

PROFIBUS-DP

Operation Manual, First Edition

**ACON
PCON
SCON-CA**

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 CD/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

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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	<ul style="list-style-type: none">• 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.<ol style="list-style-type: none">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 it in any of the following environments.<ol style="list-style-type: none">1) Location where there is any inflammable gas, inflammable object or explosive2) Place with potential exposure to radiation3) Location with the ambient temperature or relative humidity exceeding the specification range4) Location where radiant heat is added from direct sunlight or other large heat source5) Location where condensation occurs due to abrupt temperature changes6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid)7) Location exposed to significant amount of dust, salt or iron powder8) Location subject to direct vibration or impact• Do not use the product outside the specifications. Failure to do so may considerably shorten

No.	Operation Description	Description
2	Transportation	<ul style="list-style-type: none"> • 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. • Consider well so that it is not bumped against anything or dropped during the transportation. • Transport it using an appropriate transportation measure. • 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	<ul style="list-style-type: none"> • The storage and preservation environment conforms to the installation environment. <p>However, especially give consideration to the prevention of condensation.</p>
4	Installation and Start	<p>(1) Installation of Robot Main Body and Controller, etc.</p> <ul style="list-style-type: none"> • 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. • 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. <ol style="list-style-type: none"> 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 <p>(2) Cable Wiring</p> <ul style="list-style-type: none"> • 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.





No.	Operation Description	Description
4	Installation and Start	<p>(3) Grounding</p> <ul style="list-style-type: none"> ● Make sure to perform the grounding of type D (Former Type 3) for the controller. 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. <p>(4) Safety Measures</p> <ul style="list-style-type: none"> ● 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.

No.	Operation Description	Description
5	Teaching	<ul style="list-style-type: none"> • 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. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
6	Trial Operation	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Before the automatic operation is started up, make sure that there is nobody inside the safety protection fence. • Before the automatic operation is started up, make sure that all the related peripheral machines are ready for the automatic operation and there is no error indication. • Make sure to perform the startup operation for the automatic operation, out 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	<ul style="list-style-type: none"> • 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. <p>* Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.</p>
9	Modification and Dismantle	<ul style="list-style-type: none"> • Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	<ul style="list-style-type: none"> • When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. • Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.

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

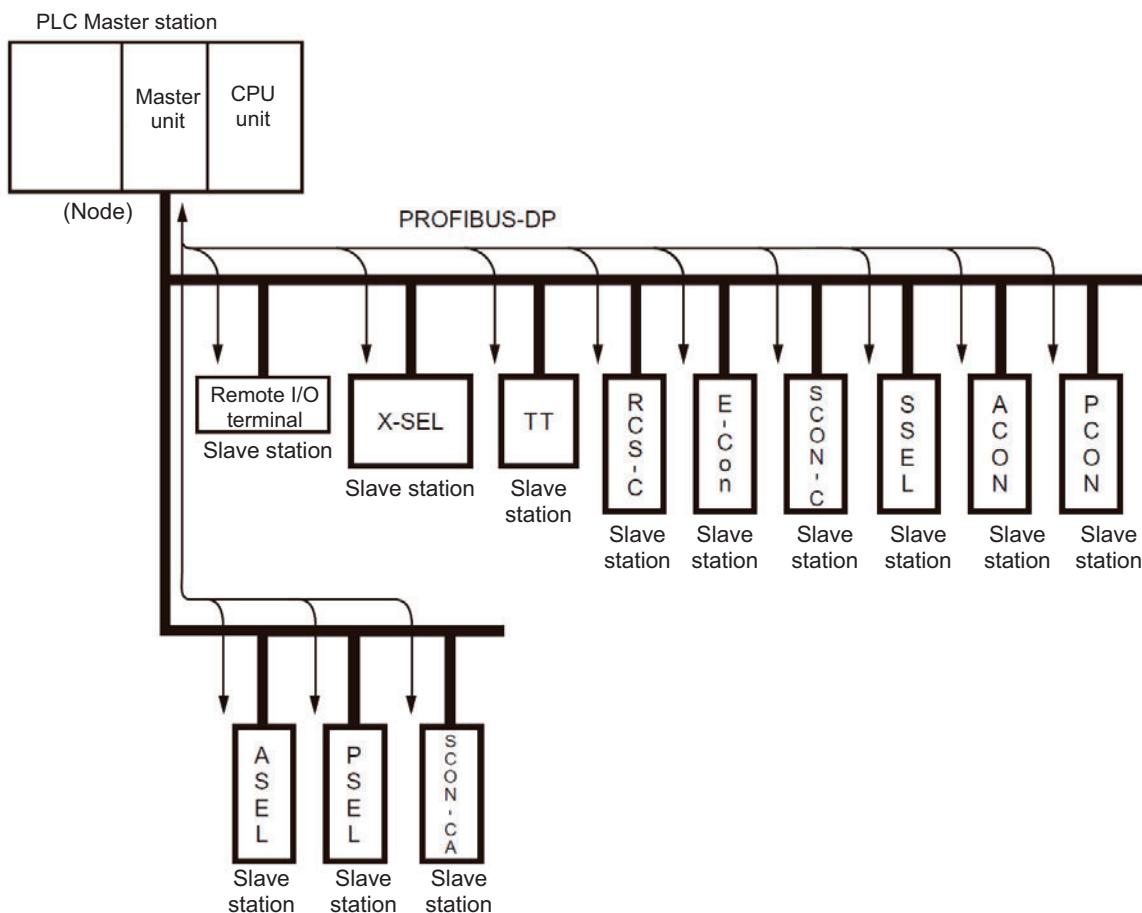
1. Overview

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, ASEL, PSEL, SSEL, ACON, PCON and SCON-CA controllers (hereinafter collectively and individually referred to as "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 and SCON-CA 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, PCON

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.

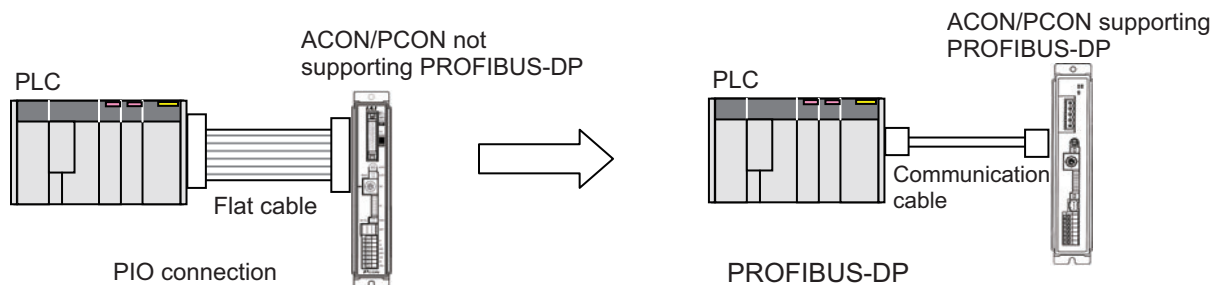
Operation Modes and Key Functions

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.

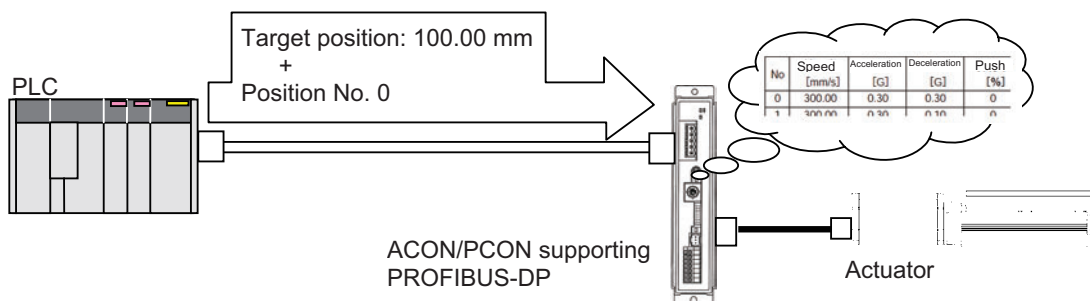
[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication.

Number of occupied bytes: 2 bytes (1 word)

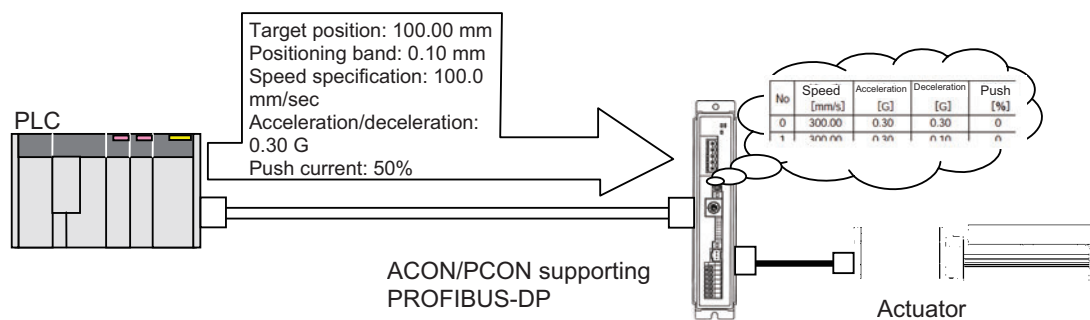


- [2] Position/simple direct mode: In this mode, the actuator is operated by specifying position numbers. You can select whether to specify the target position directly as a value, or use a value registered in the position data table, by switching a control signal. For the speed, acceleration/deceleration,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

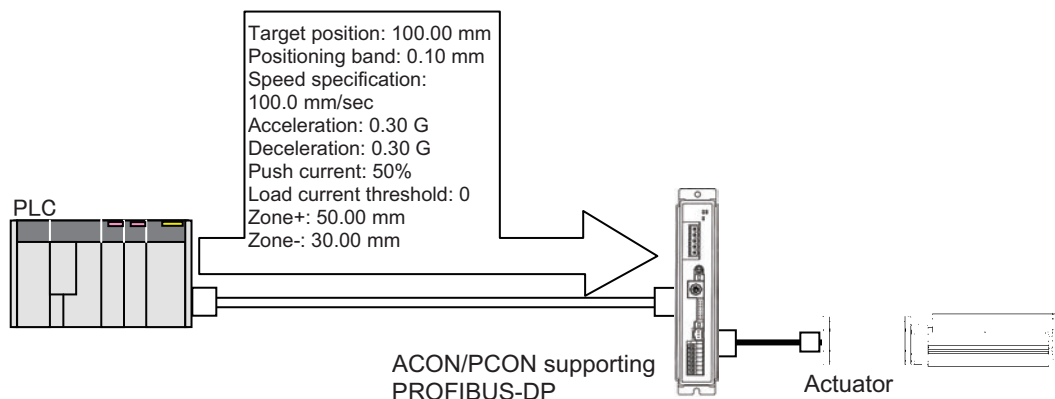
Number of occupied bytes: 8 bytes (4 words)



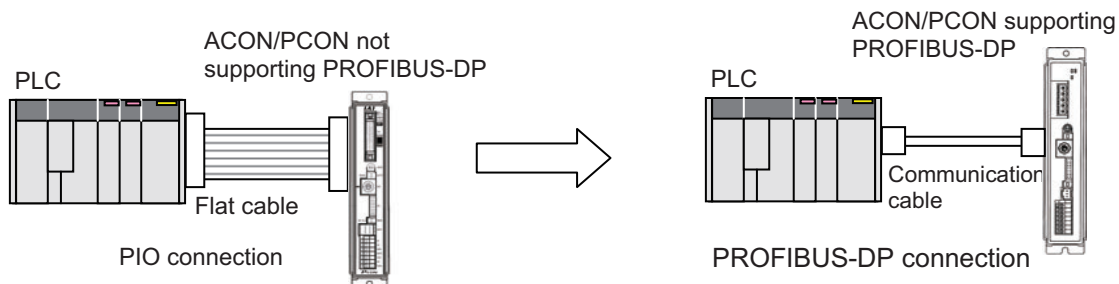
- [3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values. Number of occupied bytes: 16 bytes (8 words)



- [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)



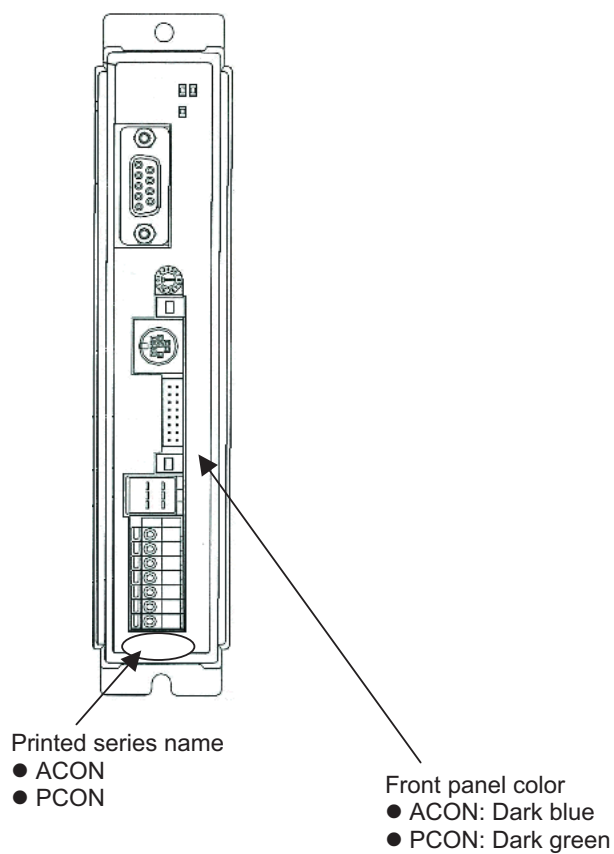
- [5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication.
The current-position and command-current read functions are available in addition to the functions provided in mode [1].
Number of occupied bytes: 12 bytes (6 words)



3.2 Model Names

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

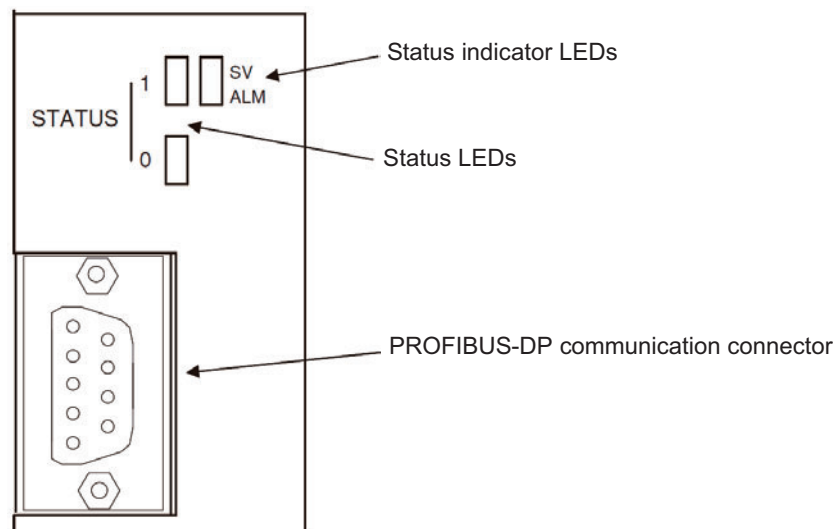
- ACON-C/CG-□-PR-□
- PCON-C/CG-□-PR-□



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)

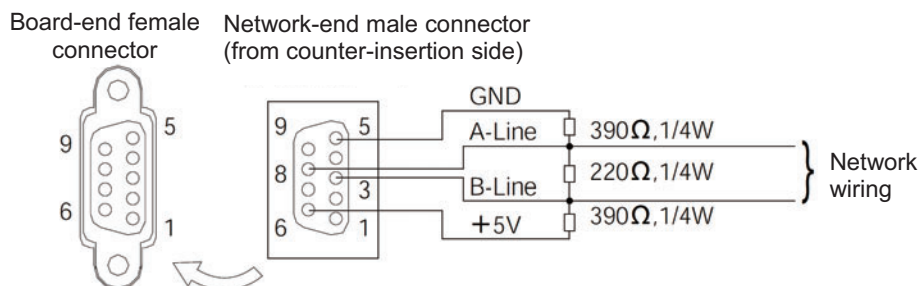
(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).

(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, "FMODE: 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.

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.

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 register					
	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		Specified position number Control signal	Positioning band	Positioning band	Occupied area	
n+2						
n+3						
n+4						
n+5						
n+6						
n+7			Speed Acceleration/deceleration Push-current limiting value Control signal	Speed specification		
n+8						
n+9						
n+10						
n+11						
n+12						
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 register				
	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.

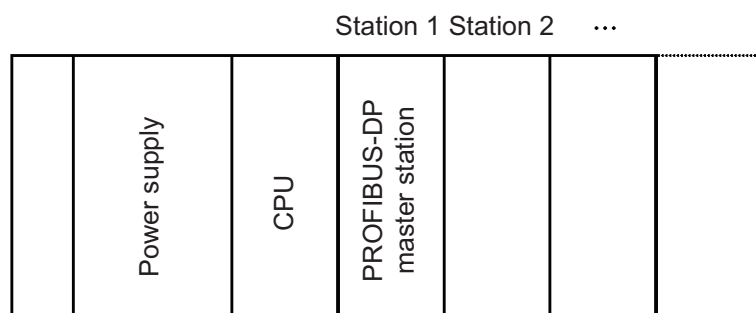


Prefix

%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.

