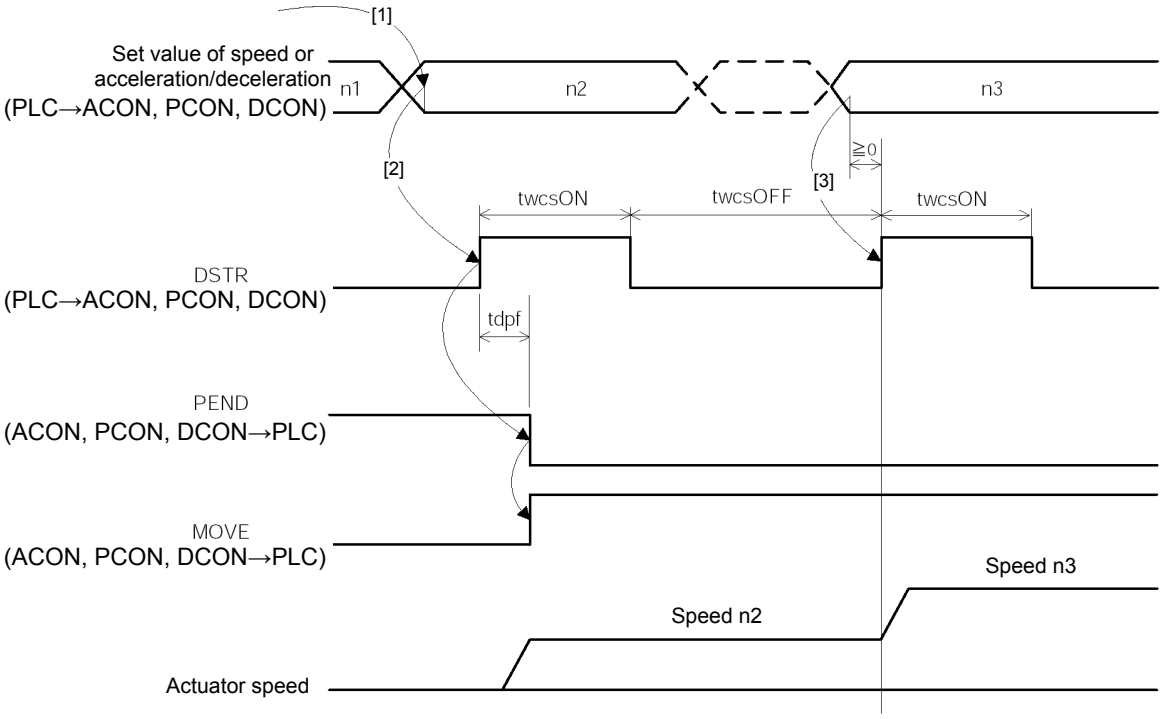


*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

※ Yt+Xt ≦ tdpf ≦ Yt+Xt+2（msec）

(4) Data change during movement

In the half direct mode and full direct mode, the values of target position data, acceleration/deceleration data, speed data, positioning band and push-current limiting value set by the PLC can be changed while the actuator is moving. After a desired data has been changed, turn the positioning command (DSTR) signal “ON” for tdpf or longer.
After the DSTR is turned “OFF,” wait for at least “twcsON + twcsOFF” before DSTR is turned “ON” again.
An example of changing the speed or acceleration/deceleration is given below.



twcsON≧Yt＋Xt＋2（msec）
twcsOFF≧Yt＋Xt＋2（msec）
※Yt＋Xt≦tpdf≦Yt＋Xt＋2（msec）

⚠ Caution:

1. If the speed is not yet set or set to “0,” the actuator will remain standstill and no alarm will generate.
2. If the speed is changed to “0” while the actuator is moving, the actuator will decelerate to a stop and no alarm will generate.
3. Even when the acceleration/deceleration or speed data alone is changed while the actuator is moving, the target position data must also be set.
4. Even when the target position alone is changed while the actuator is moving, the acceleration/deceleration and speed data must also be set.

4.7 PROFIBUS-DP Parameters

The parameters relating to PROFIBUS-DP are parameter Nos. 84 to 87, 90 and 159.
Category: C: External interface parameter

No.	Category	Symbol	Name	Factory default
1			For parameter Nos. 1 to 83, refer to the operation manual for the controller.	
≀				
83				
84	C	FMOD	Fieldbus operation mode	0
85	C	NADR	Fieldbus node address	1
86	C	FBRS	Fieldbus baud rate	0
87	C	NYTP	Network type	3
90	C	FMIO	Fieldbus I/O format	0
159	C	FBVS	FB Half Direct Mode Speed Unit	0

- Fieldbus operation mode (No. 84 FMOD)

Specify a desired operation mode in parameter No. 84 using a value between 0 and 4.

Set value of parameter No. 84	Mode name	Number of occupied bytes	Description
0 (factory setting)	Remote I/O mode	2	The actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP.
1	Position/simple direct mode	8	The target position can be specified directly as a value or using a value in the position data table. Other values required for operation are set in the position data table.
2	Half direct mode	16	Operate the actuator by specifying the speed, acceleration/deceleration and push-current value, in addition to the target position, directly using values.
3	Full direct mode	32	Operate the actuator by specifying all values relating to position control directly using values.
4	Remote I/O mode 2	12	The current-position and current-speed read functions are added to the functions available in the remote I/O mode.

- Fieldbus node address (No. 85 NADR)

Specify the slave number of the remote station in parameter No. 85.

Setting range: 0 to 125 (The factory setting is 1.)

- Fieldbus baud rate (No. 86 FBRS)

The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

- Network type (No. 87 NTYP)

Specify the network module in parameter No. 87. Do not change the default value.

- Fieldbus I/O format (No. 90 FMIO)

PLC addresses are assigned in units of 16 points (units of words) based on the I/O addresses set to the controller and number of occupied addresses in each mode.
By changing the setting of parameter No. 90, data of up to 2 words can be swapped in units of bytes before transmission within the range of communication with the PLC's I/O addresses.

Set value of parameter No. 90	Description
0 (factory setting)	Data is not swapped and sent as is to the PLC. (Refer to Example i.)
1	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. (Refer to Example ii.)
2	In the case of a word register, the upper word and lower word are swapped. (Refer to Example iii.)
3	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. In the case of a word register, the upper word and lower word are also swapped. (Refer to Example iv.)

(Example i) Set value = "0"

● indicates ON, while O indicates OFF.

PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

⇧

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

⇩

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example ii) Set value = “1”

● indicates ON, while O indicates OFF.

PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON／OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iii) Set value = “2”

● indicates ON, while O indicates OFF.

PCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

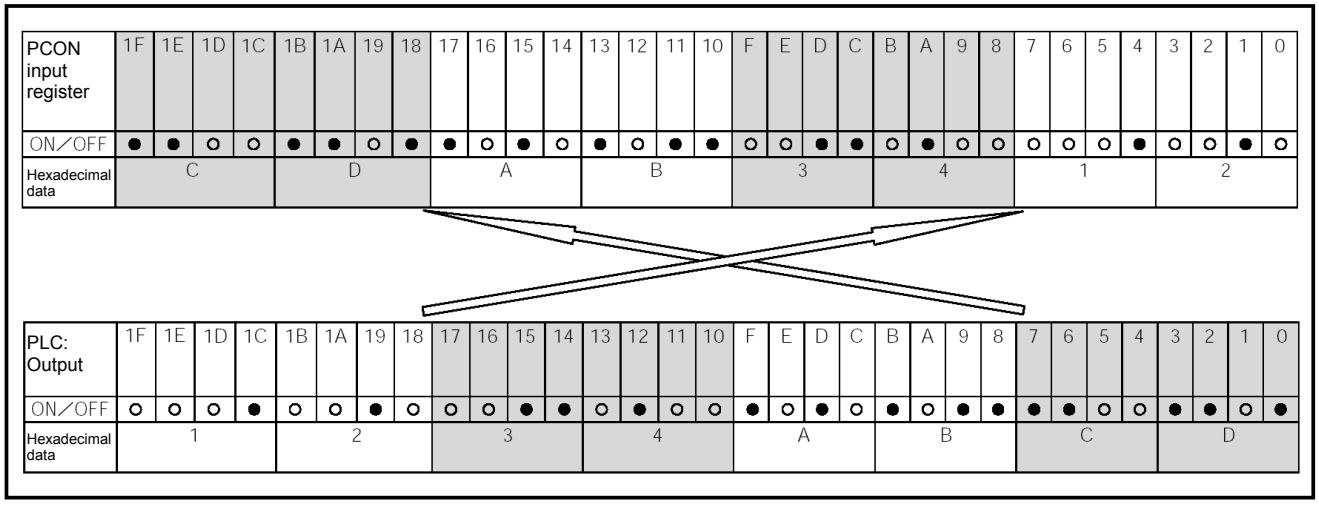
PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

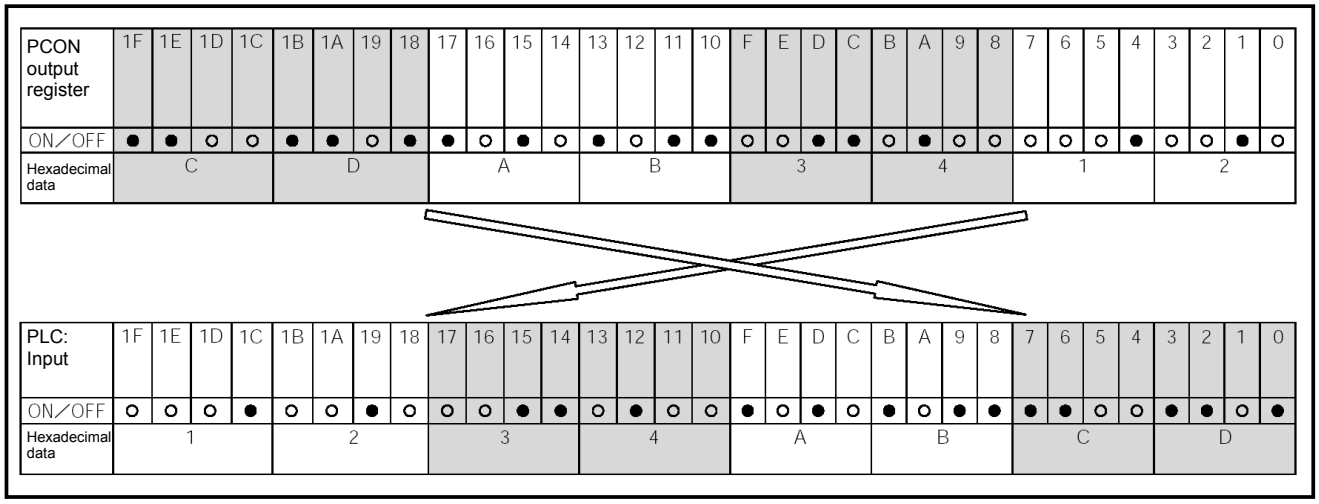
PCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iv) Set value = “3”

● indicates ON, while O indicates OFF.





● FB Half Direct Mode Speed Unit (No.159 FBVS)
Determines the unit of measure when operating the unit in Half Direct Mode.

Parameter No. 159 Setting Value	Speed Setting Unit
0 (Set in delivery)	1mm/sec
1	0.1mm/sec

4.8 Troubleshooting

4.8.1 Status LED Indicators

The illumination patterns of status LEDs (STATUS0/1) indicate the operating condition of the PROFIBUS-DP module as well as the network condition.
Should you encounter a problem, check the current conditions based on the illumination patterns of the status LEDs.
The illumination patterns of status LEDs, and corresponding communication conditions, are shown below.

LED	Color	Indicator condition	Description of indication (Meaning of indication)
STATUS1	Green	Lit	The board is online with the fieldbus network and communicating normally.
		Blinking	The board is offline from the fieldbus network.
	Orange	Blinking	A communication error is present.
STATUS0	Green	Lit	The board is operating properly.
		Blinking	The board is not yet ready.
	Orange	Lit	A communication hardware error was detected when the board was not yet ready.

4.8.2 Alarm Details and Causes/Actions

If an alarm occurs, the completed position number (four bits of PM1 to PM8) indicates a corresponding simple alarm code in the remote I/O mode or remote I/O mode 2.
In the position/simple direct mode, a simple alarm code is output to input address n+2.
In the half direct mode or full direct mode, an alarm code is output to input address n+6.

[1] Check the alarm code using the PLC's monitor function, etc., or connect the RC PC software or teaching pendant and check the code on the status monitor screen.
[2] Use the identified alarm code as the key to search the alarm list provided in the operation manual for the controller.
[3] Take an appropriate action according to the description provided under the applicable alarm code.
For the alarm codes listed below, take the actions specified in the following table.

Code	Error name	ID (*1)	RES (*2)	Cause/action
0F2	Fieldbus module error	05	x	Cause: A fieldbus module error was detected. Action: Check the applicable parameters.
0F3	Fieldbus module non-detection error	04	x	Cause: The module could not be detected. Action: Reconnect the power. If the problem persists, contact IAI.

(*1) ID → Simple alarm code
(*2) RES → Whether or not the alarm can be reset ○: Alarm can be reset / X: Alarm cannot be reset

4.9 CE Marking

If a compliance with the CE Marking is required, please follow Overseas Standards Compliance Manual (ME0287) that is provided separately.

5. SCON-CA/CB/CGB/CAL/CGAL

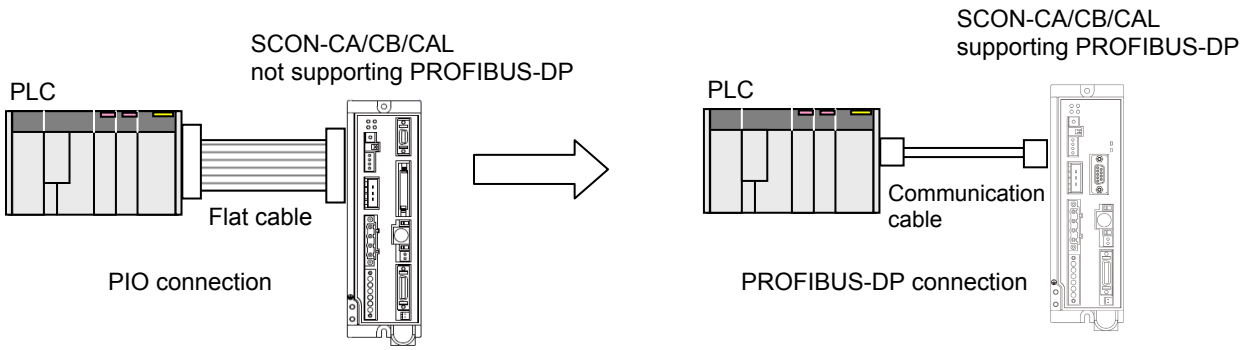
5.1 Operation Modes and Functions

All of the operation modes described in the table below for SCON-CA/CB Type applicable for PROFIBUS and those except for the ones in the shaded area for CAL Type are available to choose from for operation.

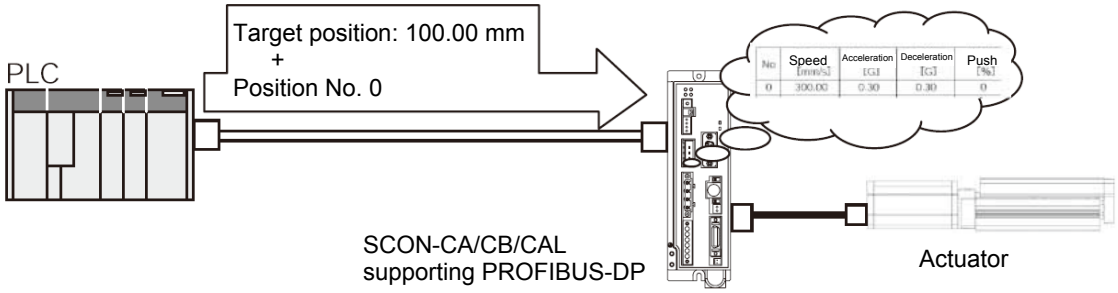
Key function	Remote I/O mode	Position/ simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2	Position/ simple direct mode 2	Half direct mode 2	Remote I/O mode 3	Half direct mode 3
Number of occupied bytes	2	8	16	32	12	8	16	12	8
Operation by position data specification	x	○(*1)	○	○	x	○(*1)	○	x	○
Direct speed/acceleration specification	x	x	○	○	x	x	○	x	○
Push-motion operation	○	○	○	○	○	○	○	○	○
Current position read	x	○	○	○	○	○	○	○	○
Current speed read	x	x	○	○	x	x	○	x	○
Operation by position number specification	○	○	x	x	○	○	x	○	x
Completed position number read	○	○	x	x	○	○	x	○	x
Maximum position table size	512	768	Not used	Not used	512	768	Not used	512	Not used
Force control	Δ(*2)	x	x	○	Δ(*2)	○	○	○	x
Vibration damping control	○	○	x	○	○	○	x	○	○
Servo gain switching	○	○	○	○	○	○	x	○	○

(*1) The actuator is operated by specifying all position data, other than positions, using position numbers.
(*2) These functions can be used when the PIO pattern is set to 6 or 7.

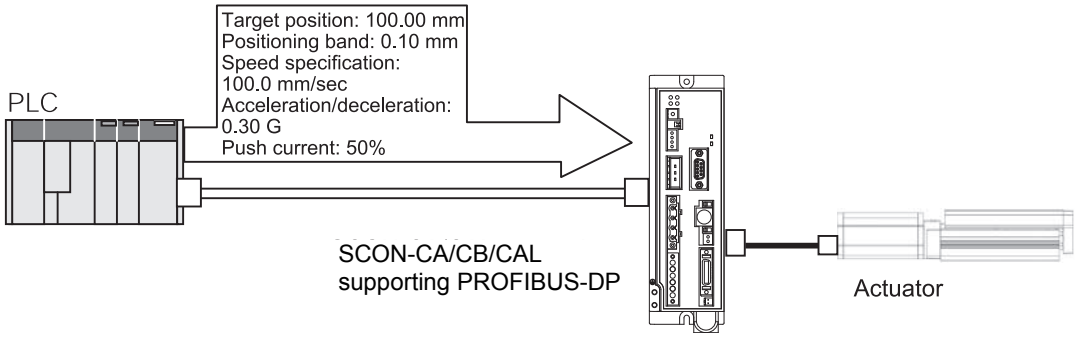
[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24 V I/Os) via PROFIBUS-DP communication.
Number of occupied bytes: 2 bytes (1 word)



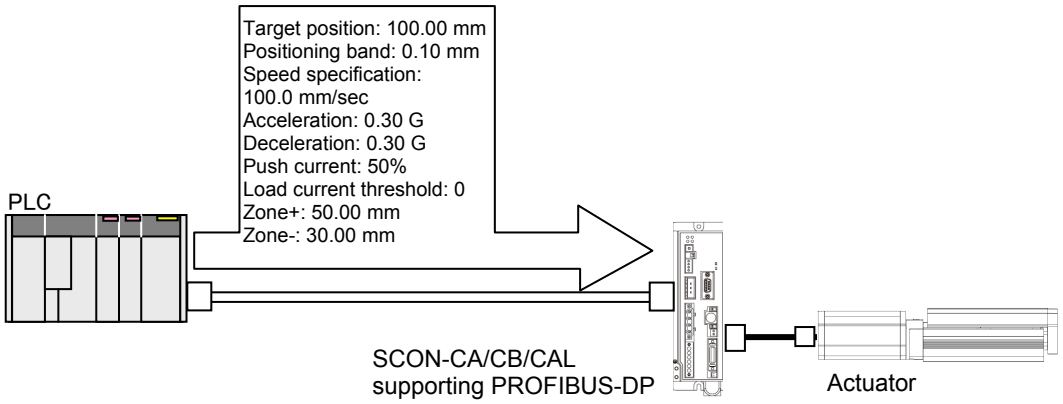
[2] Position/simple direct mode: In this mode, the actuator is operated by specifying position numbers.
You can select whether to specify the target position directly as a value, or use a value registered in the position data table, by switching a control signal.
For the speed, acceleration/deceleration, positioning band, etc., values preregistered in the position data table are used. Up to 768 position data points can be set.
Number of occupied bytes: 8 bytes (4 word)



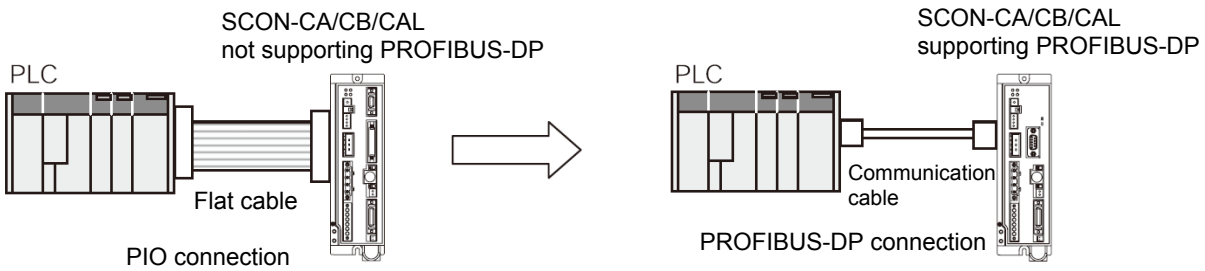
[3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.
Number of occupied bytes: 16 bytes (8 word)



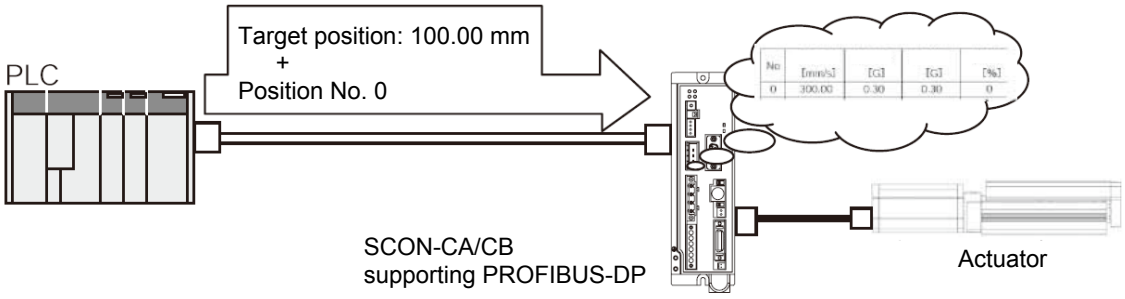
[4] Full direct mode: In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, acceleration/deceleration, etc.) directly as values.
Number of occupied bytes: 32 bytes (16 words)



[5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication.
The current-position and command-current read functions are available in addition to the functions provided in mode [1].
Number of occupied bytes: 12 bytes (6 words)

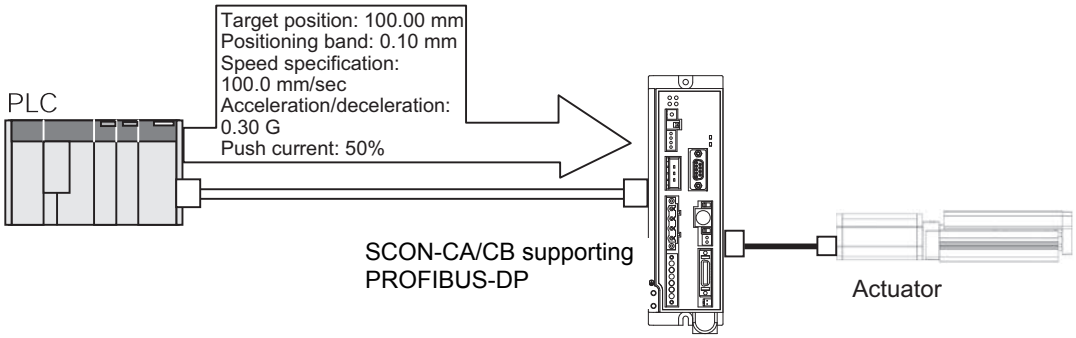


[6] Position/simple direct mode 2: In this mode, the actuator is operated by specifying position numbers.
(Not applicable for CAL Type) In this mode, the force control function is available instead of the teaching function and zone function available in mode [2].
Number of occupied bytes: 8 bytes (4 word)



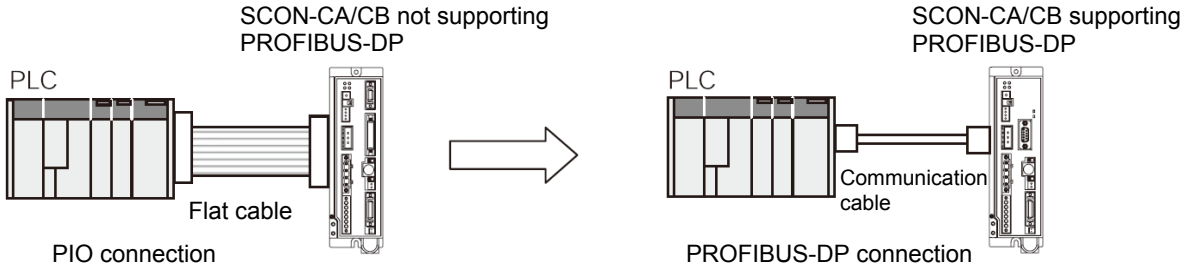
[7] Half direct mode 2:
(Not applicable for CAL Type)

In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.
Unlike in mode [3], command current cannot be read in this mode. However, load cell data can be read instead. This mode also supports force control.
Number of occupied bytes: 16 bytes (8 word)



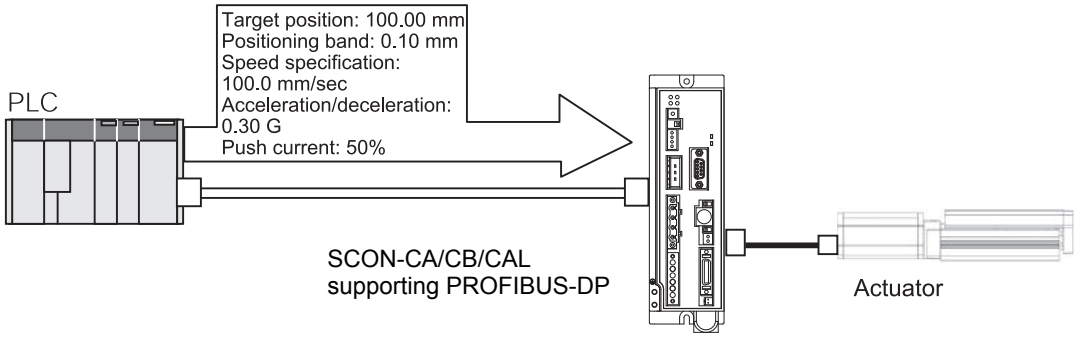
[8] Remote I/O mode 3:
(Not applicable for CAL Type)

In this mode, the actuator is operated by PROFIBUS-DP instead of PIO (24 V I/O).
Current position and command current function is added to the function [1].
Number of occupied bytes: 12 bytes (6 word)



[9] Half direct mode 3:

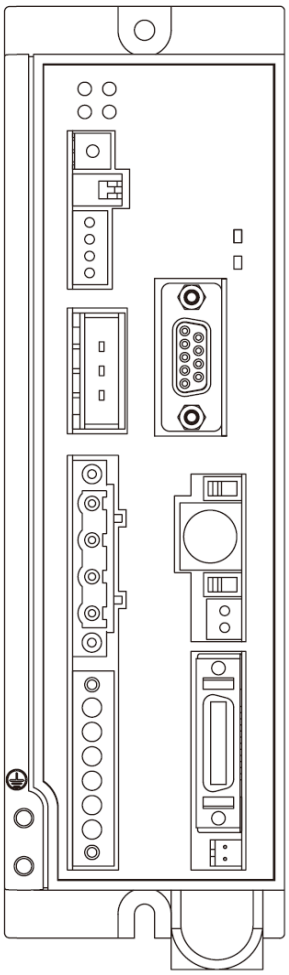
In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.
In this mode, the vibration damping function is supported instead of the jog function available in mode [3].
Number of occupied bytes: 16 bytes (8 word)



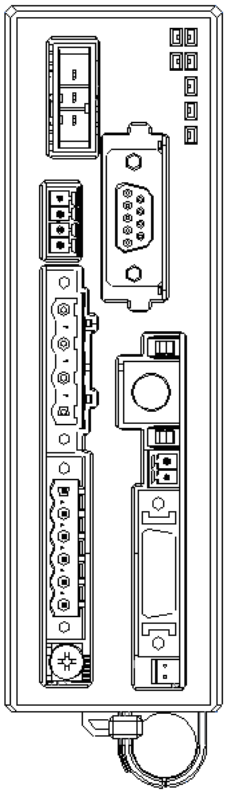
5.2 Model Names

The model names of SCON-CA/CB/CAL controller supporting PROFIBUS-DP are indicated as follows, respectively:

● SCON-CA/CB-□-PR-□



● SCON-CAL-□-PR-□

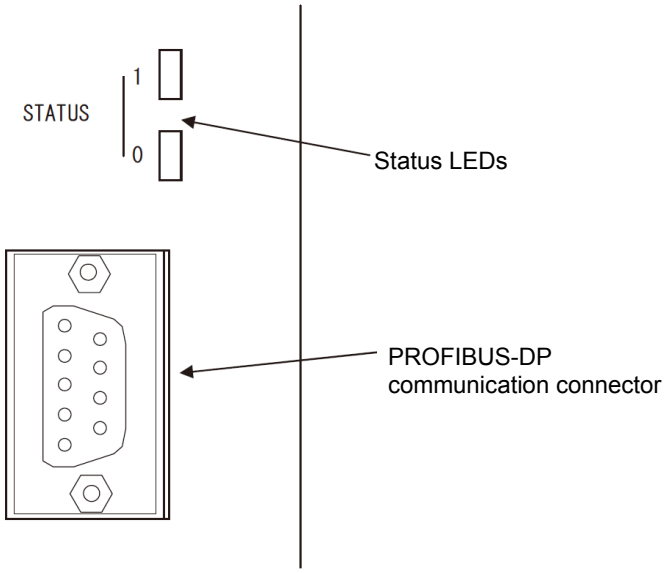


5.3 PROFIBUS-DP (Slave Station) Settings

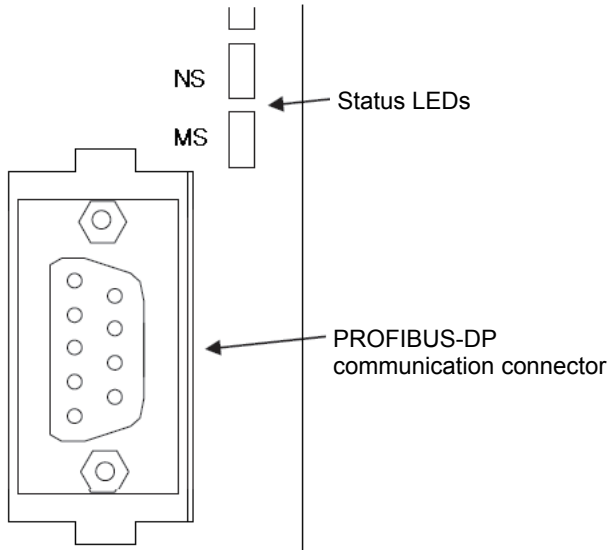
(1) Name of each part

The name of each part relating to PROFIBUS-DP is shown.

● SCON-CA/CB



● SCON-CAL



(2) PROFIBUS-DP communication connector interface specifications

This is a 9-pin, female D-sub connector recommended by the PROFIBUS-DP standard EN 50170.
Connector

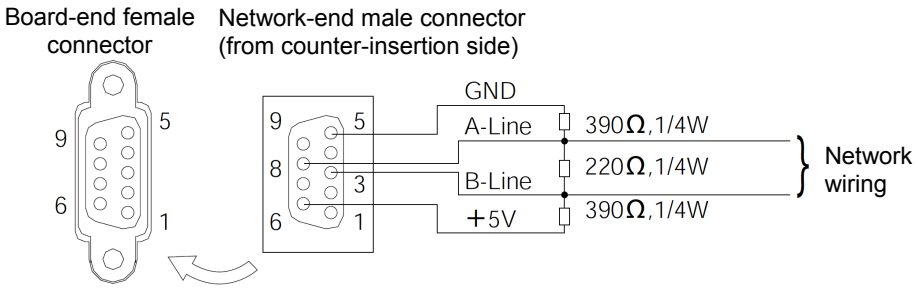
Pin No.	Description	Contents
3	B-Line	RxD, TxD (Positive signal line)
4	RTS	Request to send
5	GND	Signal ground (isolation)
6	+5V	+5-V output (isolation)
8	A-Line	/RxD, /TxD (Negative signal line)
Housing	Shield	Cable shield (enclosure and connection)

(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).
(Note 2) The cable-end connector is not supplied.

