



Operation Manual, Second 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.
- EtherCAT(R) is a registered trademark of Beckoff Automation GmbH.

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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. However, especially give consideration to the prevention of condensation.
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

EtherCAT(R), which is an open field network, is a high-speed, high-precision global open network with extended IEEE 802.3 Ethernet standards.

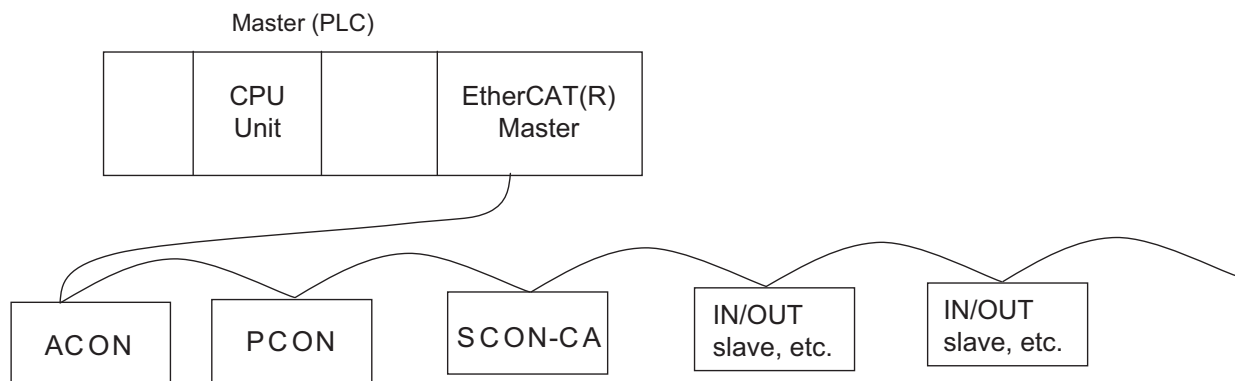
By connecting to EtherCAT(R), ACON, PCON, and SCON-CA controllers (hereinafter referred to collectively as “controllers” or individually as a “controller”) can be used to configure a system based on minimal wiring.

Each controller is treated as an I/O device on EtherCAT(R).

- * (Note 1) For further information on EtherCAT(R), refer to the Operation Manuals for the master unit and the programmable controller (PLC) to be mounted.
- (Note 2) EtherCAT(R) Distribution Clock is not supported and, thus, synchronization control is not available.
- (Note 3) Connections using products other than Omron's EtherCAT(R) master are not verified.
Connection with any other master unit needs to be verified by each customer. Furthermore, when a master unit of another manufacturer is being used, it needs to be set up manually as automatic network setup is not available.
Use this Operation Manual with operation manuals of each controller.
EtherCAT(R) cannot be used for any method other than those described as possible in this Operation Manual.

Use this operation manual with operation manual of each controller.

• System Configuration Example



1.1 EtherCAT(R) Specifications

Item	Specification
Communication standards	IEC61158Type12
Physical layer	100BASE-TX (IEEE802.3)
Communication cycle	Automatically set to the same value as the baud rate set in the master
Communication cable length	Refer to EtherCAT(R) specifications (Distance between nodes: 100 m max.)
Slave type	I/O slave
Applicable note address	0 to 127 (17 to 80 when connecting with Omron's Master Unit)
Communications cable	Straight cable of category 5e or above (Aluminum tape and braided double-shielded cable are recommended.)
Connector	Two RJ45 connectors (One each for input and output)
Connection	Daisy chain connection only

2. ACON, PCON

2.1 Operation Modes and Functions

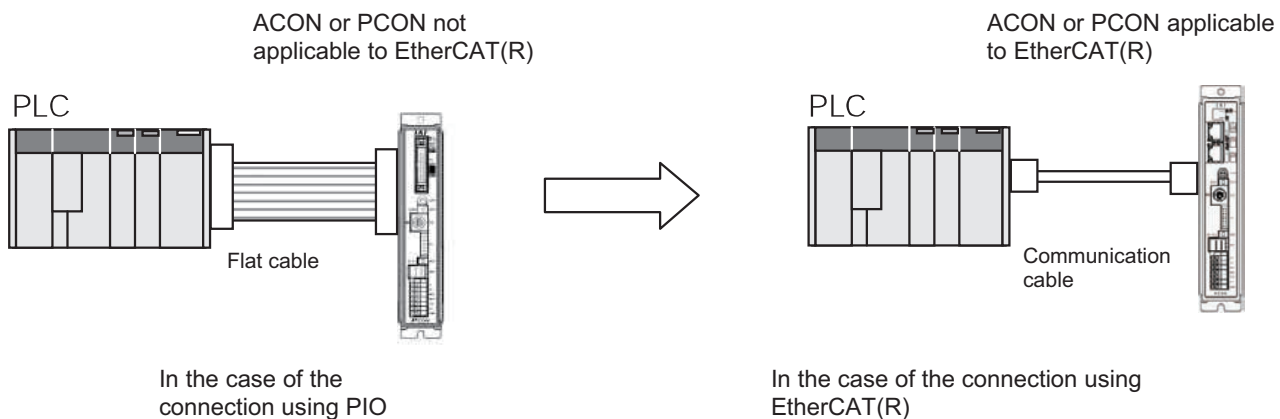
ACON or PCON applicable to EtherCAT(R) can be operated by means of selecting one mode out of the following five operation modes.

Operation Modes and Main Functions

Main Functions	Remote I/O Mode	Position/ Simplified Direct Value Mode	Half Direct Value Mode	Full Direct Value Mode	Remote I/O Mode 2
Number of occupied bytes	2	8	16	32	12
Position Data Setup Operation	x	○(*1)	○	○	x
Velocity and Acceleration Direct Setup	x	x	○	○	x
Pressing Operation	○	○	○	○	○
Current Position Read	x	○	○	○	○
Current Speed Read	x	x	○	○	x
Operation with the Position No. Specified	○	○	x	x	○
Completion Position No. Read	○	○	x	x	○
No. of Max. Position Tables	512	768	Unused	Unused	512

(*1) For the position data items except for position data, operate the system with the position No. set up.

[1] Remote I/O Mode: This is the operation method using EtherCAT(R), instead of PIO (24V I/O).
Number of occupied bytes: 2 bytes

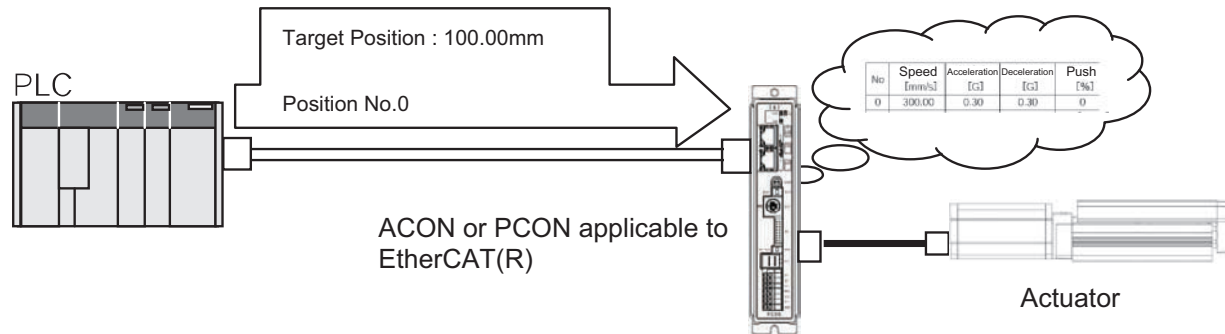


[2] Position / Simplified Direct Value Mode: This is the operation mode with the position No. set up.

Whether the target position is set directly by means of the changeover of the control signal, or the value registered on the position data is used can be selected.

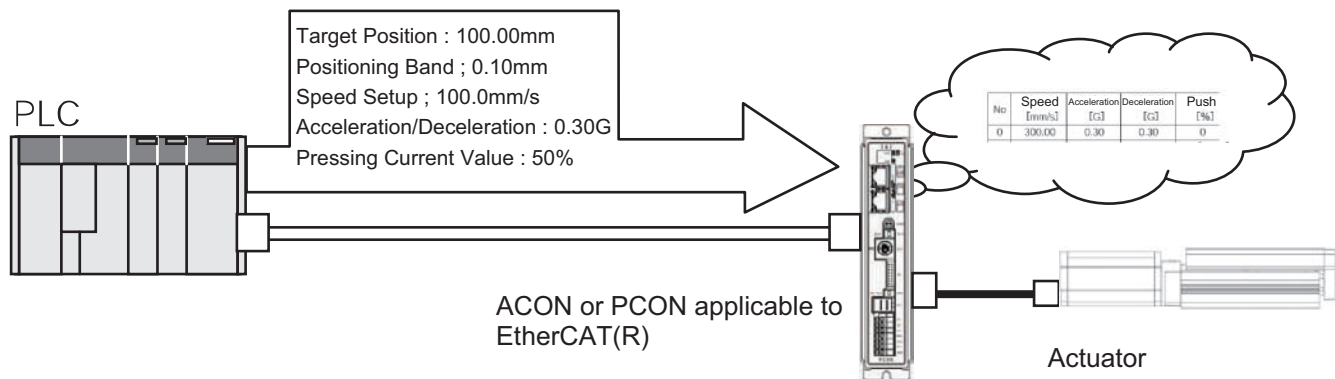
For "Speed", "Acceleration/Deceleration" and "Positioning Band", use the values already registered on the position data. The settable No. of position data items is max 768 points.

Number of occupied bytes: 8 bytes

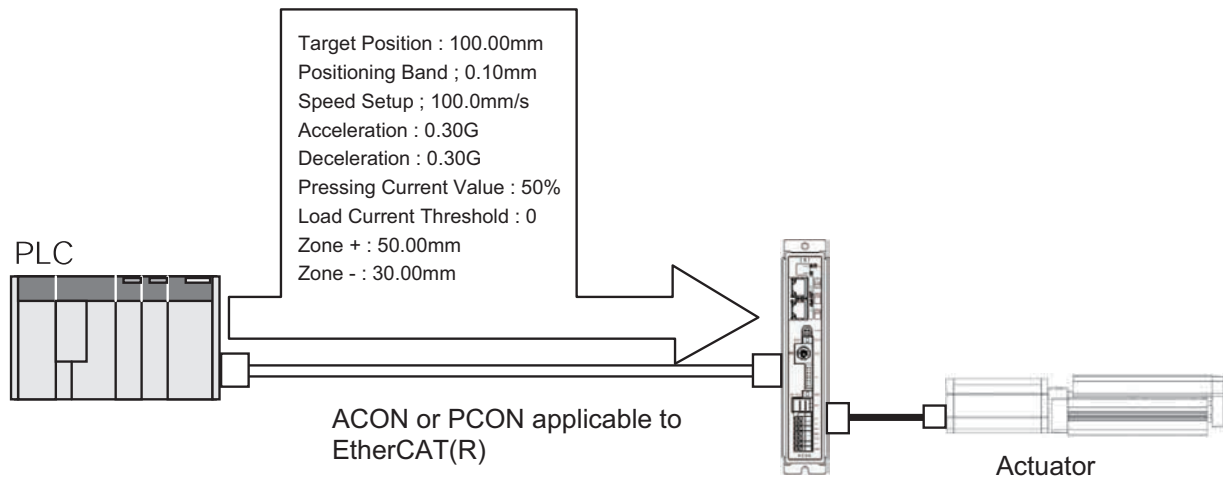


[3] Half Direct Value Mode: This is the operation method with the "Speed", "Acceleration/Deceleration", "Pressing Current Value" set up directly using the numerical values, in addition to the "Target Position".