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 (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

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

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 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	
		Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → ACON input	0	Command position number	PC1	Command position number	PC1	Command position number	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Cannot be used.	-	Teaching mode command	MODE	Cannot be used.	PC64
	7		-	Jog/inching switching	JISL		PC128
	8		-	+Jog	JOG+		-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning start	CSTR	Positioning start / Positioning data read command	CSTR/PWRT	Positioning start	CSTR
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
ACON output → PLC input	0	Completed position number	PM1	Completed position number	PM1	Completed position number	PM1
	1		PM2		PM2		PM2
	2		PM4		PM4		PM4
	3		PM8		PM8		PM8
	4		PM16		PM16		PM16
	5		PM32		PM32		PM32
	6	Moving signal	MOVE	Moving signal	MOVE	Cannot be used.	PM64
	7	Zone 1	ZONE1	Teaching mode signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE		PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal/position data read complete	PEND/WEND	Positioning complete signal	PEND
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	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	
		Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → ACON input	0	Command position number	PC1	Start position 0	ST0	Start position 0	ST0
	1		PC2	Start position 1	ST1	Start position 1	ST1
	2		PC4	Start position 2	ST2	Start position 2	ST2
	3		PC8	Start position 3	ST3	Cannot be used.	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Cannot be used.	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Cannot be used.	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning start	CSTR	Cannot be used.	-		-
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
ACON output → PLC input	0	Completed position number	PM1	Completed position 0	PE0	Rear end move command 0	LS0
	1		PM2	Completed position 1	PE1	Rear end move command 1	LS1
	2		PM4	Completed position 2	PE2	Rear end move command 2	LS2
	3		PM8	Completed position 3	PE3	Cannot be used.	-
	4		PM16	Completed position 4	PE4		-
	5		PM32	Completed position 5	PE5		-
	6		PM64	Completed position 6	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal	PEND	Cannot be used.	-
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	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	
		Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → PCON input	0	Command position number	PC1	Command position number	PC1	Command position number	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Cannot be used.	-	Teaching mode command	MODE	Cannot be used.	PC64
	7		-	Jog/inching switching	JISL		PC128
	8		-	+Jog	JOG+		-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning start	CSTR	Positioning start / Positioning data read command	CSTR/ PWRT	Positioning start	CSTR
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
PCON output → PLC input	0	Completed position number	PM1	Completed position number	PM1	Completed position number	PM1
	1		PM2		PM2		PM2
	2		PM4		PM4		PM4
	3		PM8		PM8		PM8
	4		PM16		PM16		PM16
	5		PM32		PM32		PM32
	6	Moving signal	MOVE	Moving signal	MOVE	Cannot be used.	PM64
	7	Zone 1	ZONE1	Teaching mode signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE		PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal/position data read complete	PEND/ WEND	Positioning complete signal	PEND
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Load output judgment/torque level	LOAD/ TRQS	Cannot be used.	-	Load output judgment/torque level	LOAD/ TRQS

* 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.	512-point mode		Solenoid valve mode 1		Solenoid valve mode 2	
		3		4		5	
		Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → PCON input	0	Command position number	PC1	Start position 0	ST0	Start position 0	ST0
	1		PC2	Start position 1	ST1	Start position 1	ST1
	2		PC4	Start position 2	ST2	Start position 2	ST2
	3		PC8	Start position 3	ST3	Cannot be used.	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Cannot be used.	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Cannot be used.	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning start	CSTR	Cannot be used.	-		-
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
PCON output → PLC input	0	Completed position number	PM1	Completed position 0	PE0	Rear end move command 0	LS0
	1		PM2	Completed position 1	PE1	Rear end move command 1	LS1
	2		PM4	Completed position 2	PE2	Rear end move command 2	LS2
	3		PM8	Completed position 3	PE3	Cannot be used.	-
	4		PM16	Completed position 4	PE4		-
	5		PM32	Completed position 5	PE5		-
	6		PM64	Completed position 6	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete	PEND	Positioning complete	PEND	Cannot be used.	-
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Load output judgment/torque level	LOAD/ TRQS	Load output judgment/torque level	LOAD/ TRQS	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 △: 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	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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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	ZONE1	ZONE2	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	O: 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.)

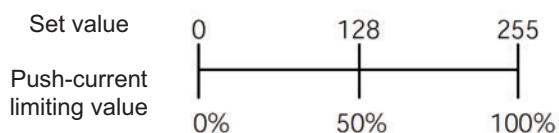
Parameter No. 84	ACON/PCON input register	PLC output address	ACON/PCON output register	PLC input address
2	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting 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 specified 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

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
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	—	—	—	—	—	—	—	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	—	—	—	—	—	—	—	—	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	—	—	—	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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

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

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

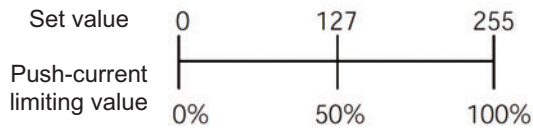
Parameter No. 84	ACON/PCON input register		PLC output address	ACON/PCON output register	PLC input address
3	Target position		n+0	Current position	n+0
			n+1		n+1
	Positioning band		n+2	Command current	n+2
			n+3		n+3
	Speed		n+4	Current speed	n+4
			n+5		n+5
	Zone boundary+		n+6	Alarm code	n+6
			n+7		n+7
	Zone boundary-		n+8	Occupied area	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	Status signal		n+14
Control signal 2		n+15		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

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
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															
PLC output address		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)		(※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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+6	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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. (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 \pm 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 \pm 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.”)

Address		Bit	Symbol	Function	Details			
PLC output	Acceleration	16-bit data	-	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.	3.6 (3)			
	Deceleration	16-bit data	-					
	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 (3)			
	Load current threshold	16-bit data	-	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.”	3.6 (3)			
	Control signal 1	b15	-	Cannot be used.	-			
		b14						
		b13						
		b12						
		b11						
		b10	ACON	-	Cannot be used.	-		
			PCON	SMO D	Standstill control mode: When the signal is ON, servo control is performed at in a standstill state.	3.4.7 (28)		
		b9	-	Cannot be used.	-			
		b8						
		b7	ACON	MOD 1	Acceleration/deceleration mode:		3.4.7 (29)	
		b6			MOD1	MOD0		Function
					OFF	OFF		Trapezoid pattern
					OFF	ON		S-motion
		ON	OFF	primary delay filter				
b7	PCON	-	Cannot be used.	-				
b6								
b5	-	Cannot be used.	-					
b4								
b3	INC	Incremental specification: Absolute position command when the signal is OFF, or incremental position command when the signal is ON.	3.4.7 (24)					

(* 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

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 (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.

n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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)	1	1	1	1	1	1	1	1	1	1	1	1	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: 000003FFH = 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: 000003FFH = 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 7.3) 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 7.3) on the front side of the controller illuminates in green.

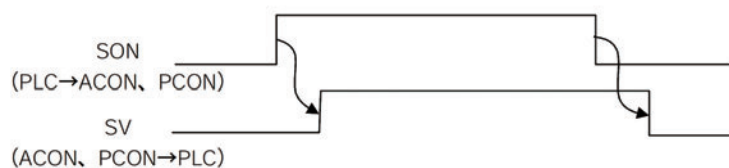
The SV signal is synchronized with this LED.

■ 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.



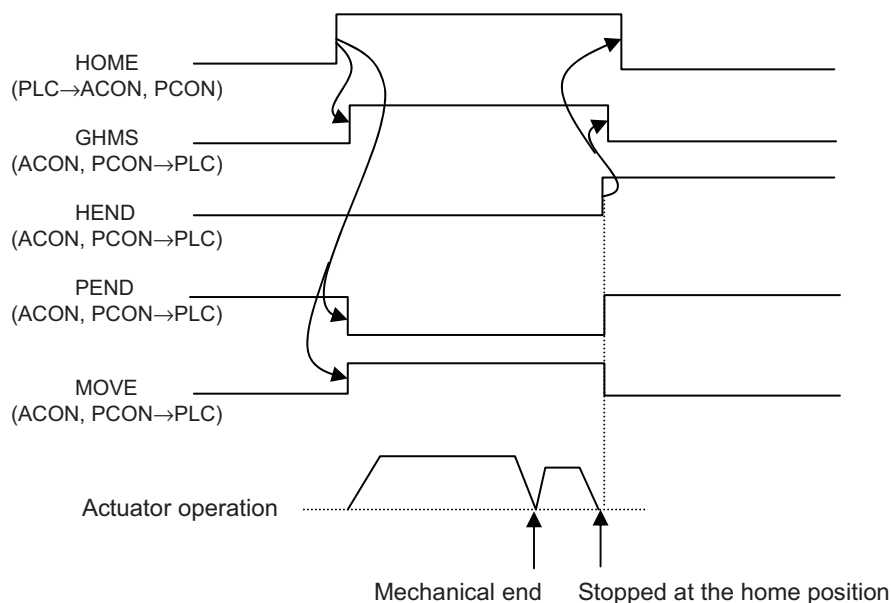
- (6) Home return (HOME) PLC output signal
 Home return complete (HEND) PLC input signal
 Home return in progress (GHMS) PLC input signal

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

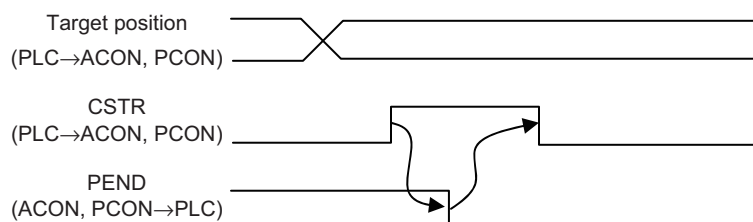
This command is processed at the leading (ON) edge of the signal, upon which the actuator moves to the position set by the target position corresponding to the specified position or the PLC's target position.

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.

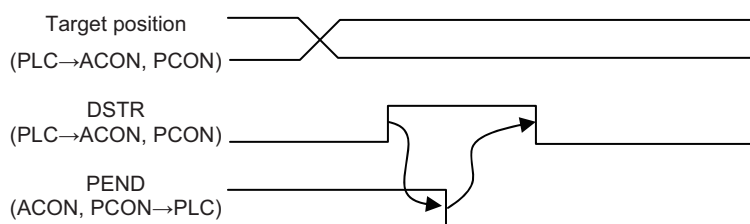
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



(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.



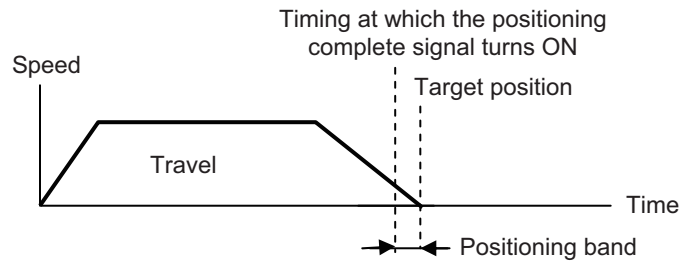
(9) Moving signal (MOVE) PLC input signal

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

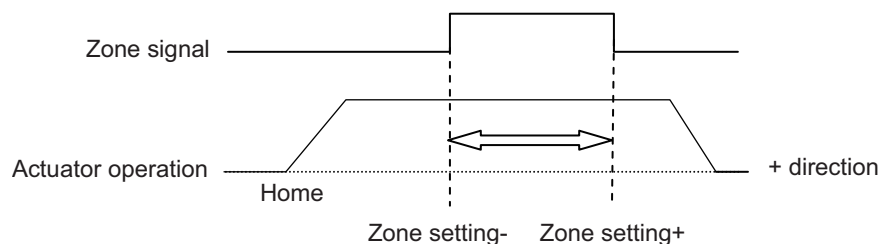
A desired zone is set using the position table or PLC.

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 7.4.1). (*2)

When the writing is completed, the WEND signal turns ON.

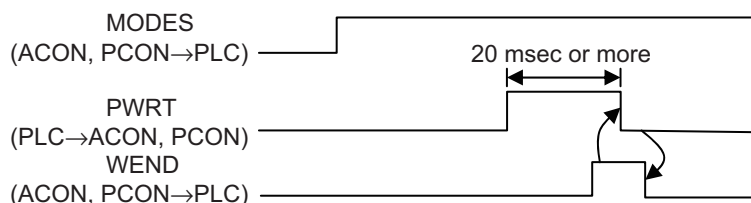
The host PLC should turn the PWRT signal OFF after the WEND signal has turned ON.

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

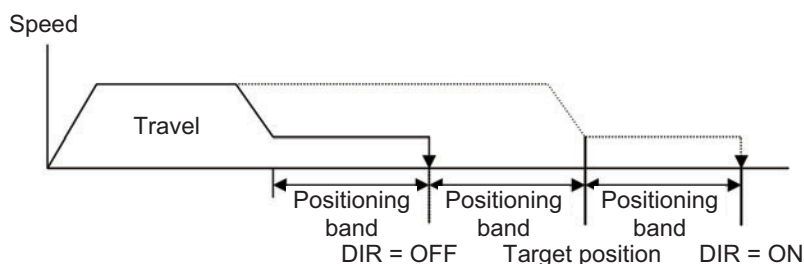
This signal specifies the direction in which the actuator will push the load.

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

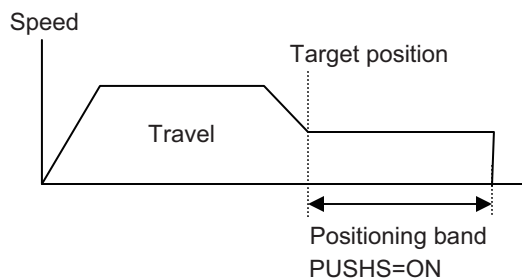
When a move command is issued while this signal is ON, the actuator will move by the value entered as the PLC's target position (*) with reference to the current position. (Incremental moves)

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 (PUSHHS) 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.

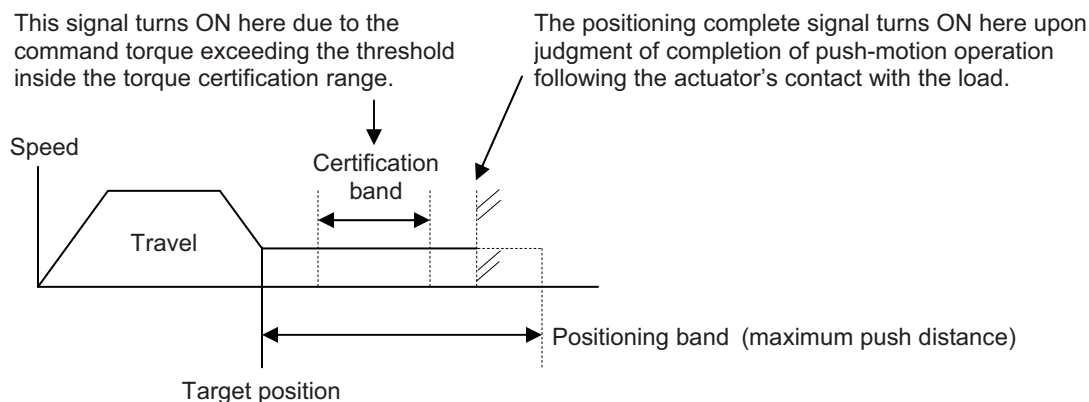
To use an actuator in a press-fit application, whether or not the specified load threshold has reached during the push-motion operation must be recognized.

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.



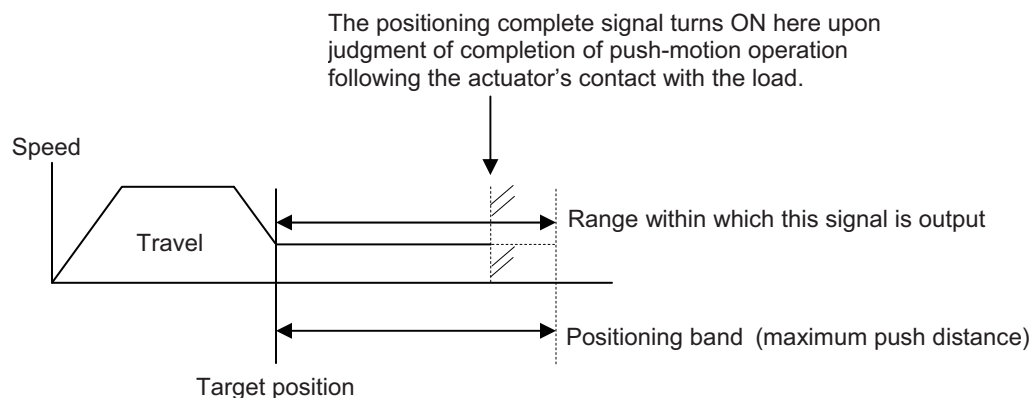
Warning:

- 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

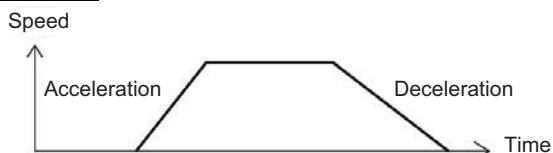
- Full-servo control mode
The holding current can be reduced by servo-controlling the pulse motor.
Although the specific level of reduction varies according to the actuator model, load condition, etc., the holding current will decrease to approx. 1/2 to 1/4.
The actual holding current can be checked 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.

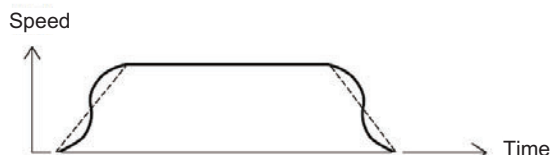
MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid pattern	Factory setting
OFF	ON	S-motion	
ON	OFF	Primary delay filter	
ON	ON	Cannot be used.	

Trapezoid pattern

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

S-motion

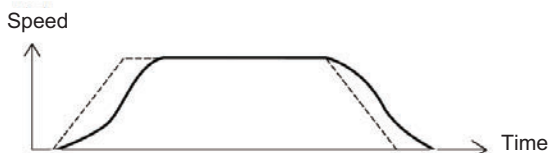
The acceleration/deceleration curve rises gradually at first and then draws a steep curve from a certain point. Use this mode if you want to set high acceleration/deceleration to meet the tact time requirement, but keep the acceleration/deceleration gradual at the start of movement or immediately before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

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:

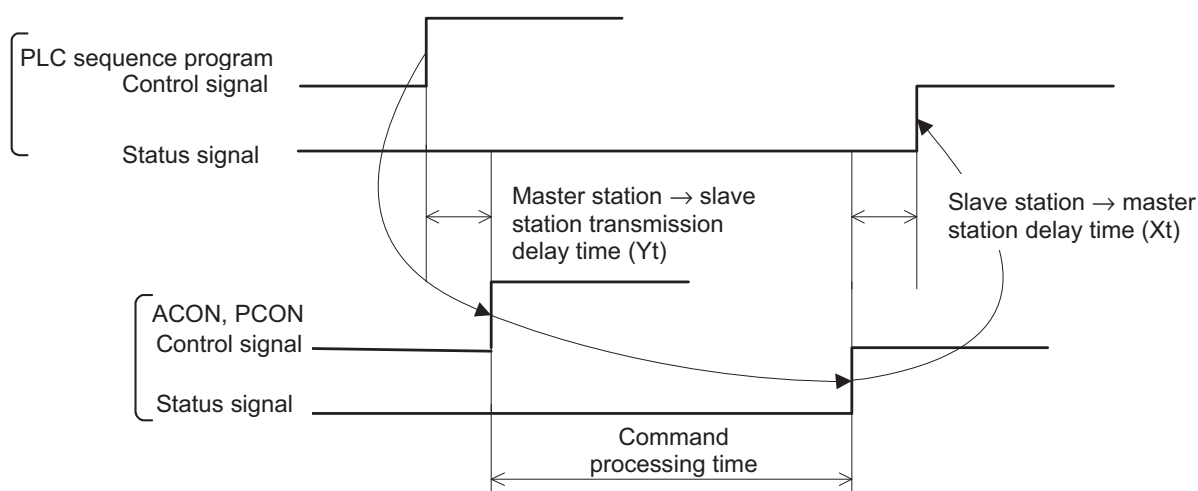
Maximum response time (msec) = $Y_t + X_t + 2 + \text{Command processing time (operation time, etc.)}$

Y_t : Master station → slave station transmission delay time

X_t : Slave station → master station delay time

} Field network transmission delay time

For the master station → slave station transmission delay time (Y_t) and slave station → master station delay time (X_t), 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.