(3) Bus terminal processing

If the connector is to be connected to the network terminal node, connect the terminal resistor to the PROFIBUS-DP communication connector as shown below or use a connector with terminal resistor.

- Example of connector with terminal resistor: SUBCON-PLUS-PROFIB/AX/SC (Phoenix Contact)
- Connecting the terminal resistor



(4) Operation mode selection (setting)

Set a desired operation mode using a parameter.
Set the mode selector switch on the front side of the controller to the MANU position, and then set parameter No. 84, “FMOD: Fieldbus operation mode” using the RC PC software (V8.00.00.00 or later).
(Refer to 5.7, “PROFIBUS-DP Parameters.”)

Set value	Operation mode	Number of occupied bytes
0 (factory setting)	Remote I/O mode	2
1	Position/simple direct mode	8
2	Half direct mode	16
3	Full direct mode	32
4	Remote I/O mode 2	12
5	Position/simple direct mode 2	8
6	Half direct mode 3	16
7	Remote I/O mode 3	12
8	Half direct mode 3	16

* If a greater value is entered, an excessive input error will occur.
The modes in the shaded area are not available for SCON-CAL.

(5) Node address setting

Set the node address using a parameter.
Set parameter No. 85, “NADR: Fieldbus node address” using the RC PC software.
(Refer to 5.7, “PROFIBUS-DP Parameters.”)

Settable range: 0 to 125 (The parameter has been set to 1 at the factory.)

(Note 1) Pay attention to duplicate node address settings.
(Note 2) PROFIBUS-DP node addresses are set with the master station always having address 0. Accordingly, addresses of slave stations can be set between 1 and 125.

(6) Status LED indications

The board operating condition and network condition can be checked using the two LEDs provided on the front side of the controller.

○ : Lit, × : Off, ☆ : Blinking

LED	Color	Indicator condition	Description of indication (Meaning of indication)
• STATUS1 • NS	Green	○	The board is online with the fieldbus network and communicating normally.
		☆	The board is offline from the fieldbus network.
	Orange	☆	A communication error is present.
		×	Offline / No power supply
• STATUS0 • MS	Green	○	The board is operating properly.
		☆	The board is not yet ready.
	Orange	○	A communication hardware error was detected when the board was not yet ready.
		×	Initializing / No power supply

(Note 1) After the necessary parameters have been set, reconnect the controller power and return the mode selector switch on the front side of the controller to the AUTO position. If the switch remains in the MANU position, PLC operation cannot be performed.
(Note 2) The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

5.4 Communication with the Master Station

5.4.1 Operation Modes and Handling of PLC Addresses

The address assignments under each operation mode are shown below.

- PLC output → SCON-CA/CB/CAL input (* n indicates the output input address for each axis.)

PLC output address (word address)	SCON-CA/CB/CAL DI and input data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Target position	Target position	Target position	Port number 0 to 15
n+1					Occupied area
n+2		Specified position number	Positioning band	Positioning band	
n+3		Control signal			
n+4			Speed	Speed specification	
n+5			Acceleration/ deceleration		
n+6			Push-current limiting value	Zone boundary+	
n+7			Control signal		
n+8				Zone boundary-	
n+9					
n+10				Acceleration	
n+11				Deceleration	
n+12				Push-current limiting value	
n+13				Load current threshold	
n+14				Control signal 1	
n+15				Control signal 2	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- PLC output → SCON-CA/CB/CAL input (* n indicates the node address for each axis.)

PLC input address (word address)	SCON-CA/CB/CAL DI and input data resister			
	Position/simple direct mode 2	Half direct mode 2	Remote I/O mode 3	Half direct mode 3
	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 12	Number of occupied bytes: 16
n	Target position	Target position	Occupied area	Target position
n+1				
n+2	Specified position number	Positioning band		Positioning band
n+3	Control signal			
n+4		Speed		Speed
n+5		Acceleration/ deceleration		Acceleration/ deceleration
n+6		Push-current limiting value		Push-current limiting value
n+7		Control signal		Control signal
n+8				
n+9				
n+10				
n+11				
n+12				
n+13				
n+14				
n+15				

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

(Note) Position / Simplified Direct Value Mode 2, Half Direct Value Mode 2 and Remote I/O Mode 3 are not available for SCON-CAL.

- SCON-CA/CB/CAL output → PLC input (* n indicates the initial input address for each axis.)

PLC input address (word address)	SCON-CA/CB/CAL DO and output data resister				
	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2
	Number of occupied bytes: 2	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 32	Number of occupied bytes: 12
n	Port number 0 to 15	Current position	Current position	Current position	Port number 0 to 15
n+1					Occupied area
n+2		Completed position number (simple alarm ID	Command current	Command current	Current position
n+3		Status signal			
n+4			Current speed	Current speed	Command current
n+5					
n+6			Alarm code	Alarm code	
n+7			Status signal	Occupied area	
n+8				Current load	
n+9					
n+10				Total moving count	
n+11					
n+12				Total moving distance	
n+13					
n+14				Status signal 1	
n+15				Status signal 2	

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.

- SCON-CA/CB/CAL output → PLC input (* n indicates the node address for each axis.)

PLC input address (word address)	SCON-CA/CB/CAL DO and output data resister			
	Position/simple direct mode 2	Half direct mode 2	Remote I/O mode 3	Half direct mode 3
	Number of occupied channels: 8	Number of occupied channels: 16	Number of occupied channels: 12	Number of occupied channels: 16
n	Current position	Current position	Port number 0 to 15	Current position
n+1			Occupied area	
n+2	Completed position number (simple alarm ID)	Current load	Current position	Command current
n+3	Status signal			
n+4		Current speed	Current load	Current speed
n+5				
n+6		Alarm code		Alarm code
n+7		Status signal		Status signal
n+8				
n+9				
n+10				
n+11				
n+12				
n+13				
n+14				
n+15				

(Note) The “occupied area” is occupied according to the operation mode setting.
This area cannot be used for any other purpose. Also pay attention to use of duplicate addresses.
(Note) Position / Simplified Direct Value Mode 2, Half Direct Value Mode 2 and Remote I/O Mode 3 are not available for SCON-CAL.

- Reference: Example of PLC address assignment rules --- Fuji Electric
  The PLC address assignment rules are shown below.

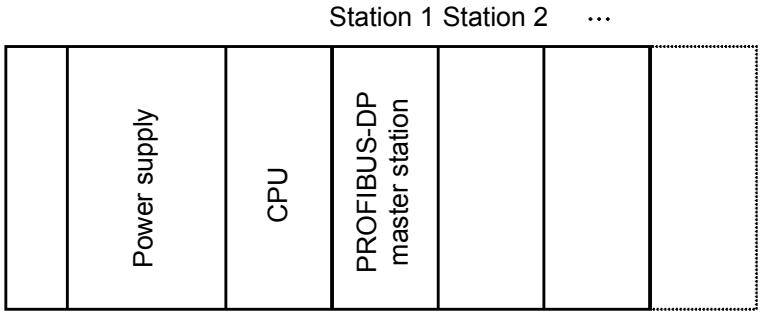
Prefix	Bus station number	.	Word number	.	Bit address

Prefix

%IX … Input bit address (address per bit)
%IW … Input word address (address per word)
%QX … Output bit address (address per bit)
%QW … Output word address (address per word)

Bus station number

This number indicates the installation position of the PROFIBUS-DP master unit within the PLC units is indicated.



Word address

Word addresses refer to addresses of DI/DOs and I/O data registers of a SCON-CA/CB/CAL assigned to the master station, being arranged sequentially in units of words.

Bit address

Bit addresses refer to addresses of DI/DOs and I/O data registers of a SCON-CA/CB/CAL assigned to a word address, being arranged sequentially in units of bits.

5.4.2 Remote I/O Mode (Number of Occupied Bytes: 2)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used.
Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)
(Note) Force control mode 1 and 2 are not available for SCON-CAL.

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, 1 zone outputs
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, 1 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The key functions that are available on Actuator controllable in this mode are shown in the table below.

Actuator function	PIO pattern							
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2	6: Force control mode 1	7: Force control mode 2
Home return operation	○	○	○	○	○	x	○	○
Positioning operation	○	○	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x	○	○
Speed change during movement	○	○	○	○	○	○	○	x
Operation at different acceleration and deceleration	○	○	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)	○	○
Zone signal output	○	○	○	x	○	○	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○	○	○

○: Supported, x: Not supported

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB/CAL DI (port number)	PLC output address	SCON-CA/CB/CAL DO (port number)	PLC input address
0	0 to 15	n	0 to 15	n

Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 1 word (2 bytes) of I/O addresses.

- I/O addresses are controlled by bit ON/OFF signals from the PLC.

PLC output address

(* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(* n indicates the initial input address for each axis.)

PLC input address

1 word = 2 bytes = 16 bits

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignments

Which signals are assigned to controller I/O ports vary according to the setting of parameter No. 25.
(For details, refer to the operation manual for the controller.)

		Setting of parameter No. 25					
Category	Port No.	Positioning mode		Teaching mode		256-point mode	
		0		1		2	
		Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → SCON-CA /CB/CAL input	0	PC1	Command position number	PC1	Command position number	PC1	Command position number
	1	PC2		PC2		PC2	
	2	PC4		PC4		PC4	
	3	PC8		PC8		PC8	
	4	PC16		PC16		PC16	
	5	PC32		PC32		PC32	
	6	-	Cannot be used.	MODE	Teaching mode command	PC64	
	7	-		JISL	Jog/inching switching	PC128	
	8	-		JOG+	+Jog	-	Cannot be used.
	9	BKRL	Forced brake release	JOG-	-Jog	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	CSTR/ PWRT	Positioning start / Positioning data read command	CSTR	Positioning start
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
SCON-CA /CB/CAL output → PLC input	0	PM1	Completed position number	PM1	Completed position number	PM1	Completed position number
	1	PM2		PM2		PM2	
	2	PM4		PM4		PM4	
	3	PM8		PM8		PM8	
	4	PM16		PM16		PM16	
	5	PM32		PM32		PM32	
	6	MOVE	Moving signal	MOVE	Moving signal	PM64	
	7	ZONE1	Zone 1	MODES	Teaching mode signal	PM128	
	8	PZONE/ ZONE2	Position zone/ Zone 2	PZONE/ ZONE1	Position zone/ Zone 1	PZONE/ ZONE1	Position zone/ Zone 1
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND/ WEND	Positioning complete signal/position data read complete	PEND	Positioning complete signal
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	*BALM	Battery alarm	*BALM	Battery alarm	*BALM	Battery alarm

* indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

		Setting of parameter No. 25					
		512-point mode		Solenoid valve mode 1		Solenoid valve mode 2	
		3		4		5	
Category	Port No.	Symbol	Signal name	Symbol	Signal name	Symbol	Signal name
PLC output → SCON-CA /CB/CAL input	0	PC1	Command position number	ST0	Start position 0	ST0	Start position 0
	1	PC2		ST1	Start position 1	ST1	Start position 1
	2	PC4		ST2	Start position 2	ST2	Start position 2
	3	PC8		ST3	Start position 3	-	Cannot be used.
	4	PC16		ST4	Start position 4	-	
	5	PC32		ST5	Start position 5	-	
	6	PC64		ST6	Start position 6	-	
	7	PC128		-	Cannot be used.	-	
	8	PC256		-		-	
	9	BKRL	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return	-	Cannot be used.
	12	*STP	Pause	*STP	Pause	-	
	13	CSTR	Positioning start	-	Cannot be used.	-	
	14	RES	Reset	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command	SON	Servo ON command
SCON-CA /CB/CAL output → PLC input	0	PM1	Completed position number	PE0	Completed position 0	LS0	Rear end move command 0
	1	PM2		PE1	Completed position 1	LS1	Rear end move command 1
	2	PM4		PE2	Completed position 2	LS2	Rear end move command 2
	3	PM8		PE3	Completed position 3	-	Cannot be used.
	4	PM16		PE4	Completed position 4	-	
	5	PM32		PE5	Completed position 5	-	
	6	PM64		PE6	Completed position 6	-	
	7	PM128		ZONE1	Zone 1	ZONE1	Zone 1
	8	PM256		PZONE/ ZONE2	Position zone/ Zone 2	PZONE/ ZONE2	Position zone/ Zone 2
	9	RMDS	Operation mode	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND	Positioning complete signal	-	Cannot be used.
	12	SV	Operation ready	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm	*ALM	Alarm
	15	*BALM	Battery alarm	*BALM	Battery alarm	*BALM	Battery alarm

* Indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

		Setting of parameter No. 25			
		Force control mode 1		Force control mode 2	
		6		7	
Category	Port No.	Symbol	Signal name	Symbol	Signal name
PLC output → SCON-CA/CB input	0	PC1	Command position number	ST0	Start position 0
	1	PC2		ST1	Start position 1
	2	PC4		ST2	Start position 2
	3	PC8		ST3	Start position 3
	4	PC16		ST4	Start position 4
	5	-	Cannot be used.	-	Cannot be used.
	6	-		-	
	7	-		-	
	8	CLBR	Load cell calibration command	CLBR -	Load cell calibration command
	9	BKRL	Forced brake release	BKRL	Forced brake release
	10	RMOD	Operation mode	RMOD	Operation mode
	11	HOME	Home return	HOME	Home return
	12	*STP	Pause	*STP	Pause
	13	CSTR	Positioning start	-	
	14	RES	Reset	RES	Reset
	15	SON	Servo ON command	SON	Servo ON command
SCON-CA/CB output → PLC input	0	PM1	Completed position number	PE0	Completed position number 0
	1	PM2		PE1	Completed position number 1
	2	PM4		PE2	Completed position number 2
	3	PM8		PE3	Completed position number 3
	4	PM16		PE4	Completed position number 4
	5	TRQS	Torque level status	TRQS	Torque level status
	6	LOAD	Load output judgment status	LOAD	Load output judgment status
	7	CEND	Load cell calibration complete	CEND	Load cell calibration complete
	8	PZONE/ ZONE1	Position zone/ Zone 1	PZONE/ ZONE1	Position zone/ Zone 1
	9	RMDS	Operation mode	RMDS	Operation mode
	10	HEND	Home return complete	HEND	Home return complete
	11	PEND	Positioning complete signal	PEND	Positioning complete signal
	12	SV	Operation ready	SV	Operation ready
	13	*EMGS	Emergency stop	*EMGS	Emergency stop
	14	*ALM	Alarm	*ALM	Alarm
	15	*BALM	Battery alarm	*BALM	Battery alarm

* Indicates a signal that is normally ON.
The signals denoted by “Cannot be used” are not controlled. (ON/OFF statuses of these signals are indeterminable.)

(Note) Force control mode 1 and 2 are not available for SCON-CAL.

5.4.3 Position/Simple Direct Mode (Number of Occupied Bytes: 8)

In this mode, the actuator is operated by specifying position numbers. You can select whether to set the target position directly as a value or use a value registered in the position data table, by switching a control signal (PMOD signal).
For all data other than the target position, such as speed, acceleration/deceleration and positioning band, values in the controller's position table are used. Set desired position data by referring to the operation manual for the controller.
Up to 768 position data points can be set.
The key functions that are available on Actuators controllable in this mode are shown in the table below.

Actuator function	○: Direct control Δ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	Δ	Position data must be set
Pitch feed (inching)	Δ	
Push-motion operation	Δ	
Speed change during movement	Δ	
Operation at different acceleration and deceleration	Δ	
Pause	○	
Zone signal output	Δ	Position data or parameters
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB/CAL input register	PLC output address	SCON-CA/CB/CAL output register	PLC input address
1	Target position	n+0	Current position	n+0
		n+1		n+1
	Specified position number	n+2	Completed position number (simple alarm code)	n+2
	Control signal	n+3	Status signal	n+3

(Note) Pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 4 words (8 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- The specified position number and completed position number are both a 1-word (16-bit) binary data. Although values from 0 to 767 can be handled by the PLC, use the PC software or teaching pendant to specify a position number for which operation conditions are already set.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (upper word)																

n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Specified position number							PC512	PC256	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1

n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD			PMOD	MODE	PWRT	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Complete position number							PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+3																
Status signal	EMGS	PWR	ZONE2	ZONE1	PZONE	MODES	WEND	RMDS	BALM	—	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.40 mm, specify “2540.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.6 (1)
	Specified position number	16-bit data	PC1 ~ PC512	16-bit integer. To operate the actuator, position data is needed for which operation conditions have already been entered using the PC software or teaching pendant. Use this register to specify the position number for which data has been entered. The specifiable range is 0 to 767. If an out-of-range value is specified or the specified position number is not yet set, an alarm will occur when the start signal is turned ON.	5.6 (1)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	5.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	5.4.11 (19)
		b13	-	Cannot be used.	-
		b12			
		b11	PMOD	Position/simple direct switching: Position mode when the signal is OFF, or simple direct mode when the signal is ON.	5.4.11 (20)
		b10	MODE	Teaching mode command: Normal mode when the signal is OFF, or teaching mode when the signal is ON.	5.4.11 (16)
		b9	PWRT	Position data read command: Position data is read when the signal is ON.	5.4.11 (17)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	5.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	5.4.11 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	5.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	5.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	5.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	5.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	5.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	5.4.11 (6)
		b0	CSTR	Positioning start: A move command is issued when the signal turns ON.	5.4.11 (7)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.6 (1)
	Completed position number (simple alarm code)	16 bit	PM1 to PM512	16-bit integer. After the actuator has moved to the target position and entered the positioning band, the position number corresponding to the completed positioning is output. “0” is output when no position movement has been performed yet or while the actuator is moving. If an alarm occurs (= the ALM status signal turns ON), a corresponding simple alarm code (refer to the operation manual for the controller) will be output.	5.6 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	5.4.11 (12)
		b10	MODES	Teaching mode signal: The signal is ON when the teaching mode is selected.	5.4.11 (16)
		b9	WEND	Position data read complete: The signal turns ON when the position data read is complete.	5.4.11 (17)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	5.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	5.4.11 (28)
		b6	-	Cannot be used.	-
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	5.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	5.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	5.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	5.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	5.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	5.4.11 (10)

5.4.4 Half Direct Mode (Number of Occupied Bytes: 16)

In this mode, the actuator is operated by specifying the target position, positioning band, speed, acceleration/deceleration and push current directly as values from the PLC.
Set each value in an applicable I/O address. If the zone function is used, set parameter Nos. 1, 2, 23 and/or 24.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control △ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	○	
Pitch feed (inching)	○	
Push-motion operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB/CAL input register	PLC output address	SCON-CA/CB/CAL output register	PLC input address
2	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	n+6	Alarm code	n+6
	Control signal	n+7	Status signal	n+7

(Note) Pay attention to use of duplicate addresses.

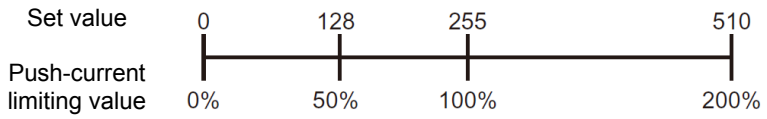
(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 8 words (16 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC.
- The speed is a 1-word (16-bit) binary data. Although values from 0 to +65535 (unit: 1.0 mm/sec or 0.1 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator. Parameter No. 159, FB Half Direct Mode Speed Unit, determines the unit of measure.

Parameter No.159 setting value	Speed setting unit
0	1.0 mm/sec
1	0.1 mm/sec

- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 999 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 510 (200%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (lower word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (upper word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning band (upper word)													524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ deceleration						1,024	512	256	128	64	32	16	8	4	2	1
n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Push-current limiting value								256	128	64	32	16	8	4	2	1
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD	DIR	PUSH	GSL1	GSL0	—	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (lower word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (upper word)																
n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (upper word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (lower word)																
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (upper word)																
n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm code																
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal	EMGS	PWR	ZONE2	ZONE1	—	—	—	RMDS	BALM	—	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.6 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	5.6 (2)
	Speed	16-bit data	-	16-bit integer. Specify the speed at which to move the actuator. Designate the unit of 1.0mm/sec or 0.1mm/sec. The settable range is 0 to 65535. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. Unit of measure is selected by Parameter No. 159 FB Half Direct Mode Speed Unit. (Example) In the case of the unit of 1.0mm/sec: To set 254.0 mm/sec, specify “254.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	5.6 (2)
	Acceleration/ deceleration	16-bit data	-	16-bit integer. Specify the acceleration/deceleration at which to move the actuator. (The acceleration and deceleration become the same value.) The unit is 0.01 G, while the specifiable range is 1 to 999. (Example) To set 0.30 G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	5.6 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Signal type</th><th>Bit</th><th>Symbol</th><th>Description</th><th>Details</th></tr>
<tr><td rowspan="20">PLC output</td><td>Push-current limiting value</td><td>16-bit data</td><td>-</td><td>16-bit integer.
Specify the current-limiting value during push-motion operation.
The specified range is 0 (0%) to 255 (100%).
The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.)
If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.</td><td>5.6 (2)</td></tr>
<tr><td rowspan="19">Control signal</td><td>b15</td><td>BKRL</td><td colspan="2">Forced brake release: The brake is released when the signal turns ON.</td><td>5.4.11 (18)</td></tr>
<tr><td>b14</td><td>RMOD</td><td colspan="2">Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.</td><td>5.4.11 (19)</td></tr>
<tr><td>b13</td><td>DIR</td><td colspan="2">Push direction specification:
When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used.
When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.</td><td>5.4.11 (22)</td></tr>
<tr><td>b12</td><td>PUSH</td><td colspan="2">Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.</td><td>5.4.11 (21)</td></tr>
<tr><td>b11</td><td>GSL1</td><td>Servo gain parameter set selection 1</td><td rowspan="2">Select the servo gain parameter set to be used.
<table><tr><th>GSL1</th><th>GSL0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Select parameter set 0.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">5.4.11 (33)</td></tr>
<tr><td>b10</td><td>GSL0</td><td>Servo gain parameter set selection 0</td></tr>
<tr><td>b9</td><td>-</td><td colspan="2">Cannot be used.</td><td>-</td></tr>
<tr><td>b8</td><td>+Jog</td><td colspan="2">+Jog: The actuator moves in the direction opposite home when the signal is ON.</td><td>5.4.11 (13)</td></tr>
<tr><td>b7</td><td>-Jog</td><td colspan="2">-Jog: The actuator moves in the direction of home when the signal is ON.</td><td>5.4.11 (13)</td></tr>
<tr><td>b6</td><td>JVEL</td><td colspan="2">Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.</td><td>5.4.11 (14)</td></tr>
<tr><td>b5</td><td>JISL</td><td colspan="2">Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.</td><td>5.4.11 (15)</td></tr>
<tr><td>b4</td><td>SON</td><td colspan="2">Servo ON command: The servo is ON when the signal is ON.</td><td>5.4.11 (5)</td></tr>
<tr><td>b3</td><td>RES</td><td colspan="2">Reset: A reset is performed when the signal turns ON.</td><td>5.4.11 (4)</td></tr>
<tr><td>b2</td><td>STP</td><td colspan="2">Pause: A pause command is issued when the signal turns ON.</td><td>5.4.11 (11)</td></tr>
<tr><td>b1</td><td>HOME</td><td colspan="2">Home return: A home return command is issued when the signal turns ON.</td><td>5.4.11 (6)</td></tr>
<tr><td>b0</td><td>DSTR</td><td colspan="2">Positioning start command: A move command is issued when the signal turns ON.</td><td>5.4.11 (8)</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.6 (2)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	5.6 (2)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	5.6 (2)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0H is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	5.6 (2)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	5.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	5.4.11 (28)
		b6	-	Cannot be used.	-
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	5.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	5.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	5.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	5.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	5.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	5.4.11 (10)

5.4.5 Full Direct Mode (Number of Occupied Bytes: 32)

In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, etc.) directly as values from the PLC.
Set each value in an I/O address.
The key functions that are available on ROBO Cylinders controllable in this mode are shown in the table below.

ROBO Cylinder function	○: Direct control x : Invalid
Home return operation	○
Positioning operation	○
Speed & acceleration/deceleration setting	○
Pitch feed (inching)	○
Push-motion operation	○
Speed change during movement	○
Operation at different acceleration and deceleration	○
Pause	○
Zone signal output	○
PIO pattern selection	x

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

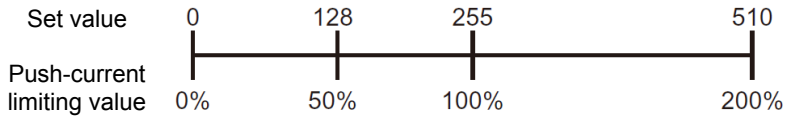
Parameter No. 84	SCON-CA/CB/CAL input register	PLC output address	SCON-CA/CB/CAL output register	PLC input address
3	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
		n+5		n+5
	Zone boundary+	n+6	Alarm code	n+6
		n+7	Occupied area	n+7
	Zone boundary-	n+8	Current load	n+8
		n+9		n+9
	Acceleration	n+10	Total moving count	n+10
	Deceleration	n+11		n+11
	Push-current limiting value	n+12	Total moving distance	n+12
	Load current threshold	n+13		n+13
	Control signal 1	n+14	Status signal 1	n+14
	Control signal 2	n+15	Status signal 2	n+15

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 16 words (32 bytes) of I/O addresses.

- Control signals 1 and 2 and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC.
- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 999 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 510 (200%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- Set a desired load current threshold. The load current threshold is a 1-word (16-bit) binary data. Values from 0 (0%) to 255 (100%) can be handled by the PLC. (Refer to the graph of push-current limiting value (upper graph).)
- The zone boundary+ and zone boundary- are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set values so that the zone boundary- becomes smaller than the zone boundary+.
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm/sec).
  Positive value: The actuator is moving in the direction opposite home. / Negative value: The actuator is moving in the direction of home.
- The alarm code is a 1-word (16-bit) binary data.
- The current load is 2-word (32-bit) binary data (unit: 0.01 N).
- The total moving count is a 2-word (32 bits) binary data (unit: times).
- The total moving distance is a 2-word (32 bits) binary data (unit: m).

PLC output address

(* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1																
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3																
Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4																
Speed (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5																
Speed (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+6																
Zone boundary+ (upper word)																
n+7																
Zone boundary+ (lower word)																

If the zone boundary+ is a negative value, it is expressed by a 2's complement.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+8																
Zone boundary- (upper word)																
n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary- (lower word)																

If the zone boundary- is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+10																
Acceleration	—	—	—	—	—	1,024	512	256	128	64	32	16	8	4	2	1
n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Deceleration	—	—	—	—	—	1,024	512	256	128	64	32	16	8	4	2	1
n+12	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Push-current limiting value	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Load current threshold	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+14	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 1	—	—	NTC1	NTC0	—	—	ASO1	ASO0	MOD1	MOD0	GSL1	GSL0	INC	DIR	PUSH	—
n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal 2	BKRL	RMOD	—	—	—	—	CLBR*	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

* Applicable only for SCON-CA/CB

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Command current (lower word)													524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (upper word)																
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																

n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

n+8	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current load (upper word) (Dedicated for SCON-CA/CB)																

n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current load (lower word) (Dedicated for SCON-CA/CB)																

If the current load is a negative value, it is expressed by a 2's complement.

n+10	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving count (lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving count (upper word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536

n+12	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving distance (lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1

n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Total moving distance (upper word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536

n+14	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal 1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	CEND*	BALM

n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal 2	EMGS	PWR	ZONE1	ZONE2	PZONE	LOAD	TRQS	RMDS	GHMS	PUSHS	PSFL	SV	ALM	MOVE	HEND	PEND

* Applicable only for SCON-CA/CB

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Address		Bit	Symbol	Function	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.6 (3)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	5.6 (3)
	Speed	32-bit data	-	32-bit integer. Specify the speed at which to move the actuator. The unit is 0.01 mm/sec, while the specifiable range is 0 to 999999. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. (Example) To set 25.41 mm/sec, specify “2541.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	5.6 (3)
	Zone boundary+ / Zone boundary-	32-bit data	-	32-bit signed integer. A valid zone signal is output after the end of home return, separately from the zone boundaries specified by parameters. If the current position is inside these ± boundaries, the status signal PZONE turns ON. (Example) To set +25.40 mm, specify “2540.” The specified unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. Enter values satisfying the relationship of “Zone boundary+ > Zone boundary-.” If this function is not used, enter the same value for both ± boundaries. * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.6 (3)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Address</th><th>Bit</th><th>Symbol</th><th>Function</th><th>Details</th></tr>
<tr><td rowspan="15">PLC output</td><td>Acceleration</td><td>16-bit data</td><td>-</td><td rowspan="2">16-bit integer.
Specify the acceleration and deceleration at which to move the actuator.
The unit is 0.01 G, while the specifiable range is 1 to 999.
(Example) To set 0.30 G, specify “30.”
If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.</td><td rowspan="2">5.6 (3)</td></tr>
<tr><td>Deceleration</td><td>16-bit data</td><td>-</td></tr>
<tr><td>Push-current limiting value</td><td>16-bit data</td><td>-</td><td>16-bit integer.
Specify the current-limiting value during push-motion operation.
The specified range is 0 (0%) to 255 (100%).
The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.)
If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.</td><td>5.6 (3)</td></tr>
<tr><td>Load current threshold</td><td>16-bit data</td><td>-</td><td>16-bit integer.
If judgment will be made as to whether or not the load current exceeded the set value, specify the threshold value for current using this register.
The specifiable range is 0 (0%) to 255 (100%).
If judgment is not performed, enter “0.”</td><td>5.6 (3)</td></tr>
<tr><td rowspan="13">Control signal 1</td><td>b15</td><td rowspan="2">-</td><td colspan="2" rowspan="2">Cannot be used.</td><td rowspan="2">-</td></tr>
<tr><td>b14</td></tr>
<tr><td>b13</td><td>NTC1</td><td>Vibration damping control mode selection 1</td><td rowspan="2">Select the vibration damping control parameter set to be used.<table><tr><th>NTC1</th><th>NTC0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Do not use vibration damping control.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">5.4.11 (29)</td></tr>
<tr><td>b12</td><td>NTC0</td><td>Vibration damping control mode selection 0</td></tr>
<tr><td>b11</td><td rowspan="2">-</td><td colspan="2" rowspan="2">Cannot be used.</td><td rowspan="2">-</td></tr>
<tr><td>b10</td></tr>
<tr><td>b9</td><td>ASO1</td><td>Stop mode 1</td><td rowspan="2">Select the stop mode during standby.<table><tr><th>ASO1</th><th>ASO0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Invalid (The servo is always on.)</td></tr><tr><td>OFF</td><td>ON</td><td>The servo turns off after the time is set in parameter No. 36.</td></tr><tr><td>ON</td><td>OFF</td><td>The servo turns off after the time is set in parameter No. 37.</td></tr><tr><td>ON</td><td>ON</td><td>The servo turns off after the time is set in parameter No. 38.</td></tr></table></td><td rowspan="2">5.4.11 (31)</td></tr>
<tr><td>b8</td><td>ASO0</td><td>Stop mode 0</td></tr>
<tr><td>b7</td><td>MOD1</td><td colspan="2" rowspan="2">Acceleration/deceleration mode:
Trapezoid pattern when both signals are OFF, S-motion when MOD1 is OFF and MOD0 is ON, or primary delay filter when MOD1 is ON and MOD0 is OFF.</td><td rowspan="2">5.4.11 (30)</td></tr>
<tr><td>b6</td><td>MOD0</td></tr>
<tr><td>b5</td><td>GSL1</td><td>Servo gain parameter set selection 1</td><td rowspan="2">Select the servo gain parameter set to be used.<table><tr><th>GSL1</th><th>GSL0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Select parameter set 0.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">5.4.11 (33)</td></tr>
<tr><td>b4</td><td>GSL0</td><td>Servo gain parameter set selection 0</td></tr>
<tr><td>b3</td><td>INC</td><td colspan="2">Incremental specification:
Absolute position command when the signal is OFF, or incremental position command when the signal is ON.</td><td>5.4.11 (24)</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Address		Bit	Symbol	Function	Details
PLC output	Control signal 1	b2	DIR	Push direction specification: When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used. When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.	5.4.11 (22)
		b1	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	5.4.11 (21)
		b0	-	Cannot be used.	-
	Control signal 2	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	5.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	5.4.11 (19)
		b13	-	Cannot be used.	-
		b12			
		b11			
		b10			
		b9	CLBR*	Load cell calibration command: Calibration is performed when this signal turns ON.	5.4.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	5.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	5.4.11 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	5.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	5.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	5.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	5.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	5.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	5.4.11 (6)
		b0	DSTR	Positioning start: A move command is issued when the signal turns ON.	5.4.11 (8)

* Applicable only for SCON-CA/CB

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.6 (3)
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	5.6 (3)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	5.6 (3)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0 is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	5.6 (3)
	Current load (Specified only for SCON-CA/CB)	32-bit data	-	32-bit signed integer. The current load cell reading is indicated. The unit is 0.01 N. * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (3)
	Total moving count	32-bit data	-	32-bit integer. The unit is times.	-
	Total moving distance	32-bit data	-	32-bit integer. The unit is m.	-
	Status signal 1	b15	-	Cannot be used.	-
		b14	-		
		b13	-		
		b12	-		
		b11	-		
		b10	-		
		b9	-		
		b8	-		
		b7	-		
		b6	-		
		b5	-		
		b4	-		
		b3	-		
		b2	CEND*	Load cell calibration is complete: This signal turns ON when calibration is complete.	5.4.11 (32)
		b1	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	5.4.11 (28)

* Applicable only for SCON-CA/CB

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Status signal 2	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	5.4.11 (12)
		b10	LOAD	Load output judgment: Reached when the signal is ON, or not yet reached when the signal is OFF. (For details, refer to the operation manual for the controller.)	5.4.11 (26)
		b9	TRQS	Torque level: Reached when the signal is ON, or not yet reached when the signal is OFF. (For details, refer to the operation manual for the controller.)	5.4.11 (27)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	5.4.11 (19)
		b7	GHMS	Home return in progress: The signal is ON while the home return is in progress.	5.4.11 (6)
		b6	PUSHS	Push-motion operation in progress: The signal is ON while the push-motion operation is in progress.	5.4.11 (25)
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	5.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	5.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	5.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	5.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	5.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	5.4.11 (10)

5.4.6 Remote I/O Mode 2 (Number of Occupied Bytes: 12)

In this mode, the actuator is operated by specifying position numbers just like when PIOs (24-V I/Os) are used. Set desired position data using the RC PC software or teaching pendant.
The number of positions to which the actuator can be operated varies according to the setting of parameter No. 25, “PIO pattern.”
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)
* Applicable only for SCON-CA/CB

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, 1 zone outputs
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, 1 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The key functions that are available on Actuator controllable in this mode are shown in the table below.