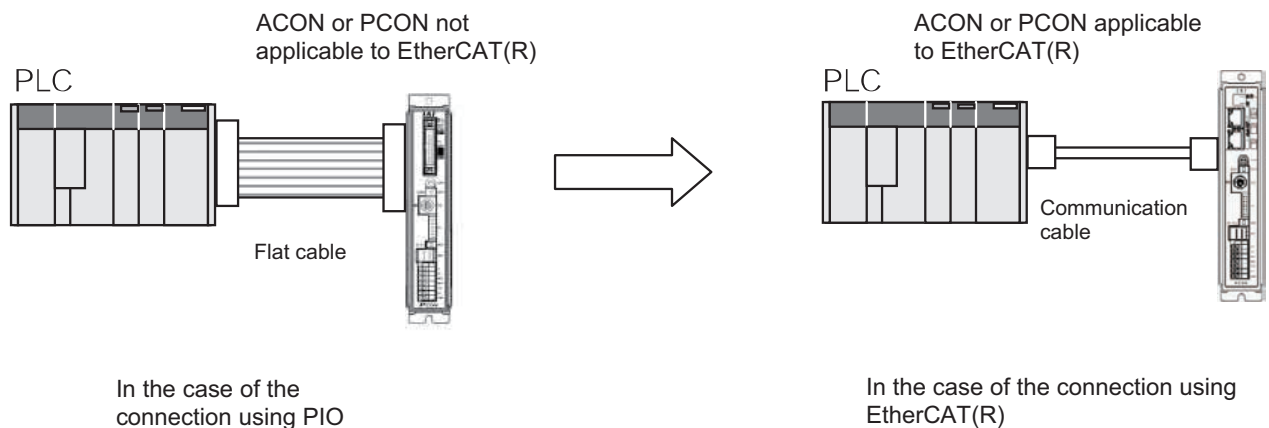
Number of occupied bytes: 16 bytes



- [4] Full Direct Value Mode: This is the operation method with all the values ("Target Position", "Speed", "Acceleration/Deceleration", etc.) related to the position control set up directly by using the numerical values.
Number of occupied bytes: 32 bytes



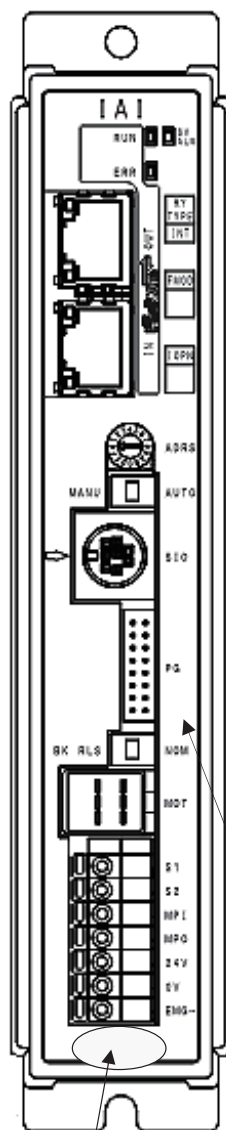
- [5] Remote I/O Mode 2: This is the operation method using EtherCAT(R), instead of PIO (24V I/O). The current position and command current value reading functions are added to the functions of [1].
Number of occupied bytes: 12 bytes



2.2 Model Numbers

The Model numbers of ACON and PCON applicable to EtherCAT(R) are described as follows.

- ACON-C/CG-□-EC-□
- PCON-C/CG-□-EC-□



Printed Series Name

- ACON
- PCON

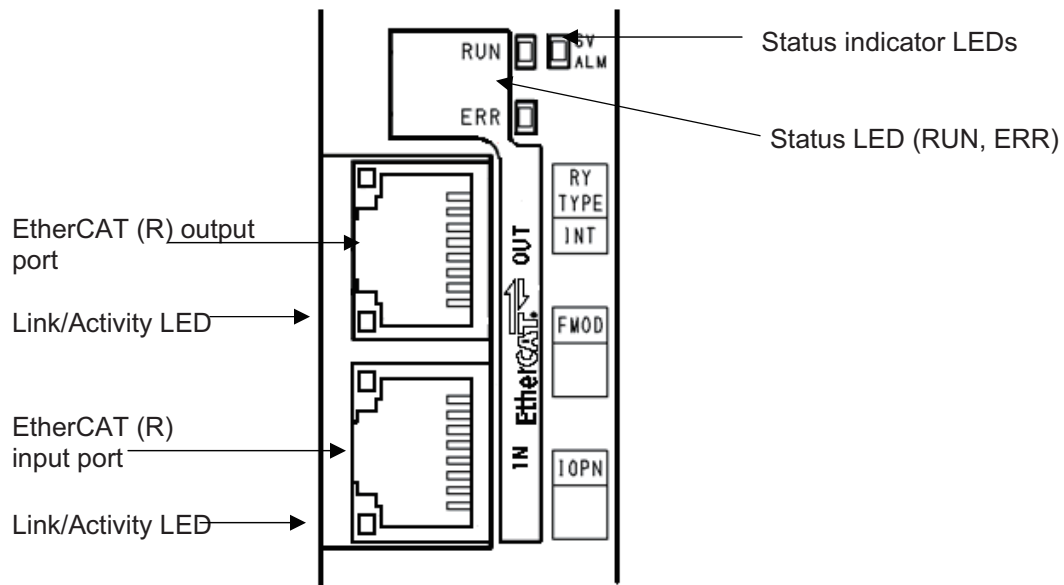
Front Panel Color

- ACON : Dark blue
- PCON : Dark green

2.3 EtherCAT(R) Interface

2.3.1 Names of the Parts

The names of each section related to EtherCAT(R) are described as follows.

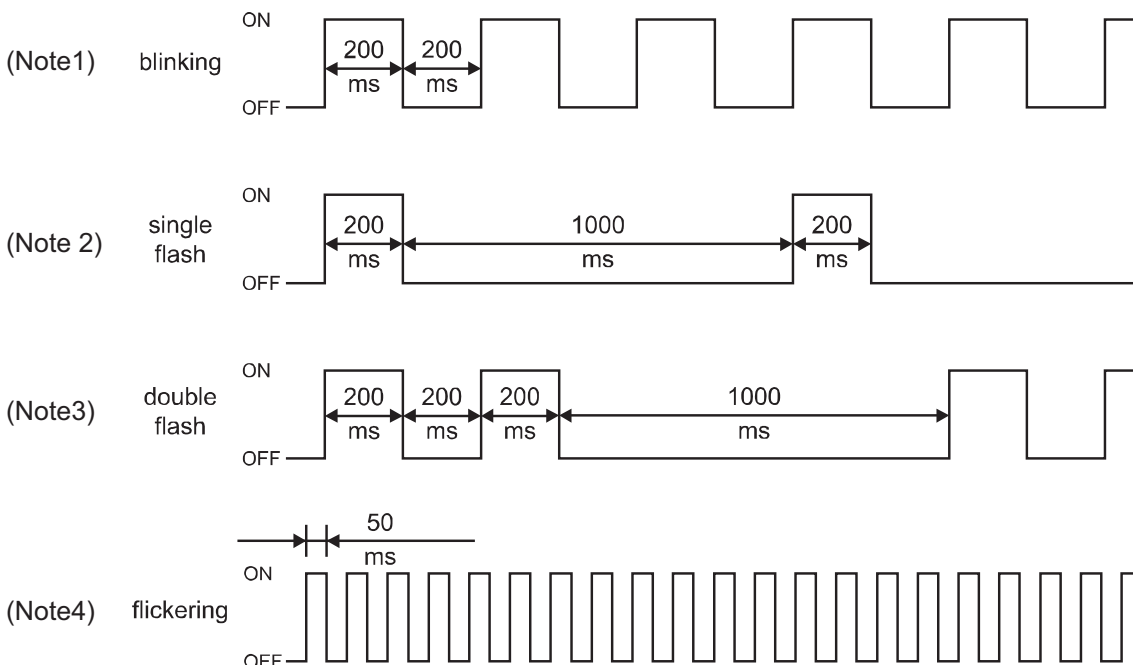


2.3.2 Monitor LED indications

The slave condition (each controller), as well as network condition, can be checked using the three LEDs, RUN, ERR and Link/Activity, provided on the front panel of the controller. The description of each is explained in the following table.