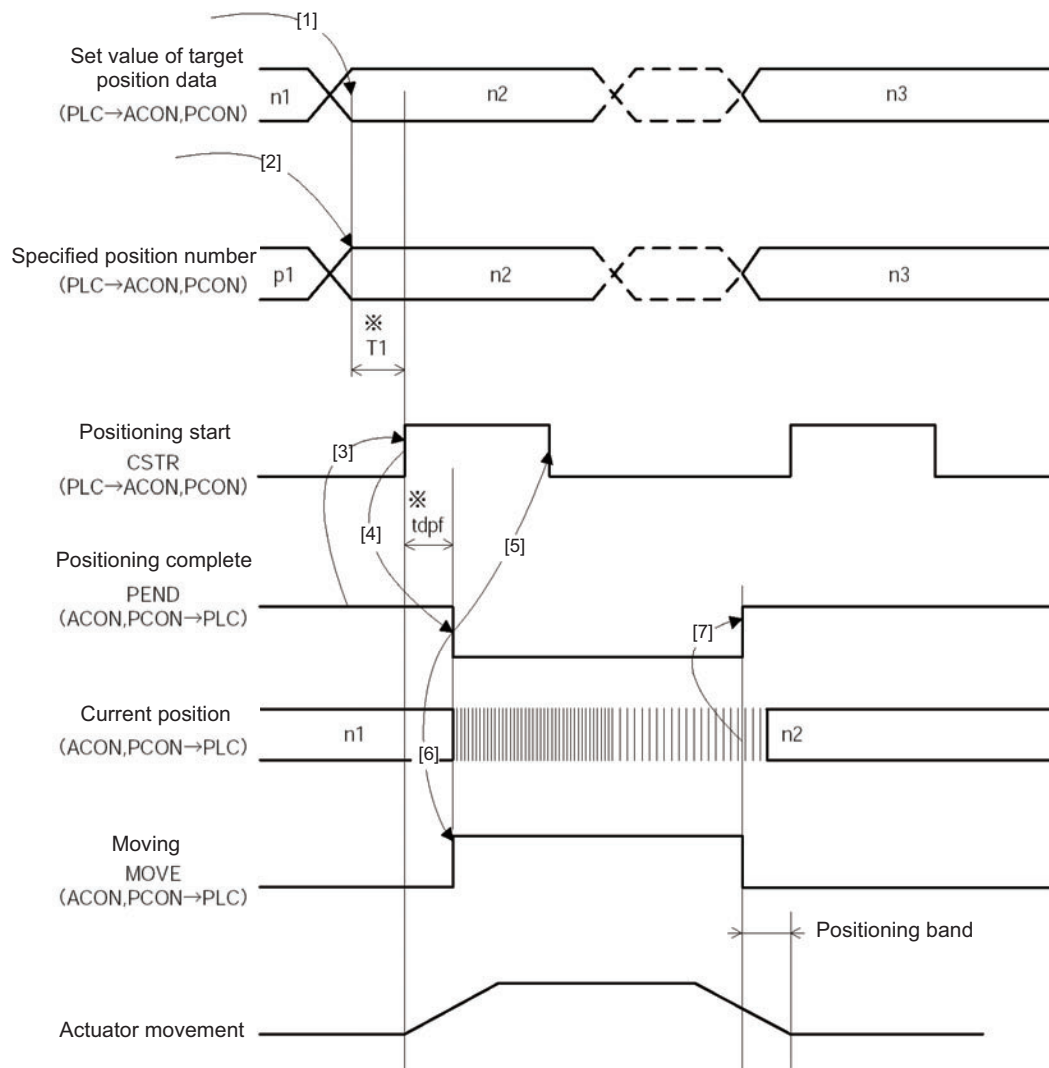
- [1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
- [2] Set the position number for which the speed, acceleration/deceleration, etc., have been set for the specified position number corresponding to output address n+2 (*).
- [3] Turn the positioning 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.)

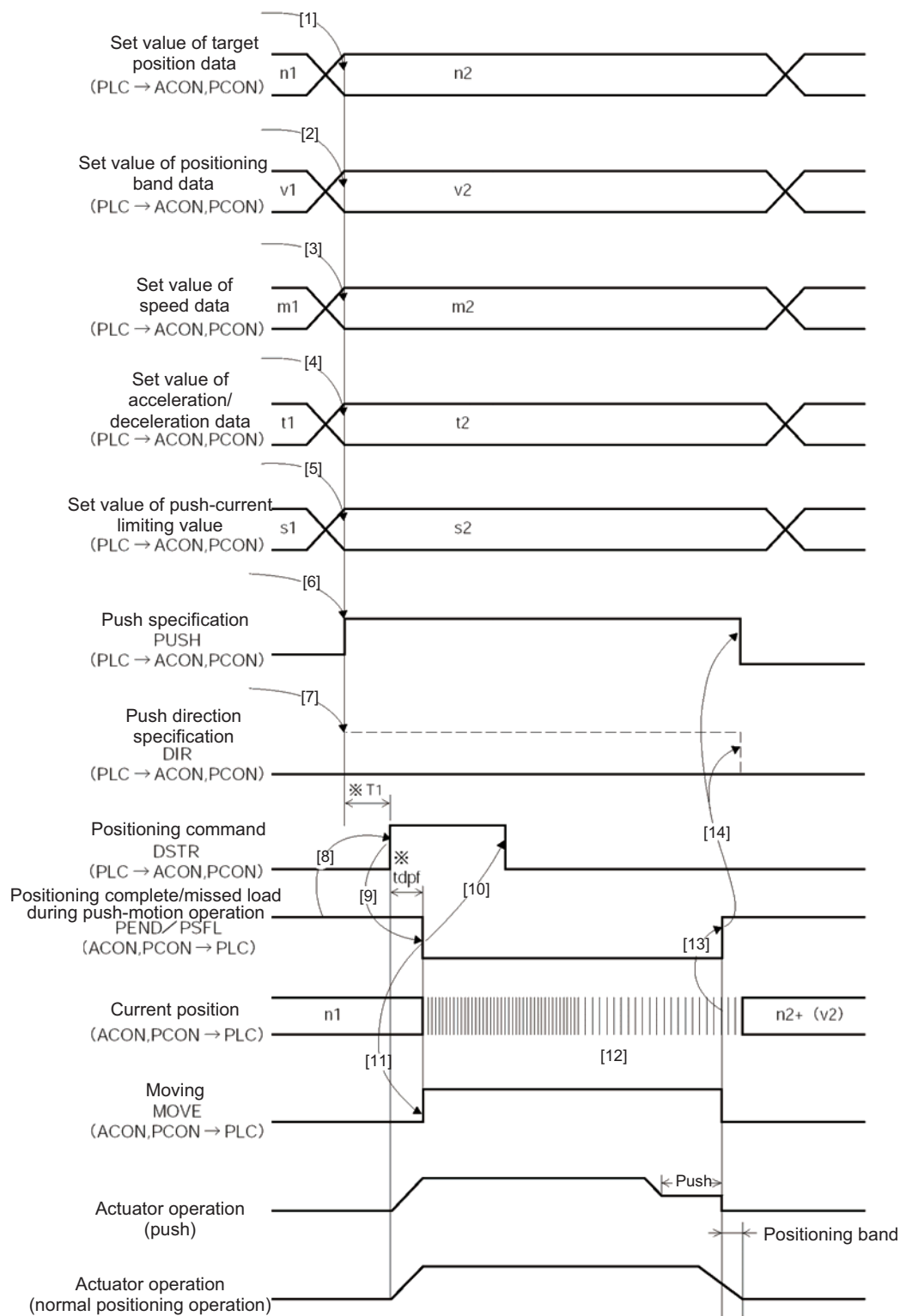
- [14] Turn the PUSH signal OFF after the PEND signal or PSFL signal has turned ON.

● 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.



(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.

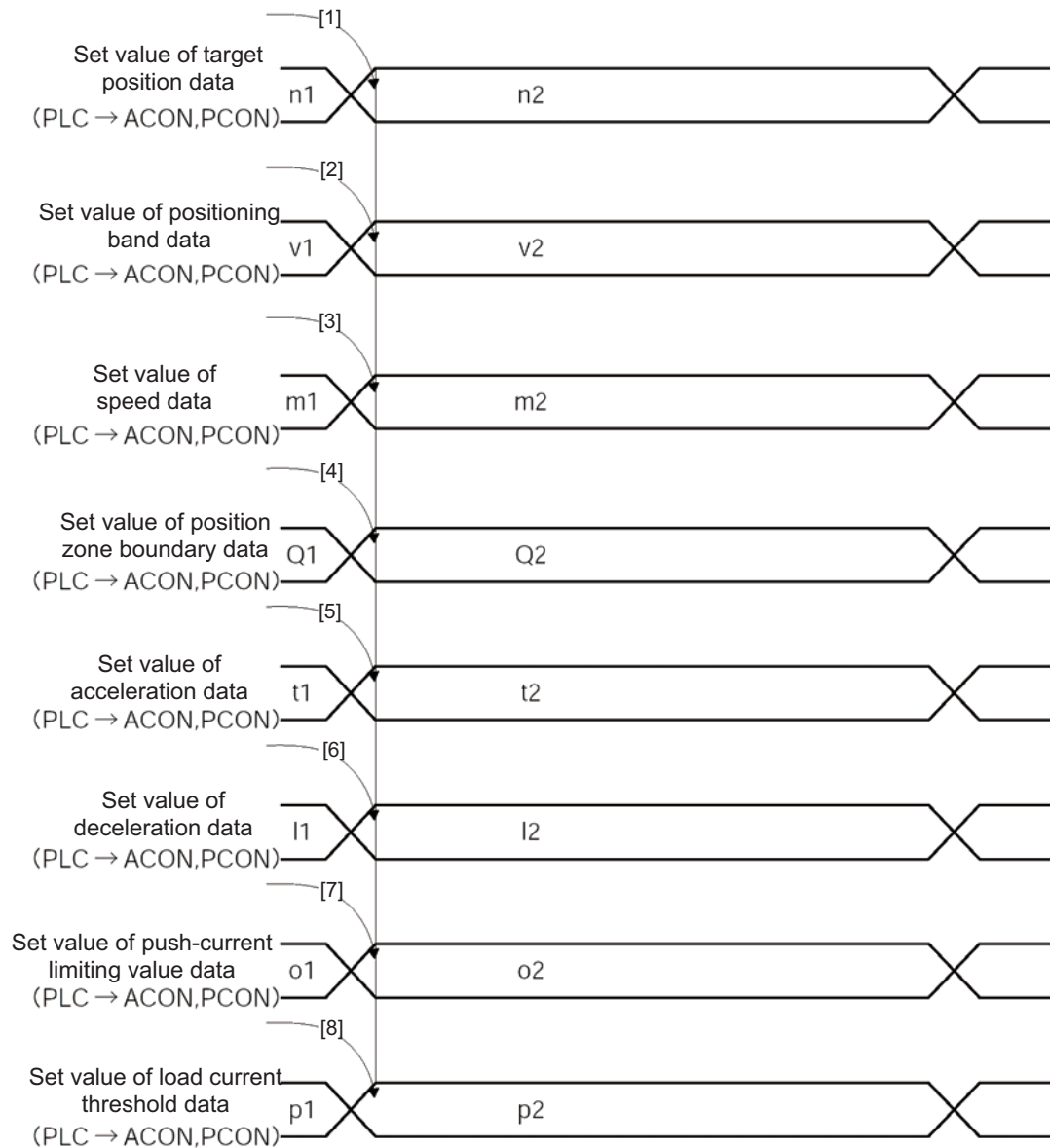
- [12] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
- [13] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [8] until the DSTR signal is turned OFF.
- [14] The MOVE signal turns ON simultaneously 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.

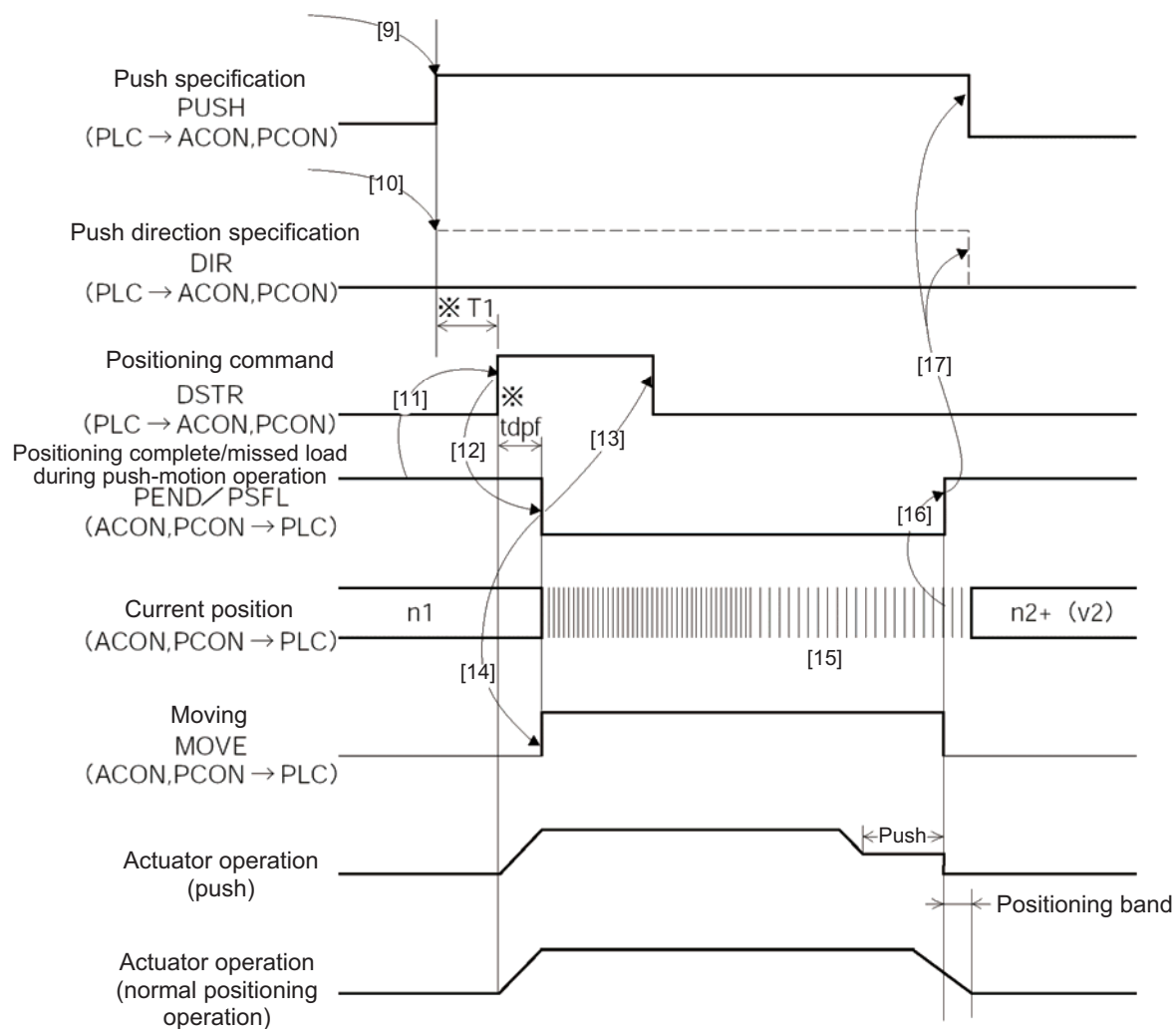
- Example of operation (normal positioning operation)

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.





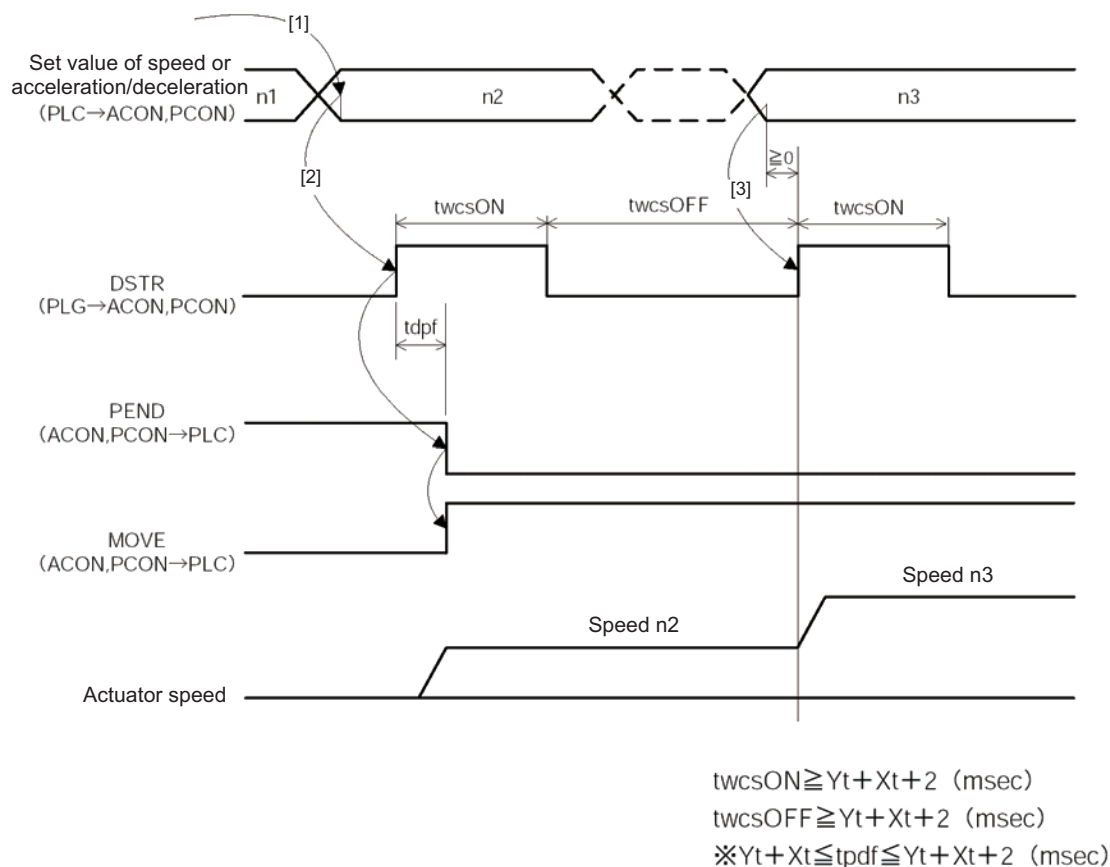
*T1: Make sure "T1 ≥ 0 ms" is satisfied by considering the scan time of the host controller.

※ $Yt + Xt \leq tdpf \leq Yt + Xt + 2$ (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.