○: Supported, x: Not supported

Actuator function	PIO pattern							
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2	6: Force control mode 1	7: Force control mode 2
Home return operation	○	○	○	○	○	x	○	○
Positioning operation	○	○	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x	○	○
Speed change during movement	○	○	○	○	x	○	○	x
Operation at different acceleration and deceleration	○	○	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)	○	○
Zone signal output	○	○	○	x	○	○	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○	○	○

(*1) This operation is supported when parameter No. 27, “Move command type” is set to “0.”
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB/CAL DI and input register	PLC output address	SCON-CA/CB/CAL DO and output register	PLC input address
4	Port number 0 to 15	n+0	Port number 0 to 15	n+0
	Occupied area	n+1	Occupied area	n+1
		n+2	Current position	n+2
		n+3		n+3
		n+4	Command current	n+4
		n+5		n+5

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 6 words (12 bytes) of I/O addresses.

- Addresses controlled by port numbers are controlled by bit ON/OFF signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)).
- The command current is a 2-word (32-bit) binary data (unit: 1 mA).

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

Address	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
n+0																
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+1																
Cannot be used.																
n+2																
Current position (upper word)																
n+3																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+4																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5																
Command current (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536

(3) I/O signal assignments

For the signal assignments in each PIO pattern, refer to (3), “I/O signal assignments” under 5.4.2, “Remote I/O Mode.”

The signal assignments for command-current and current-position read functions are shown below.

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	-
	Command current	32-bit data	-	32-bit integer. The value of electrical current specified by the present command is indicated. The unit is mA. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1023 mA	-

5.4.7 Position/Simple Direct Mode 2 (Number of Occupied Bytes: 8)

(Note) This mode is applicable only for SCON-CA/CB.
In this mode, the actuator is operated by means of force control (push-motion operation based on feedback of load cell values) and also by specifying position numbers. You can select whether to specify target positions directly as numerical values by switching the control signal (PMOD signal) or to use values already registered in the position data table.
For all data other than the target position, such as speed, acceleration/deceleration and positioning band, values in the controller's position table are used. Set desired position data by referring to the operation manual for the controller.
Up to 768 position data points can be set.
The key functions that are available on Actuators controllable in this mode are shown in the table below.

Actuator function	○: Direct control Δ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	Δ	Position data must be set
Pitch feed (inching)	Δ	
Push-motion operation	Δ	
Speed change during movement	Δ	
Operation at different acceleration and deceleration	Δ	
Pause	○	
Zone signal output	Δ	Position data or parameters
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB input register	PLC output address	SCON-CA/CB output register	PLC input address
5	Target position	n+0	Current position	n+0
		n+1		n+1
	Specified position number	n+2	Command current	n+2
	Control signal	n+3		n+3

(Note) Pay attention to use of duplicate node addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 4 words (8 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- The specified position number and completed position number are both a 1-word (16-bit) binary data. Although values from 0 to 767 can be handled by the PLC, use the PC software or teaching pendant to specify a position number for which operation conditions are already set.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0 Target position (upper word)																
n+1 Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2 Specified position number	—	—	—	—	—	—	PC512	PC256	PC128	PC64	PC32	PC16	PC8	PC4	PC2	PC1
n+3 Control signal	BKRL	RMOD	—	—	PMOD	—	CLBR	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	CSTR

PLC input address (* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Complete position number							PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+3																
Status signal	EMGS	PWR	CEND	ZONE1	PZONE/ ZONE2	LOAD	TRQS	RMDS	BALM	PUSHS	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.40 mm, specify “2540.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.9 (1)
	Specified position number	16-bit data	PC1 ~ PC512	16-bit integer. To operate the actuator, position data is needed for which operation conditions have already been entered using the PC software or teaching pendant. Use this register to specify the position number for which data has been entered. The specifiable range is 0 to 767. If an out-of-range value is specified or the specified position number is not yet set, an alarm will occur when the start signal is turned ON.	5.9 (1)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	5.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	5.4.11 (19)
		b13	-	Cannot be used.	-
		b12			
		b11	PMOD	Position/simple direct switching: Position mode when the signal is OFF, or simple direct mode when the signal is ON.	5.4.11 (20)
		b10	-	Cannot be used.	-
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	5.4.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	5.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	5.4.11 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	5.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	5.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	5.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	5.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	5.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	5.4.11 (6)
		b0	CSTR	Positioning start: A move command is issued when the signal turns ON.	5.4.11 (7)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32 bit	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (1)
	Completed position number (simple alarm code)	16 bit	PM1 ~ PM512	16-bit integer. After the actuator has moved to the target position and entered the positioning band, the position number corresponding to the completed positioning is output. “0” is output when no position movement has been performed yet or while the actuator is moving. If an alarm occurs (= the ALM status signal turns ON), a corresponding simple alarm code (refer to the operation manual for the controller) will be output.	5.9 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	CEND	Load cell calibration complete: This signal turns ON when the load cell calibration is complete.	5.4.11 (32)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	PZONE/ ZONE2	PZONE and ZONE2 can be switched in Parameter No.149. No.149 = 0 : This signal turns ON when the current Position zone position is inside the specified position zone. No.149 = 1 : This signal turns ON when the current Zone2 position is inside the specified zone.	5.4.11 (12)
		b10	LOAD	Load output judgment: When this signal is ON, the specified load output judgment has been reached. If the signal is OFF, it is not yet reached. (For details, refer to the operation manual for your controller.)	5.4.11 (26)
		b9	TRQS	Torque level: When this signal is ON, the specified torque level has been reached. If the signal is OFF, it is not yet reached. (For details, refer to the operation manual for your controller.)	5.4.11 (27)
		b8	RMDS	+JOG: The actuator moves in the direction opposite the home when this signal turns ON.	5.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	5.4.11 (28)
		b6	PUSHS	Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	5.4.11 (23)
		b5	PSFL	Jog/inch switching: The actuator jogs when this signal is OFF, and inches when it is ON.	5.4.11 (23)
		b4	SV	Servo ON command: The servo turns ON when this signal turns ON.	5.4.11 (5)
		b3	ALM	Reset: A reset is executed when this signal turns ON.	5.4.11 (3)
		b2	MOVE	Pause: A pause command is issued when this signal turns ON.	5.4.11 (9)
		b1	HEND	Home return: A home return command is issued when this signal turns ON.	5.4.11 (6)
		b0	PEND	Positioning command: A move command is issued when this signal turns ON.	5.4.11 (10)

5.4.8 Half Direct Mode 2 (Number of Occupied Bytes: 16)

(Note) This mode is applicable only for SCON-CA/CB.
In this mode, the actuator is operated by means of force control (push-motion operation based on feedback of load cell values) and also by specifying the target position, positioning band, speed, acceleration/deceleration and push current directly as numerical values. Set each value in the applicable I/O area. To use the zone function, set the necessary values in parameter Nos. 1, 2, 23 and 24.

The key functions that are available on Actuators controllable in this mode are shown in the table below.

Actuator function	○: Direct control △ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	○	
Pitch feed (inching)	○	
Push-motion operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB input register	PLC output address	SCON-CA/CB output register	PLC input address
6	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Current load	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	n+6	Alarm code	n+6
	Control signal	n+7	Status signal	n+7

(Note) Pay attention to use of duplicate addresses.

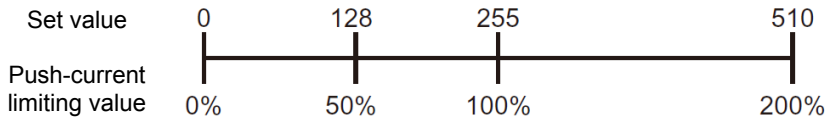
(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 8 words (16 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC.
- The speed is a 1-word (16-bit) binary data. Although values from 0 to +65535 (unit: 1.0 mm/sec or 0.1 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator. Parameter No. 159, FB Half Direct Mode Speed Unit, determines the unit of measure.

Parameter No.159 setting value	Speed setting unit
0	1.0 mm/sec
1	0.1 mm/sec

- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 999 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 510 (200%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- The current load is 2-word (32-bit) binary data (unit: 0.01 N).
- The current position is 2-word (32-bit) binary data (unit: 0.01 mm/sec).
- The alarm code is a 1-word (16-bit) binary data.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (upper word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (lower word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning band (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ deceleration	—	—	—	—	—	1,024	512	256	128	64	32	16	8	4	2	1
n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Push-current limiting value	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD	DIR	PUSH	—	—	CLBR	JOG+	JOG−	JVEL	JISL	SON	RES	STP	HOME	DSTR

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Current load (upper word)																
n+3																
Current load (lower word)																

If the current load is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+4																
Positioning band (upper word)																
n+5																
Positioning band (lower word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Status signal	EMGS	PWR	ZONE2	ZONE1	—	—	CEND	RMDS	BALM	PUSHS	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments
(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.9 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	5.9 (2)
	Speed	16-bit data	-	16-bit integer. Specify the speed at which to move the actuator. Designate the unit of 1.0mm/sec or 0.1mm/sec. The settable range is 0 to 65535. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. Unit of measure is selected by Parameter No. 159 FB Half Direct Mode Speed Unit. (Example) In the case of the unit of 1.0mm/sec: To set 254.0 mm/sec, specify “254.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	5.9 (2)
	Acceleration/ deceleration	16-bit data	-	16-bit integer. Specify the acceleration/deceleration at which to move the actuator. (The acceleration and deceleration become the same value.) The unit is 0.01 G, while the specifiable range is 1 to 999. (Example) To set 0.30 G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	5.9 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Push-current limiting value	16-bit data	-	16-bit integer. Specify the current-limiting value during push-motion operation. The specified range is 0 (0%) to 255 (100%). The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.) If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.	5.9 (2)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	5.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	5.4.11 (19)
		b13	DIR	Push direction specification: When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used. When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.	5.4.11 (22)
		b12	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	5.4.11 (21)
		b11	-	Cannot be used.	-
		b10			
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	5.4.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	5.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	5.4.11 (13)
		b6	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	5.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	5.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	5.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	5.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	5.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	5.4.11 (6)
		b0	DSTR	Positioning start command: A move command is issued when the signal turns ON.	5.4.11 (8)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (2)
	Current load	32-bit data	-	32-bit signed integer indicating the current position. The current load cell reading is indicated. The unit is 0.01 N. * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (3)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	5.9 (2)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0H is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	5.9 (2)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	-	Cannot be used.	-
		b10			
		b9	CEND	Load cell calibration is complete: This signal turns ON when calibration is complete.	5.4.11 (32)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	5.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops	5.4.11 (28)
		b6	PUSHS	Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	5.4.11 (23)
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	5.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	5.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	5.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	5.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	5.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	5.4.11 (10)

5.4.9 Remote I/O Mode 3 (Number of Occupied Bytes: 12)

(Note) This mode is applicable only for SCON-CA/CB.
In this mode, the actuator is operated by means of force control (push-motion operation based on feedback of load cell values) and also by specifying a position number just like when PIOs (24-V I/Os) are used.
Set position data using the RC PC software or other teaching tool.
The number of available positions varies depending on the setting of parameter No. 25, "PIO pattern."
In this mode, all functions available in the remote I/O mode are supported, plus functions to read the current position and current load.
The I/O specification of each PIO pattern is shown below. (For details, refer to the operation manual for the controller.)

Setting of parameter No. 25	Operation mode	I/O specification
0	Positioning mode	64 positioning points, 2 zone outputs
1	Teaching mode	64 positioning points, 1 zone output Positioning and jog operations are supported. The current position can be written under a specified position number.
2	256-point mode	256 positioning points, 1 zone output
3	512-point mode	512 positioning points, no zone output
4	Solenoid valve mode 1	7 positioning points, 2 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.
5	Solenoid valve mode 2	3 positioning points, 2 zone outputs Operation using forward, reverse and interim position commands. A positioning complete signal is output individually for forward, reverse and interim positions.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, 1 zone outputs
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, 1 zone outputs An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The key functions that are available on Actuator controllable in this mode are shown in the table below.

○: Supported, x: Not supported

Actuator function	PIO pattern							
	0: Positioning mode	1: Teaching mode	2: 256-point mode	3: 512-point mode	4: Solenoid valve mode 1	5: Solenoid valve mode 2	6: Force control mode 1	7: Force control mode 2
Home return operation	○	○	○	○	○	x	○	○
Positioning operation	○	○	○	○	○	○	○	○
Speed & acceleration/deceleration setting	○	○	○	○	○	○	○	○
Pitch feed (inching)	○	○	○	○	○	○	○	○
Push-motion operation	○	○	○	○	○	x	○	○
Speed change during movement	○	○	○	○	x	○	○	x
Operation at different acceleration and deceleration	○	○	○	○	○	○	○	○
Pause	○	○	○	○	○	○ (*1)	○	○
Zone signal output	○	○	○	x	○	○	○	○
PIO pattern selection (set by parameter)	○	○	○	○	○	○	○	○

(*1) This operation is supported when parameter No. 27, "Move command type" is set to "0."
The actuator can be paused by turning the move command OFF.

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB DI and input register	PLC output address	SCON-CA/CB DO and output register	PLC input address
4	Port number 0 to 15	n+0	Port number 0 to 15	n+0
	Occupied area	n+1	Occupied area	n+1
		n+2	Current position	n+2
		n+3		n+3
		n+4	Current load	n+4
		n+5		n+5

(Note) The [occupied area] cannot be used for any other purpose.
Also pay attention to use of duplicate addresses.

(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 6 words (12 bytes) of I/O addresses.

- Addresses controlled by port numbers are controlled by bit ON/OFF signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)).
- The current load is a 2-word (32-bit) binary data (unit: 0.01N).

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

Address n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (lower word)																

n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current position (upper word)																

If the current position is a negative value, it is expressed by a 2's complement.

n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current load (upper word)																

n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current load (lower word)																

If the current load is a negative value, it is expressed by a 2's complement.

(3) I/O signal assignments

For the signal assignments in each PIO pattern, refer to (3), “I/O signal assignments” under 5.4.2, “Remote I/O Mode.”

The signal assignments for command-current and current-position read functions are shown below.

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	-
	Current load	32-bit data	-	32-bit signed integer indicating the current position. The current load cell reading is indicated. The unit is 0.01 N. * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	-

5.4.10 Half Direct Mode 3 (Number of Occupied Bytes: 16)

In this mode, the jog function in the half direct numerical mode is not available, but the vibration damping parameter set can be changed. Set each value in the applicable I/O area. To use the zone function, set the necessary values in parameter Nos. 1, 2, 23 and 24.
The key functions that are available on Actuators controllable in this mode are shown in the table below.

Actuator function	○: Direct control Δ : Indirect control x : Invalid	Remarks
Home return operation	○	
Positioning operation	○	
Speed & acceleration/deceleration setting	○	
Pitch feed (inching)	○	
Push-motion operation	○	
Speed change during movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	Δ	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* n indicates the initial input/output address for each axis.)

Parameter No. 84	SCON-CA/CB/CAL input register	PLC output address	SCON-CA/CB/CAL output register	PLC input address
6	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	n+6	Alarm code	n+6
	Control signal	n+7	Status signal	n+7

(Note) Pay attention to use of duplicate addresses.

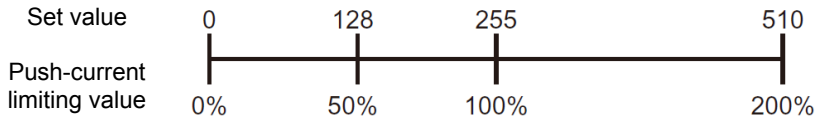
(2) I/O signal assignments for each axis

An I/O signal of each axis consists of 8 words (16 bytes) of I/O addresses.

- Control signals and status signals are bit ON/OFF signals.
- The target position and current position are both a 2-word (32-bit) binary data. Although values from -999999 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC, set position data within the software stroke range (0 up to the effective stroke length) of the applicable actuator.
- Set a desired positioning band. The positioning band is a 2-word (32-bit) binary data and values from 1 to +999999 (unit: 0.01 mm (other than DD motor) and 0.001° (DD motor)) can be handled by the PLC.
- The speed is a 1-word (16-bit) binary data. Although values from 0 to +65535 (unit: 1.0 mm/sec or 0.1 mm/sec) can be handled by the PLC, set a value not exceeding the maximum speed of the applicable actuator. Parameter No. 159, FB Half Direct Mode Speed Unit, determines the unit of measure.

Parameter No.159 setting value	Speed setting unit
0	1.0 mm/sec
1	0.1 mm/sec

- The acceleration/deceleration is a 1-word (16-bit) binary data. Although values from 1 to 999 (unit: 0.01 G) can be handled by the PLC, set a value not exceeding the maximum acceleration and maximum deceleration of the applicable actuator.
- The push-current limiting value is a 1-word (16-bit) binary data. Although values from 0 (0%) to 255 (100%) can be handled by the PLC, set a value within the specifiable range of push-current limiting values of the applicable actuator (refer to the catalog or operation manual for the actuator).



- The command current is 2-word (32-bit) binary data (unit: 1 mA).
- The current position is 2-word (32-bit) binary data (unit: 0.01 mm/sec).
- The alarm code is a 1-word (16-bit) binary data.

PLC output address (* n indicates the initial output address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Target position (lower word)																
n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target position (upper word)																

If the target position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Positioning band (lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning band (upper word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Speed	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration/ deceleration	—	—	—	—	—	1,024	512	256	128	64	32	16	8	4	2	1
n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Push-current limiting value	—	—	—	—	—	—	—	256	128	64	32	16	8	4	2	1
n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control signal	BKRL	RMOD	DIR	PUSH	GSL1	GSL0	NTC1	NTC0	MOD1	MOD0	—	SON	RES	STP	HOME	DSTR

PLC input address

(* n indicates the initial input address for each axis.)

1 word = 2 bytes = 16 bits

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0																
Current position (upper word)																
n+1																
Current position (lower word)																

If the current position is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2																
Command current (upper word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3																
Command current (lower word)	—	—	—	—	—	—	—	—	—	—	—	—	524,288	262,144	131,072	65,536
n+4																
Current speed (lower word)																
n+5																
Current speed (upper word)																

If the current speed is a negative value, it is expressed by a 2's complement.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6																
Alarm code																
n+7																
Status signal	EMGS	PWR	ZONE2	ZONE1	—	—	—	RMDS	BALM	—	PSFL	SV	ALM	MOVE	HEND	PEND

(3) I/O signal assignments
(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Specify the target position on the absolute coordinates. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is -999999 to 999999. (Example) To set +25.41 mm, specify “2541.” If the entered value exceeds the range of soft limit parameters (within 0.2 mm inside of the parameter values), the movement will be limited to within the range of soft limits (within 0.2 mm inside of the parameter values). * If this data is entered using a hexadecimal, enter a negative value as a 2’s complement.	5.9 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor), while the specifiable range is 1 to 999999. (Example) To set 25.40 mm, specify “2540.” This register has one of two meanings depending on the operation type: [1] In the case of positioning operation, this register indicates the allowable range from the target position within which the positioning is deemed completed. [2] In the case of push-motion operation, this register indicates the push band. Use the control signal PUSH to set whether to perform normal operation or push-motion operation.	5.9 (2)
	Speed	16-bit data	-	16-bit integer. Specify the speed at which to move the actuator. Designate the unit of 1.0mm/sec or 0.1mm/sec. The settable range is 0 to 65535. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. Unit of measure is selected by Parameter No. 159 FB Half Direct Mode Speed Unit. (Example) In the case of the unit of 1.0mm/sec: To set 254.0 mm/sec, specify “254.” If a move command is issued by specifying a value exceeding the maximum speed, an alarm will occur.	5.9 (2)
	Acceleration/ deceleration	16-bit data	-	16-bit integer. Specify the acceleration/deceleration at which to move the actuator. (The acceleration and deceleration become the same value.) The unit is 0.01 G, while the specifiable range is 1 to 999. (Example) To set 0.30 G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	5.9 (2)

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

<table>
<tr><th colspan="2">Signal type</th><th>Bit</th><th>Symbol</th><th>Description</th><th>Details</th></tr>
<tr><td rowspan="18">PLC output</td><td>Push-current limiting value</td><td>16-bit data</td><td>-</td><td>16-bit integer.
Specify the current-limiting value during push-motion operation.
The specified range is 0 (0%) to 255 (100%).
The actual specifiable range varies with each actuator. (Refer to the catalog or operation manual for each actuator.)
If a move command is issued by specifying a value exceeding the maximum push current value, an alarm will occur.</td><td>5.9 (2)</td></tr>
<tr><td rowspan="17">Control signal</td><td>b15</td><td>BKRL</td><td>Forced brake release: The brake is released when the signal turns ON.</td><td>5.4.11 (18)</td></tr>
<tr><td>b14</td><td>RMOD</td><td>Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.</td><td>5.4.11 (19)</td></tr>
<tr><td>b13</td><td>DIR</td><td>Push direction specification:
When the signal is OFF, the direction of the position obtained by subtracting the positioning band from the target position is used.
When the signal is ON, the direction of the position obtained by adding the positioning band to the target position is used.</td><td>5.4.11 (22)</td></tr>
<tr><td>b12</td><td>PUSH</td><td>Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.</td><td>5.4.11 (21)</td></tr>
<tr><td>b11</td><td>GSL1</td><td>Servo gain parameter set selection 1</td><td rowspan="2">Select the servo gain parameter set to be used.
<table><tr><th>GSL1</th><th>GSL0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Select parameter set 0.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">5.4.11 (33)</td></tr>
<tr><td>b10</td><td>GSL0</td><td>Servo gain parameter set selection 0</td></tr>
<tr><td>b9</td><td>NTC1</td><td>Vibration damping control mode selection 1</td><td rowspan="2">Select the vibration damping control parameter set to be used.
<table><tr><th>NTC1</th><th>NTC0</th><th>Function</th></tr><tr><td>OFF</td><td>OFF</td><td>Do not use vibration damping control.</td></tr><tr><td>OFF</td><td>ON</td><td>Select parameter set 1.</td></tr><tr><td>ON</td><td>OFF</td><td>Select parameter set 2.</td></tr><tr><td>ON</td><td>ON</td><td>Select parameter set 3.</td></tr></table></td><td rowspan="2">5.4.11 (29)</td></tr>
<tr><td>b8</td><td>NTC0</td><td>Vibration damping control mode selection 0</td></tr>
<tr><td>b7</td><td>MOD1</td><td rowspan="2">Acceleration/deceleration mode:
Trapezoid pattern when both signals are OFF, S-motion when MOD1 is OFF and MOD0 is ON, or primary delay filter when MOD1 is ON and MOD0 is OFF.</td><td rowspan="2">5.4.11 (30)</td></tr>
<tr><td>b6</td><td>MOD0</td></tr>
<tr><td>b5</td><td>-</td><td>Not available</td><td>-</td></tr>
<tr><td>b4</td><td>SON</td><td>Servo ON command: The servo is ON when the signal is ON.</td><td>5.4.11 (5)</td></tr>
<tr><td>b3</td><td>RES</td><td>Reset: A reset is performed when the signal turns ON.</td><td>5.4.11 (4)</td></tr>
<tr><td>b2</td><td>STP</td><td>Pause: A pause command is issued when the signal turns ON.</td><td>5.4.11 (11)</td></tr>
<tr><td>b1</td><td>HOME</td><td>Home return: A home return command is issued when the signal turns ON.</td><td>5.4.11 (6)</td></tr>
<tr><td>b0</td><td>DSTR</td><td>Positioning start command: A move command is issued when the signal turns ON.</td><td>5.4.11 (8)</td></tr>
</table>

(* In the table, ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”)

Signal type		Bit	Symbol	Description	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm (other than DD motor) and 0.001° (DD motor). (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (2)
	Command current	32-bit data	-	32-bit signed integer indicating the current position. The current load cell reading is indicated. The unit is 0.01 N. * If this data is read as a hexadecimal, a negative value is indicated by a 2’s complement.	5.9 (2)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FFH = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a 2’s complement.	5.9 (2)
	Alarm code	16-bit data	-	16-bit integer. If an alarm occurs, an alarm code will be output. 0H is output when no alarm is present. For details on alarms, refer to the operation manual for the controller.	5.9 (2)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	5.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	5.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	5.4.11 (12)
		b11	-	Cannot be used.	-
		b10			
		b9			
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	5.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	5.4.11 (28)
		b6	-	Cannot be used.	
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	5.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	5.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	5.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	5.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	5.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	5.4.11 (10)

5.4.11 I/O Signal Controls and Functions

* ON indicates that the applicable bit is “1,” while OFF indicates that the applicable bit is “0.”
The following specifies the controls and functions of I/O signals used in the position/simple direct mode 1 and 2, half direct mode and full direct mode 1 to 3. For the I/O signals in the remote I/O mode 1 to 3, refer to the operation manual for the controller.

(1) Controller ready (PWR) PLC input signal

This signal turns ON when the controller has become ready to perform control after the power was turned on.

■ Function

This signal turns ON when the controller has been initialized successfully following a power on and become ready to perform control, regardless of the alarm condition, servo condition, etc.
The PWR signal turns ON as long as the controller is ready to perform control, even when an alarm is present.

(2) Emergency stop (EMGS) PLC input signal

This signal turns ON when the controller has entered an emergency stop mode.

■ Function

This signal turns ON when the control has entered an emergency stop mode (= the motor drive power has become cut off). It will turn OFF once the emergency stop mode is cancelled.

(3) Alarm (ALM) PLC input signal

This signal turns ON when the controller’s protective circuit (function) has detected an abnormality.

■ Function

This signal turns ON when a protective circuit (function) has actuated following a detection of abnormality.
When the cause of the alarm is removed and the reset (RES) signal is turned ON, the ALM signal will turn OFF if the applicable alarm is an operation-cancellation alarm. (In the case of a cold-start alarm, the power must be reconnected.)
Upon detection of an alarm, the status indicator LED (refer to (6) in 5.3) on the front side of the controller illuminates in red.

(4) Reset (RES) PLC output signal

This signal has two functions: it can be used to reset controller alarms or cancel the remaining travel during a pause.

■ Function

[1] If the cause of the present alarm is removed and then this signal is turned from OFF to ON, the alarm (ALM) signal will be reset. (In the case of a cold-start alarm, the power must be reconnected.)
[2] When this signal is turned from OFF to ON while the actuator is paused, the remaining travel will be cancelled.

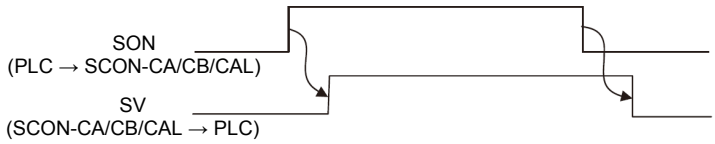
(5) Servo ON command (SON) PLC output signal

Ready (SV) PLC input signal

When the SON signal is turned ON, the servo turns ON.
When the servo turns ON, the status indicator LED (refer to (6) in 5.3) on the front side of the controller illuminates in green.
The SV signal is synchronized with this LED.

■ Function

The controller servo can be turned ON/OFF using the SON signal.
The controller servo remains ON to enable operation while the SV signal is ON.
The relationship of SON and SV signals is shown below.

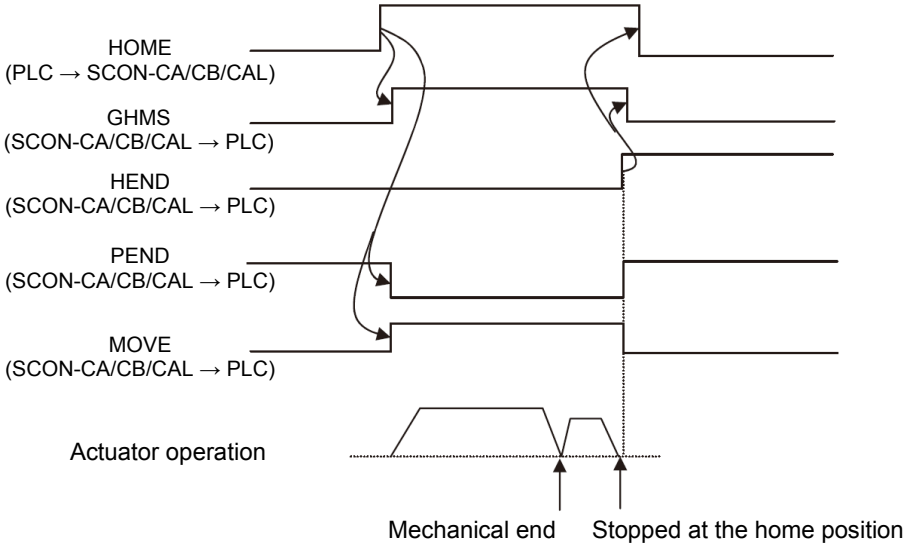


(6) Home return (HOME) PLC output signal

Home return complete (HEND) PLC input signal

Home return in progress (GHMS) PLC input signal

When the HOME signal is turned ON, the command will be processed at the leading (ON) edge of the signal and home return operation will be performed automatically. The GHMS signal turns ON while the home return is in progress.
When the home return is completed, the HEND signal turns ON while the GHMS signal turns OFF.
Turn the HOME signal OFF when the HEND signal turns ON. Once the HEND signal turns ON, it will not turn OFF until the power is turned OFF or the HOME signal is input again.
Even after home return has been completed once, another home return can be performed by turning the HOME signal ON.