Name	Display color	Explanation
RUN	OFF	Initial status ("INIT" status of EtherCAT(R) communication), or the power is turned off
	GN (Illuminating)	Normal operation ("OPERATION" status of EtherCAT(R) communication)
	GN (Flashing) (ON: 200 ms/OFF: 200 ms) (Note1)	("PRE-OPERATION" status of EtherCAT(R) communication)
	GN (Flashing) (ON: 200 ms/OFF: 1000 ms) (Note2)	("SAFE-OPERATION" status of EtherCAT(R) communication)
	OR (Illuminating)	A communication part (module) error
ERR	OFF	No error, or the power is turned off.
	OR (Flashing) (ON: 200 ms/OFF: 200 ms) (Note1)	Configuration information (setting) error (Information received from the master cannot be configured.)
	OR (Flashing) (ON: 200 ms x twice /OFF: 1000 ms) (Note3)	Communication part circuit error (Watchdog timer timeout)
	OR (Illuminating)	Communication part (module) error
Link/ Activity	OFF	Link condition is not detected, or the power is turned off.
	GN (Illuminating)	Link established (No heavy traffic on the line)
	GN (Flashing) (ON: 50 ms/OFF: 50 ms) (Note4)	Link established (Heavy traffic on the line)

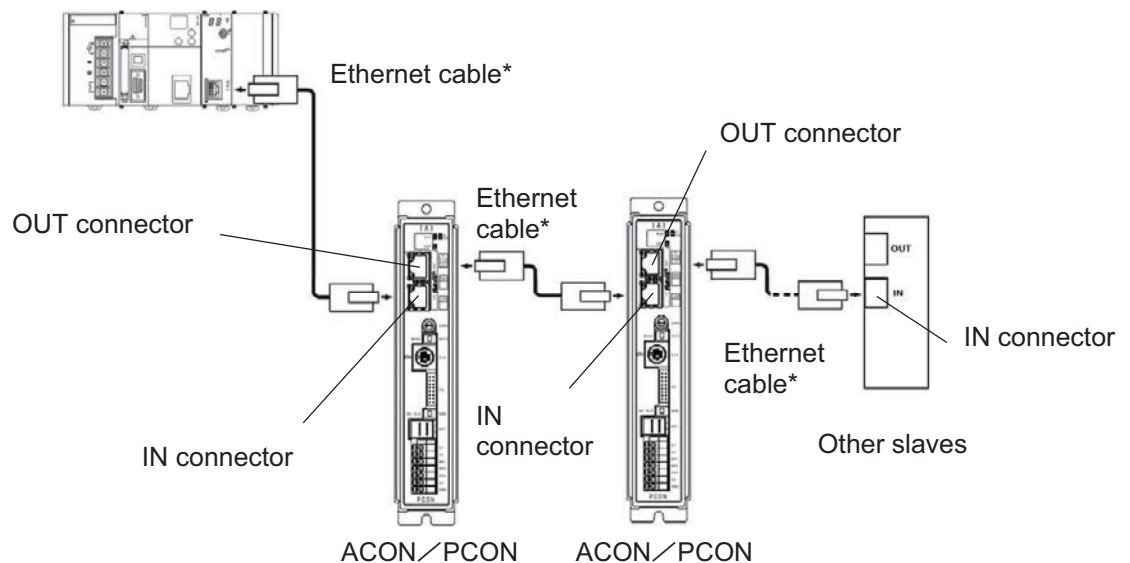
- LED Flash Timing



2.4 Wiring Example

2.4.1 Connection Diagram

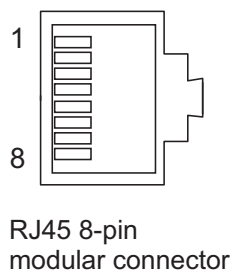
PLC (EtherCAT (R) Master Unit)



* Ethernet cable: Straight cable of category 5e or above, 100 m max
(Aluminum tape and braided double-shielded cable are recommended.)

(Note) Terminal processing is not required.

2.4.2 Connector Pin Layout



Pin number	Signal name	Signal abbreviation
1	Data transmitted +	TD+
2	Data transmitted -	TD-
3	Data received +	RD+
4	Not used	
5	Not used	
6	Data received -	RD-
7	Not used	
8	Not used	
Connector hood	Grounding pin for security	FG

2.5 Setting

Using the teaching tool, set controller parameters. Set the mode toggle switch on the front panel of the controller to “MANU” side. The versions of teaching tool compatible with EtherCAT(R) are as follows:

- RC PC-compatible software :V8.01.01.00 or later
- CON-T/TG :V1.10 (Planned)
- CON-PT/PD/PG :V1.20 (Planned)
- RCM-E/P :V2.20 (Planned)

2.5.1 Operation Mode Selecting

Set parameter No. 84 “FMODE: Field Bus Operation Mode.”

[Refer to 2.9 EtherCAT(R) Related Parameters.]

Set Value	Operation Mode	Number of occupied bytes
0 (Factory setting)	Remote I/O Mode	2
1	Position / Simplified Direct Value Mode	8
2	Half Direct Value Mode	16
3	Full Direct Value Mode	32
4	Remote I/O Mode	12

* Entering any value except for the ones described above will cause an “Excessive Input Value Error”.

2.5.2 Station No. Setting

Set parameter No. 85 “NADR: Field Bus Node Address.”

[Refer to 2.9 EtherCAT(R) Related Parameters.]

Settable Range:0 to 127 (It is set to “17” when the machine is delivered from the factory.)



Caution: Selecting a value between 17 and 80 (EtherCAT (R) I/O device range) is recommended for node address if Omron's master is being used.
If a value between 0 and 16 are selected, the Full Direct Value mode cannot be used.

- (Note) Exercise caution to avoid node address duplication.
The nodes (controllers) are assigned in the order of their node address in the remote memory areas of the PLC.
For details, refer to the Operation Manuals of the master unit and PLC in which in the master unit is installed.
- (Note) The setting for the communication speed is not required because it automatically follows the master's communication speed.
- (Note) After the parameter setting, turn on the power to the controller again and return the mode toggle switch on the front of the controller to “AUTO” side.
When the switch is set to “MANU”, the operation using PLC is not available.

2.6 Communicating with the Master Station

2.6.1 Operation Modes and Corresponding PLC I/O Areas

The channels allocated for each operation mode are described as follows.

- PLC Output → ACON/PCON input (* “n” shows the node address of each axis.)

PLC output area (bytes)	DI on the ACON or PCON side and Input Data Register					
	Remote I/O Mode	Position / Simplified Direct Value Mode	Half Direct Value Mode	Full Direct Value 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, n+1	Port No.0 to 15	Target Position	Target Position	Target Position	Port No.0 to 15	
n+2, n+3		Specified position number	Positioning Band	Positioning Band	Occupied area	
n+4, n+5		Control Signal				
n+6, n+7			Velocity	Speed Setup		
n+8, n+9			Acceleration/ Deceleration			
n+10, n+11			Pressing Current Limit Value	Zone boundary+		
n+12, n+13			Control Signal			
n+14, n+15				Zone boundary-		
n+16, n+17				Acceleration		
n+18, n+19				Deceleration		
n+20, n+21				Pressing Current Limit Value		
n+22, n+23				ACON		Occupied area
n+24, n+25				PCON		Load current threshold
n+26, n+27						
n+28, n+29				Control Signal 1		
n+30, n+31				Control Signal 2		

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting. Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

- ACON/PCON output→PLC Input Side (* “n” shows the node address of each axis.)

PLC input area (bytes)	DO on the ACON or PCON side and Output Data Register				
	Remote I/O Mode	Position / Simplified Direct Value Mode	Half Direct Value Mode	Full Direct Value 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, n+1	Port No.0 to 15	Target Position	Target Position	Target Position	Port No.0 to 15
n+2, n+3					Occupied area
n+4, n+5		Completed Position No. (simple alarm ID)	Command Current	Command Current	Target Position
n+6, n+7		Status Signal			
n+8, n+9			Current Speed	Current Speed	Command Current
n+10, n+11			Alarm Code	Alarm Code	
n+12, n+13			Status Signal	Occupied area	
n+14, n+15					
n+16, n+17					
n+18, n+19					
n+20, n+21					
n+22, n+23					
n+24, n+25					
n+26, n+27					
n+28, n+29					
n+30, n+31				Status Signal	

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting.
Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

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

This is the operation mode with the position No. set up as the same as using PIO (24V I/O).

Set the position data using compatible teaching tools.

The number of operable positions varies depending on the parameter No. 25 “PIO Pattern” setting.

The I/O specifications for the PIO pattern are described as follows. (Refer to Operation Manual for the controller main body for more information.)

Value set in parameter No. 25	Operation Mode	I/O Specification
0	Positioning mode	64 positioning points and two zone output points are available.
1	Teaching mode	64 positioning points and one zone output point are available. Positioning operation and jog operation are supported. The current position can be written to a specified position.
2	256-point mode	256 positioning points and one zone output point are available.
3	512-point mode	512 positioning points are available. There are no zone outputs.
4	Electromagnetic valve mode 1	7 positioning points and two zone output points are available. The direct operation command is available for each position No. A position complete signal is output for each position number.
5	Electromagnetic valve mode 2	3 positioning points and two zone output points are available. The actuator is operated by specifying forward, backward and intermediate position commands. A position complete signal is output separately for the front end, rear end and intermediate position.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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

○:Supported, x:Not supported

(*1) It is available when the parameter No. 27 “Movement Command Type” is set to “0”.
Turning “OFF” the “Movement Command” can stop the system temporarily.

(1) PLC channel configuration (* “n” shows the node address of each axis.)

Parameter No.84	ACON/PCON DI (Port No.)	PLC output address (bytes)	ACON/PCON DO (Port No.)	PLC input address (bytes)
0	0 to 15	n+0, n+1	0 to 15	n+0, n+1

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (1 word = 2 bytes) and one output word in the I/O areas.

- This is controlled by ON/OFF bit signals from the PLC.

PLC output (* “n” shows the node address of each axis.)

address	1 word = 2 bytes = 16 bit															
n+0, n+1	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 (* “n” shows the node address of each axis.)

address	1 word = 2 bytes = 16 bit															
n+0, n+1	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller output port number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignment

The controller's I/O port signal varies depending on the parameter No. 25 setting.
(Refer to Operation Manual for the controller main body for more information.)

ACON

		Parameter No. 25 setting					
		Positioning mode		Teaching mode		256-point mode	
		0		1		2	
Category	Port No.	Signal Name	Symbol	Signal Name	Symbol	Signal Name	Symbol
PLC Output → ACON Input	0	Command position No.	PC1	Command position No.	PC1	Command position No.	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Unavailable	-	Teaching Mode Command	MODE	Unavailable	PC64
	7		-	Jog/inching selector	JISL		PC128
	8		-	+Jog	JOG+		-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning Start	CSTR	Positioning Start/ Position Data Import 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 No.	PM1	Completed Position No.	PM1	Completed Position No.	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	Unavailable	PM64
	7	Zone 1	ZONE1	Teaching mode Signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE		PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal/ position-data read complete	PEND/ WEND	Positioning completion signal	PEND
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Unavailable	-	Unavailable	-	Unavailable	-

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled. (ON/OFF is undefined.)

ACON

		Parameter No. 25 setting					
		512-point mode		Electromagnetic valve mode 1		Electromagnetic valve mode 2	
		3		4		5	
Category	Port No.	Signal Name	Symbol	Signal Name	Symbol	Signal Name	Symbol
PLC Output → ACON Input	0	Command position No.	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	Unavailable	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Unavailable	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Unavailable	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning Start	CSTR	Unavailable	-		-
	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 No.	PM1	Position 0 complete	PE0	Retracting end movement command 0	LS0
	1		PM2	Position 1 complete	PE1	Retracting end movement command 1	LS1
	2		PM4	Position 2 complete	PE2	Retracting end movement command 2	LS2
	3		PM8	Position 3 complete	PE3	Unavailable	-
	4		PM16	Position 4 complete	PE4		-
	5		PM32	Position 5 complete	PE5		-
	6		PM64	Position 6 complete	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal	PEND	Unavailable	-
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	SV
	13	Emergency stop	*EMGS	Emergency stop	*EMGS	Emergency stop	*EMGS
	14	Alarm	*ALM	Alarm	*ALM	Alarm	*ALM
	15	Unavailable	-	Unavailable	-	Unavailable	-

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled.(ON/OFF is undefined.)