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.	
2				
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 ○ 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	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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			

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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example ii) Set value = "1"

● indicates ON, while ○ 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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	3				4				1				2				C				D				A				B			

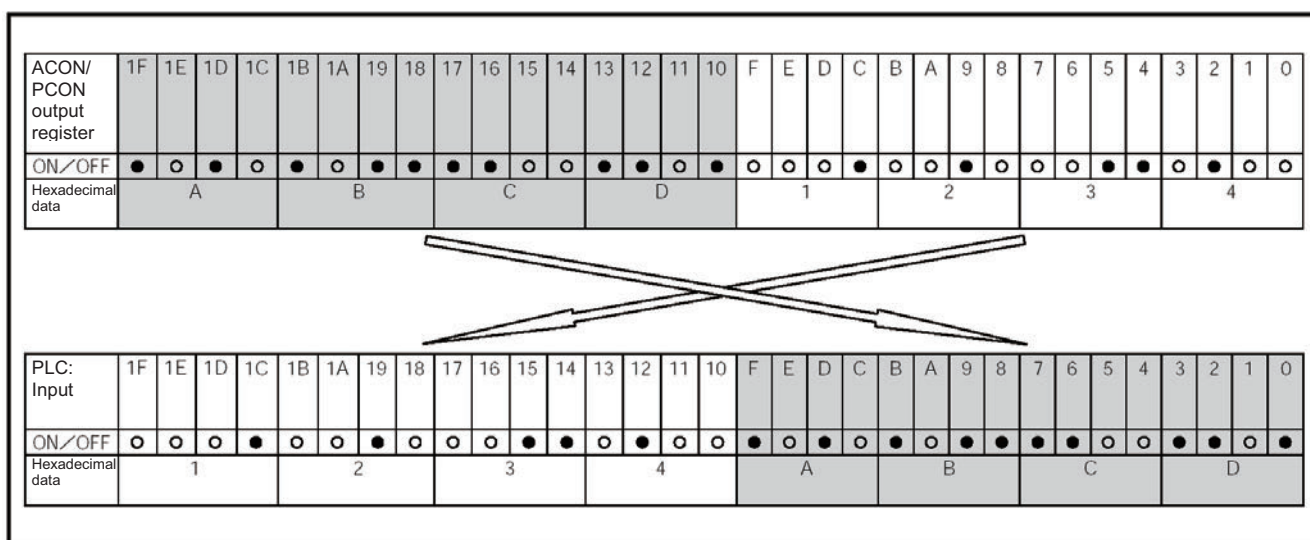
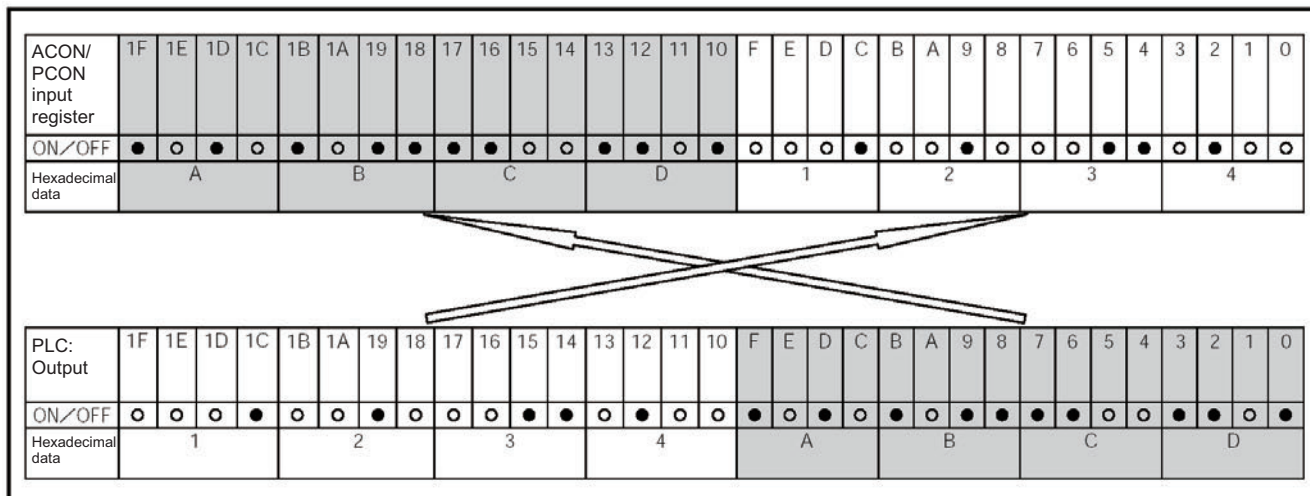
PLC: Output	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	1				2				3				4				A				B				C				D			

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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
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	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	1				2				3				4				A				B				C				D			

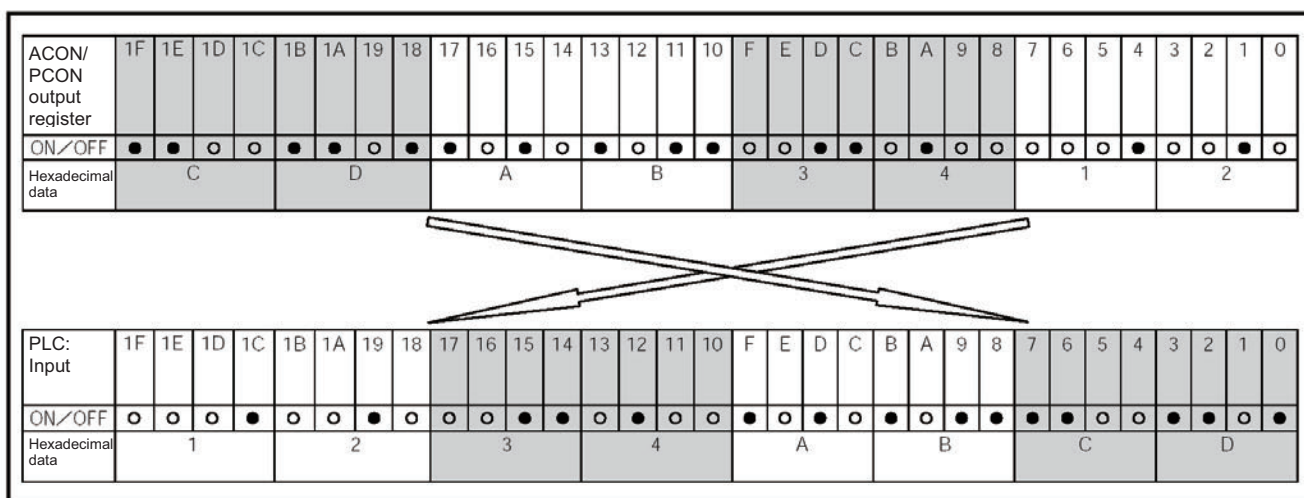
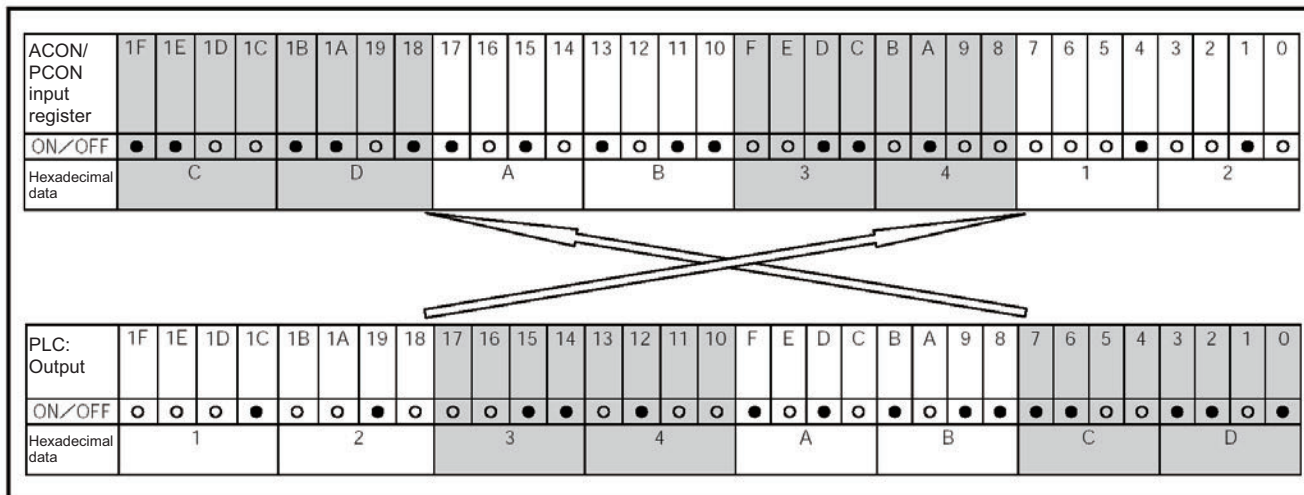
(Example iii) Set value = "2"

● indicates ON, while ○ indicates OFF.



(Example iv) Set value = "3"

● indicates ON, while O indicates OFF.



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.

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.

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

O: 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. SCON-CA

4.1 Operation Modes and Functions

SCON-CA controllers supporting PROFIBUS-DP can be operated in a desired operation mode selected from the following nine modes.

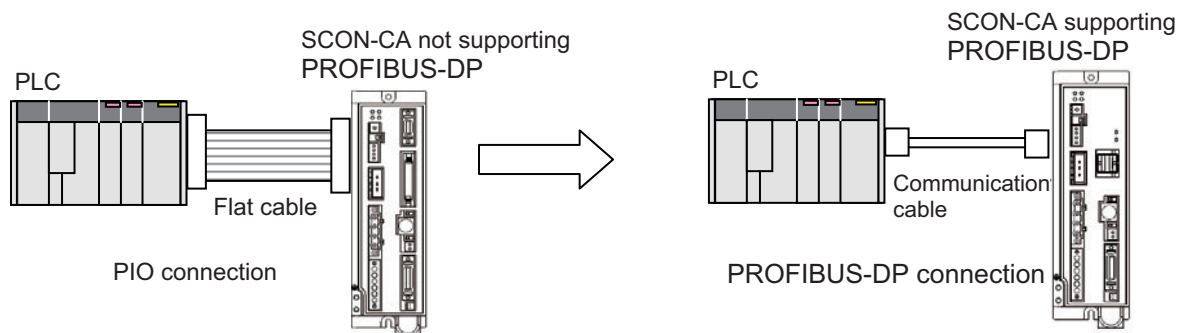
Key function	Remote I/O mode	Position/simple direct mode	Half direct mode	Full direct mode	Remote I/O mode 2	Position/simple direct mode 2	Half direct mode 2	Remote I/O mode 3	Half direct mode 3
Number of occupied bytes	2	8	16	32	12	8	16	12	8
Operation by position data specification	x	○(*1)	○	○	x	○(*1)	○	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	△(*2)	x	x	○	△(*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.

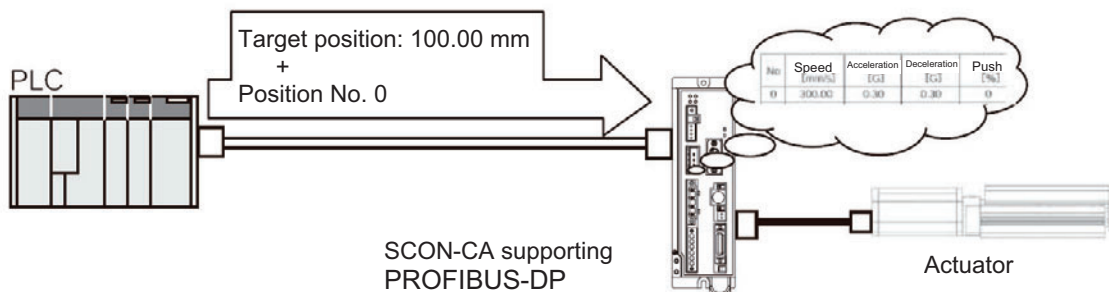
Number of occupied bytes: 2 bytes (1 word)



[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.

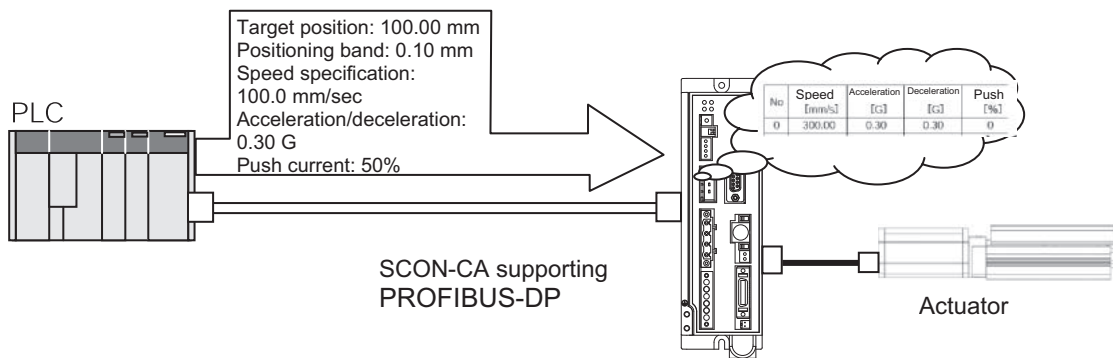
For the speed, acceleration/deceleration, positioning band, etc., values preregistered in the position data table are used. Up to 768 position data points can be set.

Number of occupied bytes: 8 bytes (4 word)

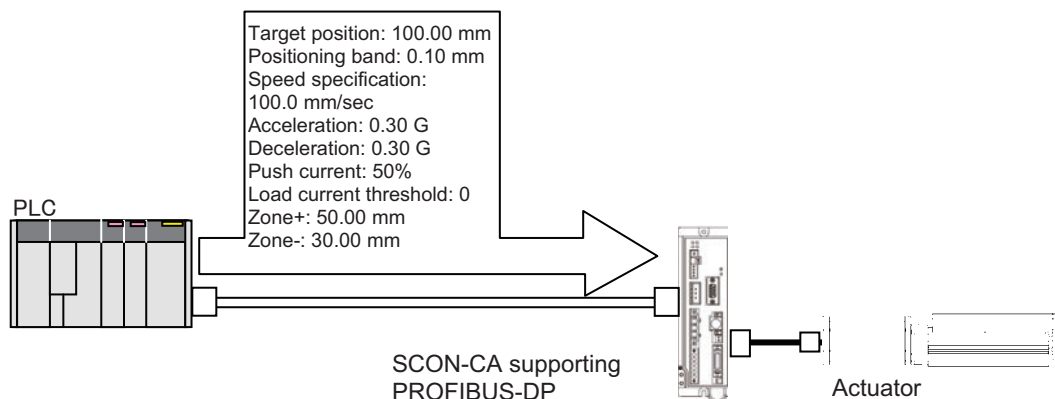


[3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.

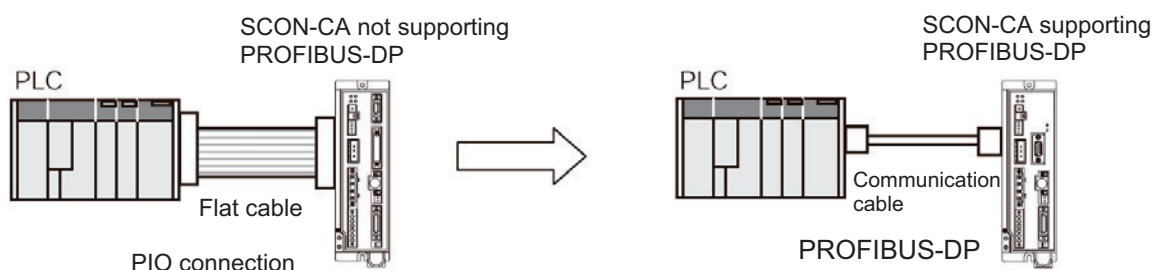
Number of occupied bytes: 16 bytes (8 word)



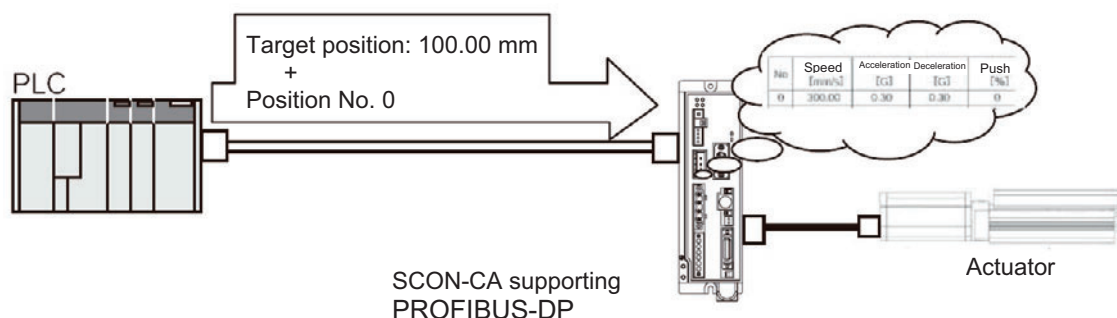
- [4] Full direct mode: In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, acceleration/deceleration, etc.) directly as values.
Number of occupied bytes: 32 bytes (16 words)



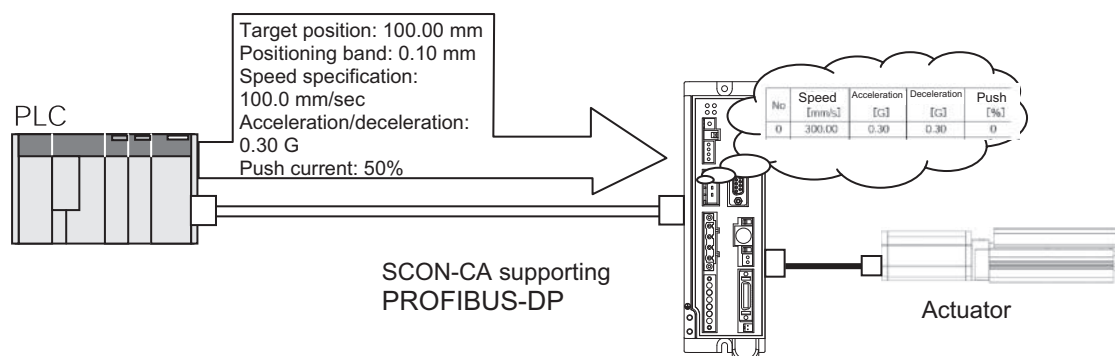
- [5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via PROFIBUS-DP communication. The current-position and command-current read functions are available in addition to the functions provided in mode [1].
Number of occupied bytes: 12 bytes (6 words)



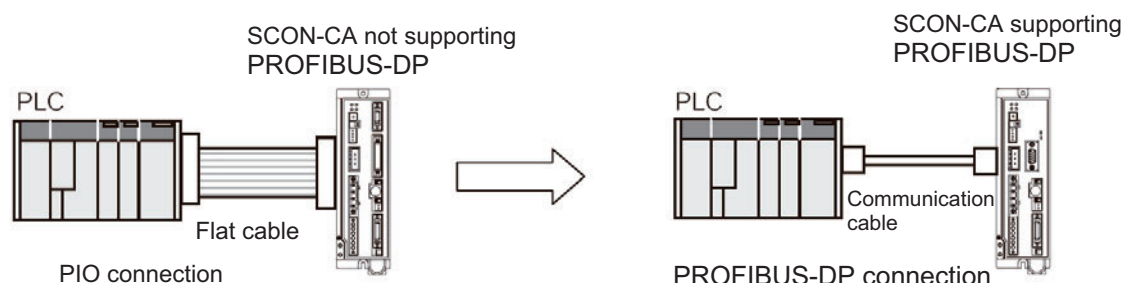
- [6] Position/simple direct mode 2: In this mode, the actuator is operated by specifying position numbers. In this mode, the force control function is available instead of the teaching function and zone function available in mode [2].
Number of occupied bytes: 8 bytes (4 word)