⚠ Caution: In the remote I/O mode 1 to 3 or position/simple direct mode 1, 2 issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will cause the actuator to automatically return home and then perform positioning, provided that this is the first positioning command after the power on.
In the half direct mode 1 to 3, issuing a positioning command to a given position immediately after the power has been turned on, before home return is performed, will generate an alarm (error code 083: ALARM HOME ABS (absolute position move command when home return is not yet completed) (operation-cancellation alarm)). Exercise caution.

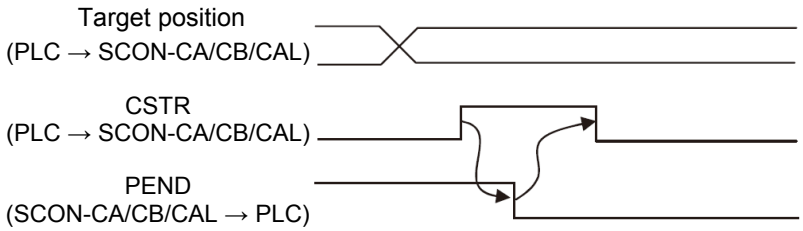
(7) Positioning start (CSTR): Used in the position/simple direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the position set by the target position corresponding to the specified position or the PLC's target position.
Whether to use the target position corresponding to the specified position number or PLC's target position (*) is determined by the control signal b11 (position/simple direct switching (PMOD) signal).

- PMOD = OFF: Use the target position data under the specified position number
- PMOD = ON: Use the set value of the PLC's target position (*)

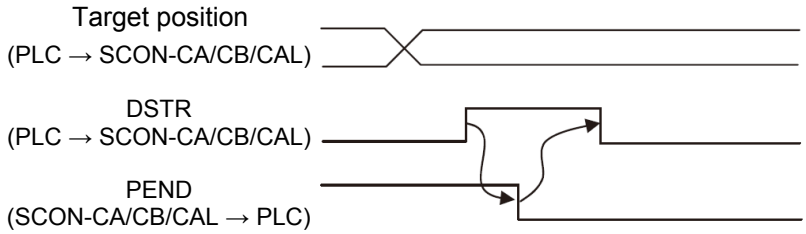
(*) Refer to 5.4.1.

If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), the actuator will automatically perform home return operation and then move to the target position.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



(8) Positioning command (DSTR): Used in the half direct mode and full direct mode PLC output signal

This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the target position entered as the PLC's target position (*). If this command is issued immediately after the power has been turned on, before home return is performed (= when the HEND signal is OFF), an alarm (operation-cancellation alarm) will occur.
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



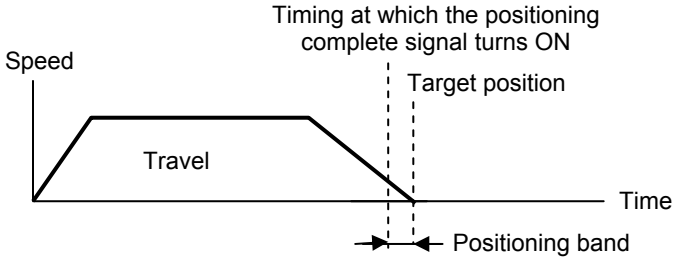
(*) Refer to 5.4.1.

(9) Moving signal (MOVE) PLC input signal

This signal turns ON while the actuator slider or rod is moving (including cases where the actuator is performing home return operation, push-motion operation or jog operation).
The signal turns OFF after the positioning, home return or push-motion operation is completed or while the operation is paused.

(10) Positioning complete signal (PEND) PLC input signal

This signal turns ON when the actuator has moved to the target position and entered the positioning band or completed the push motion.



When the servo turns from OFF to ON, positioning is performed based on the current position being the target position. As a result, this signal turns ON and will turn OFF when another positioning operation is started subsequently using the home return (HOME) signal, positioning start (DSTR) signal or positioning command (CSTR) signal.

⚠ Caution: If the servo turns OFF or an emergency stop is actuated while the actuator is standing still at the target position, the PEND signal turns OFF.
When the servo turns ON again, the signal will turn ON if the actuator is inside the positioning band.
The PEND signal will not turn ON if the CSTR or DSTR signal is ON, even after the positioning is completed.

(11) Pause (STP) PLC output signal

When this signal is turned ON, the moving axis will decelerate to a stop. Turning it OFF will resume the axis movement.
The acceleration upon resumption of operation, and deceleration at stopping, conform to the acceleration/deceleration set by the specified position number (*) in the position/simple direct mode, or to the value of acceleration/deceleration (*) in the half direct mode.
In the full direct mode, the values of acceleration (*) and deceleration (*) are used.
(*) Refer to 5.4.1.

(12) Zone 1 (ZONE1) PLC input signal

Zone 2 (ZONE2) PLC input signal

Position zone (PZONE) PLC input signal

Each signal turns ON when the current actuator position is inside the specified range, and turns OFF when the actuator is outside the range.

[1] Zones 1, 2

A desired zone is set using user parameters.

The ZONE1 signal is set using parameter Nos. 1, “Zone boundary 1+” and 2, “Zone boundary 1-.”

The ZONE2 signal is set using parameter Nos. 23, “Zone boundary 2+” and 24, “Zone boundary 2-.”

The ZONE1 and ZONE2 signals become valid upon completion of home return, after which they will remain valid even while the servo is turned OFF.

[2] Position zone

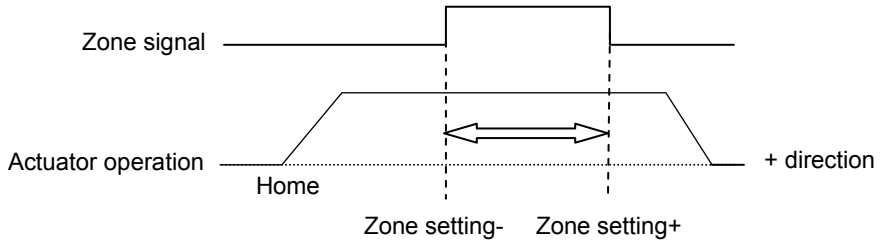
A desired zone is set using the position table or PLC.

In the position/simple direct mode, set the PZONE signal using the position table.

In the full direct mode, set the PZONE signal using the zone boundaries (refer to 5.4.1).

(*) The PZONE signal is not available in the half direct mode 1 to 3.

The PZONE signal becomes valid upon issuance of a move command after completion of home return, after which it will remain valid even while the servo is turned OFF.



(13) +Jog (JOG+) PLC output signal

-Jog (JOG-) PLC output signal

These signals are used as starting commands for jog operation or inching operation.
A + command starts the applicable operation in the direction opposite home, while a – command starts the applicable operation in the direction of home.

[1] Jog operation
Jog operation can be performed when the jog/inching switching (JISL) signal is OFF.
While JOG+ is ON, the actuator moves in the direction opposite home. When the signal turns OFF, the actuator will decelerate to a stop.
While JOG- is ON, the actuator moves in the direction of home. When the signal turns OFF, the actuator will decelerate to a stop.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the jog speed/inching distance switching (JVEL) signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals turn ON, the actuator will decelerate to a stop.

[2] Inching operation
Inching operation can be performed when the jog/inching switching (JISL) signal is ON.
The actuator moves by the inching distance with every ON input.
While JOG+ is ON, the actuator moves in the direction opposite home. While JOG- is ON, the actuator moves in the direction of home.
The specific operation conforms to the values set in the following parameters:

- The actuator moves at the speed corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves at the value of parameter No. 26, “PIO jog speed.”
  When the JVEL signal is ON, the actuator moves at the value of parameter No. 47, “PIO jog speed 2.”
- The actuator moves by the travel corresponding to the value of the parameter specified by the JVEL signal.
  When the JVEL signal is OFF, the actuator moves by the value of parameter No. 48, “PIO inching distance.”
  When the JVEL signal is ON, the actuator moves by the value of parameter No. 49, “PIO inching distance 2.”
- The actuator moves at the rated acceleration/deceleration (the specific value varies depending on the actuator).

During normal operation, the actuator will continue with the normal operation even when the JOG+ or JOG- is turned ON (= the JOG signal will be ignored).
While paused, the actuator will not move even when the JOG+ or JOG- is turned ON.

(Note) Take note that before completion of home return, the actuator may collide with the mechanical end because the software stroke limits are not valid.

(14) Jog speed/inching distance switching (JVEL) PLC output signal

This signal switches between the parameter that specifies the jog speed to be used when the jog mode is selected, and one that specifies the inching distance to be used when the inching mode is selected.
The relationships of applicable parameters are shown below.

JVEL signal	Jog operation: JISL = OFF	Inching operation: JISL = ON
OFF	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed” Parameter No. 48, “Inching distance”
ON	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2” Parameter No. 49, “Inching distance 2”

(15) Jog/inching switching (JISL) PLC output signal

This signal switches between jog operation and inching operation.
JISL = OFF: Jog operation
JISL = ON: Inching operation
If the JISL signal switches to ON (inching) while the actuator is jogging, the actuator will decelerate to a stop and the inching function will become effective.
If the JISL signal switches to OFF (jog) while the actuator is inching, the jog function will become effective after the actuator completes its movement.
The table below specifies the relationship of the ON/OFF statuses of JISL signal and jog speed/inching distance switching (JVEL) signal.

		Jog operation	Inching operation
JISL		OFF	ON
JVEL=OFF	Speed	Parameter No. 26, “Jog speed”	Parameter No. 26, “Jog speed”
	Travel	-	Parameter No. 48, “Inching distance”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
JVEL=ON	Speed	Parameter No. 47, “Jog speed 2”	Parameter No. 47, “Jog speed 2”
	Travel	-	Parameter No. 49, “Inching distance 2”
	Acceleration/ deceleration	Rated value (the specific value varies depending on the actuator)	Rated value (the specific value varies depending on the actuator)
Operation		When JOG+/JOG- is ON	Upon detection of the leading (ON) edge of JOG+/JOG-

(16) Teaching mode command (MODE) PLC output signal

Teaching mode signal (MODES) PLC input signal

When the MODE signal is turned ON, the normal operation mode switches to the teaching mode.
When the mode switches to teaching, the controller of each axis turns ON the MODES signal.
The PLC should perform teaching operation after confirming that the MODES signal has turned ON.
(Note) For the normal operation mode to switch to the teaching mode, the following conditions must be satisfied:

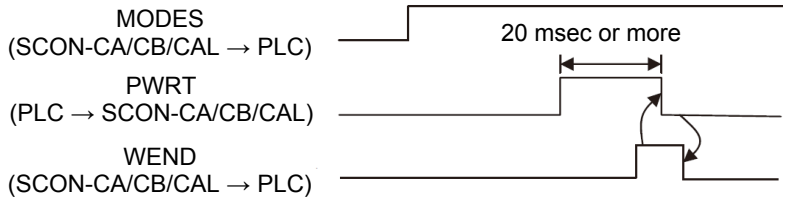
- The actuator (motor) is stopped.
- The +jog (JOG+) and -jog (JOG-) signals are OFF.
- The position data read command (PWRT) signal and positioning start (CSTR) signal are OFF.

(Note) The actuator will not return to the normal operation mode unless the PWRT signal is OFF.

(17) Position data read command (PWRT) PLC output signal

Position data read complete (WEND) PLC input signal

The PWRT signal is valid when the teaching mode signal (MODES) is ON.
Turn the PWRT signal ON (*1). This causes the current position data to be written to the Position field of the position number currently set under the position number specified by the PLC (refer to 5.4.1). (*2)
When the writing is completed, the WEND signal turns ON.
The host PLC should turn the PWRT signal OFF after the WEND signal has turned ON.
If the PWRT signal is turned OFF before the WEND signal turns ON, the WEND signal will not turn ON.
Turning the PWRT signal OFF causes the WEND signal to turn OFF.
(*1) Keep the signal ON for 20 msec or more. If the signal is turned on for less than 20 msec, the data may not be written.
(*2) If any data other than position is yet to be defined, the default value of the corresponding parameter is written. (Refer to the operation manual for the controller.)



(18) Forced brake release (BKRL) PLC output signal

The brake can be forcibly released by turning this signal ON.

(19) Operation mode (RMOD) PLC output signal

Operation mode status (RMDS) PLC input signal

A different operation mode is selected as follows based on the RMOD signal and the MODE switch on the front side of the controller.
Whether the current mode is AUTO or MANU can be checked using the RMDS signal.
RMOD signal and mode switch combinations, and corresponding operation modes, are shown below.

	Controller's MODE switch in AUTO position	Controller's MODE switch in MANU position
RMOD signal OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

(Note) Operation from the PLC is not supported in the MANU mode.

(20) Position/simple direct switching (PMOD) PLC output signal

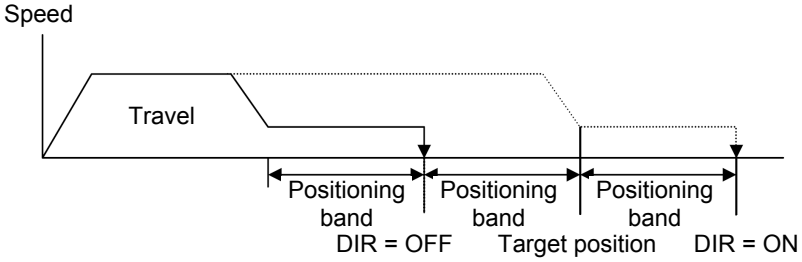
This signal switches between the mode where a value registered in the controller's position table is used as the target position for movement, and the mode where the PLC's target position (*) is used.
PMOD = OFF: Use the position table
PMOD = ON: Use the value of the PLC's target position(*)
(*) Refer to 5.4.1.

(21) Push specification (PUSH) PLC output signal

When a move command is issued after turning this signal ON, the actuator will perform push-motion operation.
If this signal is turned OFF, the actuator will perform normal positioning operation.
(Refer to (2), "Operation in the half direct mode 1 to 3" under 5.6, "Operation.")

(22) Push direction specification (DIR) PLC output signal

This signal specifies the direction in which the actuator will push the load.
When this signal is turned OFF, the actuator will push the load toward the position obtained by subtracting the positioning band from the target position.
When this signal is turned ON, the actuator will push the load toward the position obtained by adding the positioning band to the target position.
This signal is invalid during normal positioning operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode 1 to 3" under 5.6, "Operation.")



(23) Missed load during push-motion operation (PSFL) PLC input signal

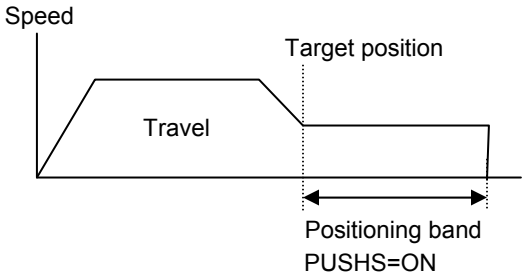
This signal turns ON when the actuator has not contacted the load after having travelled the distance set by the positioning band in the controller's position table or PLC's positioning band (refer to 5.4.1) during push-motion operation.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 5.6, "Operation.")

(24) Incremental specification (INC) PLC output signal

When a move command is issued while this signal is ON, the actuator will move by the value entered as the PLC's target position (*) with reference to the current position. (Incremental moves)
If this signal is OFF, the actuator will move to the value of the PLC's target position (*).
(*) Refer to 5.4.1.

(25) Push-motion operation in progress (PUSHS) PLC input signal

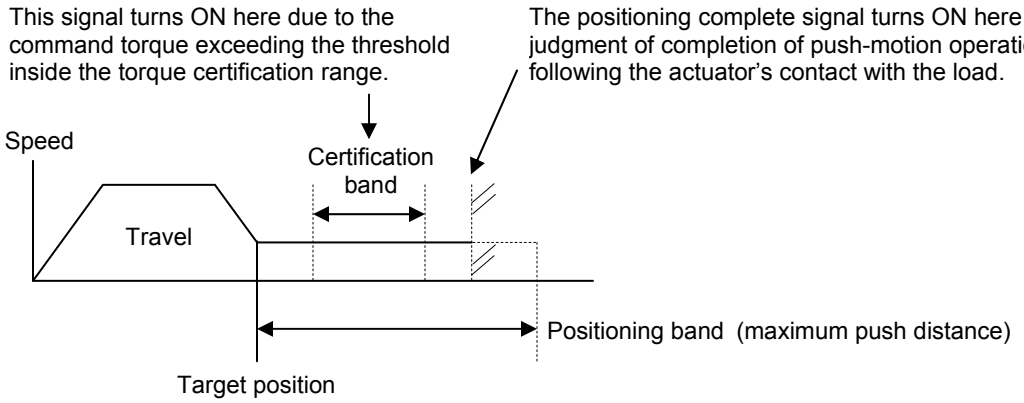
This signal turns ON while the push-motion operation is in progress.



This signal turns OFF if the actuator has missed the load in push-motion operation or paused, or the next move command has been issued, or the servo has been turned OFF.
(For the setting timing of this signal, refer to (2), "Operation in the half direct mode" under 5.6, "Operation.")

(26) Load output judgment (LOAD) PLC input signal

This signal is valid only during push-motion operation.
To use an actuator in a press-fit application, whether or not the specified load threshold has reached during the push-motion operation must be recognized.
The load threshold and certification band are set by the PLC, and this signal will turn ON when the command torque (motor current) exceeds the threshold inside the certification band.
For this signal, judgment is made based on whether the command torque has exceeded the threshold for the specified total time.
The specific procedure is the same as that for push judgment. The load output judgment time can be changed as desired using parameter No. 50, "Load output judgment time."
This signal will be retained until the next move command is received.

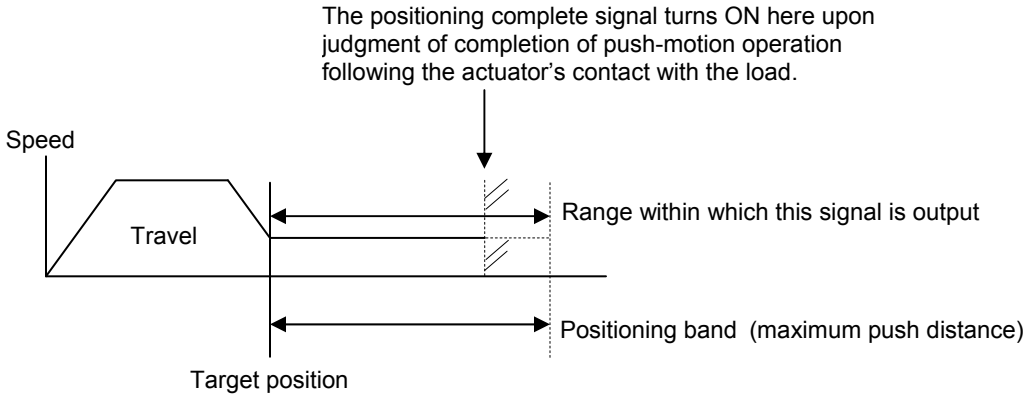


- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "0 [Enable]."
- Set the threshold certification band using the PLC's zone boundary+ and zone boundary- (*).
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 5.4.1.

⚠ Warning: The actuator continues to push the load at the standstill push current determined by the current-limiting value.
Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(27) Torque level (TRQS) PLC input signal

This signal is valid only during push-motion operation.
This signal turns ON when the motor current has reached the load threshold during push-motion operation (while the actuator is moving inside the positioning band). Since the current is monitored by level, when the current changes the ON/OFF status of this signal will also change. The speeds that can be used for push-motion operation vary depending on the motor and lead. Accordingly, the applicable parameters must be adjusted.



- Set the push speed using parameter No. 34, "Push speed."
  The parameter has been set to an appropriate value at the factory according to the characteristics of each actuator.
  Specify an appropriate speed by considering the material and shape of the load, etc.
- Set parameter No. 50, "Load output judgment time."
- Set parameter No. 51, "Torque certification range" to "1 [Disable]."
- Set the threshold using the PLC's load current threshold (*).
- Set the positioning band using the PLC's positioning band (*).
  Set a positioning band slightly longer than the last position by considering the mechanical variation of the load.
  For details, refer to the operation manual for the controller.
  (*) Refer to 5.4.1.

⚠ Warning: The actuator continues to push the load at the standstill push current determined by the current-limiting value.
Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(28) Absolute Battery Voltage Low Warning (BALM) PLC Input Signal

With an absolute system, this signal is OFF when the absolute battery voltage is normal. It remains OFF with an incremental system.
This BALM signal turns ON when the absolute battery voltage drops to 3.1 V. If the controller is operated continuously and the voltage drops further to 2.5 V, the controller can no longer retain position information. (If you are using an absolute system and this signal turns ON, replace the battery at the earliest opportunity.)

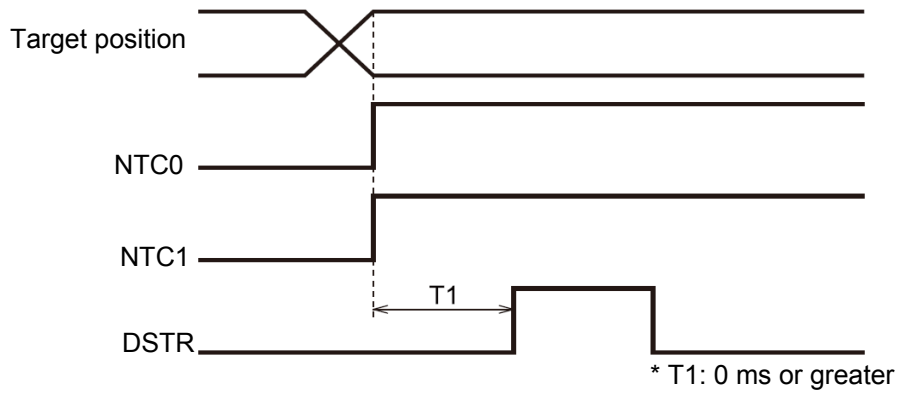
(29) Vibration Damping Mode Selection 0, 1 (NTC0, NTC1) PLC Output Signals

The vibration damping control function suppresses the load vibration induced by IAI's actuator. Measure the vibration frequency and set it in a parameter. In another parameter, select and set an appropriate option based on a combination of these signals.
For details, refer to the operation manual for your controller.

NTC1	NTC0	Function	Remarks
OFF	OFF	Do not use vibration damping control.	Factory setting
OFF	ON	Select parameter set 1	
ON	OFF	Select parameter set 2	
ON	ON	Select parameter set 3	

Input timing

An input timing chart of NTC0/NTC1 signals is shown below.



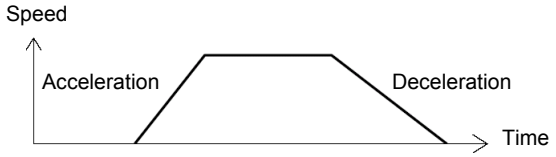
⚠ Caution: Since the statuses of NTC0/NTC1 signals are loaded when a movement command (DSTR) is recognized, nothing happens when the NTC0/NTC1 signals are turned ON/OFF while the actuator is moving.

(29) Acceleration/deceleration mode (MOD1, MOD0) PLC output signal

This signal is used to select a desired acceleration/deceleration pattern characteristic. Select one characteristic before issuing an actuator move command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid pattern	Factory setting
OFF	ON	S-motion	
ON	OFF	Primary delay filter	
ON	ON	Cannot be used.	

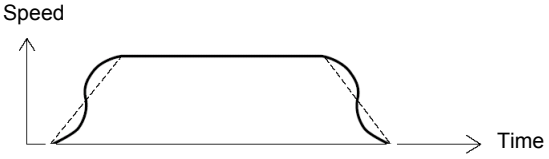
Trapezoid pattern



* The acceleration and deceleration are set in the “Acceleration” and “Deceleration” fields of the position data table.

S-motion

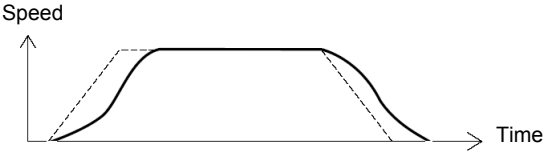
The acceleration/deceleration curve rises gradually at first and then draws a steep curve from a certain point. Use this mode if you want to set high acceleration/deceleration to meet the tact time requirement, but keep the acceleration/deceleration gradual at the start of movement or immediately before stopping.



* The S-motion level is set using parameter No. 56, “S-motion ratio setting.” The setting unit is %, while the setting range is 0 to 100.
(The above graph shows a curve assuming a 100% S-motion ratio.)
When “0” is set, the S-motion mode is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

Primary delay filter

A more gradual acceleration/deceleration curve than linear acceleration/deceleration (trapezoid pattern) is drawn. Use this mode if you don’t want the load to receive micro-vibration during acceleration/deceleration.

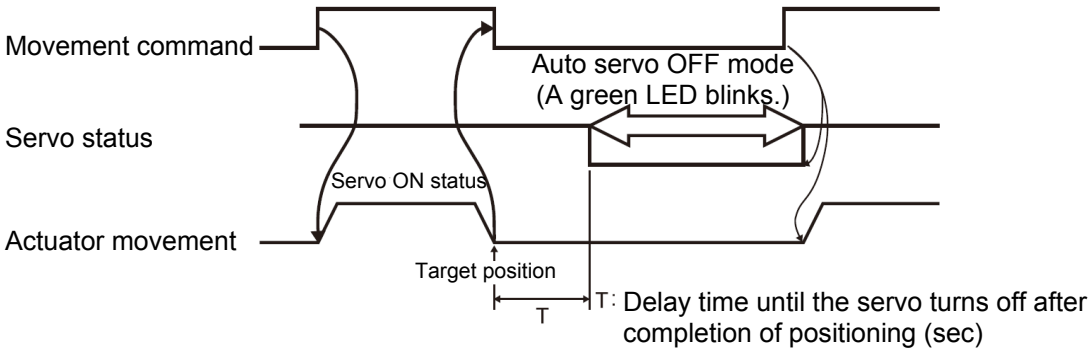


* The primary delay level is set using parameter No. 55, “Position-command primary filter time constant.” The minimum input unit is 0.1 msec, while the setting range is 0.0 to 100.0.
When “0” is set, the primary delay filter is disabled.
Take note that this setting will not be reflected in jog or inching operation performed using a PC or teaching pendant.

(31) Standstill Mode Selection (ASO0, ASO1) PLC Output Signals

Select the stop mode to be applied while the actuator is standing by to move to the next position after completing a positioning.
If the actuator remains standstill for a long time, the servo is turned off automatically to lower the power consumption.
For details, refer to the operation manual for your controller.

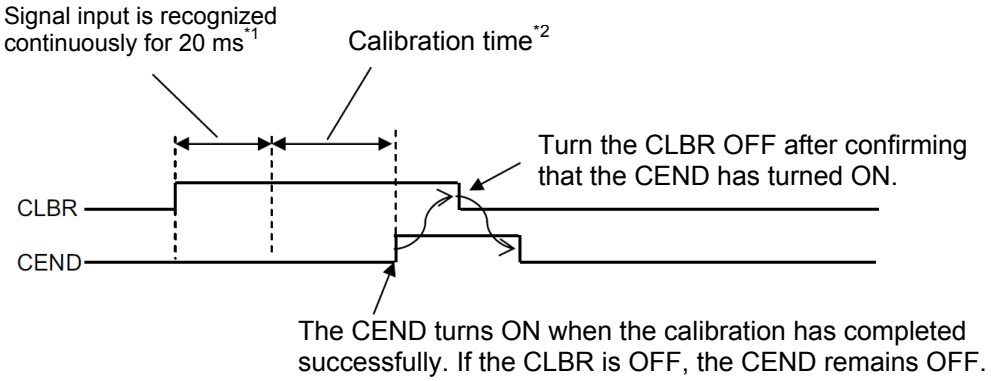
ASO1	ASO0	Standstill mode	Remarks
OFF	OFF	Disabled	Factory setting
OFF	ON	Auto servo OFF mode T in the chart below corresponds to the setting of parameter No. 36.	
ON	OFF	Auto servo OFF mode T in the chart below corresponds to the setting of parameter No. 37.	
ON	ON	Auto servo OFF mode T in the chart below corresponds to the setting of parameter No. 38.	



(32) Load Cell Calibration Command (CLBR) PLC Output Signal
Load Cell Calibration Complete (CEND) PLC Input Signal

The factory setting for the load cell is 0 N when no load is applied. If you want to use the loaded condition as the reference (0 N), perform the following calibration. Also perform this calibration in other conditions as necessary (such as during readjustment, inspection, etc.).
[1] Stop the operation. (Calibration cannot be performed while any axis is operating, pushing a work part or paused, in which case an attempt to perform calibration will generate a 0E1 (load cell calibration error) alarm.
[2] Turn ON the load cell calibration signal (CLBR) and keep it ON for at least 20 ms.
[3] Once the calibration is complete, the calibration complete signal (CEND) turns ON. Thereafter, turn OFF the CLBR signal.
If the calibration was not successful, a 0E1 (load cell calibration error) alarm generates.

⚠ Caution: Normal operation commands are not accepted while the CLBR signal is ON.



*1 If the CLBR is turned OFF during this period, the signal is not recognized and therefore calibration is not performed.
*2 If the CLBR is turned OFF during this period, an alarm generates.

(33) Servo Gain Parameter Set Selection (GSL0, GSL1) PLC Output Signals

The actuator can be operated by selecting, for each position movement, any one of the following four pre-defined sets of servo gain parameters (six different parameters).
For details, refer to the operation manual for your controller.

GSL1	GSL0	Function	Remarks
OFF	OFF	Select parameter set 0	Factory setting
OFF	ON	Select parameter set 1	
ON	OFF	Select parameter set 2	
ON	ON	Select parameter set 3	

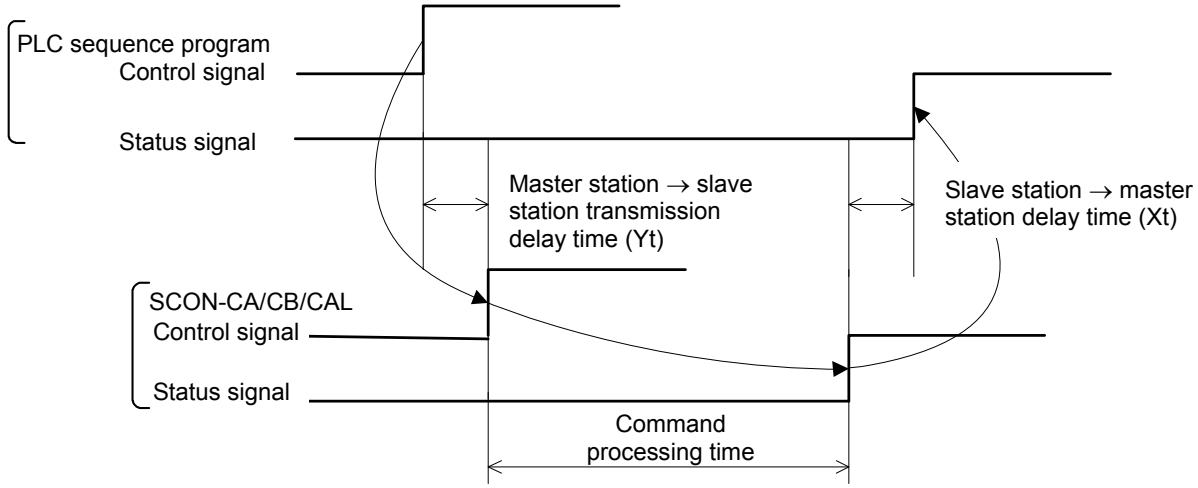
5.5 I/O Signal Timings

The maximum response time after a given control signal is turned ON to operate the ROBO Cylinder using the PLC's sequence program, until a response (status) signal is turned, is expressed by the formula below:

Maximum response time (msec) = Yt + Xt + 2 + Command processing time (operation time, etc.)

Yt: Master station → slave station transmission delay time
Xt: Slave station → master station delay time
} Field network transmission delay time

For the master station → slave station transmission delay time (Yt) and slave station → master station delay time (Xt), refer to the operation manuals for the PROFIBUS-DP master unit and the PLC in which the master unit is installed.



5.6 Operation

Next, timings in the position/simple direct mode 1, 2, half direct mode 1 to 3 and full direct mode are explained using examples of basic operations.
For the remote I/O mode 1 to 3, refer to the operation manual for the controller.
(In remote I/O mode 2 or 3, read the current position, command current or current load data from each applicable byte on the PLC side as deemed necessary.)