PCON

		Parameter No. 25 setting					
		Positioning mode		Teaching mode		256-point mode	
		0		1		2	
Category	Port No.	Signal Name	Symbol	Signal Name	Symbol	Signal Name	Symbol
PLC Output → PCON Input	0	Command position No.	PC1	Command position No.	PC1	Command position No.	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Unavailable	-	Teaching Mode Command	MODE		PC64
	7		-	Jog/inching selector	JISL		PC128
	8		-	+Jog	JOG+	Unavailable	-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning Start	CSTR	Positioning Start/ Position Data Import 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 No.	PM1	Completed Position No.	PM1	Completed Position No.	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		PM64
	7	Zone 1	ZONE1	Teaching mode Signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE	Position zone	PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal/ position-data read complete	PEND/ WEND	Positioning completion signal	PEND
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	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	Unavailable	-	Load output judgment/ torque level	LOAD/ TRQS

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled. (ON/OFF is undefined.)

PCON

		Parameter No. 25 setting					
		512-point mode		Electromagnetic valve mode 1		Electromagnetic valve mode 2	
		3		4		5	
Category	Port No.	Signal Name	Symbol	Signal Name	Symbol	Signal Name	Symbol
PLC Output → PCON Input	0	Command position No.	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	Unavailable	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Unavailable	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Unavailable	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning Start	CSTR	Unavailable	-		-
	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 No.	PM1	Position 0 complete	PE0	Retracting end movement command 0	LS0
	1		PM2	Position 1 complete	PE1	Retracting end movement command 1	LS1
	2		PM4	Position 2 complete	PE2	Retracting end movement command 2	LS2
	3		PM8	Position 3 complete	PE3	Unavailable	-
	4		PM16	Position 4 complete	PE4		-
	5		PM32	Position 5 complete	PE5		-
	6		PM64	Position 6 complete	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal	PEND	Unavailable	-
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	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	Unavailable	-

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled.(ON/OFF is undefined.)

2.6.3 Position/Simplified Direct Value Mode (Number of Occupied Bytes: 8)

This is the operation mode with the position No. set up. Whether the target position is set directly the control signals (PMOD signals), or the value registered on the position data is used can be selected.

For the speed, acceleration/deceleration and positioning band, etc., except for the target position, the values in the position table within the controller are used. Setup the position data referring the operation manual for the controller main body.

The settable No. of position data items is max 768 points.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	△	These items must be set in the position data table.
Pitch feed (inching)	△	
Pressing Operation	△	
Speed change during the 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” shows the node address of each axis.)

Parameter No.84	ACON/PCON input register	PLC output address (bytes)	ACON/PCON output register	PLC input address (bytes)
1	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Specified position number	n+4, n+5	Completed Position No. (Simple alarm code)	n+4, n+5
	Control Signal	n+6, n+7	Status Signal	n+6, n+7

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of four input words (4 words = 8 bytes) and four output words in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2 words (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- The specified position No. and completed position No. are expressed using 1-word (16 bits) binary data. The figures from 0 to 767 can be set in PLC. However, set the position No. for which the operation conditions have been set in advance using the PC software or teaching tools.

PLC output

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits																
n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																

n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

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

n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.	—	—	—	—	—	—	PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

n+6, n+7	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 assignment (* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between -999999 to +999999. (Example) When it is "+25.40mm", set it as "2540". If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	2.8 (1)
	Specified position number	16-bit data	PC1 to PC512 16-bit integer For the operation, the position data is required, for which the operation conditions have been set in advance using the teaching tools such as PC software. Set up the position No. for which the data has been input using this register. The settable range is 0 to 767. In the case that any value out of the range is set, or position No. that has not been set is specified, an alarm is output.	2.8 (1)
	Control signal	b15	BKRL Forced brake release: When it is turned ON, the brake is released.	2.6.7 (18)
		b14	RMOD Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.	2.6.7 (19)
		b13	- Unavailable	-
		b12		
		b11	PMOD Position/simple-direct switching: The position mode is selected when this signal is OFF, and the simple direct mode is selected when the signal is ON.	2.6.7 (20)
		b10	MODE Teaching Mode Command: The normal mode is selected when this signal is OFF, and the teaching mode is selected when the signal is ON.	2.6.7 (16)
		b9	PWRT Position Data Import Command: Position data is read when this signal is ON.	2.6.7 (17)
		b8	JOG+ +Jog: "ON" for Movement in the Opposite Direction of Home	2.6.7 (13)
		b7	JOG- -Jog: "ON" for Movement to the Home Direction	2.6.7 (13)
		b6	JVEL Jog-speed/inch-distance switching: The values set in parameter No. 26, "Jog speed" and parameter No. 48, "Inch distance" are used when this signal is OFF, and the values set in parameter No. 47, "Jog speed 2" and parameter No. 49, "Inch distance 2" are used when the signal is ON.	2.6.7 (14)
		b5	JISL Jog/ inching selector: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.	2.6.7 (15)
		b4	SON Servo ON Command: The servo turns ON when this signal turns ON.	2.6.7 (5)
		b3	RES Reset: A reset is performed when this signal turns ON.	2.6.7 (4)
		b2	STP Pause: A pause command is issued when this signal turns ON.	2.6.7 (11)
		b1	HOME Home return: A home-return command is issued when this signal turns ON.	2.6.7 (6)
		b0	CSTR Positioning Start: A move command is issued when this signal turns ON.	2.6.7 (7)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit	-	Current Position: 32-bit signed Integer. The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal)=10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	2.8 (1)
	Completed Position No. (Simple alarm code)	16-bit	PM1 to PM512	16-bit integer It is moved to the target position and the positioning completed position No. within the positioning band is output. In the case that the position movement has not been performed at all, or during the movement, "0" is output. When an alarm is issued (in the case that the status signal ALM is "ON"), the simplified alarm code (Refer to the Operation Manual for the controller main body) is output.	2.8 (1)
	Status code	b15	EMGS	Emergency stop: An emergency stop is actuated when this signal turns ON.	2.6.7 (2)
		b14	PWR	Controller ready : This signal turns ON when the controller becomes ready.	2.6.7 (1)
		b13	ZONE2	Zone 2:"ON" for the current position within the zone set range	2.6.7 (12)
		b12	ZONE1	Zone 1:"ON" for the current position within the zone set range	2.6.7 (12)
		b11	PZONE	Position zone: This signal turns ON when the current position is inside the specified position zone.	2.6.7 (12)
		b10	MODES	Teaching mode Signal: This signal is ON while the teaching mode is selected.	2.6.7 (16)
		b9	WEND	Position-data read complete : This signal turns ON when reading is complete.	2.6.7 (17)
		b8	RMDS	Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	2.6.7 (19)
		b7	-	Unavailable	-
		b6			
		b5	PSEL	Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	2.6.7 (23)
		b4	SV	Operation preparation end: This signal turns ON when the servo turns ON.	2.6.7 (5)
		b3	ALM	Alarm: This signal turns ON when an alarm occurs.	2.6.7 (3)
		b2	MOVE	Moving Signal: This signal remains ON while the actuator is moving.	2.6.7 (9)
		b1	HEND	Home return completion: This signal turns ON when home return is completed.	2.6.7 (6)
		b0	PEND	Positioning completion signal: This signal turns ON when positioning is completed.	2.6.7 (10)

2.6.4 Half Direct Value Mode (Number of Occupied Bytes: 16)

This is the operation mode with the target position, positioning band, speed, acceleration/deceleration and pressing current value set up in the PLC. Set each value in the I/O areas. When the zone function is used, set it using the parameter Nos. 1, 2, 23 and 24.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remark
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	○	
Pitch feed (inching)	○	
Pressing Operation	○	
Speed change during the movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* "n" shows the node address of each axis.)

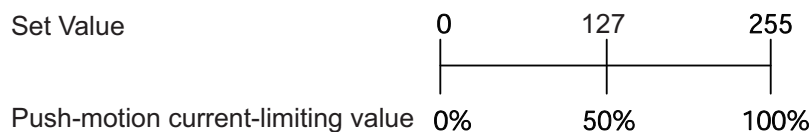
Parameter No.84	ACON/PCON input register	PLC output address (bytes)	ACON/PCON output register	PLC input address (bytes)
2	Target Position	n, n+1	Current Position	n, n+1
		n+2, n+3		n+2, n+3
	Positioning Band	n+4, n+5	Command Current	n+4, n+5
		n+6, n+7		n+6, n+7
	Velocity	n+8, n+9	Current Speed	n+8, n+9
	Acceleration/Deceleration	n+10, n+11		n+10, n+11
	Pressing Current Limit Value	n+12, n+13	Alarm Code	n+12, n+13
	Control signal	n+14, n+15	Status Signal	n+14, n+15

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (8 words = 16 bytes) and one output word in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 1-word (16 bits) binary data. The figures from 0 to +65535 (Unit: 1.0mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 255 (100%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC output

Address (* "n" shows the node address of each axis.)

n+0, n+1		1 word = 2 bytes =16 bits															
		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																	
n+2, n+3		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																	

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (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+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (upper word)													524,288	262,144	131,072	65,536
n+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity	32,768	16,384	8,192	4,096	2,048	1,024	512	256	128	64	32	16	8	4	2	1
n+10, n+11	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+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Pressing Current Limit Value									128	64	32	16	8	4	2	1
n+14, n+15	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" shows the node address of each axis.)