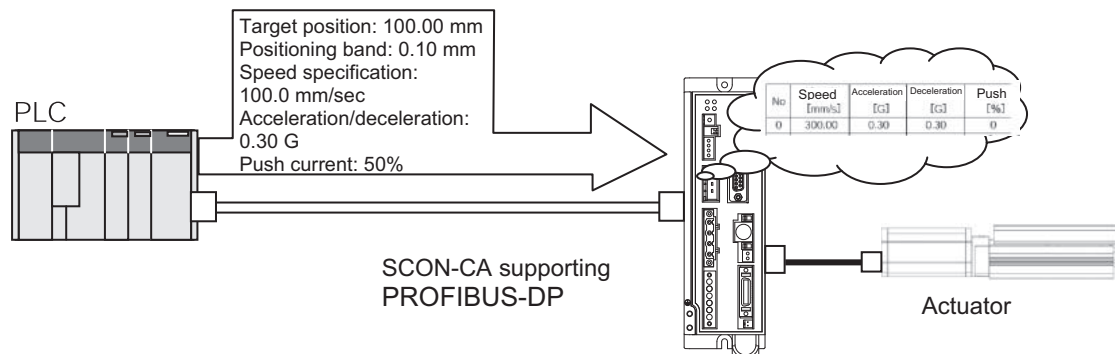
- [7] Half direct mode 2: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values. Unlike in mode [3], command current cannot be read in this mode. However, load cell data can be read instead. This mode also supports force control. Number of occupied bytes: 16 bytes (8 word)



- [8] Remote I/O mode 3: In this mode, the actuator is operated by DeviceNet 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)



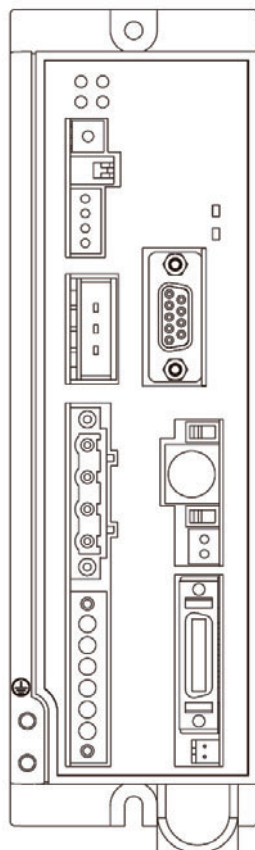
- [9] Half direct mode 3: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values. In this mode, the vibration damping function is supported instead of the jog function available in mode [3]. Number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



4.2 Model Names

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

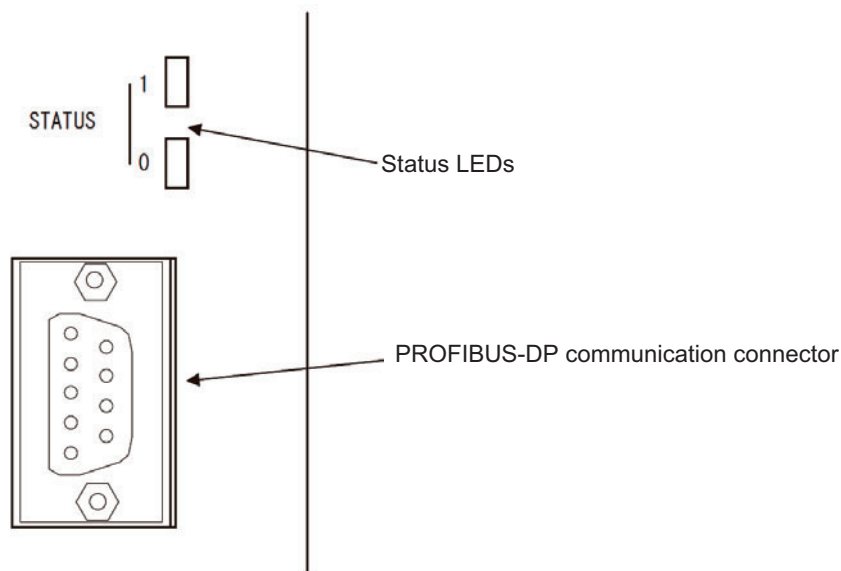
- SCON-CA-□-PR-□



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)

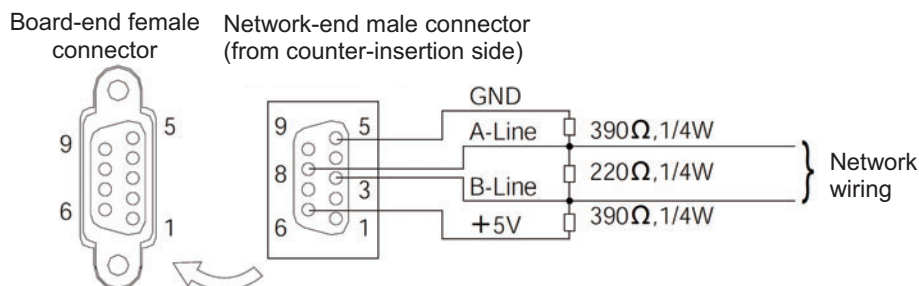
(Note 1) Pins 1, 2, 7 and 9 are not used (they need not be wired).

(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 (V8.00.00.00 or later).

(Refer to 4.7, "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.

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

PLC output address (word address)	SCON-CA 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		Specified position number Control signal	Positioning band	Positioning band	Occupied area
n+2					
n+3					
n+4					
n+5					
n+6			Speed Acceleration/ deceleration	Speed specification	
n+7					
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.

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

PLC input address (word address)	SCON-CA 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.

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

PLC input address (word address)	SCON-CA 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				Port number 0 to 15
n+1		Current position	Current position	Current position	Occupied area
n+2		Completed position number (simple alarm ID)	Command current	Command current	Current position
n+3					
n+4			Current speed	Current speed	Command current
n+5					
n+6			Alarm code	Alarm code	
n+7					
n+8				Force feedback data	
n+9					
n+10			Occupied area		
n+11					
n+12					
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 output → PLC input (* n indicates the node address for each axis.)

PLC input address (word address)	SCON-CA DO and output data register			
	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)	Force feedback data	Current position	Command current
n+3	Status signal			
n+4		Current speed	Force feedback data	Current speed
n+5		Alarm code		Alarm code
n+6		Status signal		
n+7				
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.

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

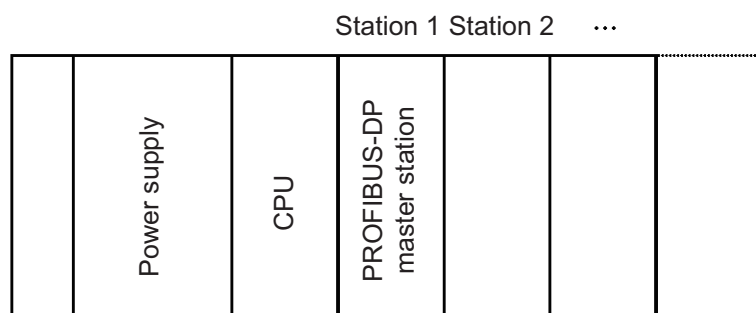


Prefix

%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 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 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.
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 DI (port number)	PLC output address	SCON-CA 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.)

n+0	1 word = 2 bytes = 16 bits															
	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.)

n+0	1 word = 2 bytes = 16 bits															
	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 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	
		Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → SCON-CA input	0	Command position number	PC1	Command position number	PC1	Command position number	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Cannot be used.	-	Teaching mode command	MODE	Cannot be used.	PC64
	7		-	Jog/inching switching	JISL		PC128
	8		-	+Jog	JOG+		-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning start	CSTR	Positioning start / Positioning data read command	CSTR/ PWRT	Positioning start	CSTR
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
SCON-CA output → PLC input	0	Completed position number	PM1	Completed position number	PM1	Completed position number	PM1
	1		PM2		PM2		PM2
	2		PM4		PM4		PM4
	3		PM8		PM8		PM8
	4		PM16		PM16		PM16
	5		PM32		PM32		PM32
	6	Moving signal	MOVE	Moving signal	MOVE	Cannot be used.	PM64
	7	Zone 1	ZONE1	Teaching mode signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE	Position zone	PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal/position data read complete	PEND/ WEND	Positioning complete signal	PEND
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Battery alarm	*BALM	Battery alarm	*BALM	Battery alarm	*BALM

* 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.	Signal name	Symbol	Signal name	Symbol	Signal name	Symbol
PLC output → SCON-CA input	0	Command position number	PC1	Start position 0	ST0	Start position 0	ST0
	1		PC2	Start position 1	ST1	Start position 1	ST1
	2		PC4	Start position 2	ST2	Start position 2	ST2
	3		PC8	Start position 3	ST3	Cannot be used.	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Cannot be used.	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME	Cannot be used.	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning start	CSTR	Cannot be used.	-		-
	14	Reset	RES	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON	Servo ON command	SON
SCON-CA output → PLC input	0	Completed position number	PM1	Completed position 0	PE0	Rear end move command 0	LS0
	1		PM2	Completed position 1	PE1	Rear end move command 1	LS1
	2		PM4	Completed position 2	PE2	Rear end move command 2	LS2
	3		PM8	Completed position 3	PE3	Cannot be used.	-
	4		PM16	Completed position 4	PE4		-
	5		PM32	Completed position 5	PE5		-
	6		PM64	Completed position 6	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation mode	RMDS	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal	PEND	Cannot be used.	-
	12	Operation ready	SV	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Battery alarm	*BALM	Battery alarm	*BALM	Battery alarm	*BALM

* 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.	Signal name	Symbol	Signal name	Symbol
PLC output → SCON-CA input	0	Command position number	PC1	Start position 0	ST0
	1		PC2	Start position 1	ST1
	2		PC4	Start position 2	ST2
	3		PC8	Start position 3	ST3
	4		PC16	Start position 4	ST4
	5	Cannot be used.	-	Cannot be used.	-
	6		-		-
	7		-		-
	8	Load cell calibration command	CLBR	Load cell calibration command	CLBR -
	9	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operation mode	RMOD	Operation mode	RMOD
	11	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP
	13	Positioning start	CSTR		-
	14	Reset	RES	Reset	RES
	15	Servo ON command	SON	Servo ON command	SON
SCON-CA output → PLC input	0	Completed position number	PM1	Completed position number 0	PE0
	1		PM2	Completed position number 1	PE1
	2		PM4	Completed position number 2	PE2
	3		PM8	Completed position number 3	PE3
	4		PM16	Completed position number 4	PE4
	5	Torque level status	TRQS	Torque level status	TRQS
	6	Load output judgment status	LOAD	Load output judgment status	LOAD
	7	Load cell calibration complete	CEND	Load cell calibration complete	CEND
	8	Position zone	PZONE	Position zone	PZONE
	9	Operation mode	RMDS	Operation mode	RMDS
	10	Home return complete	HEND	Home return complete	HEND
	11	Positioning complete signal	PEND	Positioning complete signal	PEND
	12	Operation ready	SV	Operation ready	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM
	15	Battery alarm	*BALM	Battery alarm	*BALM

* 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.)

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 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 input register	PLC output address	SCON-CA 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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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	ZONE1	ZONE2	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	-	4.6 (1)
	Specified position number	16-bit data	PC1 ~ PC512	4.6 (1)
	Control signal	b15	BKRL	4.4.11 (18)
		b14	RMOD	4.4.11 (19)
		b13	-	-
		b12		
		b11	PMOD	4.4.11 (20)
		b10	MODE	4.4.11 (16)
		b9	PWRT	4.4.11 (17)
		b8	JOG+	4.4.11 (13)
		b7	JOG-	4.4.11 (13)
		b6	JVEL	4.4.11 (14)
		b5	JISL	4.4.11 (15)
		b4	SON	4.4.11 (5)
		b3	RES	4.4.11 (4)
		b2	STP	4.4.11 (11)
		b1	HOME	4.4.11 (6)
		b0	CSTR	4.4.11 (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. (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 (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.	4.6 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	4.4.11 (12)
		b10	MODES	Teaching mode signal: The signal is ON when the teaching mode is selected.	4.4.11 (16)
		b9	WEND	Position data read complete: The signal turns ON when the position data read is complete.	4.4.11 (17)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	4.4.11 (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.	4.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	4.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.11 (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	O: 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.)

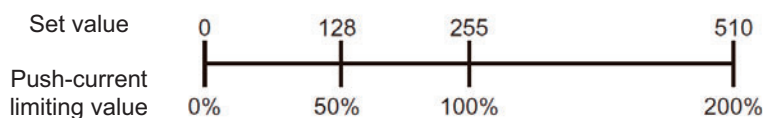
Parameter No. 84	SCON-CA input register	PLC output address	SCON-CA output register	PLC input address
2	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	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 specified 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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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	—	—	—	—	—	—	—	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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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, 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, while the specifiable range is 0 to 65535. (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)

(* 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.	4.6 (2)
	Control signal	b15	BKRL Forced brake release: The brake is released when the signal turns ON.	4.4.11 (18)
		b14	RMOD Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.11 (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.	4.4.11 (22)
		b12	PUSH Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	4.4.11 (21)
		b11	GSL1 Servo gain parameter set selection 1	4.4.11 (33)
		b10	GSL0 Servo gain parameter set selection 0	
		b9	- Cannot be used.	
		b8	JOG+ +Jog: The actuator moves in the direction opposite home when the signal is ON.	
		b7	JOG- -Jog: The actuator moves in the direction of home when the signal is ON.	4.4.11 (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.	4.4.11 (14)
		b5	JISL Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.11 (15)
		b4	SON Servo ON command: The servo is ON when the signal is ON.	4.4.11 (5)
		b3	RES Reset: A reset is performed when the signal turns ON.	4.4.11 (4)
		b2	STP Pause: A pause command is issued when the signal turns ON.	4.4.11 (11)
		b1	HOME Home return: A home return command is issued when the signal turns ON.	4.4.11 (6)
		b0	DSTR Positioning start command: A move command is issued when the signal turns ON.	4.4.11 (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
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)
Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.11 (2)
	b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
	b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
	b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (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.	4.4.11 (19)
	b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	4.7.11 (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.	4.4.11 (23)
	b4	SV	Ready: The signal is ON when the servo is ON.	4.4.11 (5)
	b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.11 (3)
	b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.11 (9)
	b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.11 (6)
	b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.11 (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	O: Direct control x: Invalid
Home return operation	O
Positioning operation	O
Speed & acceleration/deceleration setting	O
Pitch feed (inching)	O
Push-motion operation	O
Speed change during movement	O
Operation at different acceleration and deceleration	O
Pause	O
Zone signal output	O
PIO pattern selection	x

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

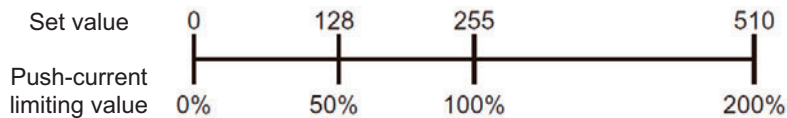
Parameter No. 84	SCON-CA input register	PLC output address	SCON-CA output register	PLC input address
3	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
		n+5		n+5
	Zone boundary+	n+6	Alarm code	n+6
		n+7	Occupied area	n+7
	Zone boundary-	n+8	Force feedback data	n+8
		n+9		n+9
	Acceleration	n+10	Occupied area	n+10
	Deceleration	n+11		n+11
	Push-current limiting value	n+12		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) 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 force feedback data is 2-word (32-bit) binary data (unit: 0.01 N).

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
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

n+8	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+10	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Acceleration								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								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 (*3)								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

PLC input address (* n indicates the initial input 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
-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----	----	----	----	----

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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
-----	-----	-----	-----	-----	-----	-----	----	----	----	----	----	----	----	----	----	----

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
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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.

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
Cannot be used.																

n + 8	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (upper word)																

n + 9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (lower word)																

If the force feedback data is a negative value, it is expressed by a 2's complement.

n + 10~n + 13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

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	ZONE2	ZONE1	PZONE	LOAD	TRQS	RMDS	GHMS	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.")

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. (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 \pm 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 \pm 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.”)

Address		Bit	Symbol	Function			Details	
PLC output	Acceleration	16-bit data	-	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.			4.6 (3)	
	Deceleration	16-bit data	-					
	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 (3)	
	Load current threshold	16-bit data	-	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.”			4.6 (3)	
	Control signal 1	b15	-	Cannot be used.			-	
		b14						
		b13	NTC1	Vibration damping control mode selection 1	Select the vibration damping control parameter set to be used.		4.4.11 (29)	
		b12	NTC0	Vibration damping control mode selection 0	NTC1	NTC0		Function
					OFF	OFF		Do not use vibration damping control.
					OFF	ON		Select parameter set 1.
					ON	OFF		Select parameter set 2.
		b11	-	Cannot be used.			-	
		b10						
		b9	ASO1	Stop mode 1	Select the stop mode during standby.		4.4.11 (31)	
		b8	ASO0	Stop mode 2	ASO1	ASO0		Function
					OFF	OFF		Invalid (The servo is always on.)
					OFF	ON		The servo turns off after the time is set in parameter No. 36.
		b7	MOD1	MOD0	ON	OFF	The servo turns off after the time is set in parameter No. 37.	
					ON	ON	The servo turns off after the time is set in parameter No. 38.	
b6	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.			4.4.11 (30)				
b5	GSL1	Servo gain parameter set selection 1	Select the servo gain parameter set to be used.		4.4.11 (33)			
b4	GSL0	Servo gain parameter set selection 0	GSL1	GSL0		Function		
			OFF	OFF		Select parameter set 0.		
			OFF	ON		Select parameter set 1.		
b3	INC		ON	OFF	Select parameter set 2.			
			ON	ON	Select parameter set 3.			
Incremental specification: Absolute position command when the signal is OFF, or incremental position command when the signal is ON.			4.4.11 (24)					

(* 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.	4.4.11 (22)
		b1	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	4.4.11 (21)
		b0	-	Cannot be used.	-
	Control signal 2	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	4.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.11 (19)
		b13	-	Cannot be used.	-
		b12			
		b11			
		b10			
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	4.4.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	4.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	4.4.11 (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.	4.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	4.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	4.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	4.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	4.4.11 (6)
		b0	DSTR	Positioning start: A move command is issued when the signal turns ON.	4.4.11 (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. (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)
	Force feedback data	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.	4.9 (3)
	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.	4.4.11 (32)
		b1	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	4.4.11 (28)

(* 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.	4.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
		b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	4.4.11 (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.)	4.4.11 (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.)	4.4.11 (27)
		b8	RMDS	Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.11 (19)
		b7	GHMS	Home return in progress: The signal is ON while the home return is in progress.	4.4.11 (6)
		b6	PUSHS	Push-motion operation in progress: The signal is ON while the push-motion operation is in progress.	4.4.11 (25)
		b5	PSFL	Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	4.4.11 (23)
		b4	SV	Ready: The signal is ON when the servo is ON.	4.4.11 (5)
		b3	ALM	Alarm: The signal turns ON when an alarm occurs.	4.4.11 (3)
		b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	4.4.11 (9)
		b1	HEND	Home return complete: The signal turns ON when the home return is completed.	4.4.11 (6)
		b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.11 (10)

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."