(1) Operation in the position/simple direct mode 1, 2

Operate the actuator by writing the position data to the PLC's target position, while specifying the speed, acceleration/deceleration, positioning band, push-current limiting value, etc., in the position table.

- Example of operation (normal positioning operation)

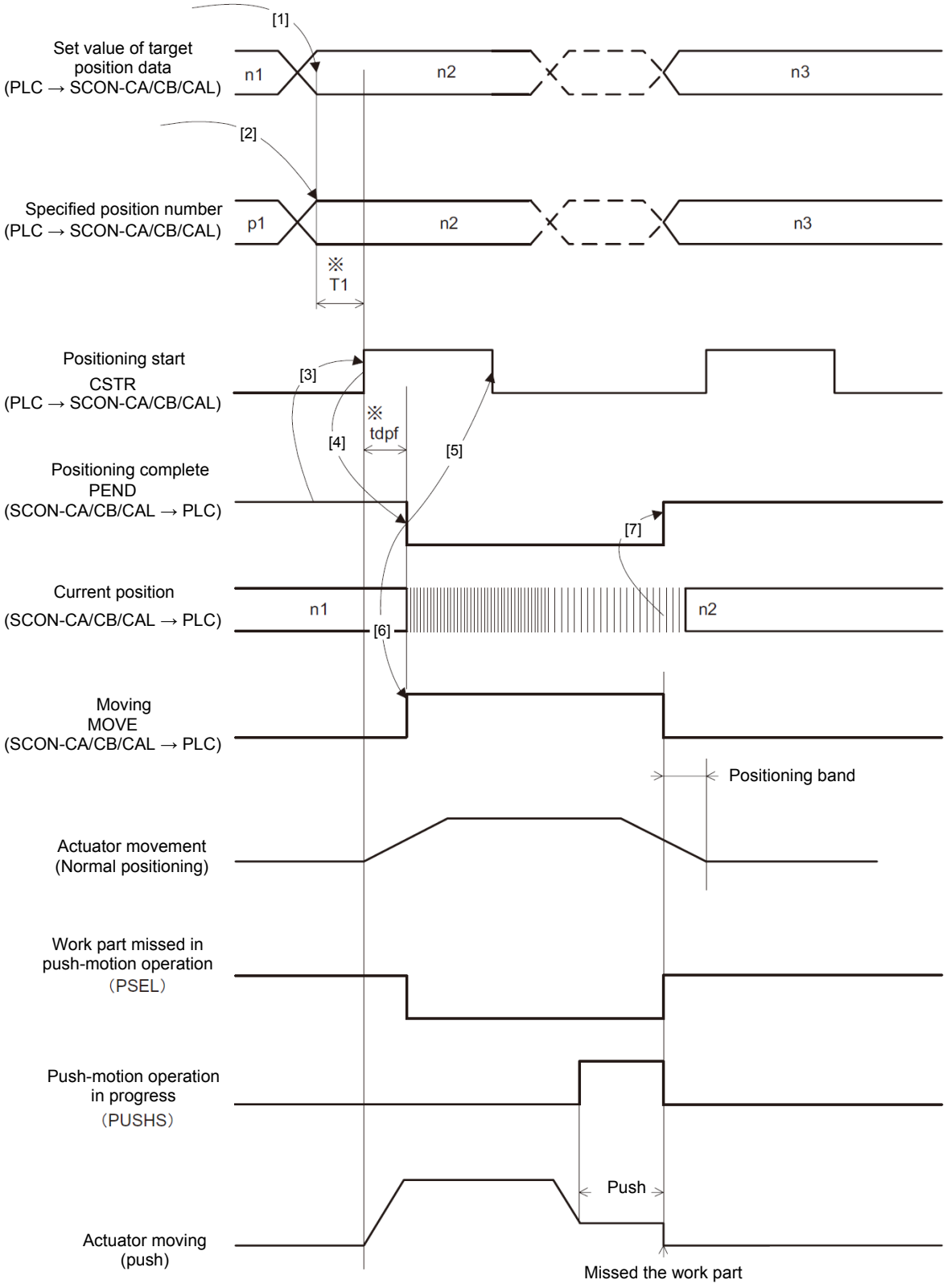
(Preparation) Set all position data other than the target position (speed, acceleration/deceleration, positioning band, etc.) in the position table.
Turn the position/simple direct switching (PMOD) signal ON.

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the position number for which the speed, acceleration/deceleration, etc., have been set for the specified position number corresponding to output address n+2 (*).
[3] Turn the positioning start (CSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] and [2] are read by the controller at the leading edge of the CSTR signal.
[4] The CSTR signal turns ON and PEND turns ON tpdf thereafter.
[5] Turn the CSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the target value (*) until the CSTR signal is turned OFF.
[6] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[7] The current position data (*) in input addresses n and n+1 are constantly updated. When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON if the CSTR signal is OFF, upon which the completed position number is output to the completed position number (*) corresponding to input address n+2.
Accordingly, wait until the PEND signal turns ON and an appropriate time (time to move the remaining travel) elapses before reading the completed position number (*) following the completion of positioning.
The current position data may vary slightly due to vibration, etc., even when the actuator is at standstill.
[8] The target position data can be changed while the actuator is moving.
To change the target position, change the target position data, wait until at least the PLC's scan time elapses, and then turn the CSTR signal ON.
Change the value of the CSTR signal after an elapse of at least the PLC's scan time.

- Example of operation (push-motion operation)

In push-motion operation, a current-limiting value is set in the Push field of the position data table in the "preparation" stage.
When positioning is started by specifying the position number for which the above value has been set in the Push field, push-motion operation is performed.

(*) Refer to 5.4.1.



*T1: Make sure "T1 ≥ 0 ms" is satisfied by considering the scan time of the host controller.
*Yt + Xt ≤ tdpf ≤ Yt + Xt + 3 (msec)

(2) Operation in the half direct mode 1 to 3

Operate the actuator by specifying data for the PLC's target position, positioning band, specified speed, acceleration/deceleration and push-current limiting specification.

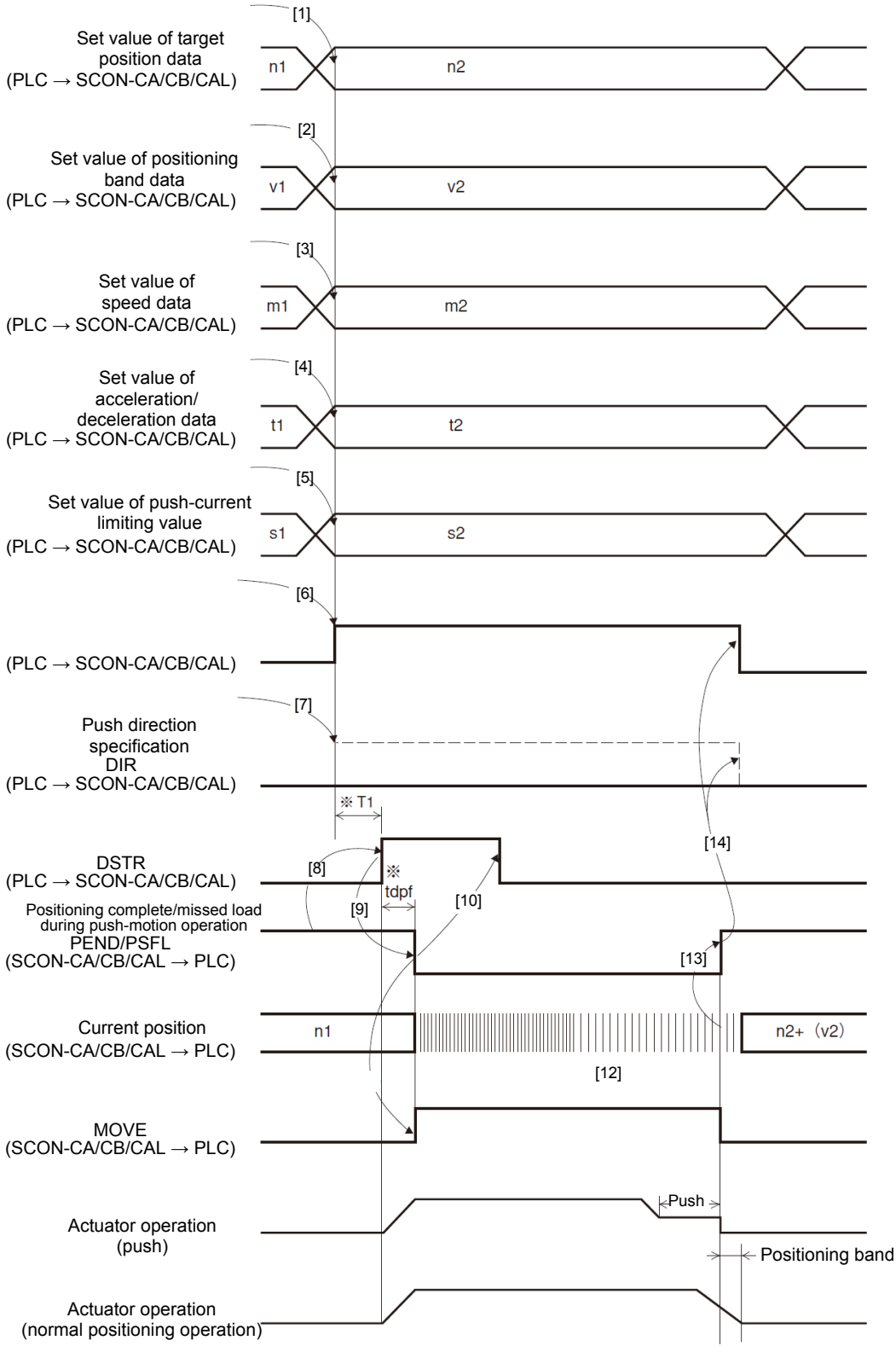
- Example of operation (push-motion operation)

[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set the speed data for the speed (*) corresponding to output address n+4.
[4] Set the acceleration/deceleration data for the acceleration/deceleration (*) corresponding to output address n+5.
[5] Set the push-current limiting data for the push-current limiting value (*) corresponding to output address n+6.
[6] Turn the push specification (PUSH) signal ON.
[7] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 5.4.7.)
[8] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [5] are read by the controller at the leading edge of the DSTR signal.
[9] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[10] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [5] until the DSTR signal is turned OFF.
[11] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[12] The current position data (*) in input addresses n and n+1 are constantly updated.
[13] The PEND signal turns ON when the motor current reaches the current-limiting value set in [5] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [5] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[14] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [6] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 5.4.1.



*T1: Make sure "T1 ≥ 0 ms" is satisfied by considering the scan time of the host controller.

*Yt + Xt ≤ tdpf ≤ Yt + Xt + 2 (msec)

(3) Operation in the full direct mode

Operate the actuator by specifying from the PLC all conditions required for positioning, such as the PLC's target position and positioning band.

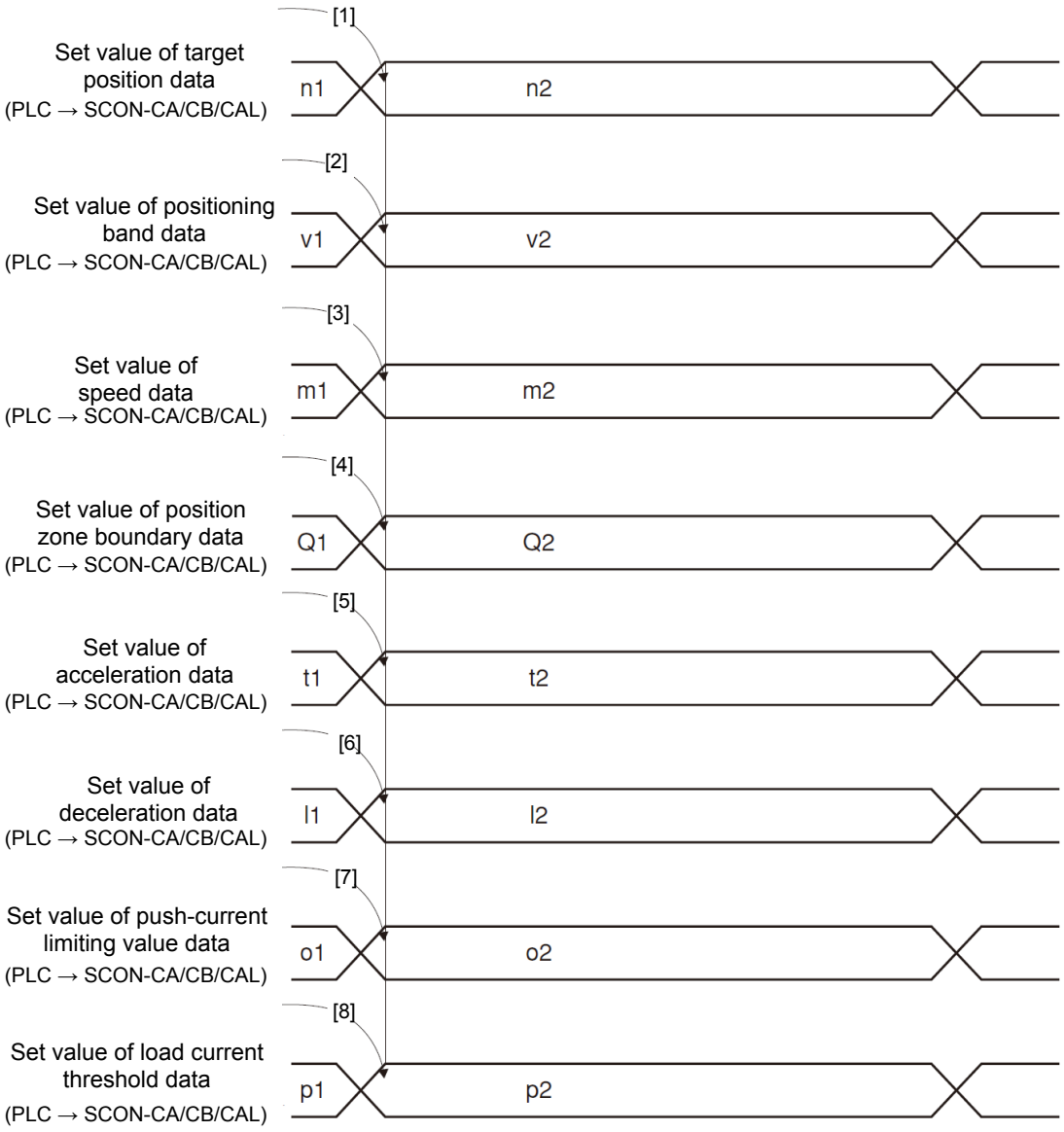
- Example of operation (push-motion operation)

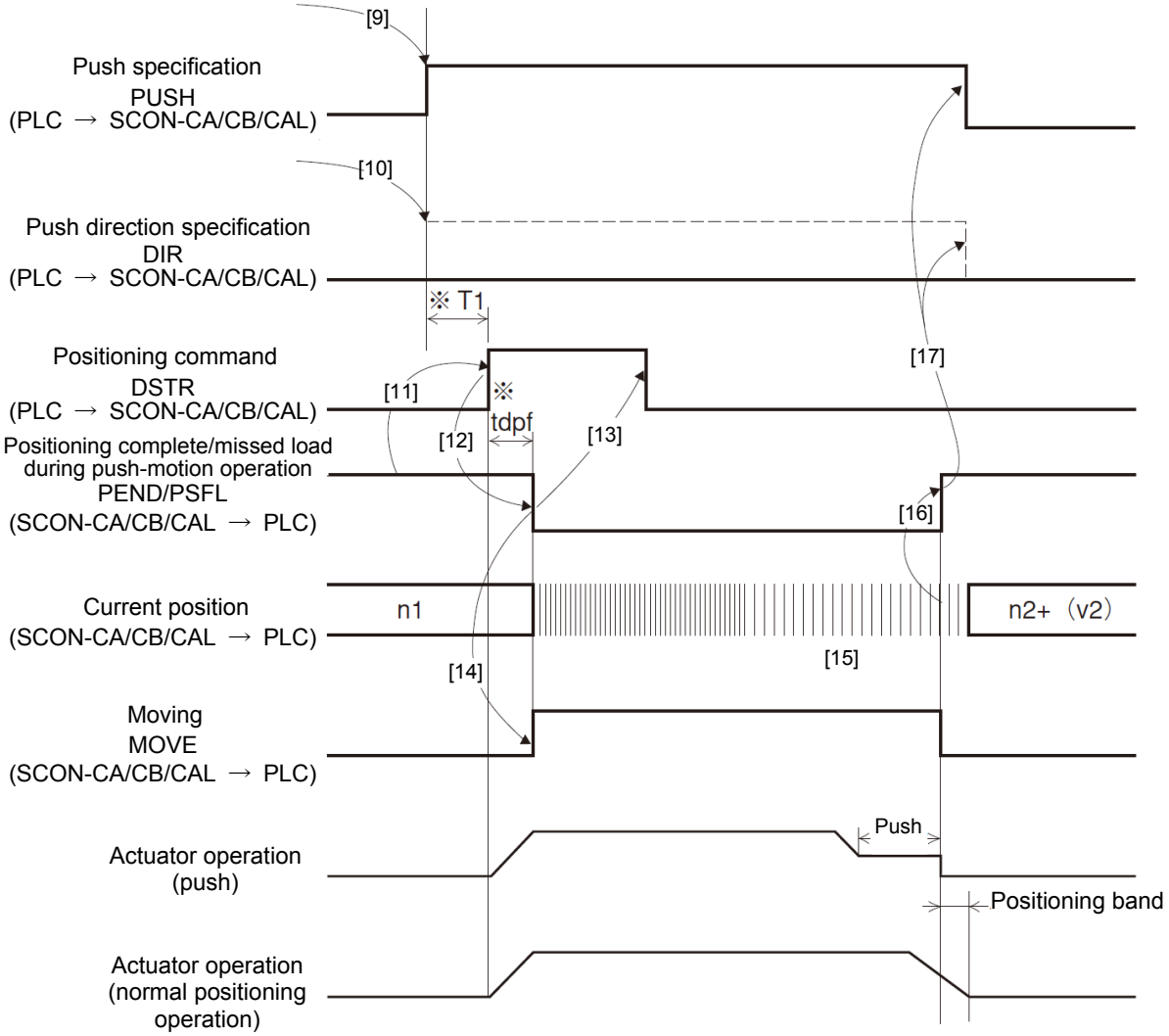
[1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
[2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
[3] Set speed data for the speeds (*) corresponding to output addresses n+4 and n+5.
[4] Set the position-zone output boundary data for the zone boundary+ and zone boundary- (*) corresponding to output addresses n+6 to n+9.
[5] Set the acceleration data for the acceleration (*) corresponding to output address n+10.
[6] Set the deceleration data for the deceleration (*) corresponding to output address n+11.
[7] Set the push-current limiting value data for the push-current limiting value (*) corresponding to output address n+12.
[8] Set the load current threshold data for the load current threshold (*) corresponding to output address n+13.
[9] Turn the push specification (PUSH) signal ON.
[10] Specify the push direction using the push direction specification (DIR) signal. (Refer to (22) of 5.4.7.)
[11] Turn the positioning command (DSTR) signal ON while the positioning complete (PEND) signal is ON or moving signal (MOVE) is OFF.
The data set in [1] to [8] are read by the controller at the leading edge of the DSTR signal.
[12] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
[13] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [8] until the DSTR signal is turned OFF.
[14] The MOVE signal turns ON simultaneously as the PEND signal turns OFF.
[15] The current position data (*) in input addresses n and n+1 are constantly updated.
[16] The PEND signal turns ON when the motor current reaches the current-limiting value set in [7] while the DSTR signal is OFF. (Push-motion operation is completed.)
If the motor current does not reach the current-limiting value set in [7] after the positioning band set in [2] has been reached, the missed load in push-motion operation (PSFL) signal turns ON. In this case, the PEND signal will not turn ON. (The actuator has missed the load during push-motion operation.)
[17] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

- Example of operation (normal positioning operation)

In normal positioning operation, the signal in [9] is set to OFF.
When the remaining travel falls within the positioning band set by the position data table, the PEND signal turns ON as long as the DSTR signal is OFF.

(*) Refer to 5.4.1.


[1]
Set value of target position data (PLC → SCON-CA/CB/CAL)
n1
n2
[2]
Set value of positioning band data (PLC → SCON-CA/CB/CAL)
v1
v2
[3]
Set value of speed data (PLC → SCON-CA/CB/CAL)
m1
m2
[4]
Set value of position zone boundary data (PLC → SCON-CA/CB/CAL)
Q1
Q2
[5]
Set value of acceleration data (PLC → SCON-CA/CB/CAL)
t1
t2
[6]
Set value of deceleration data (PLC → SCON-CA/CB/CAL)
l1
l2
[7]
Set value of push-current limiting value data (PLC → SCON-CA/CB/CAL)
o1
o2
[8]
Set value of load current threshold data (PLC → SCON-CA/CB/CAL)
p1
p2

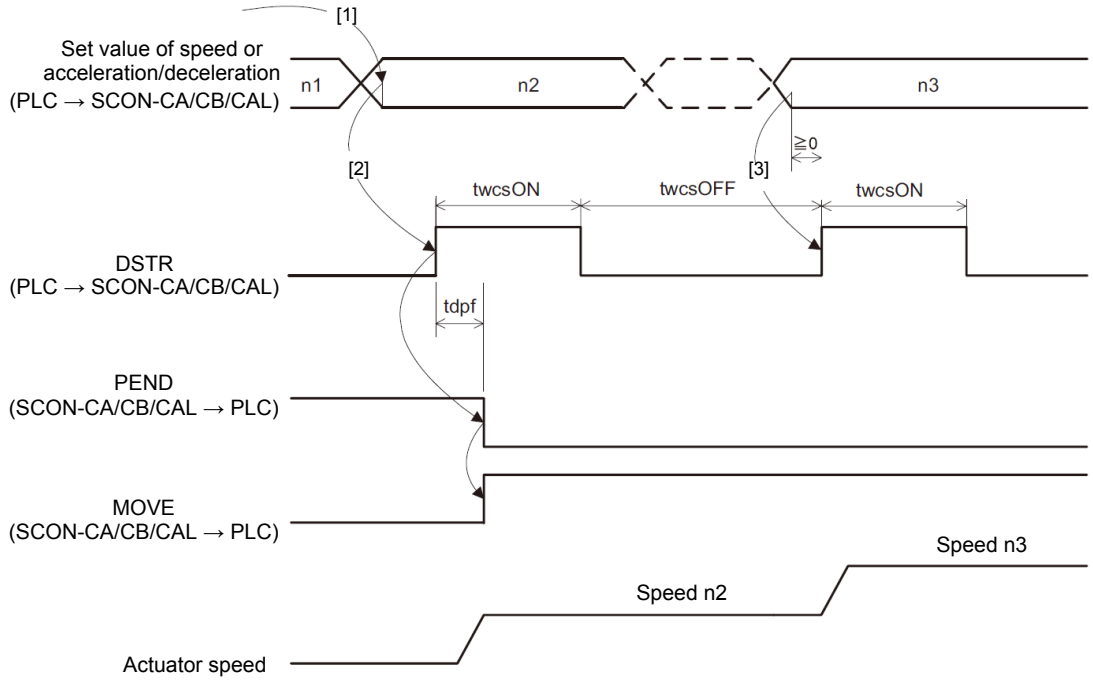


*T1: Make sure “T1 ≥ 0 ms” is satisfied by considering the scan time of the host controller.

*Yt + Xt ≤ tdpf ≤ Yt + Xt + 2 (msec)

(4) Data change during movement

In the half direct mode 1 to 3 and full direct mode, the values of target position data, acceleration/deceleration data, speed data, positioning band and push-current limiting value set by the PLC can be changed while the actuator is moving. After a desired data has been changed, turn the positioning command (DSTR) signal “ON” for tdpf or longer.
After the DSTR is turned “OFF,” wait for at least “twcsON + twcsOFF” before DSTR is turned “ON” again.
An example of changing the speed or acceleration/deceleration is given below.



twcsON≧Yt＋Xt＋2（msec）
twcsOFF≧Yt＋Xt＋2（msec）
※Yt＋Xt≦tpdf≦Yt＋Xt＋2（msec）

⚠ Caution:

1. If the speed is not yet set or set to “0,” the actuator will remain standstill and no alarm will generate.
2. If the speed is changed to “0” while the actuator is moving, the actuator will decelerate to a stop and no alarm will generate.
3. Even when the acceleration/deceleration or speed data alone is changed while the actuator is moving, the target position data must also be set.
4. Even when the target position alone is changed while the actuator is moving, the acceleration/deceleration and speed data must also be set.

5.7 PROFIBUS-DP Parameters

The parameters relating to PROFIBUS-DP are parameter Nos. 84 to 87, 90 and 159.

Category: C: External interface parameter

No.	Category	Symbol	Name	Factory default
1			For parameter Nos. 1 to 83, refer to the operation manual for the controller.	
↓				
83				
84	C	FMOD	Fieldbus operation mode	0
85	C	NADR	Fieldbus node address	1
86	C	FBRS	Fieldbus baud rate	0
87	C	NYTP	Network type	3
90	C	FMIO	Fieldbus I/O format	0
159	C	FBVS	FB Half Direct Mode Speed Unit	0

- Fieldbus operation mode (No. 84 FMOD)

Specify a desired operation mode in parameter No. 84 using a value between 0 and 4.

Set value of parameter No. 84	Mode name	Number of occupied bytes	Description
0 (factory setting)	Remote I/O mode	2	The actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP.
1	Position/simple direct mode	8	The target position can be specified directly as a value or using a value in the position data table. Other values required for operation are set in the position data table.
2	Half direct mode	16	Operate the actuator by specifying the speed, acceleration/deceleration and push-current value, in addition to the target position, directly using values.
3	Full direct mode	32	Operate the actuator by specifying all values relating to position control directly using values.
4	Remote I/O mode 2	12	The current-position and current-speed read functions are added to the functions available in the remote I/O mode.
5	Position/simple direct mode 2	8	Set this value to implement force control in the position/simple direct numerical mode.
6	Half direct mode 2	16	Set this value to implement force control in the half direct numerical mode.
7	Remote I/O mode 3	12	Set this value to implement force control in the remote I/O mode 2.
8	Half direct mode 3	16	Set this value to switch servo gains or vibration damping control parameters in the half direct numerical mode.

(Note) SCON-CAL is not applicable for the operation modes 5 to 7.

- Fieldbus node address (No. 85 NADR)

Specify the slave number of the remote station in parameter No. 85.

Setting range: 0 to 125 (The factory setting is 1.)

- Fieldbus baud rate (No. 86 FBRS)

The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

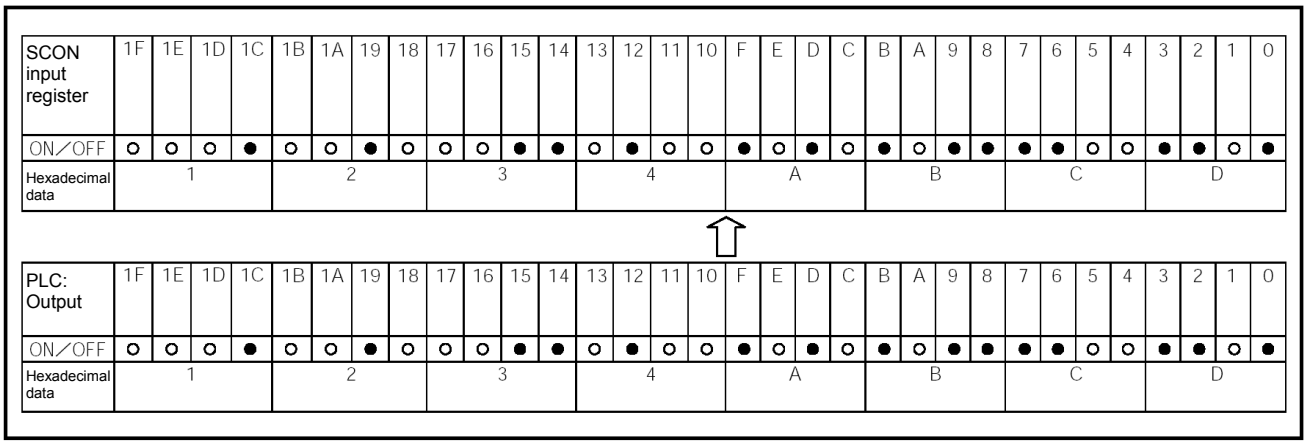
● Network type (No. 87 NTYP)
Specify the network module in parameter No. 87. Do not change the default value.

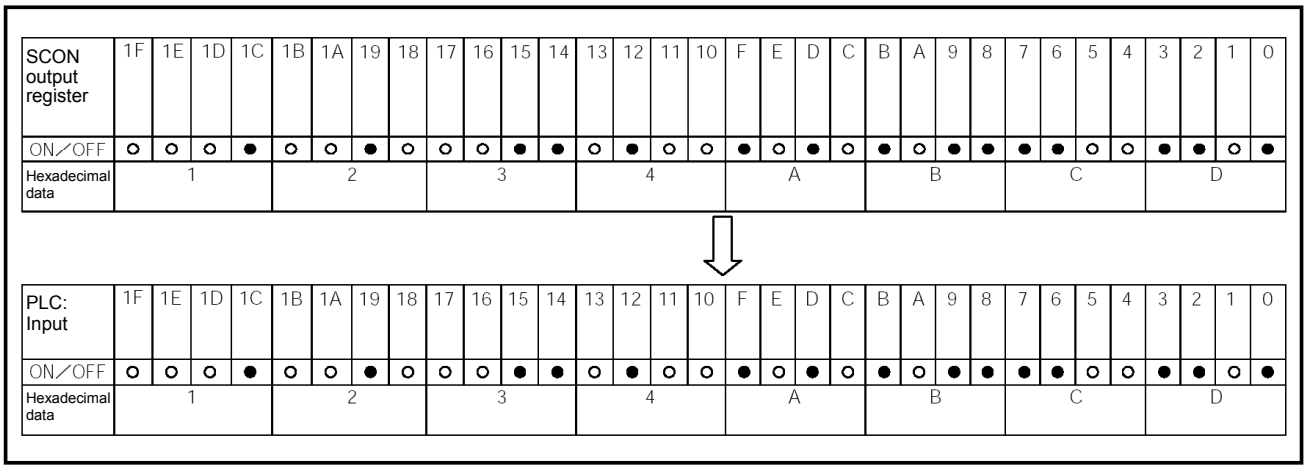
● Fieldbus I/O format (No. 90 FMIO)
PLC addresses are assigned in units of 16 points (units of words) based on the I/O addresses set to the controller and number of occupied addresses in each mode.
By changing the setting of parameter No. 90, data of up to 2 words can be swapped in units of bytes before transmission within the range of communication with the PLC's I/O addresses.

Set value of parameter No. 90	Description
0 (factory setting)	Data is not swapped and sent as is to the PLC. (Refer to Example i.)
1	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. (Refer to Example ii.)
2	In the case of a word register, the upper word and lower word are swapped. (Refer to Example iii.)
3	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. In the case of a word register, the upper word and lower word are also swapped. (Refer to Example iv.)

(Example i) Set value = "0"

● indicates ON, while O indicates OFF.





(Example ii) Set value = “1”

● indicates ON, while O indicates OFF.

SCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

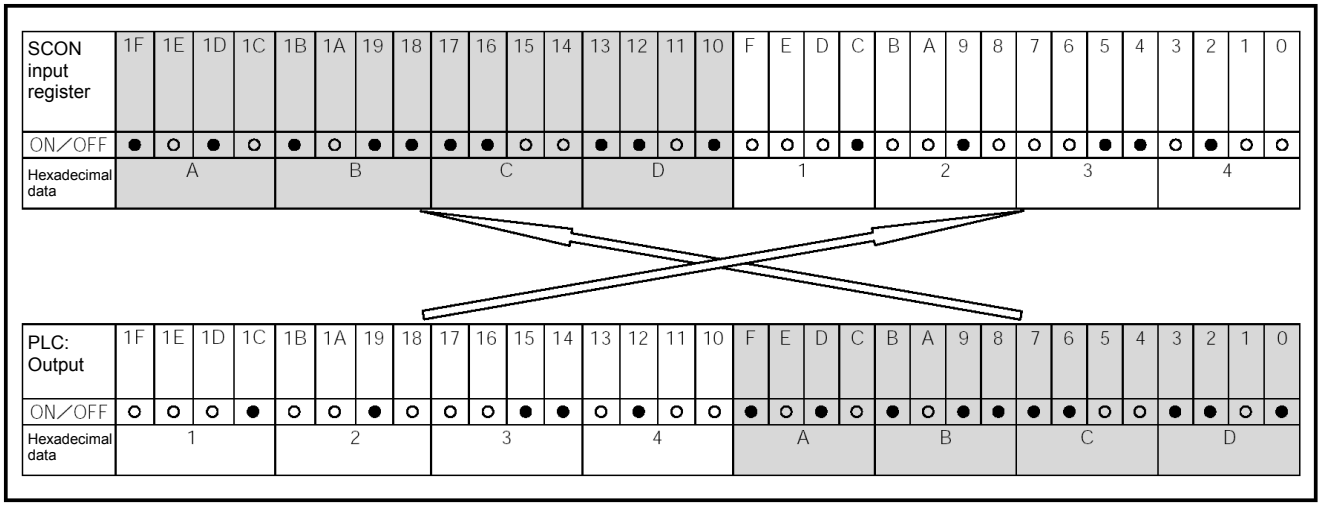
PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

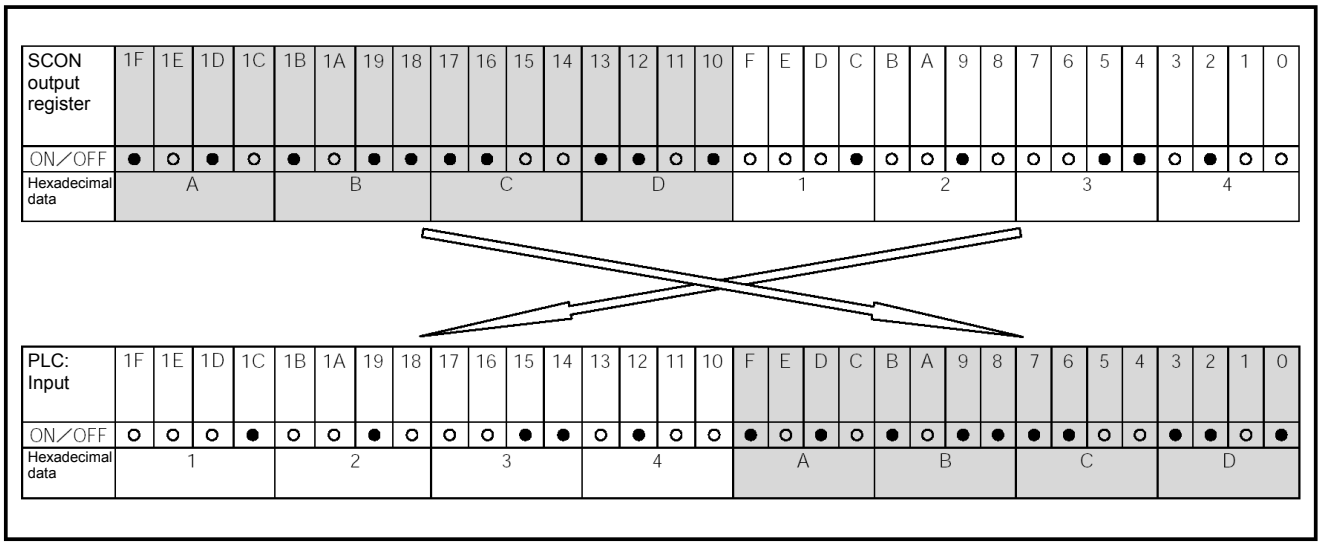
SCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	●	●	O	●	O	O	O	O	O	●	O	O	●	O	●	●	O	O	●	●	O	●	●	O	●	O	●	O	●	●
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iii) Set value = “2”

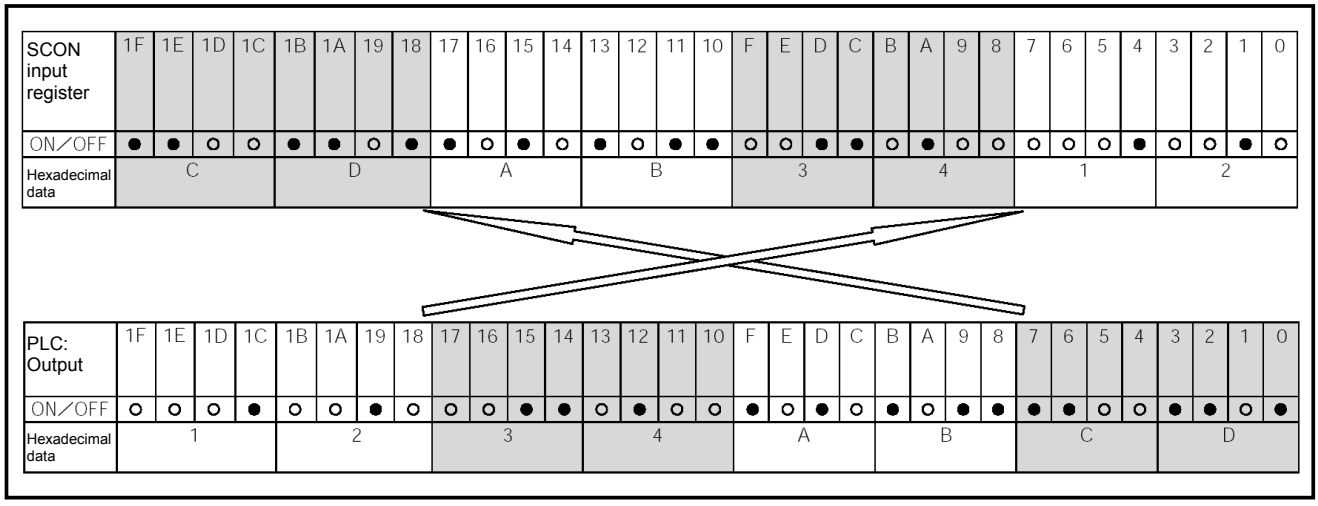
● indicates ON, while O indicates OFF.

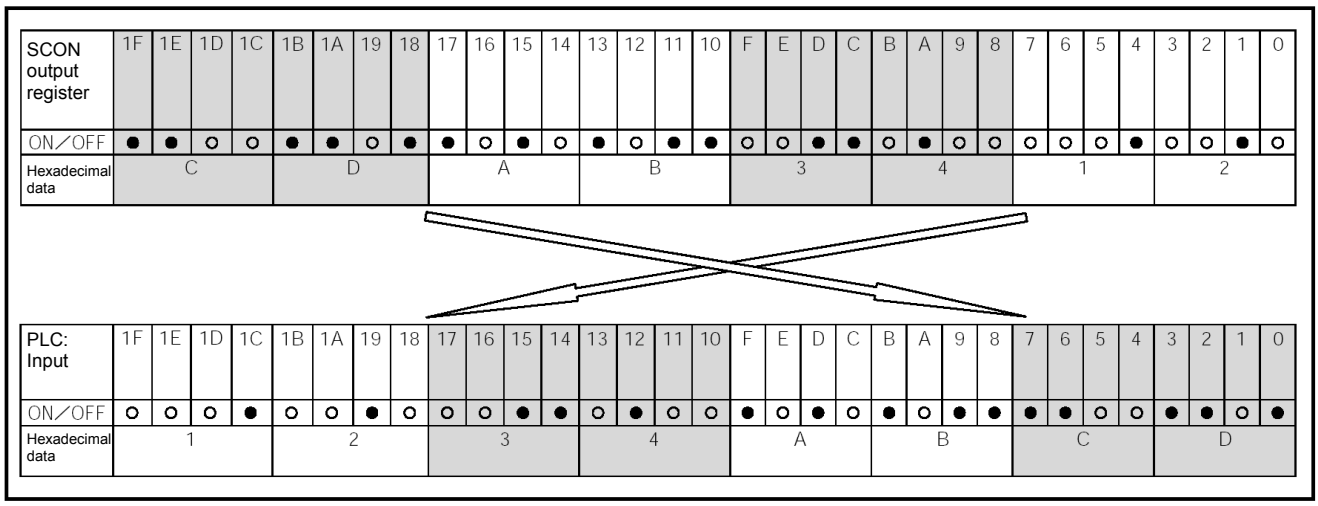




(Example iv) Set value = “3”

● indicates ON, while O indicates OFF.





- FB Half Direct Mode Speed Unit (No.159 FBVS)
  Determines the unit of measure when operating the unit in Half Direct Mode.

Parameter No.159 setting value	Speed setting unit
0 (Set in delivery)	1.0 mm/sec
1	0.1 mm/sec

5.8 Troubleshooting

5.8.1 Status LED Indicators

The illumination patterns of status LEDs (STATUS0/1) indicate the operating condition of the PROFIBUS-DP module as well as the network condition.
If a problem occurs, the current condition can be checked based on the illumination pattern of status LEDs.
The illumination patterns of status LEDs, and corresponding communication conditions, are shown below.

○ : Lit, × : Off, ☆ : Blinking

LED	Color	Indicator condition	Description of indication (Meaning of indication)
· STATUS1 · NS	Green	○	The board is online with the fieldbus network and communicating normally.
		☆	The board is offline from the fieldbus network.
	Orange	☆	A communication error is present.
· STATUS0 · MS	Green	○	The board is operating properly.
		☆	The board is not yet ready.
	Orange	○	A communication hardware error was detected when the board was not yet ready.

5.8.2 Alarm Details and Causes/Actions

If an alarm occurs, the completed position number (four bits of PM1 to PM8) indicates a corresponding simple alarm code in the remote I/O mode 1 to 3
In the position/simple direct mode, a simple alarm code is output to input address n+2.
In the half direct numerical modes 1 to 3 and full direct numerical mode, an alarm code is output to the input address n+6.

[1] Check the alarm code using the PLC's monitor function, etc., or connect the RC PC software or teaching pendant and check the code on the status monitor screen.
[2] Use the identified alarm code as the key to search the alarm list provided in the operation manual for the controller.
[3] Take an appropriate action according to the description provided under the applicable alarm code.
For the alarm codes listed below, take the actions specified in the following table.

Code	Error name	ID (*1)	RES (*2)	Cause/action
0F2	Fieldbus module error	05	x	Cause: A fieldbus module error was detected. Action: Check the applicable parameters.
0F3	Fieldbus module non-detection error	04	x	Cause: The module could not be detected. Action: Reconnect the power. If the problem persists, contact IAI.

(*1) ID → Simple alarm code
(*2) RES → Whether or not the alarm can be reset ○: Alarm can be reset / X: Alarm cannot be reset

6. Servo Press Type SCON-CB/CGB

Note As CB and CGB Types possess the same functions, this manual describes them together as CB Type.

6.1 Operation Modes and Functions

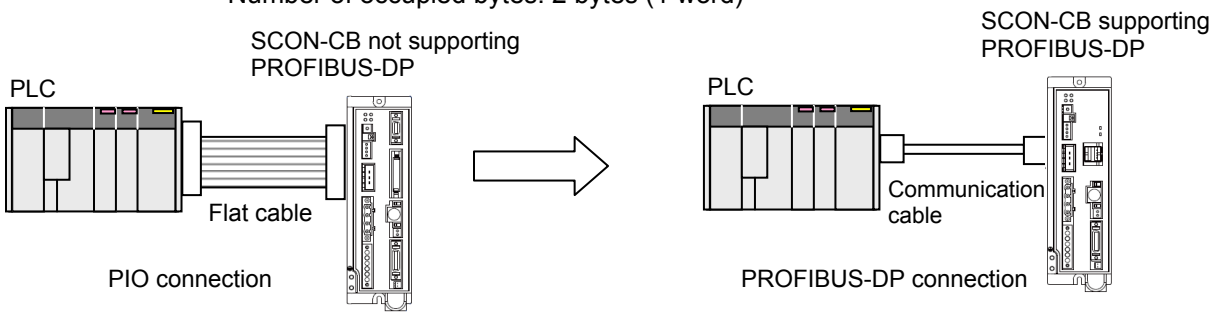
The operation modes described in the table below for SCON-CB Type applicable for PROFIBUS-DP are available to choose from for operation.

Operation modes and key functions

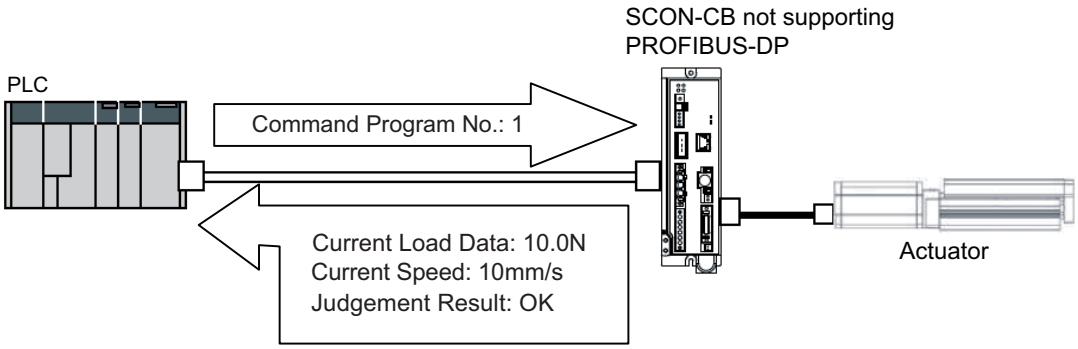
Key function	Remote I/O mode	Full function mode
Number of occupied bytes	2	32
Operation by position data specification	×	○
Direct speed/acceleration specification	×	○
Current position reading	×	○
Current speed reading	×	○
Program number command operation	○	○
Judgement result reading	○	○
Current load data reading	×	○
Overload level monitor	×	○
Servo gain switching	○(*1)	○(*1)

(*1) One servo gain can be registered to one press program.

[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24 V I/Os) via PROFIBUS-DP communication.
Number of occupied bytes: 2 bytes (1 word)



[2] Full function mode: It is the system to support all the features such as movement by direct indication or current load reading in addition to those for servo press such as startup of press program or judgment result reading.
Number of occupied bytes: 32 bytes (16 word)

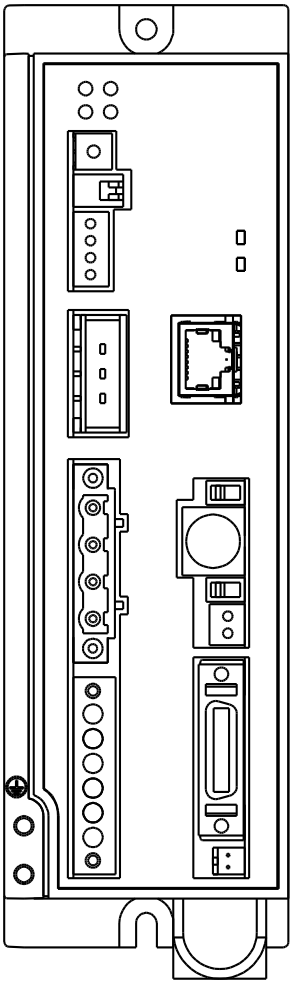


6.2 Model Numbers

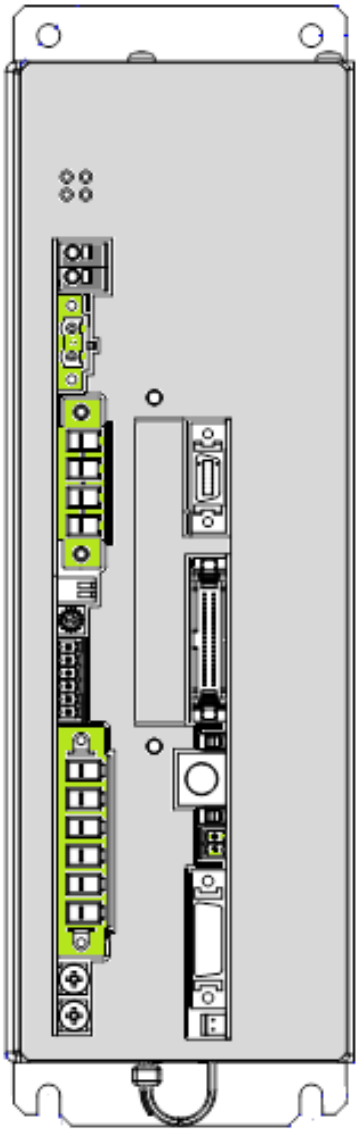
The model numbers of SCON-CB controller supporting PROFIBUS-DP are indicated as follows, respectively:

● SCON-CB-☐F-PR-☐

For ~ 750W motor
(The figure below 400W or less type)



For 3000 ~ 3300W motor

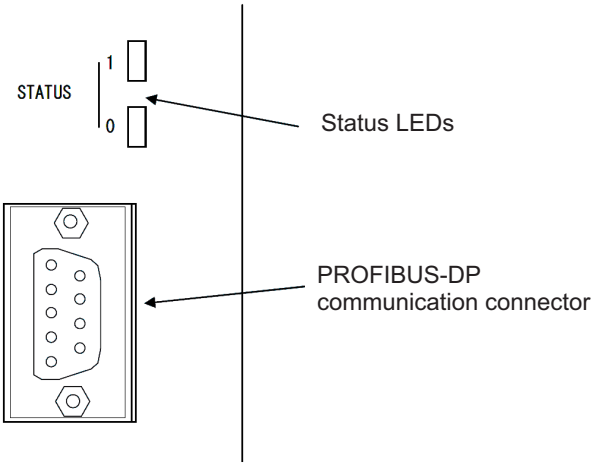


6.3 PROFIBUS-DP (Slave Station) Settings

(1) Name of each part

The name of each part relating to PROFIBUS-DP is shown.

● SCON-CB



(2) PROFIBUS-DP communication connector interface specifications

This is a 9-pin, Female D-sub connector recommended by the PROFIBUS-DP standard EN 50170.

Connector

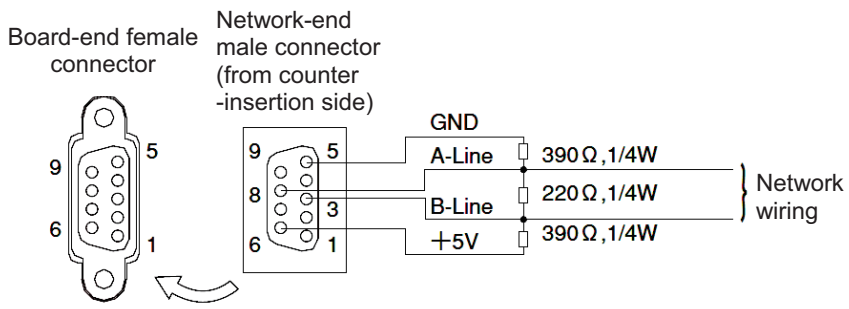
Pin No.	Description	Contents
3	B-Line	RxD, TxD (Positive signal line)
4	RTS	Request to send
5	GND	Signal ground (isolation)
6	+5V	+5 V output (isolation)
8	A-Line	/RxD, /TxD (Negative signal line)
Housing	Shield	Cable shield (enclosure and connection)

(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).
(Note 2) The cable-end connector is not supplied.

(3) Bus terminal processing

If the connector is to be connected to the network terminal node, connect the terminal resistor to the PROFIBUS-DP communication connector as shown below or use a connector with terminal resistor.

- Example of connector with terminal resistor: SUBCON-PLUS-PROFIB/AX/SC (Phoenix Contact)
- Connecting the terminal resistor



(4) Operation mode selection (setting)

Set parameter No. 84 “FMOD: Field bus operation mode.”
[Refer to 6.7 PROFIBUS-DP Related Parameters.]

Set value	Operation mode	Number of occupied bytes
0 (Factory setting)	Remote I/O mode	2
1	Full function mode	32

* Entering any value except for the ones described above will cause an “Excessive Input Value Error”.

(5) Node address setting

Set the node address using a parameter.
Set parameter No. 85, “NADR: Fieldbus node address” using the RC PC software.
[Refer to 6.7 PROFIBUS-DP Related Parameters.]

Settable range: 0 to 125 (The parameter has been set to 1 at the factory.)

(Note 1) Pay attention to duplicate node address settings.
(Note 2) PROFIBUS-DP node addresses are set with the master station always having address 0. Accordingly, addresses of slave stations can be set between 1 and 125.

(6) Status LED indications

The board operating condition and network condition can be checked using the two LEDs provided on the front side of the controller.

○ : Lit, × : Off, ☆ : Blinking

LED	Color	Indicator condition	Description of indication (Meaning of indication)
STATUS1	Green	○	The board is online with the fieldbus network and communicating normally.
		☆	The board is offline from the fieldbus network.
	Orange	☆	A communication error is present.
	-	×	Offline / No power supply
STATUS0	Green	○	The board is operating properly.
		☆	The board is not yet ready.
	Orange	○	A communication hardware error was detected when the board was not yet ready.
	-	×	Initializing / No power supply

(Note 1) After the necessary parameters have been set, reconnect the controller power and return the mode selector switch on the front side of the controller to the AUTO position. If the switch remains in the MANU position, PLC operation cannot be performed.
(Note 2) The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

6.4 Communicating with the Master Station

6.4.1 Operation Modes and Corresponding PLC I/O Areas

The channels allocated for each operation mode are described as follows.

• PLC output → SCON-CB input (* "n" indicates the node address of each axis.)

PLC output area (bytes)	DI on the SCON-CB side and input data register	
	Remote I/O mode	Full function mode
	Number of occupied bytes: 2	Number of occupied bytes: 32
n+0	Port No. 0 to 15	Target position
n+1		
n+2		Positoning band
n+3		
n+4		Command speed
n+5		
n+6		Occupied area
n+7		
n+8		
n+9		
n+10		Acceleration
n+11		Deceleration
n+12		Occupied area
n+13		Load current threshold
n+14		Status signal 1
n+15		Status signal 2

• SCON-CB input → PLC output (* "n" indicates the node address of each axis.)

PLC output area (bytes)	DO on the SCON-CB side and output data register	
	Remote I/O mode	Full function mode
	Number of occupied bytes: 2	Number of occupied bytes: 32
n+0	Port No. 0 to 15	Current position
n+1		
n+2		Feedback current
n+3		
n+4		Current speed
n+5		
n+6		Current load data
n+7		
n+8		Occupied area
n+9		
n+10		Program alarm code
n+11		Alarm code
n+12		Overload level monitor
n+13		Execution program
n+14		Status signal 1
n+15		Status signal 2

(Note) The Occupied area shows the area to be occupied with the operation mode setting. Therefore, this area cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

6.4.2 Remote I/O Mode (Number of Occupied Bytes: 2)

This is the operation mode with the position No. set up as the same as using PIO (24V I/O).
Create a press program on a PC software for RC.
The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

Operation modes and key functions

Key function	○: directly controls ×: Invalid
Operation by position data specification	×
Direct speed/acceleration specification	×
Current position reading	×
Current speed reading	×
Program number command operation	○
Judgement result reading	○
Current load data reading	×
Overload level monitor	×
Servo gain switching	○ (*1)

(*1) One servo gain can be registered to one press program.

(1) PLC address configuration (* “n” indicates the I/O first address of each axis.)

Parameter No. 84	SCON-CB side Input resister	PLC side output address (bytes)	SCON-CB side Output resister	PLC side input address (bytes)
0	0 to 15	n	0 to 15	n

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input (1 word=2 bytes) and one output word (channel) in the I/O areas.

- Each address is controlled by ON/OFF bit signals.

PLC output

Address (* “n” indicates the I/O first address of each axis.)

	1 word = 2 bytes =16 bit															
n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller input port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

PLC input

Address (* “n” indicates the I/O first address of each axis.)

	1 word = 2 bytes =16 bit															
n+0	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignment [Refer to Instruction manual for the controller main body for more information.]

Category	Port No.	Symbol	Signal name
PLC output → SCON-CB input	0	PC1	Command program No.
	1	PC2	
	2	PC4	
	3	PC8	
	4	PC16	
	5	PC32	
	6	PSTR	Program start
	7	PHOM	Program home movement
	8	ENMV	Axis movement permission
	9	FPST	Program compulsory stop
	10	CLBR	Loadcell calibration command
	11	BKRL	Forced brake release
	12	RMOD	Operation mode switching
	13	HOME	Home-return
	14	RES	Reset
	15	SON	Servo ON command

Category	Port No.	Symbol	Signal name
SCON-CB output →PLC input	0	PCMP	Program finished in normal condition
	1	PRUN	Program execution
	2	PORG	Program home position
	3	APRC	While in aproaching operation
	4	SERC	While in probing operation
	5	PRSS	While in pressurizing operation
	6	PSTP	While in pressurizing stop
	7	MPHM	While in program home movement
	8	JDOK	Judgement OK
	9	JDNG	Judgement NG
	10	CEND	Loadcell calibration completion
	11	RMDS	Operation mode status
	12	HEND	Home-return completion
	13	SV	Servo ON status
	14	* ALM	Alarm
	15	* ALML	Light failure alarm

The symbol with a * mark shows the ON signal in normal condition.

6.4.3 Full Function Mode (Number of Occupied Bytes: 32)

It is the mode operation system to conduct all the servo press features in fieldbus communication. Set each value in the input and output areas.
The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

Operation modes and key functions

Key function	○: directly controls ×: Invalid
Operation by position data specification	○
Direct speed/acceleration specification	○
Current position reading	○
Current speed reading	○
Program number command operation	○
Judgement result reading	○
Current load data reading	○
Overload level monitor	○
Servo gain switching	○(*1)

(*1) One servo gain can be registered to one press program.

(1) PLC address configuration (* “n” indicates the I/O first address of each axis.)

Parameter No. 84	SCON-CB side input side resister	PLC side output address (bytes)	SCON-CB side output side resister	PLC side input address (bytes)
1	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Feedback current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
		n+5		n+5
	Occupied area	n+6	Current load data	n+6
		n+7		n+7
	Occupied area	n+8	Occupied area	n+8
		n+9		n+9
	Acceleration	n+10	Program alarm code	n+10
	Deceleration	n+11	Alarm code	n+11
	Occupied area	n+12	Overload level monitor	n+12
	Command program No.	n+13	Execution program No.	n+13
	Status signal 1	n+14	Status signal 1	n+14
	Status signal 2	n+15	Status signal 2	n+15

(Note) The Occupied area shows the area to be occupied with the operation mode setting. Therefore, this area cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of sixteen input words (16-words = 32 bytes) and four output words in the I/O areas.

- The control signals 1,2 and status signals 1,2 are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from –999999 to +999999 (Unit: 0.001 mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- The positioning band are expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.001 mm/sec) can be set in PLC.
- The speed are expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01 mm/sec) can be set in PLC. However, Set a value that does not exceed the max. speed of the applicable actuator.
- The acceleration/deceleration using 1-word (16 bits) binary data. The figures from 1 to 999 (Unit: 0.01 G) can be set in PLC. However, Set a value that does not exceed the max. acceleration/deceleration of the applicable actuator.
- The command program No. using 1-word (16 bits) binary data. The figures from 0 to 63 can be set in PLC.
- The feedback current using 2-word (32 bits) binary data (Unit: 0.1%).
- The current speed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code, program alarm code using 1-word (16 bits) binary data.
- The current load data using 2-word (32 bits) binary data (Unit: 0.01N).
- The overload level monitor using 1-word (16 bits) binary data (Unit: %).
- The execution program No. using 1-word (16 bits) binary data.

PLC output
Address (* “n” indicates the output first address of each axis.)

1 word = 2 bytes = 16 bit

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0 Target position (Lower word)																
n+1 Target position (Upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2 Positioning band (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3 Positioning band (Upper word)	-	-	-	-	-	-	-	-	-	-	-	-	524,288	262,144	131,072	65,536
n+4 Speed (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+5 Speed (Upper word)	-	-	-	-	-	-	-	-	-	-	-	-	524,288	262,144	131,072	65,536
n+6 Can not be used																
n+7 Can not be used																

Address (* “n” indicates the output first address of each axis.)

1 word = 2 bytes = 16 bit

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+8 Can not be used																
n+9 Can not be used																
n+10 Acceleration	-	-	-	-	-	1,024	512	256	128	64	32	16	8	4	2	1
n+11 Deceleration	-	-	-	-	-	1,024	512	256	128	64	32	16	8	4	2	1
n+12 Can not be used																
n+13 Command program No.	-	-	-	-	-	-	-	-	-	-	PC32	PC16	PC8	PC4	PC2	PC1
n+14 Status signal 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n+15 Status signal 2	DSTR	JOG-	JOG+	JVEL	JISL	SSTP	FPST	ENMV	PHOM	PSTR	BKRL	RMOD	CLBR	RES	HOME	SON

PLC input

Address (* “n” indicates the input first address of each axis.)

1 word = 2 bytes = 16 bit

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+0 Current position (Lower word)																
n+1 Current position (Upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+2 Feedback current (Lower word)	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+3 Feedback current (Upper word)	-	-	-	-	-	-	-	-	-	-	-	-	524,288	262,144	131,072	65,536

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+4 Current speed (Lower word)																
n+5 Current speed (Upper word)																

When the current speed is shown using the negative figure, it is expressed using the complement of 2.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+6 Current load (Lower word)																
n+7 Current load (Upper word)																

When the current load is shown using the negative figure, it is expressed using the complement of 2.

Address (* “n” indicates the input first address of each axis.)