		1 word = 2 bytes =16 bits															
n+0, n+1		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																	
n+2, n+3		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																	

When the Current Position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (lower word)																
n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (upper word)																

When the Current Speed is shown using the negative figure, it is expressed using the complement of 2.

n+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																
n+14, n+15	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 assignment* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	-	<p>32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between -999999 to +999999. (Example) When it is "+25.41mm", set it as "2541". If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.</p>	2.8 (2)
	Positioning Band	32-bit data	-	<p>32-bit integer The unit is 0.01mm and settable range is between 1 to +999999. (Example) When it is "25.40mm", set it as "2540". This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position, that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the "PUSH" control signal setting.</p>	2.8 (2)
	Velocity	16-bit data	-	<p>16-bit integer Specify the speed at which to move the actuator. The unit is 1.0mm/sec and settable range is 0 to 65535. (Example) When it is "254.0mm/sec", set it as "254". When the movement command is set with the value bigger than the max. speed, an alarm is issued.</p>	2.8 (2)
	Acceleration/Deceleration	16-bit data	-	<p>16-bit integer Specify the acceleration / deceleration at which to move the actuator (the acceleration and deceleration will be the same value). The unit is 0.01G and settable range is 1 to 300. (Example) To set "0.30 G", specify "30". If a move command is issued by specifying "0" or any value exceeding the maximum acceleration or deceleration, an alarm will occur.</p>	2.8 (2)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Pressing Current Limit Value	16-bit data	-	16-bit integer Specify the current-limiting value to be used during push-motion operation. The allowable specification range is 0 (0%) to 255 (100%). The actual settable range varies depending on each actuator.(Refer to the catalog or Operation Manual for the actuator.) If a move command is issued by specifying a value exceeding the maximum push-motion current, an alarm will occur.	2.8 (2)
	Control Signal	b15	BKRL	Forced brake release: When it is turned ON, the brake is released.	2.6.7 (18)
		b14	RMOD	Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.	2.6.7 (19)
		b13	DIR	Push direction specification: “OFF” for the direction reducing the positioning band from the target position, “ON” for the direction adding the positioning band to the target position	2.6.7 (22)
		b12	PUSH	Push-motion specification: Positioning operation is performed when this signal is OFF, and push-motion operation is performed when the signal is ON.	2.6.7 (21)
		b11	-	Unavailable	-
		b10			
		b9			
		b8	JOG+	+ Jog: “ON” for Movement in the Opposite Direction of Home	2.6.7 (13)
		b7	JOG-	-Jog: “ON” for Movement to the Home Direction	2.6.7 (13)
		b6	JVEL	Jog-speed/inch-distance switching: The values set in parameter No. 26, “Jog speed” and parameter No. 48, “Inch distance” are used when this signal is OFF, and the values set in parameter No. 47, “Jog speed 2” and parameter No. 49, “Inch distance 2” are used when the signal is ON.	2.6.7 (14)
		b5	JISL	Jog/inch switching: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.	2.6.7 (15)
		b4	SON	Servo ON Command: The servo turns ON when this signal turns ON.	2.6.7 (5)
		b3	RES	Reset: A reset is performed when this signal turns ON.	2.6.7 (4)
		b2	STP	Pause: A pause command is issued when this signal turns ON.	2.6.7 (11)
		b1	HOME	Home return: A home-return command is issued when this signal turns ON.	2.6.7 (6)
		b0	DSTR	Positioning Command: A move command is issued when this signal turns ON.	2.6.7 (8)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	- 32-bit signed integer indicating the current position The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	2.8 (2)
	Command Current	32-bit data	- 32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. (Example) Reading:000003FF _H =1023 (decimal) =1023mA	2.8 (2)
	Current Speed	32-bit data	- 32-bit signed integer indicating the current position 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 setting unit is 0.01mm/sec. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm/sec * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	2.8 (2)
	Alarm Code	16-bit data	- 16-bit integer When an alarm is issued, the alarm code is output. When any alarm is not issued, it is "0 _H ". Refer to the Operation Manual for the controller main body for the details of the alarms.	2.8 (2)
	Status Signal	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	2.6.7 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	2.6.7 (1)
		b13	ZONE2 Zone 2:"ON" for the current position within the zone set range	2.6.7 (12)
		b12	ZONE1 Zone 1:"ON" for the current position within the zone set range	2.6.7 (12)
		b11	- Unavailable	-
		b10		
		b9		
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	2.6.7 (19)
		b7	- Unavailable	-
		b6		
		b5	PSEL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	2.6.7 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	2.6.7 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	2.6.7 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	2.6.7 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	2.6.7 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	2.6.7 (10)

2.6.5 Full Direct Value Mode (Number of Occupied Bytes: 32)

This is the operation mode with all the values (target position, speed, etc.) set up directly using values from PLC. Set each value in the I/O area.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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

(1) PLC address configuration (* "n" shows the node address of each axis.)

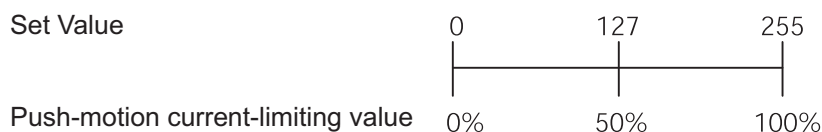
Parameter No.84	ACON/PCON input register		PLC output address (bytes)	ACON/PCON output register	PLC input address (bytes)
3	Target Position		n, n+1	Current Position	n, n+1
			n+2, n+3		n+2, n+3
	Positioning Band		n+4, n+5	Command Current	n+4, n+5
			n+6, n+7		n+6, n+7
	Velocity		n+8, n+9	Current Speed	n+8, n+9
			n+10, n+11		n+10, n+11
	Zone boundary +		n+12, n+13	Alarm Code	n+12, n+13
			n+14, n+15		n+14, n+15
	Zone boundary -		n+16, n+17	Occupied area	n+16, n+17
			n+18, n+19		n+18, n+19
	Acceleration		n+20, n+21		n+20, n+21
	Deceleration		n+22, n+23		n+22, n+23
	Pressing Current Limit Value		n+24, n+25		n+24, n+25
	ACON	Occupied area	n+26, n+27		n+26, n+27
	PCON	Load current threshold			
Control Signal 1		n+28, n+29	n+28, n+29		
Control Signal 2		n+30, n+31	Status Signal	n+30, n+31	

(Note) The areas denoted by **Occupied area** cannot be used for any other purpose.
Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (16 words = 32 bytes) and one output word in the I/O areas.

- Control signals 1 and 2 and status signals are ON/OFF bit signals.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 255 (100%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- Set the load current threshold. The load current threshold is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 255 (100%) can be set in PLC. (Refer to the graph of push-motion current-limiting value (above graph).)
- Zone Boundary “+” and Zone Boundary “-” are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 can be set in PLC. However make sure to set the smaller value for the Zone Boundary “-” than that for the Zone Boundary “+”.
- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC output
address (* "n" shows the node address of each axis.)

1 word = 2 bytes =16 bits																
n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (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+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (upper word)													524,288	262,144	131,072	65,536
n+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity (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+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity (upper word)													524,288	262,144	131,072	65,536
n+12, + n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary + (lower word)																
n+14, n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary + (upper word)																

When the zone boundary is shown using the negative figure, it is expressed using the complement of 2.

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes =16 bits																
n+16, n+17	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary – (lower word)																
n+18, +n+19	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary – (upper word)																

When the zone boundary is shown using the negative figure, it is expressed using the complement of 2.

n+20, n+21	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+22, n+23	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+24, n+25	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Pressing Current Limit Value									128	64	32	16	8	4	2	1
n+26, n+27	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Load current threshold (*3)									128	64	32	16	8	4	2	1
n+28, n+29	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal 1						(*1)			(*2)			INC	DIR	PUSH		
n+30, n+31	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Control Signal 2	BKRL	RMOD						JOG+	JOG-	JVEL	JISL	SON	RES	STP	HOME	DSTR

(*1) Signal assignment for b10 of n+28, n+29

Controller	Symbol	
	ACON	PCON
b10	-	SMOD

(*2) Signal assignment for b7 and b6 of n+28, n+29

Controller	Symbol	
	ACON	PCON
b7	MOD1	-
b6	MOD0	-

(*3) This is a dedicated function for PCON controllers. It is not available with ACON controllers.

PLC input

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (lower word)																
n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (upper word)																

When the current speed is shown using the negative figure, it is expressed using the complement of 2.

n+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																
n+14 to n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																
n+30, n+31	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) Signal assignment for b10 and b9 of n+30, n+31