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.

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)	○	○	○	○	○	○	○	○

○: 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 DI and input register	PLC output address	SCON-CA 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.)

PLC output 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 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 (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.																
n+4	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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)													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 8.4.2, "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: 000003FFH = 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: 000003FFH = 1023 (decimal) = 1023 mA	-

4.4.7 Position/Simple Direct Mode 2 (Number of Occupied Bytes: 8)

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 △: 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	△	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 input register	PLC output address	SCON-CA 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) 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		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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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	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, 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.	4.9 (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.	4.9 (1)
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	4.4.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.11 (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.	4.4.11 (20)
		b10	-	Cannot be used.	-
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	4.4.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	4.4.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	4.4.11 (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.	4.4.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	4.4.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	4.4.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	4.4.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	4.4.11 (6)
	b0	CSTR	Positioning start: A move command is issued when the signal turns ON.	4.4.11 (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. (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.	4.9 (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.	4.9 (1)
	Status signal	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.11 (2)
		b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
		b13	CEND	Load cell calibration complete: This signal turns ON when the load cell calibration is complete.	4.4.11 (32)
		b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (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.	4.4.11 (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.)	4.4.11 (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.)	4.4.11 (27)
		b8	RMDS	+JOG: The actuator moves in the direction opposite the home when this signal turns ON.	4.4.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	4.4.11 (28)
		b6	PUSHS	Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	4.4.11 (23)
		b5	PSFL	Jog/inch switching: The actuator jogs when this signal is OFF, and inches when it is ON.	4.4.11 (23)
		b4	SV	Servo ON command: The servo turns ON when this signal turns ON.	4.4.11 (5)
		b3	ALM	Reset: A reset is executed when this signal turns ON.	4.4.11 (3)
		b2	MOVE	Pause: A pause command is issued when this signal turns ON.	4.4.11 (9)
		b1	HEND	Home return: A home return command is issued when this signal turns ON.	4.4.11 (6)
		b0	PEND	Positioning command: A move command is issued when this signal turns ON.	4.4.11 (10)

4.4.8 Half Direct Mode 2 (Number of Occupied Bytes: 16)

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	O: 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.)

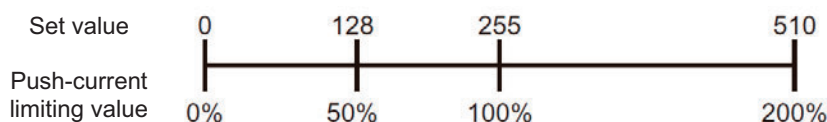
Parameter No. 84	SCON-CA input register	PLC output address	SCON-CA output register	PLC input address
6	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Force feedback data	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting 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 specified 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 force feedback data 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

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
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								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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (upper word)																

n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (lower word)																

If the force feedback data 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
Positioning band (upper word)																

n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning band (lower word)																

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

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	—	—	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, 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.	4.9 (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.	4.9 (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. (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.	4.9 (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 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.	4.9 (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.	4.9 (2)
	Control signal	b15	BKRL Forced brake release: The brake is released when the signal turns ON.	4.4.11 (18)
		b14	RMOD Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.11 (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.	4.4.11 (22)
		b12	PUSH Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	4.4.11 (21)
		b11	-	-
		b10		
		b9	CLBR Load cell calibration command: Calibration is performed when this signal turns ON.	4.4.11 (32)
		b8	JOG+ +Jog: The actuator moves in the direction opposite home when the signal is ON.	4.4.11 (13)
		b7	JOG- -Jog: The actuator moves in the direction of home when the signal is ON.	4.4.11 (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.	4.4.11 (14)
		b5	JISL Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	4.4.11 (15)
		b4	SON Servo ON command: The servo is ON when the signal is ON.	4.4.11 (5)
		b3	RES Reset: A reset is performed when the signal turns ON.	4.4.11 (4)
		b2	STP Pause: A pause command is issued when the signal turns ON.	4.4.11 (11)
		b1	HOME Home return: A home return command is issued when the signal turns ON.	4.4.11 (6)
		b0	DSTR Positioning start command: A move command is issued when the signal turns ON.	4.4.11 (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. (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.	4.9 (2)
	Force feedback data	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.	4.9 (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.	4.9 (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.	4.9 (2)
	Status signal	b15	EMGS Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.11 (2)
		b14	PWR Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
		b13	ZONE2 Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b12	ZONE1 Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b11	-	-
		b10		
		b9	CEND Load cell calibration is complete: This signal turns ON when calibration is complete.	4.4.11 (32)
		b8	RMDS Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops	4.4.11 (28)
		b6	PUSHS Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	4.4.11 (23)
		b5	PSFL Missed load during push-motion operation: The signal turns ON when the actuator missed the load during push-motion operation.	4.4.11 (23)
		b4	SV Ready: The signal is ON when the servo is ON.	4.4.11 (5)
		b3	ALM Alarm: The signal turns ON when an alarm occurs.	4.4.11 (3)
		b2	MOVE Moving signal: The signal is ON while the actuator is moving.	4.4.11 (9)
		b1	HEND Home return complete: The signal turns ON when the home return is completed.	4.4.11 (6)
		b0	PEND Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.11 (10)

4.4.9 Remote I/O Mode 3 (Number of Occupied Bytes: 12)

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 force feedback data.

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.

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)	○	○	○	○	○	○	○	○

○: 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 DI and input register	PLC output address	SCON-CA 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		n+4
		n+5	Force feedback data	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 force feedback data 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
Force feedback data (upper word)																

n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (lower word)																

If the current force feedback data 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 4.7.2, "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: 000003FFH = 1023 (decimal) = 10.23 mm * If this data is read as a hexadecimal, a negative value is indicated by a 2's complement.	-
	Force feedback data	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.	-

4.4.10 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	O: 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.)

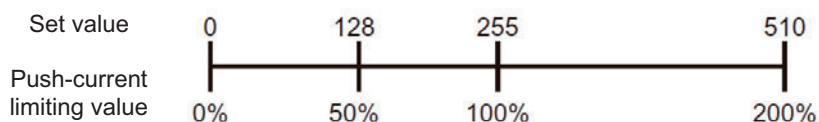
Parameter No. 84	SCON-CA input register	PLC output address	SCON-CA output register	PLC input address
6	Target position	n+0	Current position	n+0
		n+1		n+1
	Positioning band	n+2	Command current	n+2
		n+3		n+3
	Speed	n+4	Current speed	n+4
	Acceleration/ deceleration	n+5		n+5
	Push-current limiting value	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) 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 specified 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 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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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	—	—	—	—	—	—	—	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

n+0	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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.

n+2	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
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 (lower word)																

n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (upper word)																

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

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, 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.	4.9 (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.	4.9 (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. (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.	4.9 (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 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.	4.9 (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.	4.9 (2)
	Control signal	b15	BKRL Forced brake release: The brake is released when the signal turns ON.	4.4.11 (18)
		b14	RMOD Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	4.4.11 (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.	4.4.11 (22)
		b12	PUSH Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	4.4.11 (21)
		b11	GSL1 Servo gain parameter set selection 1	4.4.11 (33)
		b10	GSL0 Servo gain parameter set selection 0	
		b9	NTC1 Vibration damping control mode selection 1	
		b8	NTC0 Vibration damping control mode selection 0	
		b7	MOD1 Acceleration/deceleration mode:	4.4.11 (30)
		b6	MOD0 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.	
		b5	- Not available	
		b4	SON Servo ON command: The servo is ON when the signal is ON.	
		b3	RES Reset: A reset is performed when the signal turns ON.	4.4.11 (4)
		b2	STP Pause: A pause command is issued when the signal turns ON.	4.4.11 (11)
		b1	HOME Home return: A home return command is issued when the signal turns ON.	4.4.11 (6)
		b0	DSTR Positioning start command: A move command is issued when the signal turns ON.	4.4.11 (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. (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.	4.9 (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.	4.9 (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.	4.9 (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.	4.9 (2)
	Status signal	b15	EMGS Emergency stop: An emergency stop is being executed when the signal is ON.	4.4.11 (2)
		b14	PWR Controller ready: The signal turns ON when the controller becomes ready.	4.4.11 (1)
		b13	ZONE2 Zone 2: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b12	ZONE1 Zone 1: The signal is ON when the current position is inside the specified zone.	4.4.11 (12)
		b11	-	-
		b10		
		b9		
		b8	RMDS Operation mode: The signal is OFF when the current mode AUTO, or ON when the current mode is MANU.	4.4.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	4.4.11 (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.	4.4.11 (23)
		b4	SV Ready: The signal is ON when the servo is ON.	4.4.11 (5)
		b3	ALM Alarm: The signal turns ON when an alarm occurs.	4.4.11 (3)
		b2	MOVE Moving signal: The signal is ON while the actuator is moving.	4.4.11 (9)
		b1	HEND Home return complete: The signal turns ON when the home return is completed.	4.4.11 (6)
		b0	PEND Positioning complete signal: The signal turns ON when the positioning is completed.	4.4.11 (10)

4.4.11 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 7.3) 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.

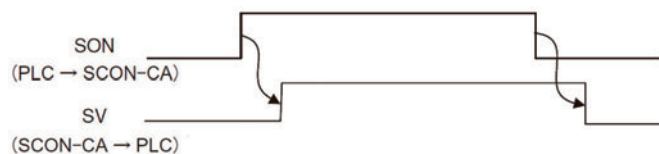
The SV signal is synchronized with this LED.

■ 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.



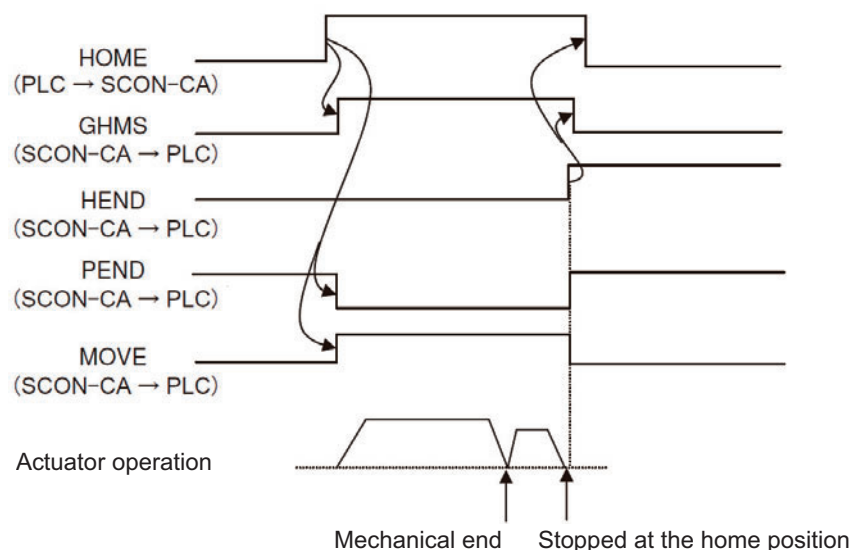
- (6) Home return (HOME) PLC output signal
 Home return complete (HEND) PLC input signal
 Home return in progress (GHMS) PLC input signal

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 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.

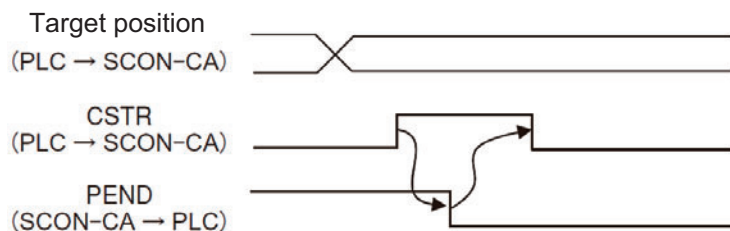
Whether to use the target position corresponding to the specified position number or PLC's target position (*) is determined by the control signal b11 (position/simple direct switching (PMOD) signal).

- 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 4.4.1.

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.

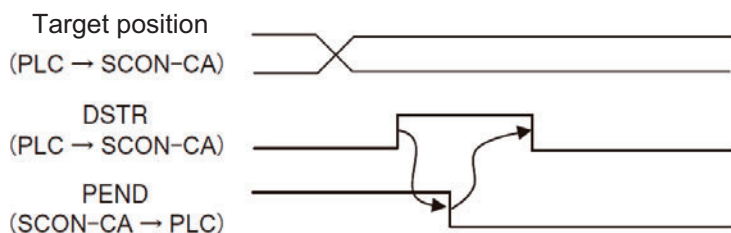
Turn this signal OFF after confirming that the positioning complete signal (PEND) has turned OFF.



(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 4.4.1.

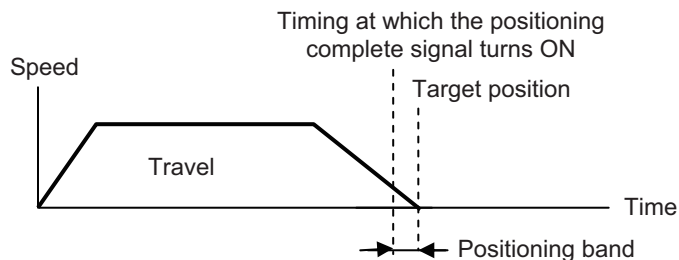
(9) Moving signal (MOVE) PLC input signal

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.

(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

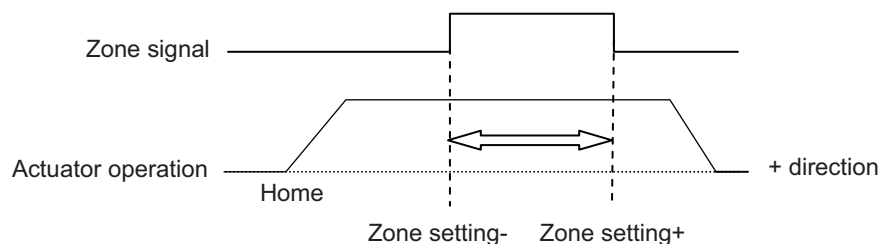
A desired zone is set using the position table or PLC.

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 4.4.1).

(*) 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 4.4.1). (*2)

When the writing is completed, the WEND signal turns ON.

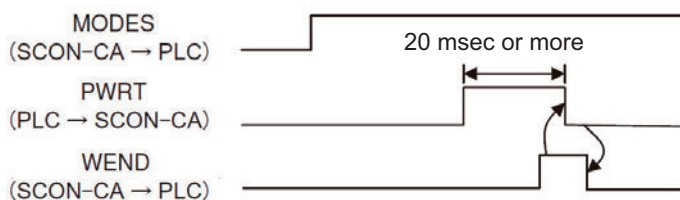
The host PLC should turn the PWRT signal OFF after the WEND signal has turned ON.

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 1 to 3" under 4.6, "Operation.")

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

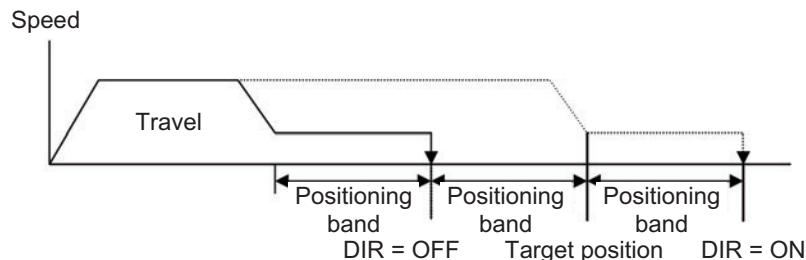
This signal specifies the direction in which the actuator will push the load.

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 1 to 3" 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

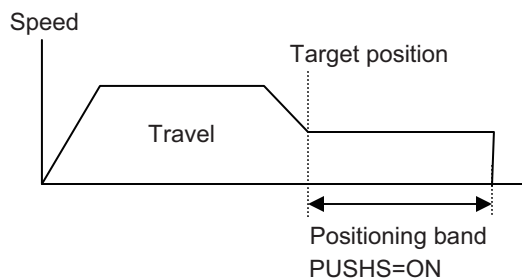
When a move command is issued while this signal is ON, the actuator will move by the value entered as the PLC's target position (*) with reference to the current position. (Incremental moves)

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 (PUSHHS) 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

This signal is valid only during push-motion operation.

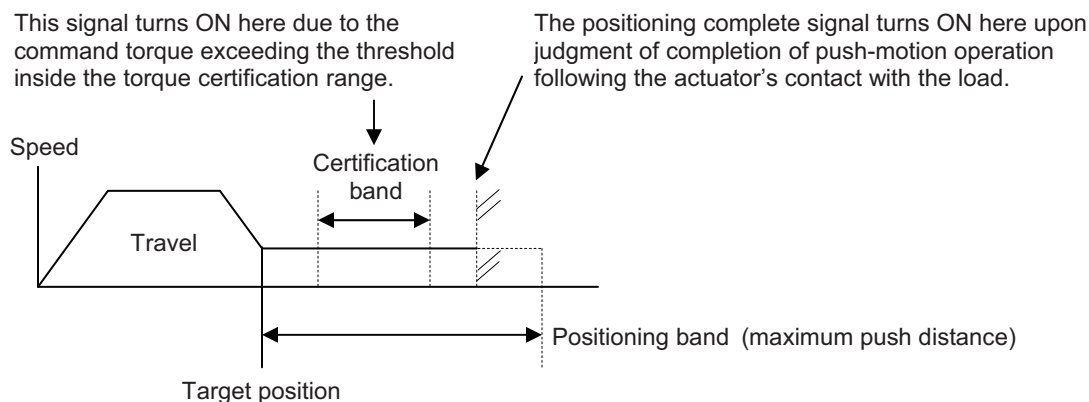
To use an actuator in a press-fit application, whether or not the specified load threshold has reached during the push-motion operation must be recognized.

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.

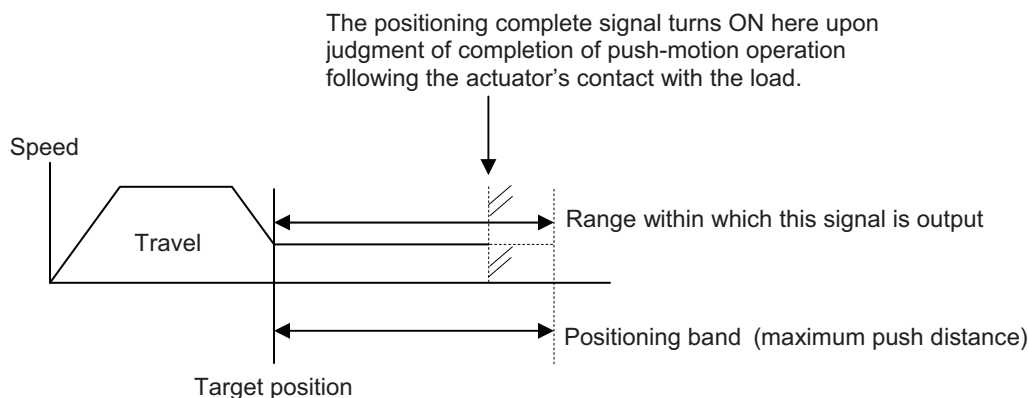


Warning: The actuator continues to push the load at the standstill push current determined by the current-limiting value.
Since the actuator is not stopped, exercise due caution when handling the actuator, etc., in this condition.