1 word = 2 bytes = 16 bit

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
n+8 Can not be used																
n+9 Can not be used																
n+10 Program alarm code																
n+11 Alarm code																
n+12 Overload lebel monitor	-	-	-	-	-	-	-	-	-	PC64	PC32	PC16	PC8	PC4	PC2	PC1
n+13 Execution program No.	-	-	-	-	-	-	-	-	-	-	PC32	PC16	PC8	PC4	PC2	PC1
n+14 Status signal 1	JDNG	JDOK	LJNG	LJOK	PJNG	PJOK	-	-	-	WAIT	RTRN	DCMP	PSTP	PRSS	SERC	APRC
n+15 Status signal 2	EMGS	ALM	ALML	PALM	MPHM	PORG	PRUN	PCMP	ZONE2	ZONE1	-	PEND	RMDS	CEND	HEND	SV

(3) I/O signal assignment (* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Adress		Bit	Symbol	Function	Details
PLC output	Target position	32-bit data	-	32-bit signed integer. Set the target position on the absolute coordinates. The unit is 0.001 mm, while the specifiable range is -999999 to 999999. (Example) When it is “+2.541mm”, set it as “2541”. If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). * When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	6.6 (2)
	Positioning band	32-bit data	-	32-bit integer. The unit is 0.001 mm, while the specifiable range is 1 to 999999. (Example) When it is “2.540mm”, set it as “2540”. It shows the allowable range from the target position, that is regarded as the positioning completion.	6.6 (2)
	Speed	32-bit data	-	32-bit integer. Specify the speed at which to move the actuator. The unit is 0.01 mm/sec, while the specifiable range is 0 to 999999. Deceleration stop if and to specify in motion 0. It under suspension, it will remain stopped on the spot. (Example) When it is “25.41mm”, set it as “2540”. When the movement command is set with the value bigger than the max. speed, an alarm is issued.	6.6 (2)
	Acceleration	16-bit data	-	16-bit integer. Specify the acceleration and deceleration at which to move the actuator. The unit is 0.01G, while the specifiable range is 1 to 999. (Example) To set 0.30G, specify “30.” If a move command is issued by specifying “0” or a value exceeding the maximum acceleration or maximum deceleration, an alarm will occur.	6.6 (2)
	Deceleration	16-bit data	-		
	Command program No.	16-bit data	-	16-bit integer. Excection, or specify the movement to press program number for press program home. Available range is from 0 to 63. After specified, excective program when turns ON press program start signal (PSTR). Also, movement press program home movement signal when turns ON press program home movement signal (PHOM).	6.6 (2)

(* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Adress		Bit	Symbol	Function	Details
PLC output	Control signal 1	b15	-	Can not be used.	-
		b14			
		b13			
		b12			
		b11			
		b10			
		b9			
		b8			
		b7			
		b6			
		b5			
		b4			
		b3			
		b2			
		b1			
		b0			
	Control signal 2	b15	DSTR	Positioning start: when the movement command is ON	6.6.4 (15)
		b14	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	6.6.4 (14)
		b13	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	6.6.4 (14)
		b12	JVEL	Jog speed/inching distance switching: Parameter No. 26, “Jog speed” and parameter No. 48, “Inching distance” are used when the signal is OFF, or parameter No. 47, “Jog speed 2” and parameter No. 49, “Inching distance 2” are used when the signal is ON.	6.6.4 (13)
		b11	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	6.6.4 (12)
		b10	SSTP	Probing stage: When this bit is ON at the time when probing stage completes, stops at probing stage complete position	6.6.4 (11)
		b9	FPST	Program compulsory stop: Executed press program stopped when it turns ON.	6.6.4 (10)
		b8	ENMV	Axis operation permission: Axis operation permitted when it turns ON.	6.6.4 (9)
		b7	PHOM	Program home return movement	6.6.4 (8)
		b6	PSTR	Program start	6.6.4 (7)
		b5	BKRL	Forced brake release: The brake is released when the signal turns ON.	6.6.4 (6)
		b4	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	6.6.4 (5)
		b3	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	6.6.4 (4)
		b2	RES	Reset: A reset is performed when the signal turns ON.	6.6.4 (3)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	6.6.4 (2)
		b0	SON	Servo ON command: The servo is ON when the signal is ON.	6.6.4 (1)

(* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Signal Type		Bit	Symbol	Contents	Details
PLC input	Current position	32-bit data	-	32-bit signed integer indicating the current position. The unit is 0.01 mm. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 1.023 mm * If this data is read as a hexadecimal, a negative value is indicated by a complement of 2.	6.6 (2)
	Feedback current	32-bit data	-	32-bit integer. It shows the feedback current value. The unit is 0.1 %. (Example) Reading: 00000FF$_H$ = 255 (decimal) = 25.5 %	6.6 (2)
	Current speed	32-bit data	-	32-bit signed integer. The current speed is indicated. Positive value: The actuator is moving in the direction opposite home. Negative value: The actuator is moving in the direction of home. The unit is 0.01 mm/sec. (Example) Reading: 000003FF$_H$ = 1023 (decimal) = 10.23 mm/sec * If this data is read as a hexadecimal value, a negative value is indicated by a compliment of 2.	6.6 (2)
	Current load data	32-bit data	-	32-bit signed integer. The unit is 0.01N. * If this data is read as a hexadecimal value, a negative value is indicated by a compliment of 2.	6.6 (2)
	Program alarm code	16-bit data	-	16-bit integer. The alarm code currently generated output. 0 is output when no alarm is present. For details on alarms, refer to the instruction manual for the controller.	6.6 (2)
	Alarm code	16-bit data	-	16-bit integer. The signal turns ON when an alarm occurs. 0 is output when no alarm is present. For details on alarms, refer to the instruction manual for the controller.	5.8 (2)
	Overload level monitor	16-bit data	-	16-bit integer. Motor temperature estimated from feedback current value, and output in ratio with allowable upper limit as 100%. The unit is %. Overload alarm (E0) will be generated when this value gets to 100%.	6.6 (2)
	Execution program No.	16-bit data	-	16-bit integer. The press program number currently executed is output. This value is retained unless the next program number gets indicated or the servo gets turned OFF. This value is retained until alarm reset when an alarm is generated while a program is executed.	6.6 (2)

(* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Signal Type		Bit	Symbol	Contents	Details
PLC input	Status signal 1	b15	JDNG	Overall Judgment NG: Turns ON when overall judgment was made for load and position (distance) as a NG.	6.6.4 (31)
		b14	JDOK	Overall Judgment OK: Turns ON when Overall judgment was made for load and position (distance) as a OK.	6.6.4 (31)
		b13	LJNG	Load judgement NG: Turns ON when load for pressing operation judged NG.	6.6.4 (30)
		b12	LJOK	Load judgement OK: Turns ON when load for pressing operation judged OK.	6.6.4 (30)
		b11	PJNG	Position (distance) judgement OK: Turns ON when load for pressing operation position (distance) judged NG.	6.6.4 (30)
		b10	PJOK	Position (distance) judgement NG: Turns ON when load for pressing operation position (distance) judged OK.	6.6.4 (30)
		b9	-	Can not be used.	-
		b8	-		
		b7	-		
		b6	WAIT	Press program standby: Turns ON in standby status after press program finished in normal condition.	6.6.4 (29)
		b5	RTRN	Returned during the operation: Turns ON during returning stage.	6.6.4 (28)
		b4	DCMP	While in decompressing operation: Turns ON during decompressing stage.	6.6.4 (27)
		b3	PSTP	Pressurize during the stop: Turns on during stop in pressurizing stage.	6.6.4 (26)
		b2	PRSS	While in pressurizing operation: Turns ON while pressurizing operation executed in pressurizing stage.	6.6.4 (25)
		b1	SERC	While in probing operation: Turns ON when probing stage executed.	6.6.4 (24)
		b0	APRC	While in approaching the operation: Turns ON when approaching stage executed.	6.6.4 (23)
	Status signal 2	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	6.6.4 (22)
		b14	ALM	Alarm: The signal turns ON when an alarm occurs.	6.6.4 (21)
		b13	ALML	Light failure alarm: The signal turns ON when an light failure alarm occurs.	6.6.4 (20)
		b12	PALM	Program alarm: The signal turns ON when an program alarm occurs.	6.6.4 (19)
		b11	MPHM	Program home return during the movement: Turns ON while in movement to home position set to each press program.	6.6.4 (8)
		b10	PORG	Program home position: Turns ON while in achieve to reach to home position set to each press program.	6.6.4 (8)
		b9	PRUN	Press program excecuted: Turns ON when press program executed.	6.6.4 (7)

(* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Signal Type		Bit	Symbol	Contents	Details
PLC input	Status signal 1	b8	PCMP	Press program finished in normal condition: Turns ON when press program finished with no alarm generated. (Note) There is no relation to press judgment.	6.6.4 (7)
		b7	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	6.6.4 (18)
		b6	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	6.6.4 (18)
		b5	-	Can not be used.	-
		b4	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	6.6.4 (16)
		b3	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	6.6.4 (5)
		b2	CEND	Loadcell calibration completion: ON when the calibration completion.	6.6.4 (4)
		b1	HEND	Home return completion: ON when the home return completion	6.6.4 (2)
		b0	SV	Operation ready: ON when the Servo ON	6.6.4 (1)

6.4.4 I/O Signal Controls and Function

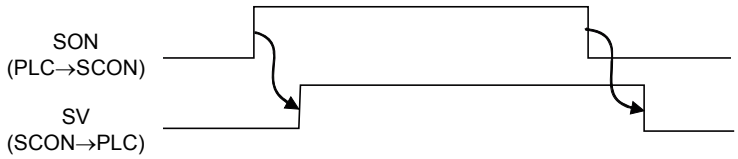
* ON indicates that the applicable bit signal is “1”, while OFF indicates that the bit signal is “0”.
The I/O control and functions used in the full function mode are described as follows. For the I/O signals for the Remote I/O Modes, refer to the instruction manual for the controller main body for servo press.

(1) Servo ON command (SON) PLC output signal
Operation preparation end (SV) PLC input signal

When the SON signal is turned ON, the servo will turn ON.
When “SON” signal is turned “ON”, the servo-motor is turned “ON”. When the servo-motor is turned ON, the Status Indicator LED (Refer to 5.3, " PROFINET IO Interface”) on the front surface of the controller illuminates in green.
The “SV” signal is synchronized with this LED.

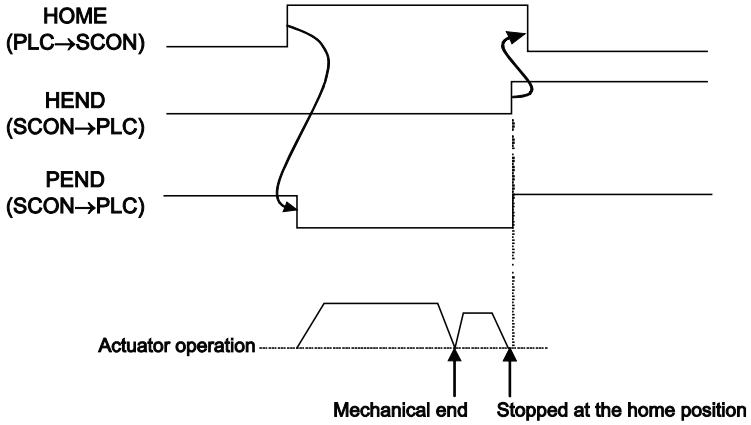
■Function

Using the “SON” signal, the turning ON/OFF of the controller is available.
While the “SV” signal is ON, the controller's servo-motor is turned “ON” and the operation becomes available.
The relationship between the “SON” signal and “SV” signal is as follows.



(2) Home return (HOME) PLC output signal
Home return completion (HEND) PLC input signal

When the “HOME” signal is turned “ON”, this command is processed at the startup (ON-edge), and the home return operation is performed automatically. During the home return operation, the “HEND” signal is turned “ON”.
When the “HEND” signal is turned “ON”, turn “OFF” the “HOME” signal.
Once the “HEND” signal is turned “ON”, it can not be turned “OFF” until the power is turned “OFF” or the “HOME” signal is input again. Once the HEND signal is turned ON, it can not be turned OFF until the power is turned OFF or the HOME signal is input again.
Even after the completion of the home return operation, when the “HOME” signal is turned “ON”, the home return operation can be performed.



⚠ Caution: In the Remote I/O Modes when the movement command is issued without performing the home return operation, the movement is performed after the automatic home return operation.
In the full function mode, issuing a movement command following the power on, without performing a home return first, will generate an alarm “Error Code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed)” (operation-reset alarm).

(3) Reset (RES) PLC output signal

This signal has two functions. It can reset the controller alarm and cancel the reminder for planned movements during pause conditions.

■Function

[1] When this signal is turned ON from OFF condition after eliminating the cause of the alarm during the alarm output, the alarm (ALM) signal can be reset. (In the case of the alarm with the cold start level, re-injection of the power is required)

[2] When this signal is turned ON from OFF condition during the pause condition, the reminder of the planned movement left can be cancelled.

(4) Load cell calibration command (CLBR) PLC output signal

Load cell calibration complete (CEND) PLC input signal

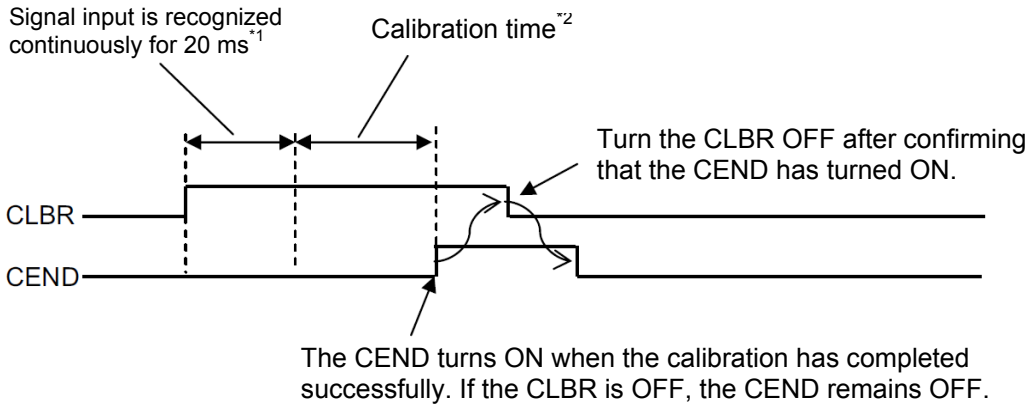
The factory setting for the load cell is 0N when no load is applied. If you want to use the loaded condition as the reference (0 N), perform the following calibration. Also perform this calibration in other conditions as necessary (such as during readjustment, inspection, etc.).

[1] Stop the operation. (Calibration cannot be performed while any axis is operating, pushing a work part or paused, in which case an attempt to perform calibration will generate a 0E1 (load cell calibration error) alarm.

[2] Turn ON the load cell calibration signal (CLBR) and keep it ON for at least 20 ms.

[3] Once the calibration is complete, the calibration complete signal (CEND) turns ON. Thereafter, turn OFF the CLBR signal.
If the calibration was not successful, a 0E1: (load cell calibration error) alarm generates.

⚠ Caution: Normal operation commands are not accepted while the CLBR signal is ON.



*1 If the CLBR is turned OFF during this period, the signal is not recognized and therefore calibration is not performed.

*2 If the CLBR is turned OFF during this period, an alarm generates.

(5) Operating mode selector (RMOD) PLC output signal
Operation mode status (RMDS) PLC input signal

The operation mode is selected with the RMOD signal and the MODE switch located on the front surface of the controller.

Also, which mode is currently set, AUTO or MANU, can be confirmed using the RMDS signal.
The operation modes with the combination of the RMOD signal and the MODE switch ON/OFF are described as follows.

	Controller MODE Switch = AUTO	Controller MODE Switch = MANU
RMOD signal = OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal = ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

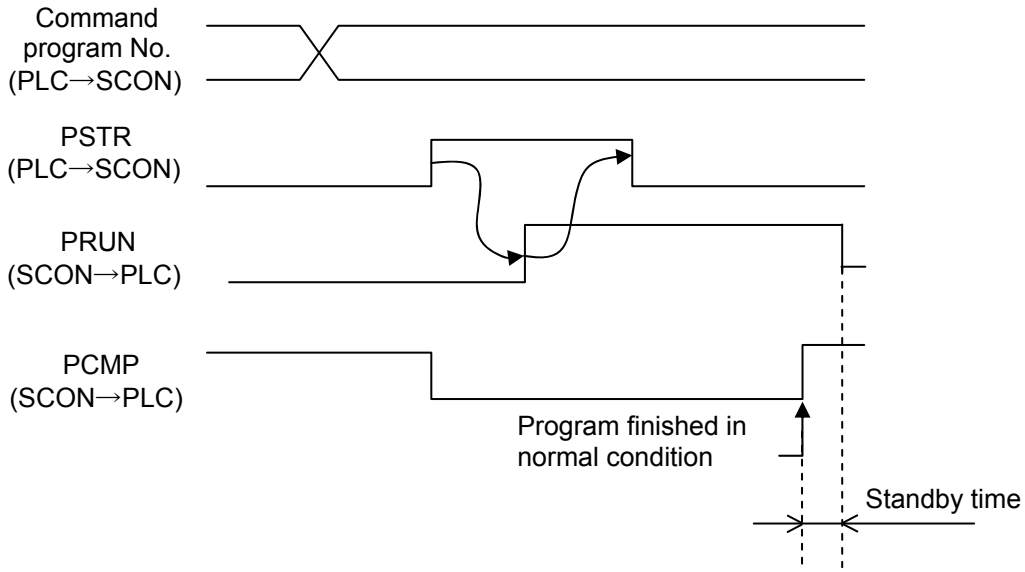
(Note) In MANU mode, the startup of the operation from PLC is not available.

(6) Brake release (BKRL) PLC output signal

Turning this signal "ON" can release the brake forcibly.

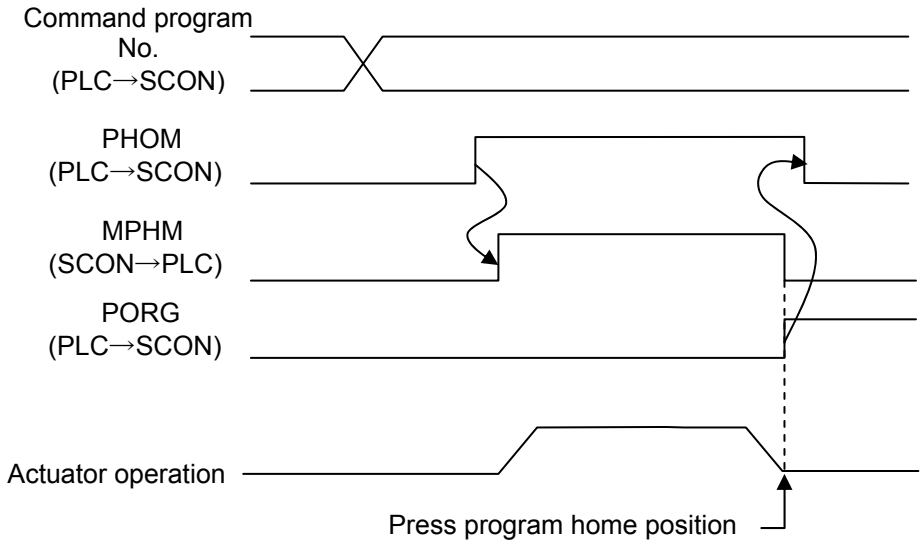
(7) Press program start (PSTR) PLC output signal
Press program executed (PRUN) PLC input signal
Press program finished in normal condition (PCMP) PLC input signal

PSTR signal gets processed at the startup (ON-edge), and executes the press program in the program number input in the PLC command program number register.
PCMP signal turns ON when a program is finished in normal condition with no alarm being generated, and it is transited to the standby stage. PCMP Signal will be retained until the start of the next program, movement command or servo gets turned OFF. Also, PCMP signal will not turn on when the press program.home-return is finished. Turn PSTR signal off after confirming the program executing (PRUN) signal has been turned ON.



(8) Press program home return (PHOM) PLC output signal
Press program home movement (MPHM) PLC input signal
Press program home position (PORG) PLC input signal

This command gets processed at the startup (ON-edge) when PHOM signal is ON, and executes to move to the home position in the program number input in the PLC command program number register. MPHM signal turns ON during movement. PORG signal turns ON once completes to move to the home position.
Turn PHOM Signal OFF once PORG Signal turns ON.
For the speed to move to home position, the setting in parameter No. 8 velocity initial value, and for the acceleration/deceleration, the setting in Parameter No. 9 acceleration/deceleration initial value is used.



⚠ Caution: The program alarm occurs if press program home position movement signal get input while the press program is executed.

(9) Axis operation permission (ENMV) PLC output signal

Operation of axis and execution of program are permitted while this signal is turned ON.
Servo will not turn OFF even when this signal turns from ON → OFF.
If the axis movement and program are stopped by turning this signal from ON → OFF, the stopped axis movement and program will not resume even if this signal is turned from OFF → ON.

(10) Program compulsory stop (FPST) PLC output signal

Turn FPST Signal ON, and the executed press program stops.
The operation after stop can be selected from returning to press program home position and parameter No. 179 stopping at the point by establishing the setting in the return operation setting at press program compulsory stop.
For the speed to move to home position, the setting in parameter No. 8 velocity initial value, and for the acceleration/deceleration, the setting in parameter No. 9 acceleration/deceleration initial value is used.
This signal is invalid if input while moving to the press program home position.

(11) Probing stop (SSTP) PLC output signal

When SSTP signal is ON at the time when probing stage completes, stops at probing stage complete position, and press program stop. Servo ON is continued.
After program is turn off, even if SSTP signal return OFF will not resume press program.

(12) Jog/inching switching (JISL) PLC output signal

This signal changes over the jog operation and the inching operation.
JISL=OFF : Jog operation
JISL=ON : Inching operation
When the JISL signal is turned "ON" (for inching operation) during the jog operation, the actuator is decelerated and performs the inching operation.
When the JISL signal is turned OFF (jog) while the actuator is moving by inching, the actuator will complete the movement and then switch to the jog function.
The table below summarizes the relationship of the ON/OFF statuses of the JISL signal and jog speed/inch-distance switching (JVEL) signal.

		Jog operation	Inching operation
JISL		OFF	ON
JVEL =OFF	Speed	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed"
	Travel	-	Parameter No. 48, "Inching distance"
	Acceleration/ Deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
JVEL =ON	Speed	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2"
	Travel	-	Parameter No. 49 "Inching distance 2"
	Acceleration/ Deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
Operation		When the JOG +/JOG – signal is ON.	Upon detection of the leading (ON) edge of the JOG +/JOG – signal.

(13) Jog-speed/inching-distance switching (JVEL) PLC output signal

This change-over signal is used for the parameters specifying the jog speed when the jog operation is selected or the inching distance when the inching operation is selected.
The relationship is as follows.

JVEL signal	Jog operation: JISL=OFF	Inching operation: JISL=ON
OFF	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed" Parameter No. 48, "Inching distance"
ON	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2" Parameter No. 49, "Inching distance 2"

(14) +Jog (JOG+) PLC output signal
-Jog (JOG-) PLC output signal

This signal is the command for the jog operation startup or inching operation startup.
If a + command is issued, the actuator will operate in the direction opposite home. When a – command is issued, the actuator will operate in the direction of home.

[1] Jog operation
Jog operation can be performed when the jog/inching switching (JISL) signal is OFF.
While the "JOG+" is turned "ON", the movement direction is to the opposite of the home and when it is turned "OFF", the actuator is decelerated and stopped.
While the JOG – is ON, the actuator will operate in the direction of home and when it is turned OFF, it is decelerated to a stop.
The operation is performed based on the set values of the following parameters.

- The speed is based on the parameter value specified using the Jog speed/Inching distance change-over (JVEL) signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No. 26, "PIO jog speed".
  If the JVEL signal is ON, the actuator operates according to parameter No. 47, "PIO jog speed 2".
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals are turned "ON", the actuator is decelerated and stopped.

[2] Inching operation
The inching operation is available while the IISI signal is turned "ON".
Once it is turned "ON", the actuator is moved as much as the inching distance.
When the JOG+ is turned "ON", the movement is to the opposite of the home and when the JOG- is turned "ON", the movement is to the home.
The operation is performed based on the set values of the following parameters.

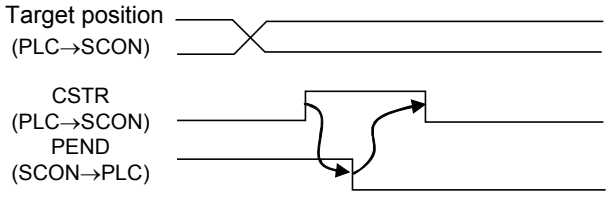
- The speed conforms to the value of the parameter specified by the JVEL signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No. 26, "PIO jog speed".
  If the JVEL signal is ON, the actuator operates according to parameter No. 47, "PIO jog speed 2".
- The travel conforms to the value of the parameter specified by the JVEL signal.
  If the JVEL signal is OFF, the actuator operates according to parameter No. 48, "PIO inch distance".
  If the JVEL signal is ON, the actuator operates according to parameter No. 49, "PIO inch distance 2".
- The Acceleration/Deceleration is based on the rated acceleration/deceleration (depending on the actuator).

During the normal operation, even when the "+" Jog signal or "-" Jog signal is turned "ON", the normal operation is continued. (The Jog signal is ignored)
In the pause condition, even when the "+" Jog signal or "-" Jog signal is turned "ON", the actuator is not moved.

(Note) Because the software stroke limit is disabled before the home return operation, the actuator might run against the mechanism end. Take the greatest care.

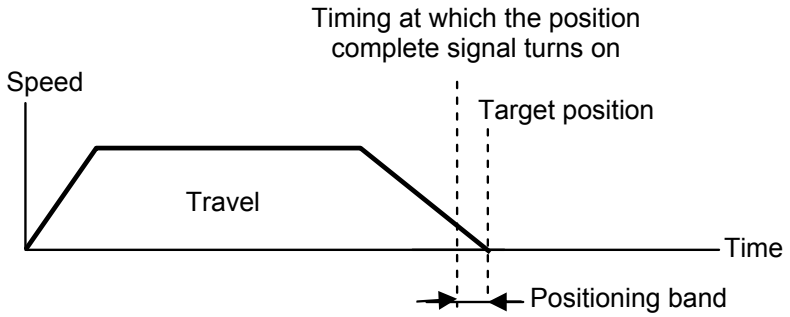
(15) Positioning command (DSTR) PLC output signal

This signal is processed at the startup (ON-edge) and the positioning to the target position input in the PLC's target position register is performed. When this signal is issued in the condition where the home return operation has not performed at all after the power injection (HEND signal OFF), an alarm is issued (Operation Cancellation Level).
Turn "OFF" this signal after confirming that the Positioning Completion Signal (PEND) signal has been turned "OFF".



(16) Positioning completion signal (PEND) PLC input signal

This signal is turned “ON” when the actuator is moved to the target position and reaches the positioning band and the pressing is completed.



When the servo-motor is turned ON from OFF condition, the positioning is performed with the position set as the target position. Accordingly, this signal is turned “ON” and after that, when the positioning operation is started with the home return (HOME) signal, positioning start (CSTR) signal and positioning command (DSTR) signal, this signal is turned “OFF”.

⚠ Caution: When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the PEND signal is turned “OFF” temporarily.
Then, when the servo-motor is turned “ON” and the actuator is within the positioning band, the PEND signal is turned “ON” again.
When the positioning is completed with the CSTR signal or DSTR signal turned “ON”, the PEND signal is not turned “ON”.

(17) Zone 1 (ZONE1) PLC input signal

Zone 2 (ZONE2) PLC input signal

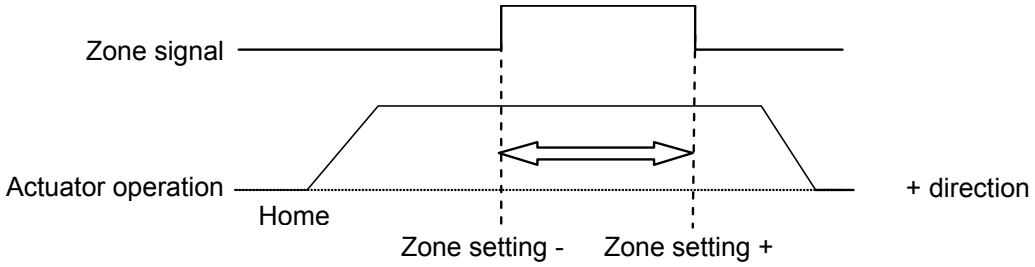
These signals are turned ON when the current position of the actuator is within the set area and turned OFF when the current position is out of the set area.

The zone is set using the user parameters.

The Zone 1 signal is set using the parameter No. 1 “Zone Boundary 1 “+” side” and No. 2 “Zone Boundary 1 “-“ side”.

The Zone 2 signal is set using the parameter No. 23 “Zone Boundary 2 “+” side” and No. 24 “Zone Boundary 2 “–“ side”.

The Zone 1 signal and Zone 2 signal become effective when the home return operation is completed. After that, even during the servo OFF, it is effective.



(18) Program alarm (PALM) PLC input signal

This turns ON when a press program alarm is detected.
The alarm turns OFF when the reset (RES) signal gets turned ON if it is an operation cancelation level alarm. (without removing the cause of alarm, the alarm will be generated again when press program is executed.)

(19) Light failure status (ALML) PLC input signal

It turns to 1 when a message level (light alarm available to continue) alarm is generated.
This signal is not linked to ALM_LED on the controller front panel.
[Detail of the alarm refer to SCON controller instruction manual for servo press]

(20) Alarm (ALM) PLC input signal

When any error is detected using the controller protection circuit (function), it is turned “ON”.
■Function
When any error is detected and the protection circuit (function) is activated, this signal is turned “ON”.
When the cause of the alarm is eliminated and the reset (RES) signal is turned “ON”, the alarm is turned “OFF” in the case that it is the alarm with the operation cancellation level. (In the case of the alarm with the cold start level, re-injection of the power is required)
When the alarm is detected, the status indicator LED on the front surface of the controller illuminates in red.

(21) Emergency stop (EMGS) PLC input signal

When the controller is stopped in an emergency, it is turned “ON”.
■Function
When the controller is stopped in an emergency (motor driving power is cut OFF), it is turned “ON”. When the emergency stop status is cleared, it is turned “OFF”.

(22) While in approaching operation (APRC) PLC input signal

It turns ON during the approaching stage in press program.

(23) While in probing operation (SERC) PLC input signal

It turns ON during the probing stage in press program.

(24) While in pressurizing operation (PRSS) PLC input signal

It turns ON during the pressurizing stage in press program.

(25) While in pressurizing stop (PSTP) PLC input signal

It turns ON at the stop after pressurizing in the pressurizing stage in press program.

(26) While in decompressing operation (DCMP) PLC input signal

It turns ON during the decompressing stage in press program.

(27) While in returning operation (RTRN) PLC input signal

It turns ON during the returning stage in press program.

(28) Press program standby (WAIT) PLC input signal

It turns ON during standby after press program finished in normal condition.

(29) Position (distance) judgment OK (PJOK) PLC input signal

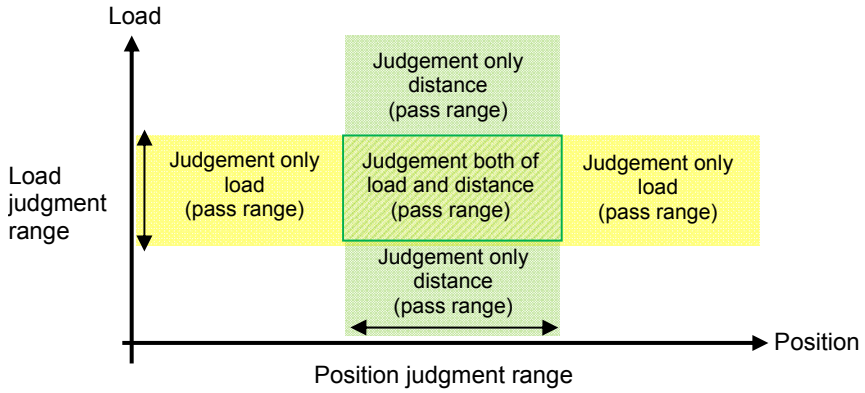
Position (distance) judgment NG (PJNG) PLC input signal

Load judgment OK (LJOK) PLC input signal

Load judgment NG (LJNG) PLC input signal

PJOK signal turns ON when the position (distance) range set as the judgment of press program is kept when the pressurizing operation is finished, and PJNG signal turns ON when it is not kept.

LJNG signal turns ON when the position (distance) range set as the judgment of press program is kept when the pressurizing operation is finished, and LJNG signal turns ON when it is not kept.



(30) Overall Judgment OK (JDOK) PLC input signal

Overall Judgment NG (JDNG) PLC input signal

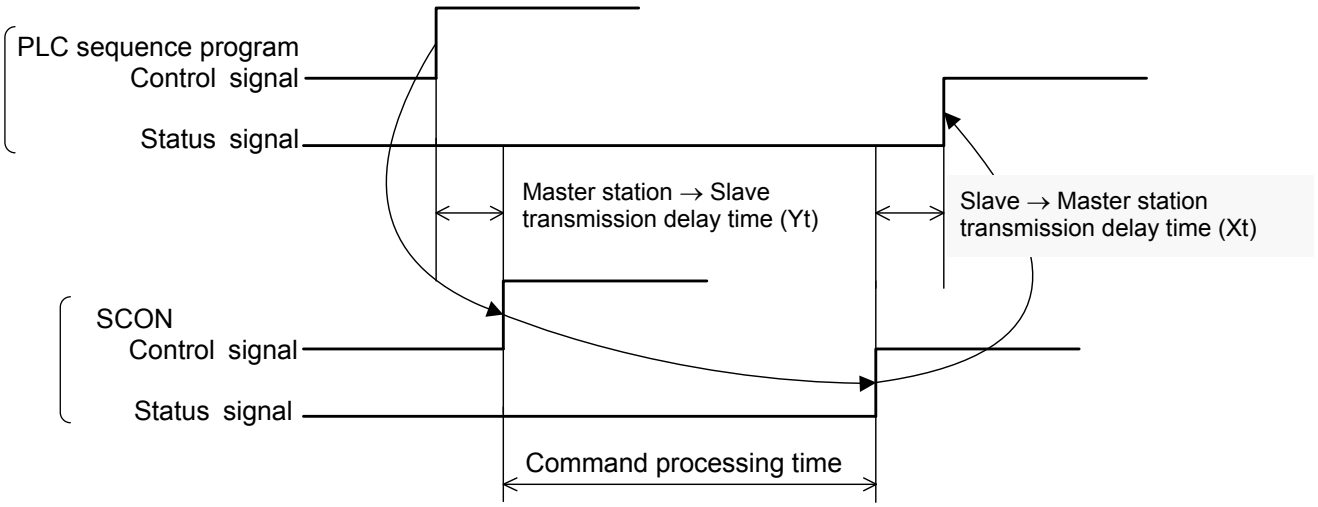
Overall judgment is made from the position (distance) judgment and the load judgment, and JDOK signal turns ON when it passes and JDNG signal is turned ON when it fails.