	Symbol	
Controller	ACON	PCON
b10	-	LOAD
b9	-	TRQS

(3) I/O signal assignment (* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed integer indicating the current position Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is -999999 to +999999. (Example) When it is "+25.41mm", set it as "2541". If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). * When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	2.8 (3)
	Positioning Band	32-bit data	- 32-bit integer The unit is 0.01mm and settable range is 1 to +999999. (Example) When it is "25.40mm", set it as "2540". This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position, that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the "PUSH" control signal setting.	2.8 (3)
	Velocity	32-bit data	- 32-bit integer Specify the speed at which to move the actuator. The unit is 0.01 mm/sec and the settable range is 0 to 999999. (Example) When it is "25.41mm/sec", set it as "2541". When the movement command is set with the value bigger than the max. speed, an alarm is issued.	2.8 (3)
	Zone boundary+ /Zone boundary-	32-bit data	- 32-bit signed integer indicating the current position After completion of home return, an effective zone signal can be output separately from the zone boundaries specified by parameters. The status signal PZONE turns ON when the current position is inside these +/- boundaries. (Example) When it is "+25.40mm", set it as "2540". The unit is 0.01mm and the settable range is -999999 to 999999. Enter a value that satisfies the relationship of "Zone boundary + > Zone boundary -". If this function is not used, enter the same value for both the positive and negative boundaries. *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	2.8 (3)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "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 0.01G and settable range is 1 to 300. (Example) When it is “0.30G”, set it as “30”. If a move command is issued by specifying “0” or any value exceeding the maximum acceleration or deceleration, an alarm will occur.	2.8 (3)
	Deceleration	16-bit data	-			
	Pressing Current Limit Value	16-bit data	-		16-bit integer Specify the current- limit value to be used during push-motion operation. The allowable specification range is 0 (0%) to 255 (100%). The actual settable range varies depending on each actuator.(Refer to the catalog or Operation Manual for the actuator.) If a move command is issued by specifying a value exceeding the maximum push-motion current, an alarm will occur.	2.8 (3)
	Load current threshold	16-bit data	-		16-bit integer Set the current threshold in this register when whether or not the load current exceeds the threshold is judged. The allowable specification range is 0 (0%) to 255 (100%). If threshold judgment is not required, enter “0”.	2.8 (3)
	Control Signal 1	b15	-		Unavailable	-
		b14				
		b13				
		b12				
		b11				
		b10	ACON	-	Unavailable	-
			PCON	SMOD	Stopping control mode: When this signal is ON, servo control is performed during stopping.	2.6.7 (28)
		b9	-		Unavailable	-
		b8				
		b7	ACON	MOD1	Acceleration / deceleration mode: When both signals are OFF, the trapezoid pattern mode is selected. When one signal is OFF and the other signal is ON, the S-motion mode is selected. When one signal is ON and the other signal is OFF, the primary delay filter mode is selected.	2.6.7 (29)
		b6		MOD0		
		b7	PCON	-	Unavailable	-
		b6				
		b5	-		Unavailable	-
		b4				
		b3	INC		Incremental Command: Absolute position commands are issued when this signal is OFF, and incremental position commands are issued when the signal is ON.	2.6.7 (24)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Address	Bit	Symbol	Function	Details
PLC Output	Control Signal 1	b2	DIR Push direction specification: "OFF" for the direction reducing the positioning band from the target position "ON" for the direction adding the positioning band to the target position	2.6.7 (22)
		b1	PUSH Push-motion specification : Positioning operation is performed when this signal is OFF, and push-motion operation is performed when the signal is ON.	2.6.7 (21)
		b0	- Unavailable	-
	Control Signal 2	b15	BKRL Forced brake release: When it is turned ON, the brake is released	2.6.7 (18)
		b14	RMOD Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.	2.6.7 (19)
		b13	- Unavailable	-
		b12		
		b11		
		b10		
		b9		
		b8	JOG+ +Jog: "ON" for Movement in the Opposite Direction of Home	2.6.7 (13)
		b7	JOG- -Jog: "ON" for Movement to the Home Direction	2.7.7 (13)
		b6	JVEL Jog-speed/inch-distance switching: The values set in parameter No. 26, "Jog speed" and parameter No. 48, "Inch distance" are used when this signal is OFF, and the values set in parameter No. 47, "Jog speed 2" and parameter No. 49, "Inch distance 2" are used when the signal is ON.	2.6.7 (14)
		b5	JISL Jog/inch switching: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.	2.6.7 (15)
		b4	SON Servo ON Command: The servo turns ON when this signal turns ON.	2.6.7 (5)
		b3	RES Reset: A reset is performed when this signal turns ON.	2.6.7 (4)
		b2	STP Pause: A pause command is issued when this signal turns ON.	2.6.7 (11)
		b1	HOME Home return: A home-return command is issued when this signal turns ON.	2.6.7 (6)
		b0	DSTR Positioning Start: A move command is issued when this signal turns ON.	2.6.7 (8)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	- 32-bit signed integer indicating the current position The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	2.8 (3)
	Command Current	32-bit data	- 32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. (Example) Reading:000003FF _H =1023 (decimal) =1023mA	2.8 (3)
	Current Speed	32-bit data	- 32-bit signed integer indicating the current position 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 setting unit is 0.01mm/sec. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm/sec * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	2.8 (3)
	Alarm Code	16-bit data	- 16-bit integer When an alarm is issued, the alarm code is output. When any alarm is not issued, it is "0". Refer to the operation manual for the controller main body for the details of the alarms.	2.8 (3)
	Status Signal	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	2.6.7 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	2.6.7 (1)
		b13	ZONE2 Zone 2:"ON" for the current position within the zone set range	2.6.7 (12)
		b12	ZONE1 Zone 1:"ON" for the current position within the zone set range	2.6.7 (12)
		b11	PZONE Position zone: This signal turns ON when the current position is inside the specified position zone.	2.6.7 (12)
		b10	ACON - Unavailable (ON/OFF is undefined)	-
			PCON LOAD Load output judgment: When this signal is ON, the specified load has been reached. When the signal is OFF, the load has not been reached yet. (Refer to Operation Manual for the controller main body for more information)	2.6.7 (26)
		b9	ACON - Unavailable (ON/OFF is undefined)	-
			PCON TROS Torque level: When this signal is ON, the specified load has been reached. When the signal is OFF, the load has not been reached yet. (Refer to Operation Manual for the controller main body for more information)	2.6.7 (27)
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	2.6.7 (19)
		b7	GHMS Under Home return Operation: This signal remains ON while home return is in progress.	2.6.7 (6)
		b6	PUSHS Push motion in progress: This signal remains ON while push-motion operation is in progress.	2.6.7 (25)
		b5	PSEL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	2.6.7 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	2.6.7 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	2.6.7 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	2.6.7 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	2.6.7 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	2.6.7 (10)

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

This is the operation mode with the position No. set up as the same as using PIO (24V I/O).

Set the position data using the teaching tools.

The number of operable positions varies depending on the parameter No. 25 "PIO Pattern" setting.

This mode is the same as the remote I/O mode, but the current-position read function and command-current read function are also available.

The features of each PIO pattern are shown below. (Refer to Operation Manual for the controller main body for more information)

Value set in parameter No. 25	Operation Mode	I/O Specification
0	Positioning mode	64 positioning points and two zone output points are available.
1	Teaching mode	64 positioning points and one zone output point are available. Positioning operation and jog operation are supported. The current position can be written to a specified position.
2	256-point mode	256 positioning points and one zone output point are available.
3	512-point mode	512 positioning points are available. There are no zone outputs.
4	Electromagnetic valve mode 1	7 positioning points and two zone output points are available. The direct operation command is available for each position No. A position complete signal is output for each position number.
5	Electromagnetic valve mode 2	3 positioning points and two zone output points are available. The actuator is operated by specifying forward, backward and intermediate position commands. A position complete signal is output separately for the front end, rear end and intermediate position.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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

○:Supported, x:Not supported

(*1) It is available when the parameter No. 27 "Movement Command Type" is set to "0".

Turning "OFF" the "Movement Command" can stop the system temporarily.

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No.84	ACON/PCON DI and input register	PLC output address (bytes)	ACON/PCON DO and output register	PLC input address (bytes)
4	Port No.0 to 15	n, n+1	Port No.0 to 15	n, n+1
	Occupied area	n+2, n+3	Occupied area	n+2, n+3
		n+4, n+5	Current Position	n+4, n+5
		n+6, n+7		n+6, n+7
		n+8, n+9	Command Current	n+8, n+9
		n+10, n+11		n+10, n+11

(Note) The areas denoted by **Occupied area** cannot be used for any other purpose.
Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of 6 input words (channels) and 6 output words (6 words=12 bytes) in the I/O areas.

- The areas controlled by port number are controlled using ON/OFF bit signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm).
- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).

PLC output

Address (* “n” shows the node address of each axis.)

		1 word = 2 bytes =16 bits															
n+0, n+1		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" shows the node address of each axis.)

		1 word = 2 bytes =16 bits															
n+0, n+1		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+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																

n+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+8, n+9	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+10, n+11	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

(3) I/O signal assignment

For the signal assignments corresponding to each PIO pattern, refer to the I/O signal assignments for the remote I/O mode explained in 2.6.2 (3).

The signal allocation for the Command Current and Current Position, is shown in the following table.

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	-	-
	Command Current	32-bit data	-	-

2.6.7 I/O Signal Controls and Function

* ON indicates that the applicable bit signal is “1”, while OFF indicates that the bit signal is “0”.

The I/O control and functions used in the Position/Simplified Direct Value Mode, Half Direct Value Mode and Full Direct Value Mode, are described as follows. For the I/O signals for the Remote I/O Mode and Remote I/O Mode 2, refer to the Operation Manual for the controller main body.

(1) Controller ready (PWR) PLC input signal

When the controller can control the system after the power injection, it is turned “ON”.

■ Function

Regardless of the alarm or servo conditions, when the controller initialization is completed normally after the power injection and the controller can control the system, it is turned “ON”.

Even in the alarm condition, when the controller can control the system, it is turned “ON”.

(2) Emergency stop (EMGS) PLC input signal

When the controller is stopped in an emergency, it is turned “ON”.

■ Function

When the controller is stopped in an emergency (motor driving power is cut off), it is turned “ON”. When the emergency stop status is cleared, it is turned “OFF”.

(3) Alarm (ALM) PLC input signal

When any error is detected using the controller protection circuit (function), it is turned “ON”.

■ Function

When any error is detected and the protection circuit (function) is activated, this signal is turned “ON”.

When the cause of the alarm is eliminated and the reset signal is turned “ON”, the alarm is turned “OFF” in the case that it is the alarm with the operation cancellation level. (In the case of the alarm with the cold start level, re-injection of the power is required)

When the alarm is detected, the Status Indicator LED (Refer to 4, “EtherCAT(R) Interface”) on the front surface of the controller illuminates in red.

(4) Reset (RES) PLC output signal

This signal has two functions. It can reset the controller alarm and cancel the reminder for planned movements during pause conditions.

■ Function

[1] When this signal is turned ON from OFF condition after eliminating the cause of the alarm during the alarm output, the alarm (ALM) signal can be reset. (In the case of the alarm with the cold start level, re-injection of the power is required)

[2] When this signal is turned ON from OFF condition during the pause condition, the reminder of the planned movement left can be cancelled.

- (5) Servo ON Command (SON) PLC output signal
Operation preparation end (SV) PLC input signal

When the SON signal is turned ON, the servo will turn ON.

When "SON" signal is turned "ON", the servo-motor is turned "ON". When the servo-motor is turned ON, the Status Indicator LED (Refer to 2.3, "EtherCAT(R) Interface") on the front surface of the controller illuminates in green.

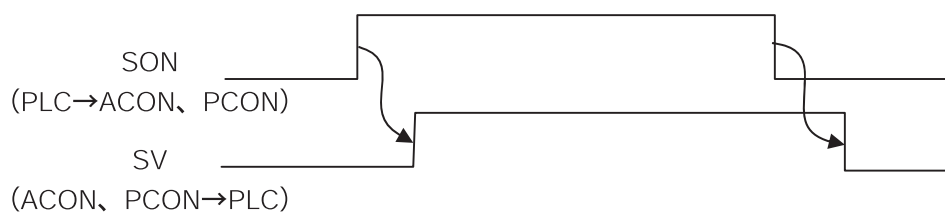
The "SV" signal is synchronized with this LED.

■ Function

Using the "SON" signal, the turning ON/OFF of the controller is available.

While the "SV" signal is ON, the controller's servo-motor is turned "ON" and the operation becomes available.

The relationship between the "SON" signal and "SV" signal is as follows.