(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 4.4.1.



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

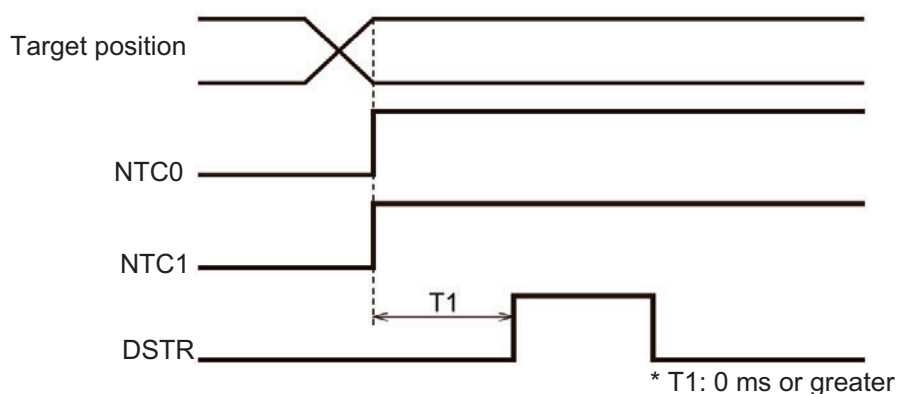
The vibration damping control function suppresses the load vibration induced by IAI's actuator. Measure the vibration frequency and set it in a parameter. In another parameter, select and set an appropriate option based on a combination of these signals.

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.

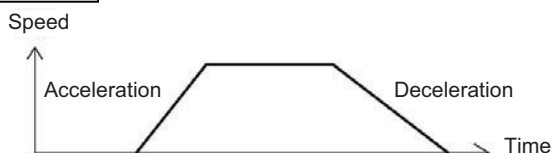


Caution: Since the statuses of NTC0/NTC1 signals are loaded when a movement command (DSTR) is recognized, nothing happens when the NTC0/NTC1 signals are turned ON/OFF while the actuator is moving.

(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.

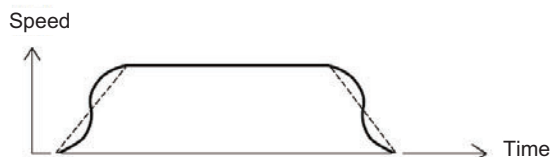
MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid pattern	Factory setting
OFF	ON	S-motion	
ON	OFF	Primary delay filter	
ON	ON	Cannot be used.	

Trapezoid pattern

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

S-motion

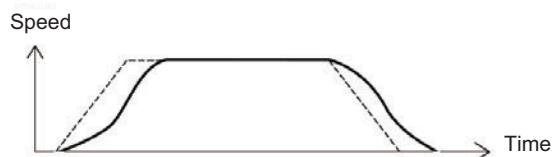
The acceleration/deceleration curve rises gradually at first and then draws a steep curve from a certain point. Use this mode if you want to set high acceleration/deceleration to meet the tact time requirement, but keep the acceleration/deceleration gradual at the start of movement or immediately before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

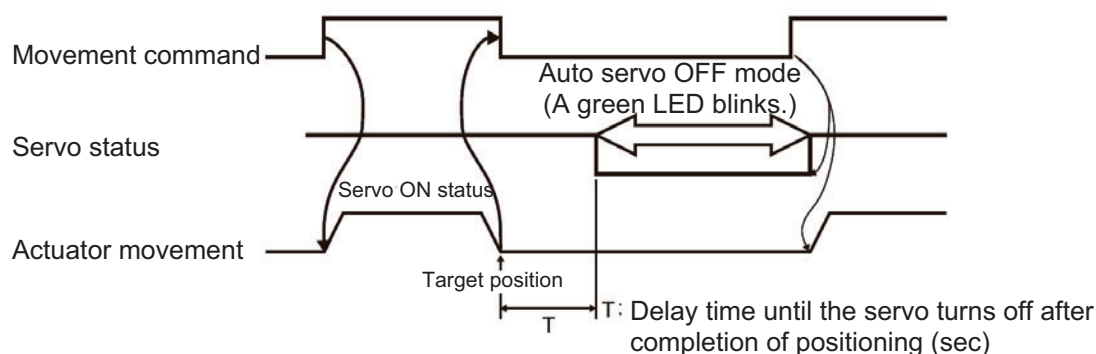
(31) Standstill Mode Selection (ASO0, ASO1) PLC Output Signals

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

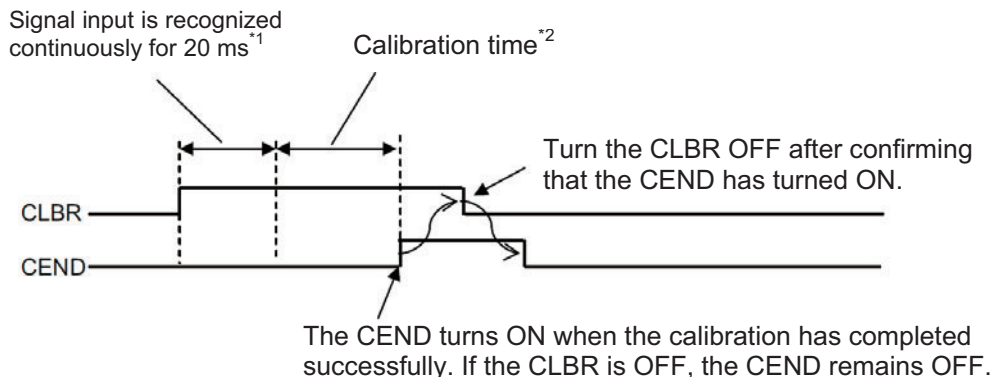
Load Cell Calibration Complete (CEND) PLC Input Signal

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	

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:

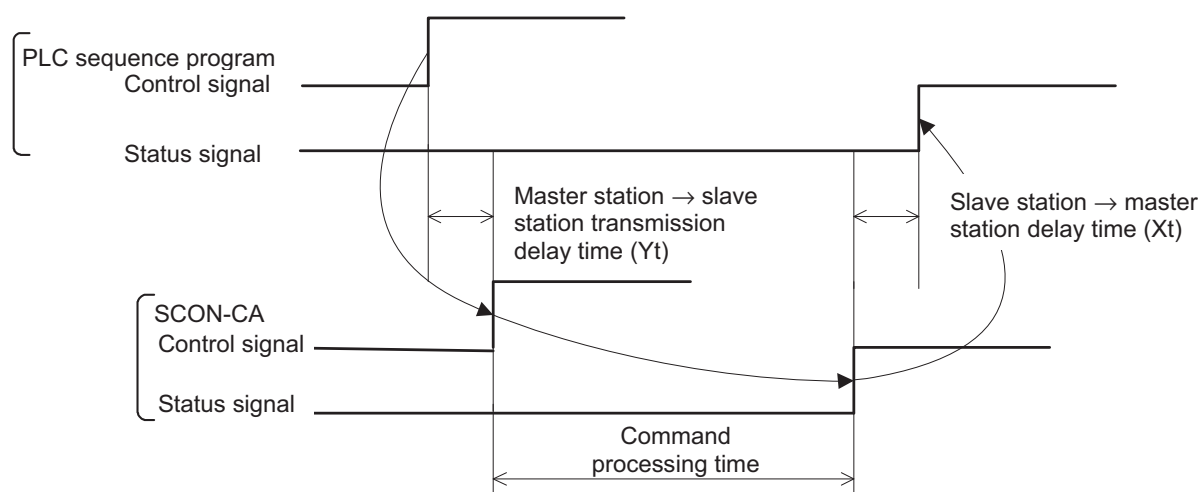
Maximum response time (msec) = $Y_t + X_t + 2 + \text{Command processing time (operation time, etc.)}$

Y_t : Master station → slave station transmission delay time

X_t : Slave station → master station delay time

} Field network transmission delay time

For the master station → slave station transmission delay time (Y_t) and slave station → master station delay time (X_t), 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 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 force feedback 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.

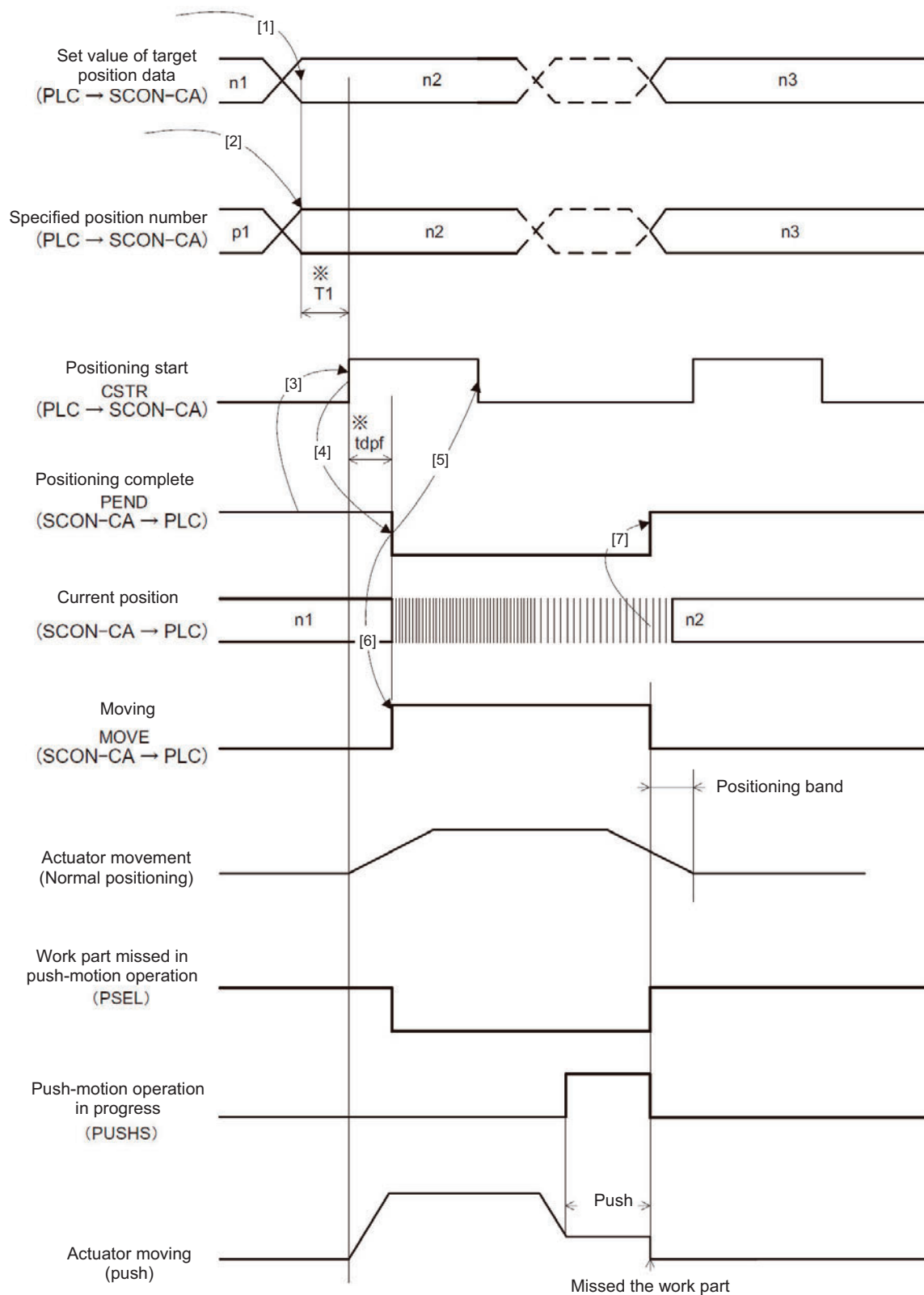
- [1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
- [2] Set the position number for which the speed, acceleration/deceleration, etc., have been set for the specified position number corresponding to output address n+2 (*).
- [3] Turn the positioning 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 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 + 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)

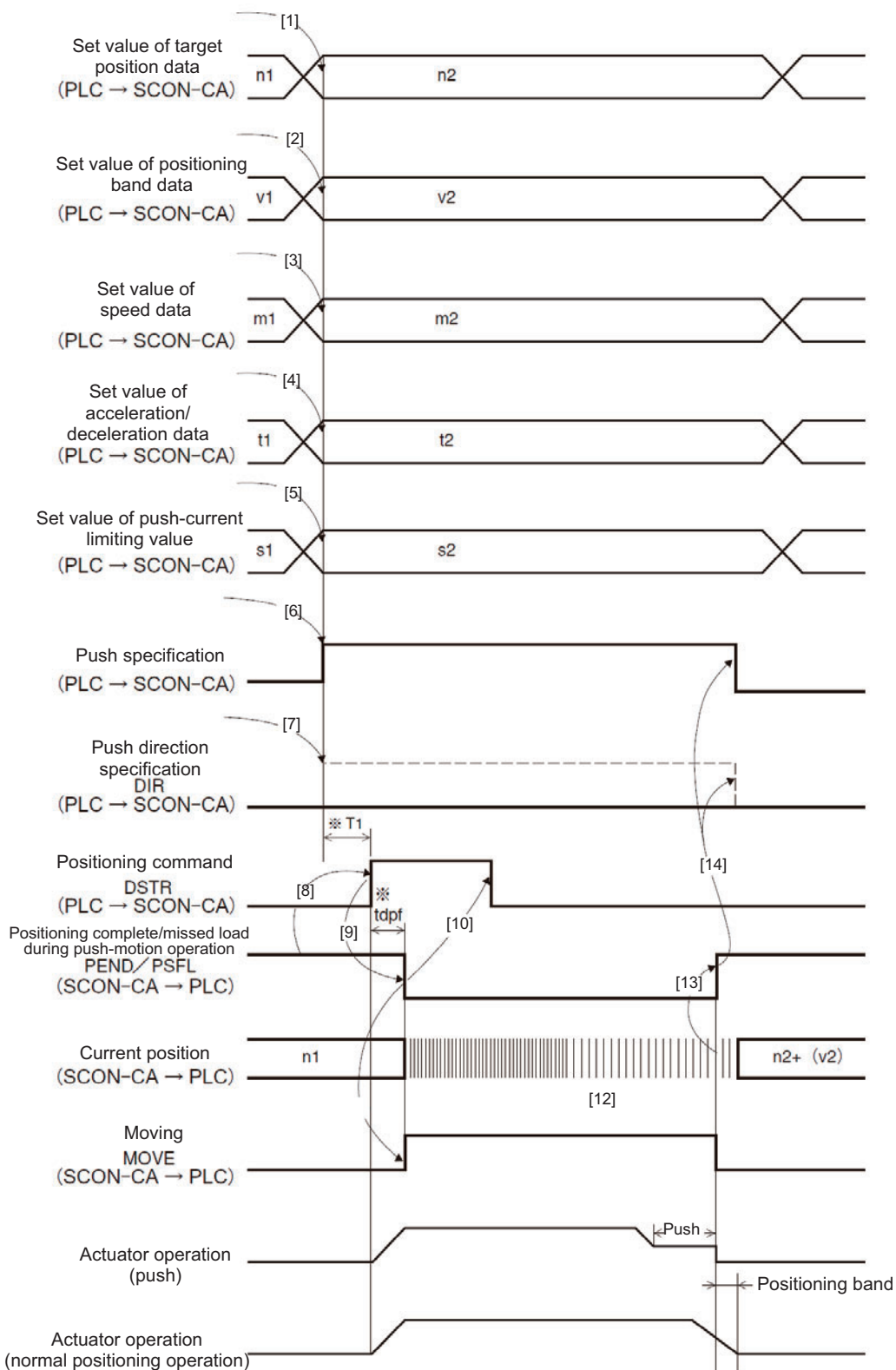
- [1] Set the target position data for the target positions (*) corresponding to output addresses n and n+1.
- [2] Set the positioning band data for the positioning bands (*) corresponding to output addresses n+2 and n+3.
- [3] Set the speed data for the speed (*) corresponding to output address n+4.
- [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 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 " $T1 \geq 0$ ms" is satisfied by considering the scan time of the host controller.

* $Yt + Xt \leq tdpf \leq Yt + Xt + 2$ (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.

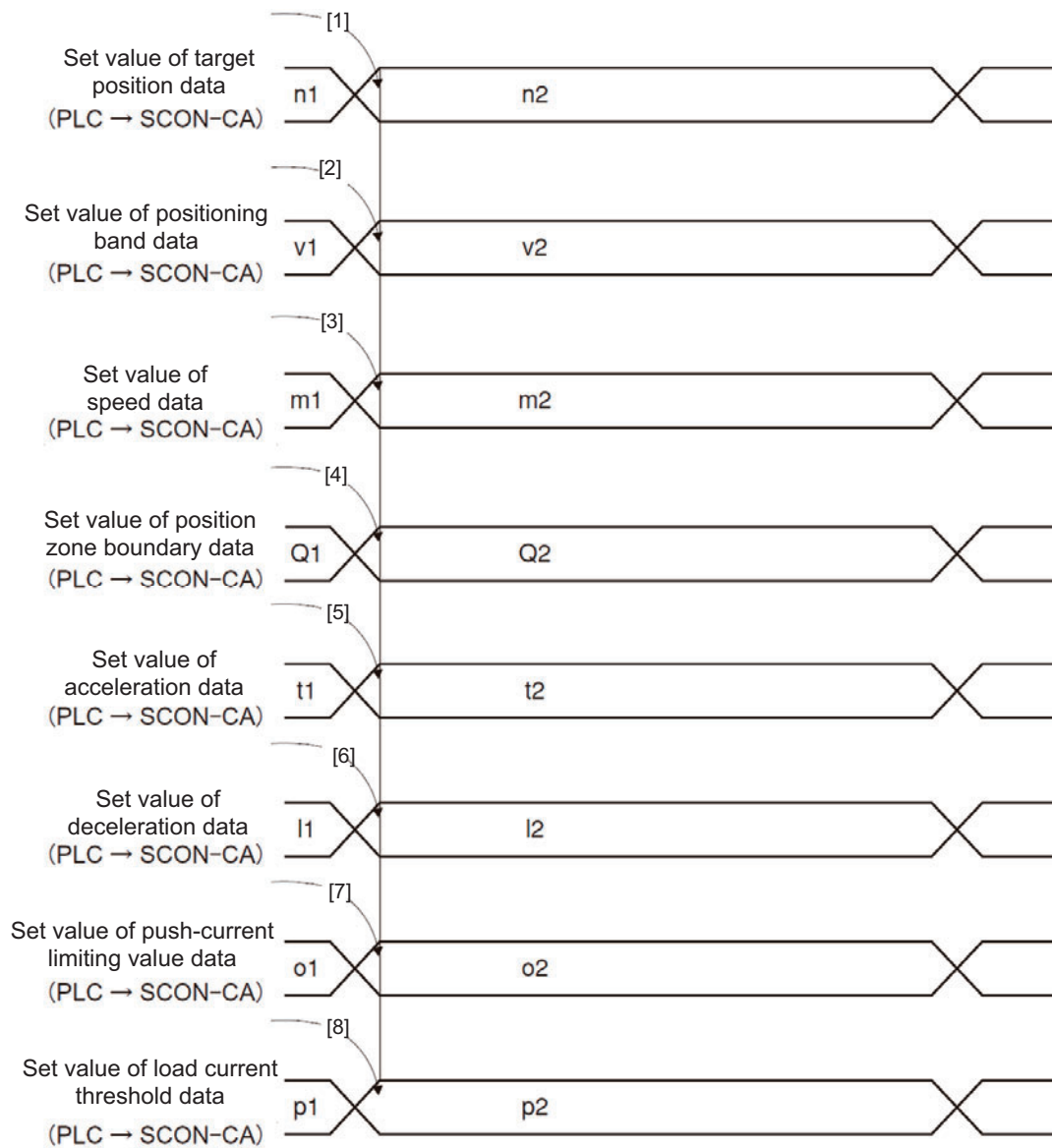
- [12] The DSTR signal turns ON and PEND turns ON tpdf thereafter.
- [13] Turn the DSTR signal OFF after confirming that the PEND signal has turned OFF or MOVE signal has turned ON. Do not change the values set in [1] to [8] until the DSTR signal is turned OFF.
- [14] The MOVE signal turns ON simultaneously 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.