6.5 I/O Signal Timings

When any of the control signal is turned ON to perform the operation of the actuator using the PLC's sequence program, the response (status) is returned to the PLC. The maximum response time is expressed using the following formula.

Maximum response time (msec)=Yt+Xt+3+command processing time (operation time, etc.)
Yt: Master Station → slave transmission delay time
Xt: Slave → Master Station Transmission Delay Time
} Filed Network Transmission Delay Time

Master Station → For the master station → slave transmission delay (Yt) and slave → master station transmission delay (Xt), refer to the instruction manuals for the PROFIBUS-DP master unit and PLC installed in the master unit.



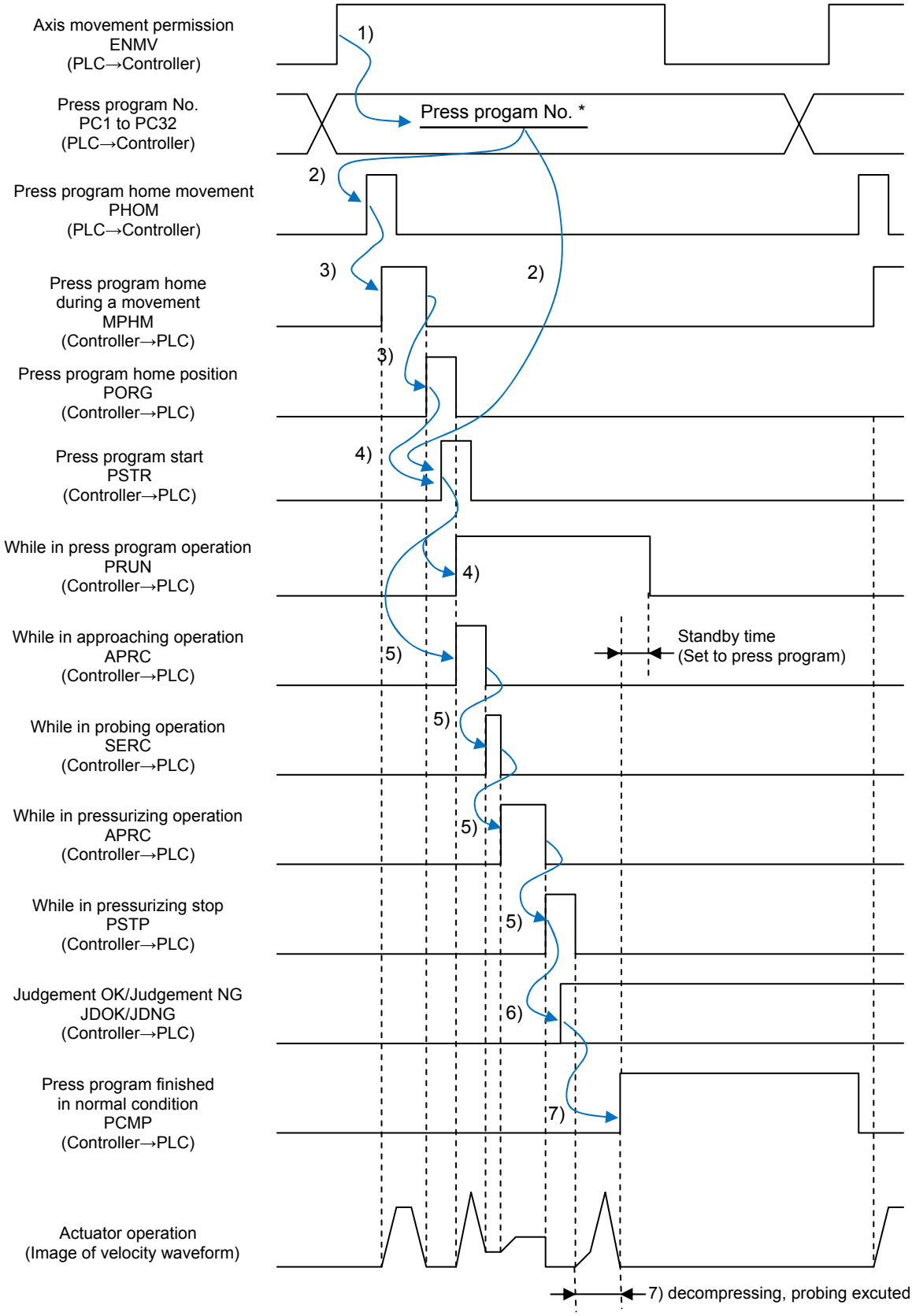
6.6 Operation

The timings for the basic operation examples.

(1) Operation in the remote I/O mode

Here, it shows examples for when executing one press program to turn the servo ON, return to home position and having loadcell calibration.

- Example of operation
  1) Turn ON (operation enable) axis movement permission signal (ENMV).
  2) Indicate the press program number (PC1 to PC32).
  3) Turn the press program home position movement signal (PHOM) ON. During the movement to home position, the press program home position movement signal is kept ON. The press program home position signal (PORG) turns ON once the home position movement completes.
  4) Turn the press program start signal (PSTR) on to execute the press program.
     The press program execution signal (PRUN) turns ON while the press program is executed *.
     * Duration from program start till standby time pass after return stage
  5) Each stage execution signal is kept on while each stage in the press program is executed.
     - While in approaching stage executed = While in approaching operation signal (APRC)
     - While in probing stage executed = While in probing operation signal (SERC)
     - While in pressurizing stage (pressurize) executed = While in pressurizing operation (APRC)
     - While in pressurizing stage (stop) executed = While in pressurizing stop (PSTP)
  6) Judgment made for pressurizing stop (PSTP ON).
     The result is output in judgment OK signal (JDOK) and judgment NG signal (JDNG).
  7) Once each of decompressing and return stage is finished, the press program normal complete signal (PCMP) turns ON.



Note 1 Considering scan time of PLC, have the time of 0 ms or more from input of the press program number to PSTR to turn ON.

(2) Operation in the full function mode

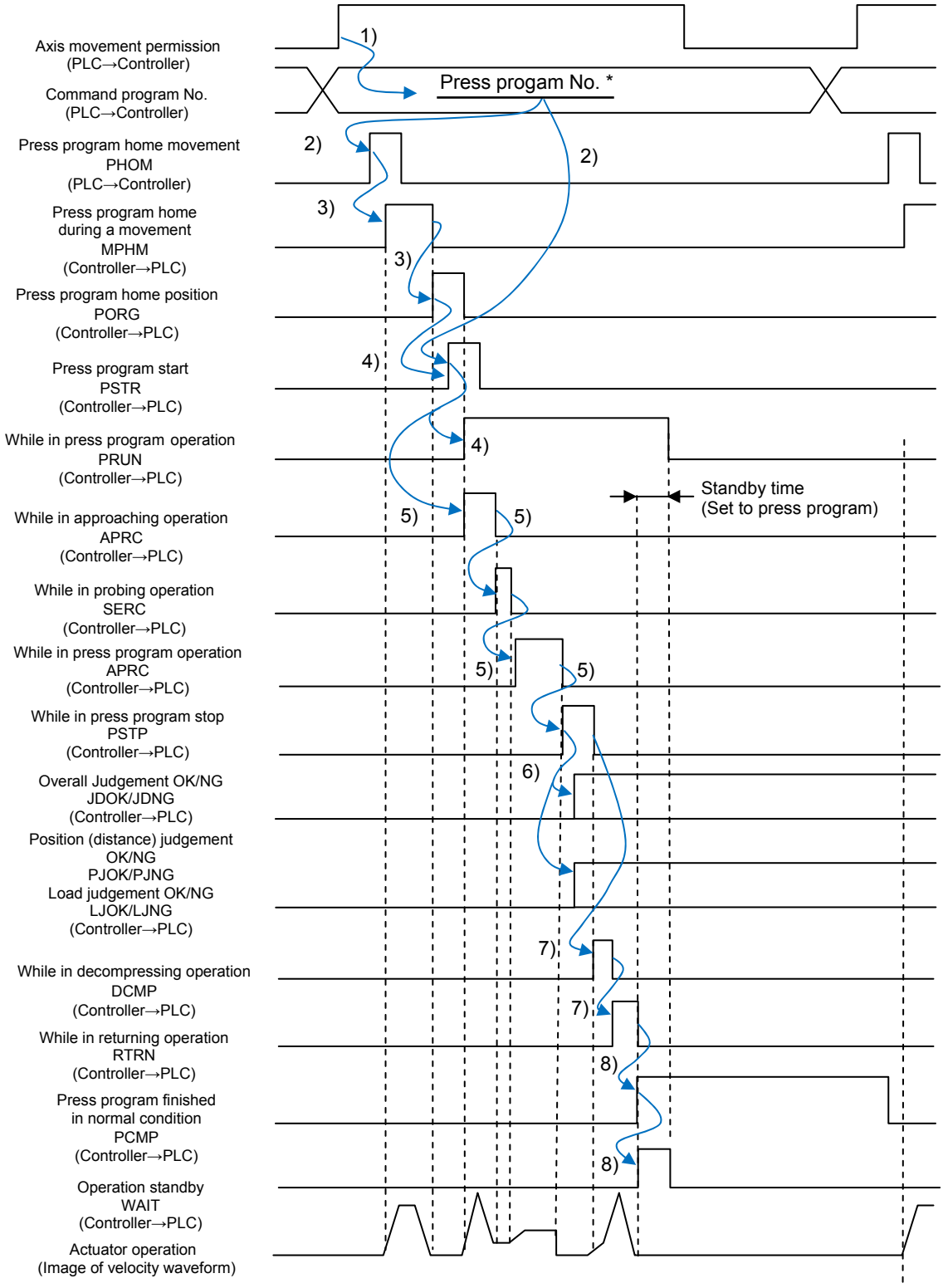
Here, it shows examples for [1] when executing one press program and [2] when performing direct indication movement to the target position after completing to turn the servo ON, return to home position and having loadcell calibration.

[1] Example for when executing one press program

1) Turn ON (operation enable) axis movement permission signal (ENMV).
2) Set the press program number to execute to the command program number register.
3) Turn the press program home position movement signal (PHOM) ON. During the movement to home position, the press program home position movement signal is kept ON. The press program home position signal (PORG) turns ON once the home position movement completes.
4) Turn the press program start signal (PSTR) on to execute the press program.
The press program execution signal (PRUN) turns ON while the press program is executed *.
* Duration from program start till standby time pass after return stage
5) Each stage execution signal is kept on while each stage in the press program is executed.
- While in approaching stage executed = While in approaching operation signal (APRC)
- While in probing stage executed = While in probing operation signal (SERC)
- While in pressurizing stage (pressurize) executed = While in pressurizing operation (APRC)
- While in pressurizing stage (stop) executed = While in pressurizing stop (PSTP)

6) Judgment made for pressurizing stop (PSTP ON).
The position (distance) result is output in judgement OK signal (PJOK), judgment NG signal (PJNG).
The load result is output in judgment OK signal (LJOK), judgment NG signal (LJNG).
The overall judgement result is output in judgment OK signal (JDOK), judgment NG signal (JDNG).
7) Executing signal for each stage turns on during operation of each stage in press program.
- While decompressing stage executed = While decompressing operation signal (DCMP)
- While returning stage executed = While returning operation signal (RTRN)

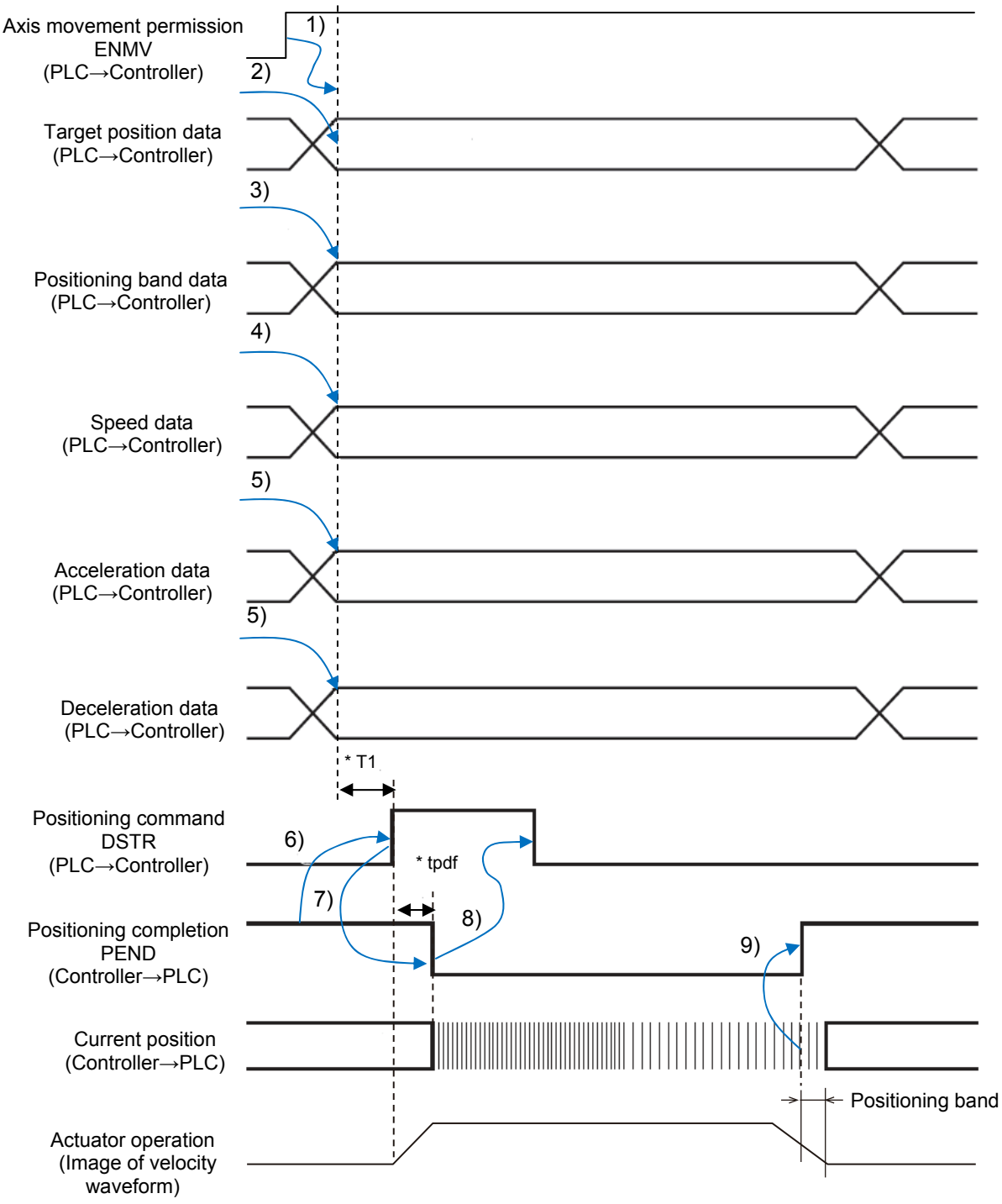
8) Once each of decompressing and return stage is finished, the press program normal complete signal (PCMP) turns ON, stops operation for the duration of standby time set in the press program, and turns ON the press program standby signal (WAIT). Wait for the standby time before making a command when the next press program is to be executed.



Note 1 Considering scan time of PLC, have the time of 0 ms or more from input of the press program number to PSTR to turn ON.

[2] Example for when performing direct indication movement to the target position

1) Turn ON (operation enable) axis movement permission signal (ENMV).
2) Set the target position data in the target position register.
3) Set the positioning band data in the positioning band register.
4) Set the speed data to the speed resister.
5) Set the acceleration/deceleration data in the acceleration/deceleration register,.
6) In the condition where the positioning completion (PEND) signal is turned “ON”, turn “ON” the positioning command (DSTR) signal.
   The data items set in Steps 2) through 5) are read in the controller at the startup (ON-edge) of the DSTR signal.
7) After the DSTR signal is turned “ON”, the PEND signal is turned “OFF” after tpdf.
8) After confirming that the PEND signal is turned “OFF”, turn “OFF” the DSTR signal. Do not change any value in each register until the DSTR signal has been turned “OFF”.
9) When the DSTR signal is turned “OFF” and the motor current reaches the current-limiting value set in Step 3), the PEND signal is turned “ON” .



* T1 Establish setting to have T1 ≥ 0ms.
* Yt+Xt ≤ tdpf ≤ Yt+Xt+3 (msec)
Refer to 6.5 I/O Signal Timings

6.7 PROFIBUS-DP Related Parameters

Parameters relating to PROFIBUS-DP are No. 84 to No. 87, No. 90 and No. 159.

Category: C: External interface parameter

No.	Category	Symbol	Name	Factory default
1			For parameter Nos. 1 to 83, refer to the operation manual for the controller.	
~				
83				
84	C	FMOD	Fieldbus operation mode	0
85	C	NADR	Fieldbus node address	1
86	C	FBRS	Fieldbus baud rate	0
87	C	NYTP	Network type	3
90	C	FMIO	Fieldbus I/O format	0
159	C	FBVS	FB Half Direct Mode Speed Unit	0

- Field bus operation mode (No. 84 FMOD)
  Specify the operation mode in parameter No. 84 using a value between 0 and 8.

Value set in parameter No. 84	Mode	Number of occupied bytes	Contents
0 (Factory setting)	Remote I/O mode	2	Operation using PIOs (24 V I/Os) is performed via PROFIBUS-DP.
1	Full function mode	32	It is the system to support all the features such as movement by direct indication or current load reading in addition to those for servo press such as startup of press program or judgment result reading.

- Fieldbus node address (No. 85 NADR)
  Specify the slave number of the remote station in parameter No. 85.

  Setting range: 0 to 125 (The factory setting is 1.)

- Fieldbus baud rate (No. 86 FBRS)
  The baud rate is automatically set according to the corresponding setting on the master side and thus need not be set.

- Network type (No. 87 NTYP)
  Specify the network module in parameter No. 87. Do not change the default value.

● Fieldbus I/O format (No. 90 FMIO)
PLC addresses are assigned in units of 16 points (units of words) based on the I/O addresses set to the controller and number of occupied addresses in each mode.
By changing the setting of parameter No. 90, data of up to 2 words can be swapped in units of bytes before transmission within the range of communication with the PLC's I/O addresses.

Set value of parameter No. 90	Description
0 (factory setting)	Data is not swapped and sent as is to the PLC. (Refer to Example i.)
1	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. (Refer to Example ii.)
2	In the case of a word register, the upper word and lower word are swapped. (Refer to Example iii.)
3	The upper byte and lower byte of the upper word are swapped, while the upper byte and lower byte of the lower word are also swapped. In the case of a word register, the upper word and lower word are also swapped. (Refer to Example iv.)

(Example i) Set value = "0"

● indicates ON, while O indicates OFF.

SCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

⇧

PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

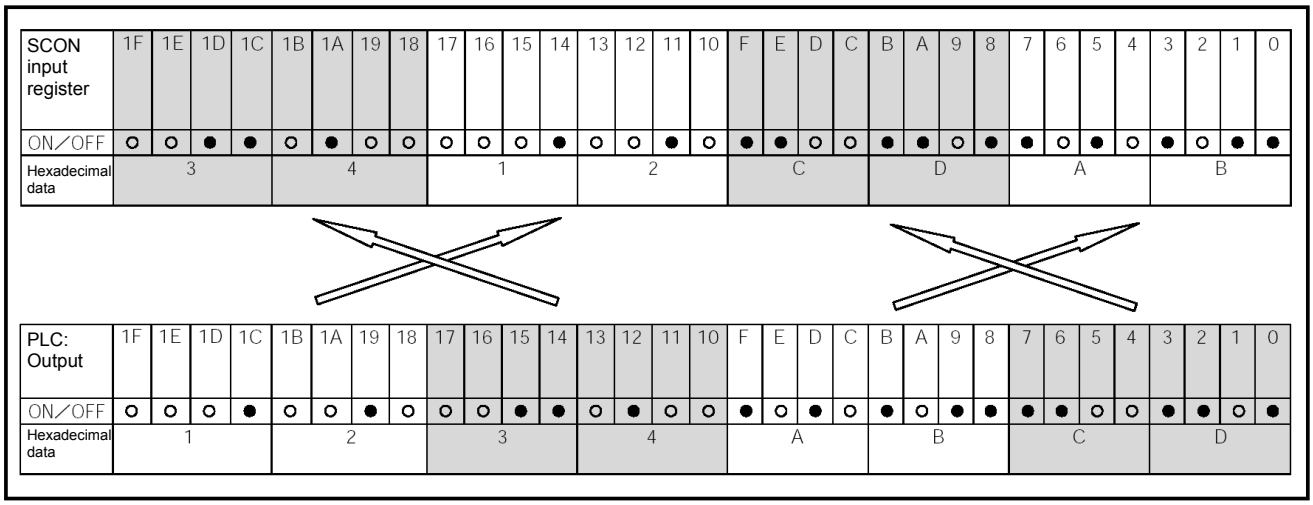
SCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

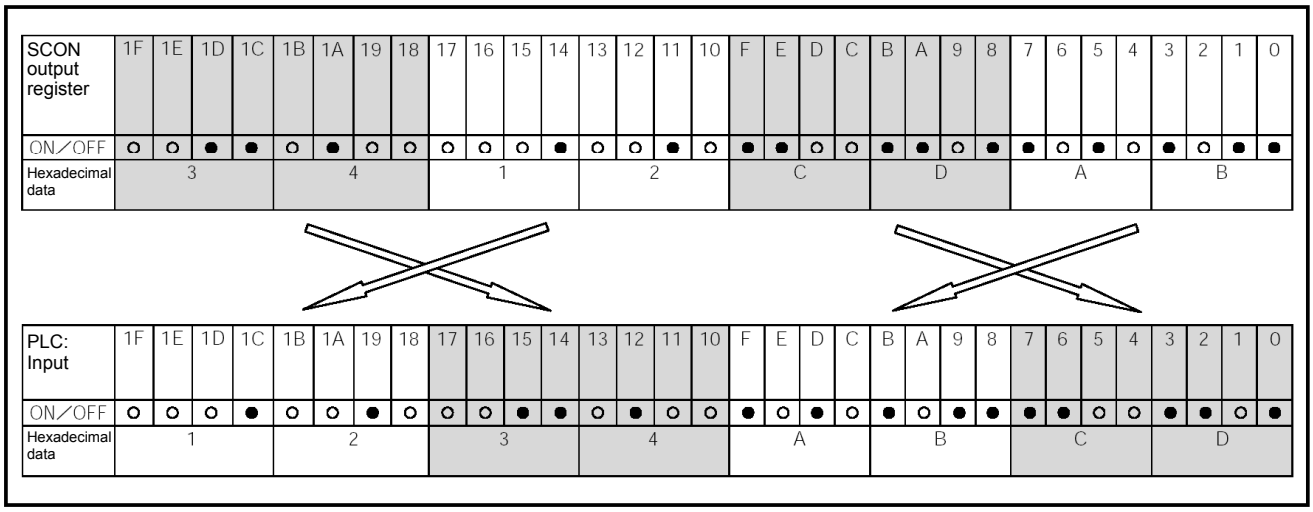
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PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example ii) Set value = “1”

● indicates ON, while O indicates OFF.





(Example iii) Set value = “2”

● indicates ON, while O indicates OFF.

SCON input register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

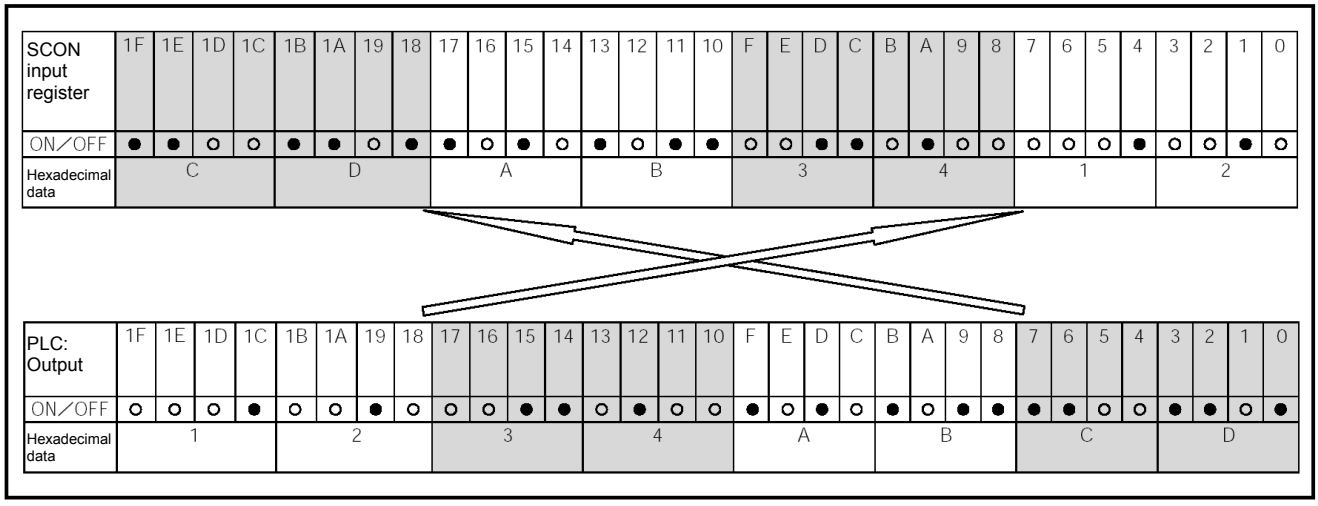
PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

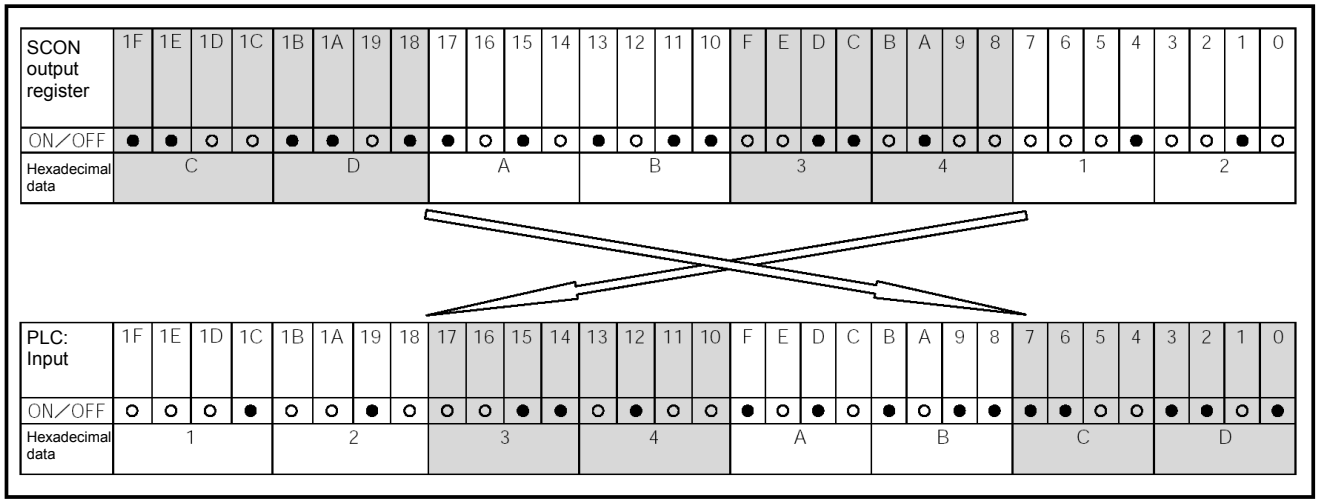
SCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O
Hexadecimal data	A				B				C				D				1				2				3				4			

PLC: Input	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	O	O	O	●	O	O	●	O	O	O	●	●	O	●	O	O	●	O	●	O	●	O	●	●	●	●	O	O	●	●	O	●
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example iv) Set value = “3”

● indicates ON, while O indicates OFF.





- FB Half Direct Mode Speed Unit (No.159 FBVS)
  Determines the unit of measure when operating the unit in Half Direct Mode.

Parameter No.159 setting value	Speed setting unit
0 (Set in delivery)	1.0 mm/sec
1	0.1 mm/sec

6.8 Troubleshooting

- Alarm messages and causes/actions

  The alarm signal (ALM) or light malfunction alarm (ALML) is output in active low in the remote I/O mode when an alarm is generated.

  In the full functional mode, an alarm code gets output to the press program alarm code register and alarm code register.

  [1] Check the alarm code using the monitor function of the PLC, etc., or connect the RC PC software or other teaching tool and check the status monitor screen.

  [2] Search the alarm list in the instruction manual for your controller to find the section corresponding to the identified alarm code.

  [3] Take an appropriate action according to the explanation of the alarm code.
  For the alarm codes listed below, take the corresponding actions:

Code	Error name	ID (*1)	RES (*2)	Cause/action
094	Press program alarm detection	02	○	Cause: It shows an alarm has occurred while the press program is executed. Action: Have a countermeasure by referring to the press program alarm list provided below. [Refer to Program Alarm in Controller Instruction Manual]
0AD	Press program data error	06	○	Cause: Program check at controller startup, program startup command and program home position movement command has detected an error. Action: As the program number is stored in the detail code, check the applicable grogram setting.
0F2	Fieldbus module error	05	×	Cause: A fieldbus module error has been detected. Action: Check the applicable parameters.
0F3	Fieldbus module non-detection error	04	×	Cause: The module could not be detected. Action: Reconnect the power. If the problem persists, please contact IAI.
0FD	Extension device error	05	×	Cause: Error in load data analog output component (Note) An error will not be detected when parameter No. 180 DAC Output is set inactivated. Action: Check the wires for analog output. In case there is no fault wiring, please contact IAI.

(*1) ID → Simple alarm code

(*2) RES → Alarm can/cannot be reset ○: Alarm can be reset / ×: Alarm cannot be reset

7. Change History

Revision Date	Description of Revision
November 2011	First edition Contents changed in Safety Guide Caution notes added for when working with two or more persons ACON and PCON picked up from existing Operation Manual and SCON-CA added to rearrange new Operation Manual
June 2012	Second edition Contents added and changed in Safety Guide PCON-CA/CFA added
November 2012	Third edition Unit of measurement parameter adjustment added for SCON-CA half direct value mode, half direct value mode 2 and half direct value mode 3 Maintenance information added to the SCON-CA full direct mode
August 2013	Fourth edition Positioning unit changed to 0.001° when DD motor is connected
October 2013	Fifth edition ACON-CA, DCON-CA added
August 2014	Sixth edition SCON-CAL added
March 2015	Seventh edition ACON-CB, DCON-CB, PCON-CB, SCON-CB added
August 2015	Eighth edition Servo press type SCON-CB/CGB added
December 2015	Ninth edition PCON-CB series added
February 2016	9C edition SCON for servo press (3000 ~ 3300W) added
January 2017	9D edition Servo Press Type SCON-CB/CGB correction made

Manual No.: ME0258-9D (January 2017)

IAI
Quality and Innovation

IAI Corporation

Head Office: 577-1 Obane Shimizu-KU Shizuoka City Shizuoka 424-0103, Japan
TEL +81-54-364-5105 FAX +81-54-364-2589
website: www.iai-robot.co.jp/

Technical Support available in USA, Europe and China

IAI America, Inc.

Head Office: 2690 W. 237th Street, Torrance, CA 90505
TEL (310) 891-6015 FAX (310) 891-0815
Chicago Office: 110 East State Parkway, Schaumburg, IL 60173
TEL (847) 908-1400 FAX (847) 908-1399
Atlanta Office: 1220 Kennestone Circle, Suite 108, Marietta, GA 30066
TEL (678) 354-9470 FAX (678) 354-9471
website: www.intelligentactuator.com

IAI Industrieroboter GmbH

Ober der Röth 4, D-65824 Schwalbach am Taunus, Germany
TEL 06196-88950 FAX 06196-889524

IAI (Shanghai) Co., Ltd.

SHANGHAI JIAHUA BUSINESS CENTER A8-303, 808, Hongqiao Rd. Shanghai 200030, China
TEL 021-6448-4753 FAX 021-6448-3992
website: www.iai-robot.com

IAI Robot (Thailand) Co., Ltd.

825 PhairojKijja Tower 12th Floor, Bangna-Trad RD., Bangna, Bangna, Bangkok 10260, Thailand
TEL +66-2-361-4458 FAX +66-2-361-4456

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