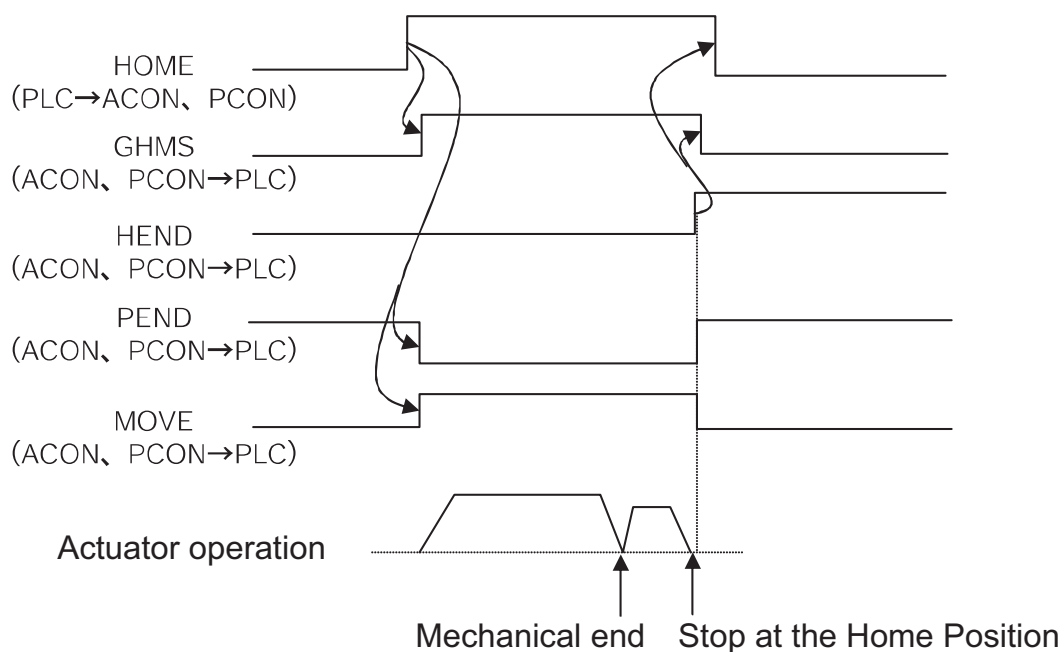
- (6) Home return (HOME) PLC output signal
 Home return completion (HEND) PLC input signal
 Under Home return Operation (GHMS) PLC input signal

When the "HOME" signal is turned "ON", this command is processed at the startup (ON edge), and the home return operation is performed automatically. During the home return operation, the "GHMS" signal is turned "ON".

When the "HEND" signal is turned "ON", turn "OFF" the "HOME" signal.

Once the "HEND" signal is turned "ON", it can not be turned "OFF" until the power is turned "OFF" or the "HOME" signal is input again. Once the HEND signal is turned ON, it can not be turned OFF until the power is turned OFF or the HOME signal is input again.

Even after the completion of the home return operation, when the "HOME" signal is turned "ON", the home return operation can be performed.



Caution: In the Remote I/O mode, Remote I/O Mode 2 and Position/Simplified Direct Value Mode, when the positioning command is issued without performing the home return operation after the power injection, the positioning is performed after the automatic home return operation. Exercise caution that in the half direct mode or full direct mode, issuing a positioning command to a given position following the power on, without performing a home return first, will generate an alarm "Error Code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed)" (operation-reset alarm).

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

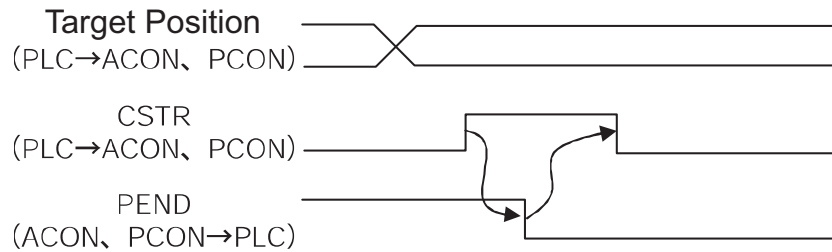
This signal is processed at the startup (ON edge) and the positioning is performed to the target position with the specified position No. or set using the PLC's target position register.

Whether if the target position with the specified position No. is used or the setting using the PLC's target position register is used, depends on the Control Signal b11: "Position/Simplified Direct Value Change-Over (PMOD) Signal".

- PMOD=OFF: Target position data for the specified position No. is used.
- PMOD=ON :Value for the target position set using the PLC's target position register is used.

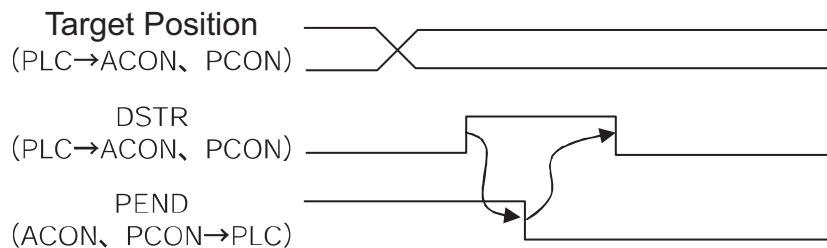
When this signal is issued in the condition where the home return operation has not performed at all after the power injection (HEND signal OFF), the positioning to the target position is performed after the home return operation is performed automatically.

Turn "OFF" this signal after confirming that the Positioning Completion Signal (HEND) signal has been turned "OFF".

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

This signal is processed at the startup (ON edge) and the positioning to the target position input in the PLC's target position register is performed. When this signal is issued in the condition where the home return operation has not performed at all after the power injection (HEND signal OFF), an alarm is issued (Operation Cancellation Level).

Turn "OFF" this signal after confirming that the Positioning Completion Signal (PEND) signal has been turned "OFF".

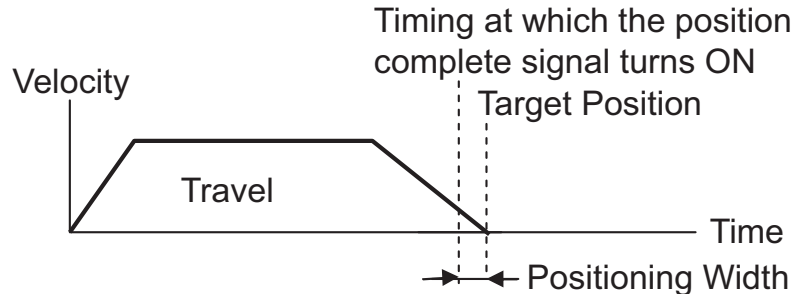
(9) Moving Signal (MOVE) PLC input signal

This signal is turned ON while the actuator's slider or rod is moving. (Including the pressing or jog operation after the home return operation)

After the completion of the positioning, home return or pressing operation, or during the pause condition, this signal is turned "ON".

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

This signal is turned "ON" when the actuator is moved to the target position and reaches the positioning band and the pressing is completed.



When the servo-motor is turned ON from OFF condition, the positioning is performed with the position set as the target position. Accordingly, this signal is turned "ON" and after that, when the positioning operation is started with the home return (HOME) signal, positioning start (CSTR) signal and positioning command (DSTR) signal, this signal is turned "OFF".



Caution: When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the PEND signal is turned "OFF" temporarily. Then, when the servo-motor is turned "ON" and the actuator is within the positioning band, the PEND signal is turned "ON" again.
When the positioning is completed with the CSTR signal or DSTR signal turned "ON", the PEND signal is not turned "ON".

(11) Pause (STP) PLC output signal

When this signal is turned "ON", the actuator movement is decelerated and stopped. When it is turned "OFF", the actuator movement is restarted.

The acceleration in the operation restart or the deceleration in stopping operation, is expressed as the value for the acceleration/deceleration for the position No. set using the specified position No. register in the Position/Simplified Direct Value Mode, and as the value set in the acceleration/deceleration register in the Half Direct Value Mode.

In the Full Direct Value Mode, the value is expressed as the value set in the acceleration register or deceleration register.

(12) Zone 1 (ZONE1)	PLC input signal
Zone 2 (ZONE2)	PLC input signal
Position zone (PZONE)	PLC input signal

These signals are turned ON when the current position of the actuator is within the set domain and turned OFF when the current position is out of the set domain.

[1] Zone 1, Zone 2

The zone is set using the user parameters.

The Zone 1 Signal is set using the parameter No. 1 “Zone Boundary 1 “+” Side” and No. 2 “Zone Boundary 1 “-” Side”.

The Zone 2 Signal is set using the parameter No. 23 “Zone Boundary 2 “+” Side” and No. 24 “Zone Boundary 2 “-” Side”.

The Zone 1 Signal and Zone 2 Signal become effective when the home return operation is completed. After that, even during the servo OFF, it is effective.

[2] Position zone

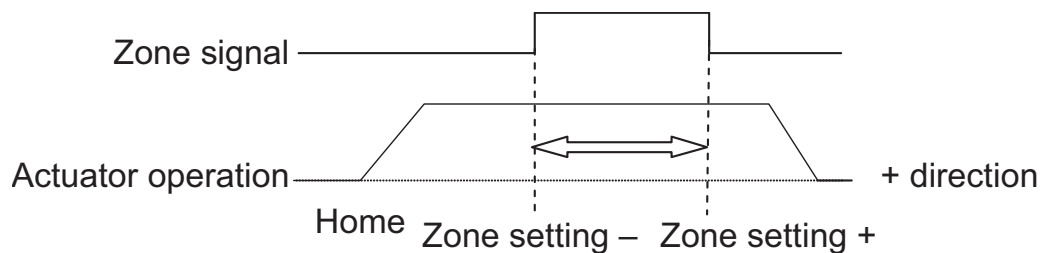
Each zone is set in the position table or using the zone boundary register.

In the case of the Position/Simplified Direct Value Mode, the PZONE signal is set using the position table.

In the case of the Full Direct Value Mode, the PZONE signal is set using the Zone Boundary Value Register.

(*)In the Half Direct Value Mode, there is no PZONE signal.

The PZONE signal becomes effective with the movement command after the home return operation. After that, even during the servo OFF, it is effective.



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

This signal is the command for the jog operation startup or inching operation startup.

If a + command is issued, the actuator will operate in the direction opposite home. When a – command is issued, the actuator will operate in the direction of home.

[1] Jog operation

Jog operation can be performed when the jog/inch switching (JISL) signal is OFF.

While the “JOG+” is turned “ON”, the movement direction is to the opposite of the home and when it is turned “OFF”, the actuator is decelerated and stopped.

While the JOG – is ON, the actuator will operate in the direction of home and when it is turned OFF, it is decelerated to a stop.

The operation is performed based on the set values of the following parameters.

- The velocity is based on the parameter value specified using the Jog Speed/Inching Distance Change-Over (JVEL) signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 26, “PIO jog speed”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 47, “PIO jog speed 2”.
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals are turned “ON”, the actuator is decelerated and stopped.

[2] Inch operation

The inching operation is available while the IISI signal is turned “ON”.

Once it is turned “ON”, the actuator is moved as much as the inching distance.

When the JOG+ is turned “ON”, the movement is to the opposite of the home and when the JOG- is turned “ON”, the movement is to the home.

The operation is performed based on the set values of the following parameters.

- The speed conforms to the value of the parameter specified by the JVEL signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 26, “PIO jog speed”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 47, “PIO jog speed 2”.
- The travel conforms to the value of the parameter specified by the JVEL signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 48, “PIO inch distance”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 49, “PIO inch distance 2”.
- The Acceleration/Deceleration is based on the rated acceleration/deceleration (depending on the actuator).

During the normal operation, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the normal operation is continued. (The Jog signal is ignored)

In the pause condition, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the actuator is not moved.

(Note) Because the software stroke limit is disabled before the home return operation, the actuator might run against the mechanism end. Take the greatest care.