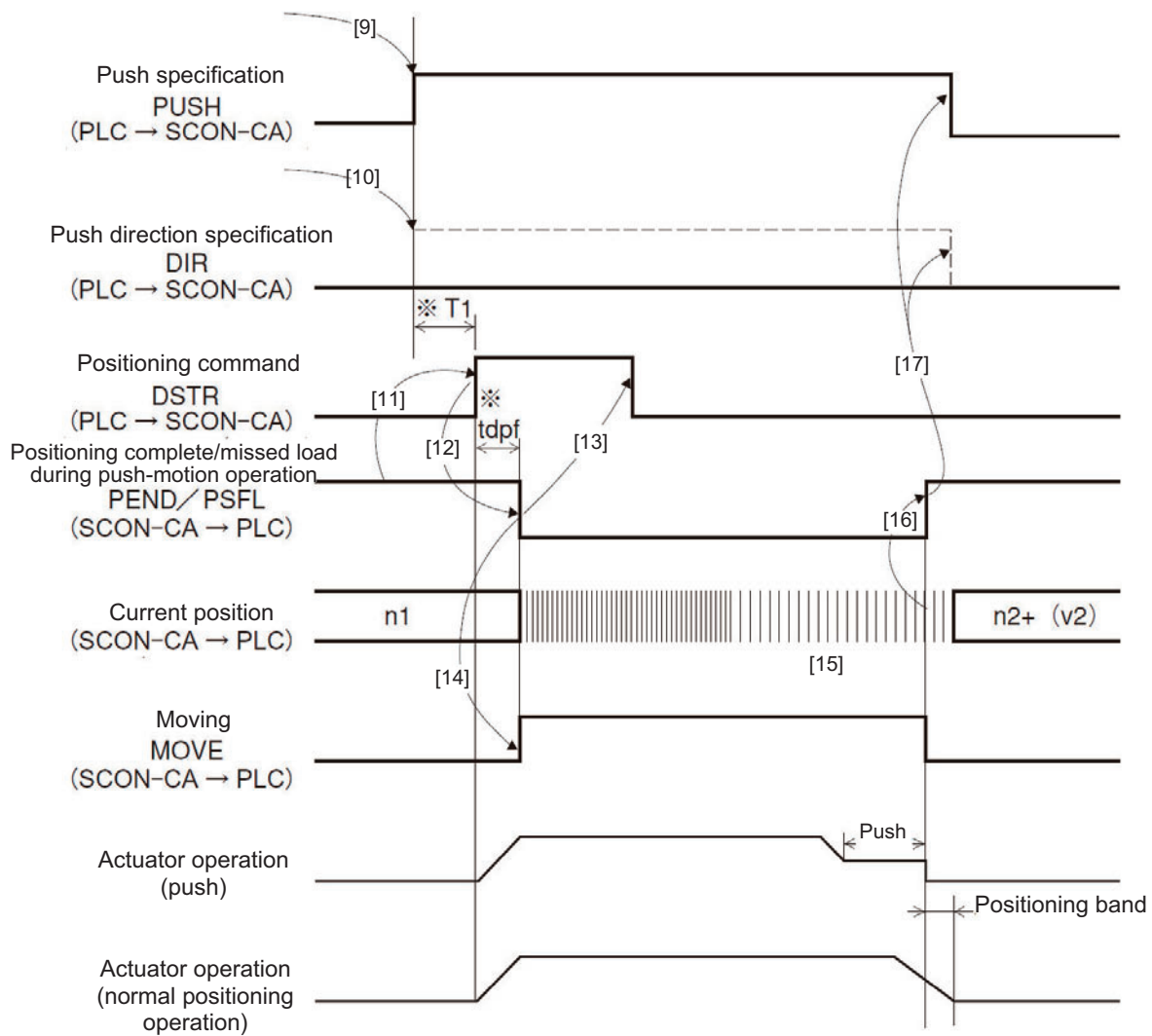
- Example of operation (normal positioning operation)

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.





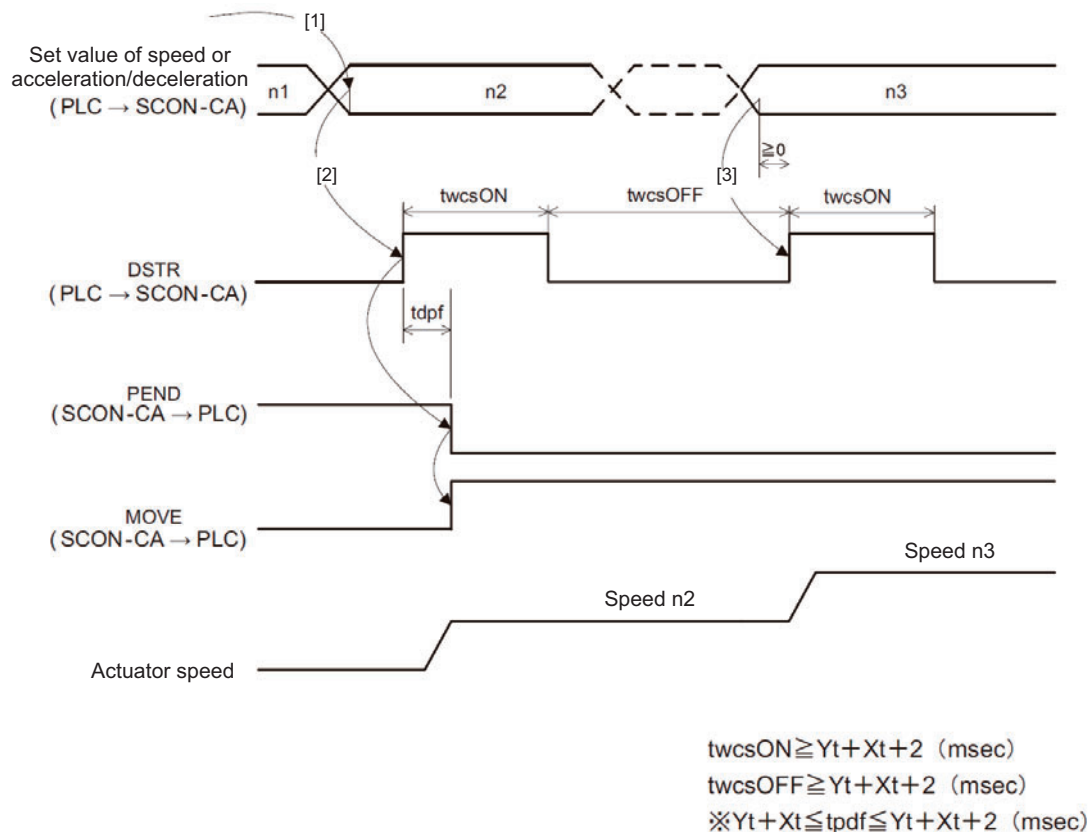
*T1: Make sure "T1 ≥ 0 ms" is satisfied by considering the scan time of the host controller.

*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.



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 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.	
2				
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.
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.

- 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)

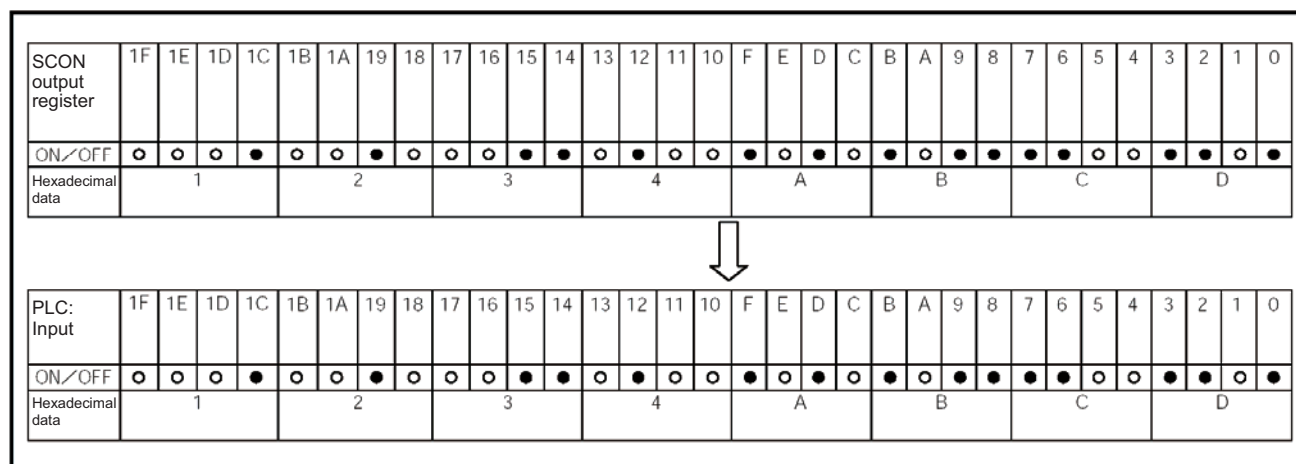
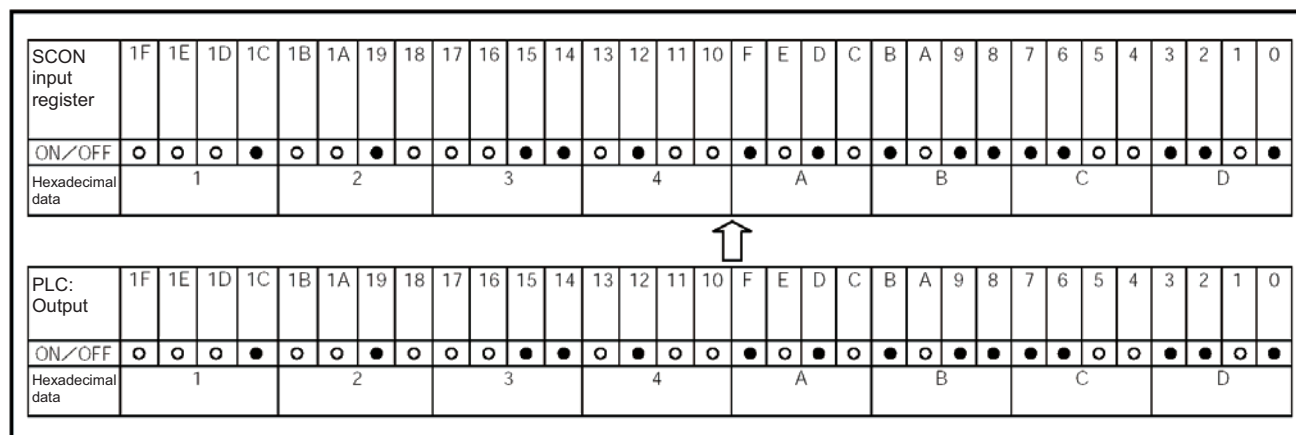
PLC addresses are assigned in units of 16 points (units of words) based on the I/O addresses set to the controller and number of occupied addresses in each mode.

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.)

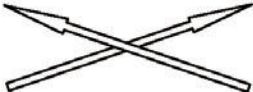
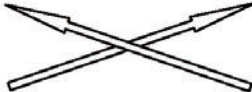
(Example i) Set value = "0"



● indicates ON, while ○ indicates OFF.



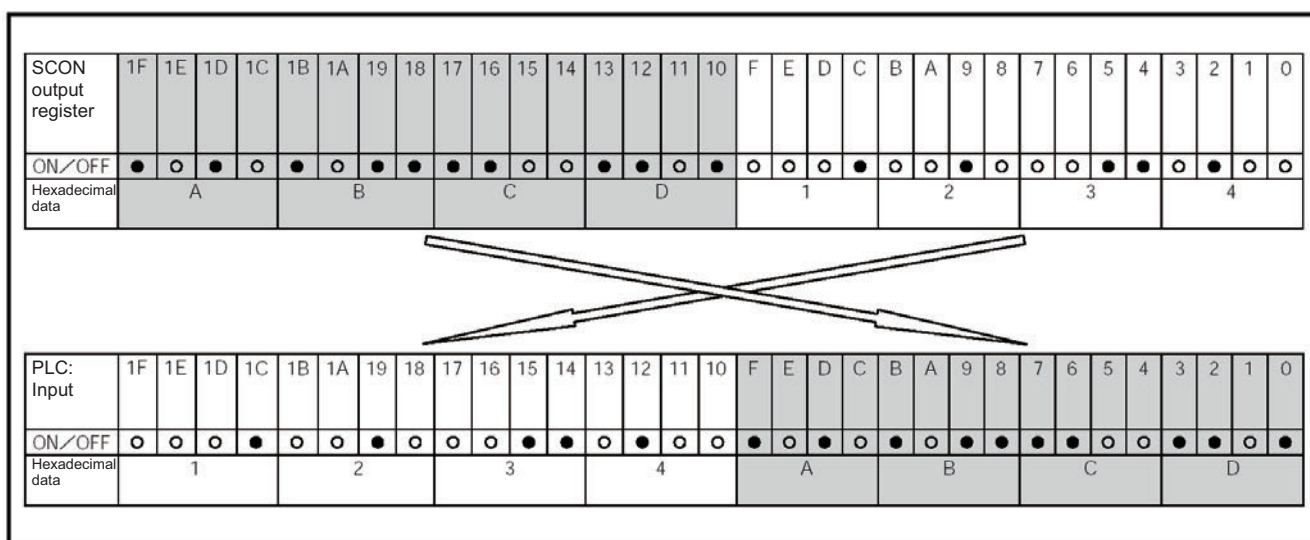
(Example ii) Set value = "1"

● indicates ON, while ○ 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	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	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○	●																															
Hexadecimal data	1				2				3				4				A				B				C				D																																		

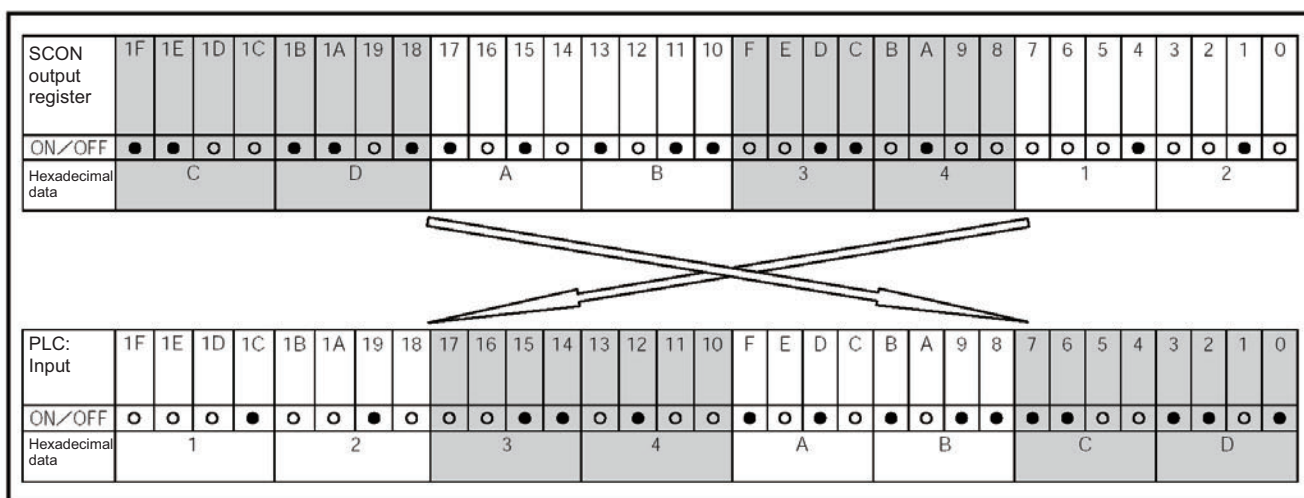
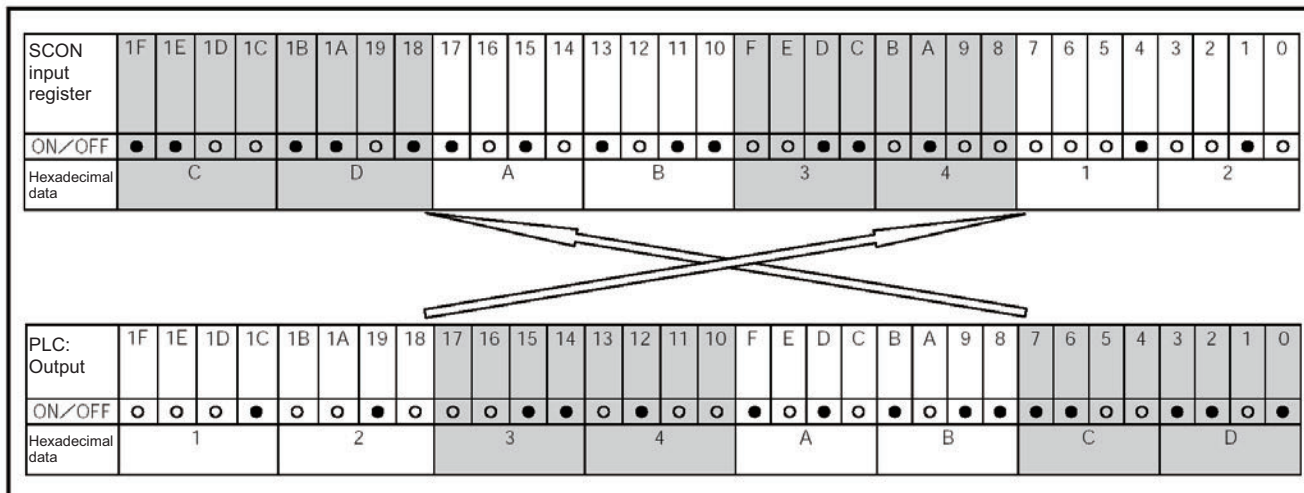
SCON output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																															
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	○	●	○	○	●	●																															
Hexadecimal data	3				4				1				2				C				D				A				B													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

● indicates ON, while O indicates OFF.



(Example iv) Set value = "3"

● indicates ON, while O indicates OFF.



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.

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.

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 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

5. 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



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