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

This change-over signal is used for the parameters specifying the jog speed when the jog operation is selected or the inching distance when the inching operation is selected.

The relationship is as follows.

Controller ready	Jog operation: JISL=OFF	Inch operation: JISL=ON
OFF	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed" Parameter No. 48, "Inch distance"
ON	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2" Parameter No. 49, "Inch distance 2"

(15) Job/inch switching (JISL) PLC output signal

This signal changes over the jog operation and the inching operation.

JISL=OFF: Jog operation

JISL=ON :Inch operation

When the JISL signal is turned "ON" (for inching operation) during the jog operation, the actuator is decelerated and performs the inching operation.

When the JISL signal is turned OFF (jog) while the actuator is moving by inching, the actuator will complete the movement and then switch to the jog function.

The table below summarizes the relationship of the ON/OFF statuses of the JISL signal and jog speed/inch-distance switching (JVEL) signal.

		Jog operation	Inch operation
JISL		OFF	ON
JVEL=OFF	Velocity	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed"
	Travel	–	Parameter No. 48, "Inch 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	Velocity	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2"
	Travel	–	Parameter No. 48, "Inch distance"
	Acceleration/Deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
Operation		When the JOG +/JOG – signal is ON.	Upon detection of the leading (ON) edge of the JOG +/JOG – signal.

(16) Teaching Mode Command (MODE) PLC output signalTeaching mode Signal (MODES) PLC input signal

When the MODE signal is turned "ON", the normal operation mode is changed to the teaching mode.

When the mode for the controllers for each actuator is changed to the teaching mode, the MODES signal is turned ON.

After confirming that the MODES signal is turned "ON" on the PLC side, start the teaching operation.

(Note) In order to change the normal operation mode to the teaching mode, the following conditions are required.

- The actuator operation (motor) is stopped.
- The + JOG (JOG+) signal and – JOG (JOG-) signal are turned "OFF".
- The Position Data Import Command (PWRT) Signal and Positioning Start (CSTR) Signal are turned "OFF".

(Note) When the PWRT signal is not turned OFF, the mode is not returned to the normal operation mode.

(17) Position Data Import Command (PWRT) PLC output signalPosition data import complete (WEND) PLC input signal

The PWRT signal is available when the teaching mode signal (MODES) is turned "ON".

Turn the PWRT signal ON (*1), and the data of the current position will be written to the "Position" field under the position number set to the specified position number register of the PLC (*2).

When the data writing is completed, the WEND signal is turned "ON".

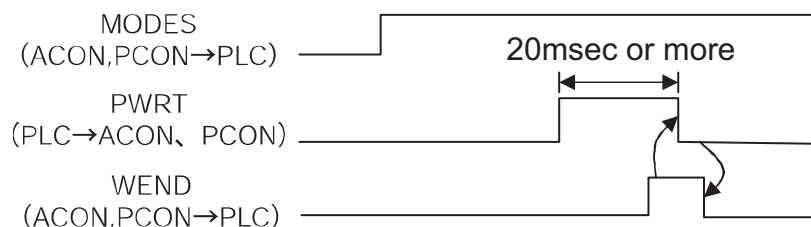
After the WEND signal is turned ON, turn OFF the PWRT signal in the host machine.

When the PWRT signal is turned ON before the WEND signal is turned "ON", the WEND signal is not turned "ON".

When the PWRT signal is turned "OFF" the WEND signal is also turned "OFF".

(*1) Turn it on for 20msec or more. If the time is shorter than 20msec, the writing is not completed.

(*2) When the data items except for the position have not been defined, the parameter initial values are written. (Refer to the Operation Manual for the controller main body)

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

Turning this signal "ON" can release the brake forcibly.

(19) Operating mode selector (RMOD) PLC output signalOperation Mode Status (RMDS) PLC input signal

The operation mode is selected with the RMOD signal and the MODE switch located on the front surface of the controller.

Also, which mode is currently set, AUTO or MANU, can be confirmed using the RMDS signal.

The operation modes with the combination of the RMOD signal and the MODE switch ON/OFF are described as follows.

	Controller MODE Switch = AUTO	Controller MODE Switch = MANU
RMOD signal = OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal = ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

(Note) In MANU mode, the startup of the operation from PLC is not available.

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

This signal changes over the use of the value registered in the controller position table for the target position in the movement and the use of the value specified in the PLC's target position register.

PMOD=OFF: Use the position table

PMOD=ON :Use the value of the target position register

(21) Push-motion specification (PUSH) PLC output signal

When the movement command signal is output after this signal is turned ON, the pressing operation is performed.

When this signal is set to "OFF", the normal positioning operation is performed.

(Refer to Item (2) Operation in Half Direct Value Mode in "2.8 Operation" for the setting timing for this signal)

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

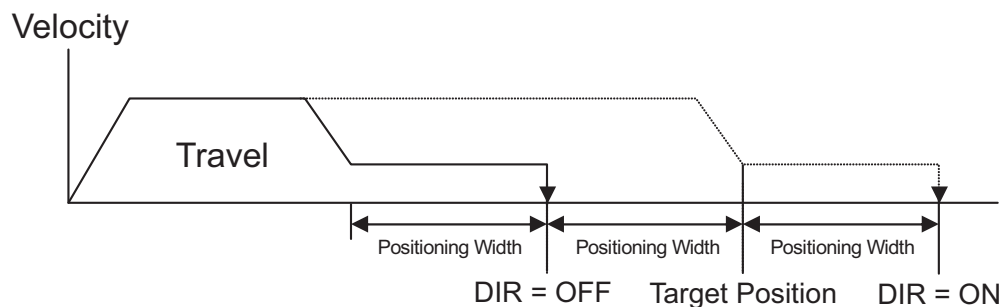
This signal specifies the pressing direction.

When this signal is turned "OFF", the pressing operation is performed to the position expressed using the value reducing the positioning band from the target position.

When this signal is turned "ON", the pressing operation is performed to the direction of the value determined by adding the positioning band to the target position.

In the case of the normal pressing operation, this signal is disabled.

(Refer to Item (2) Operation in Half Direct Value Mode in "2.8 Operation" for the setting timing for this signal)



(23) Pressing and a Miss (PSFL) PLC input signal

In the case that the pressing operation was performed, and the actuator moved the travel distance set in the controller position table positioning band or set using the PLC's positioning band register, but it was not pushed against the work part, this signal is turned "ON".

(Refer to Item (2) Operation in Half Direct Value Mode in "2.8 Operation" for the setting timing for this signal)

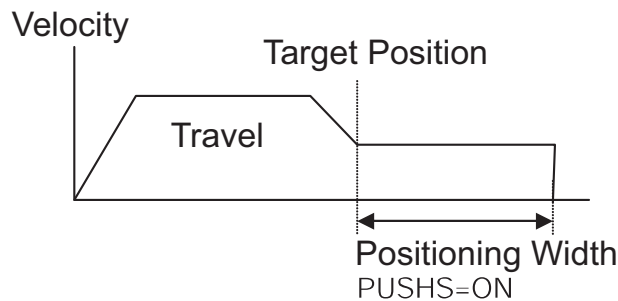
(24) Incremental Command (INC) PLC output signal

When the movement command is issued while this signal is turned "ON", the actuator is moved to the position expressed as the value input in the PLC's target position register based on the current position. (Incremental move)

When this signal is turned "OFF", the actuator is moved to the position expressed as the value set in the PLC's target position register.

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

This signal is turned "ON" during the pressing operation.



This signal is turned "OFF" when the pressing and a miss signal or the next movement command signal is output, or the servo-motor is turned "OFF".

(Refer to Item (2) Operation in Half Direct Value Mode in "2.8 Operation" for the setting timing for this signal)

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

This signal is available only in the pressing operation.

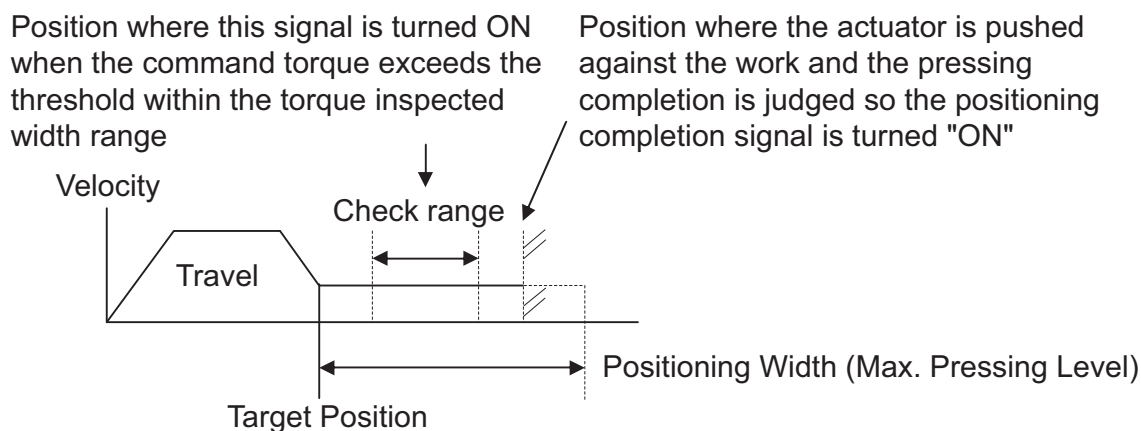
When this signal is used for pressing-in purpose, it should be know whether if the set load threshold is reached during the pressing operation.

The load threshold and check range are set by the PLC and the LOAD signal will turn ON when the command torque (motor current) exceeds the threshold inside the check range.

This signal judges the load output based on the fact that the command torque excesses the threshold for the specified time period.

This processing procedure is the same as for the pressing judgment. The judgment time period can be changed freely using the parameter No. 50 "Load Output Judgment Time Period".

This signal is continued until the next movement command is received.



- Set the pressing speed using the parameter No. 34 "Pressing Speed".
When the machine is delivered, it has been individually set depending on the actuator characteristics.
Set an appropriate velocity considering the work part material and shape.
- Set the parameter No. 50 "Load Output Judgment Time Period".
- Set the parameter No. 51 "Torque Inspected Range" to "0" (enabled).
- Set the threshold inspected width using the PLC's Zone Boundary + Register or Zone Boundary - Register.
- Set the threshold using the PLC's Load Current Threshold Register.
- Set the positioning band using the PLC's Positioning Band Register.
Set it a bit longer from the backmost position considering the mechanical dispersion of the work part.
Refer to the Operation Manual for the controller for more information.



- Caution:**
- If the actuator pushes against the work part before the target position, it is regarded as a servo-motor error.
Take care of the positional relationship between the target position and the work part position.
 - The actuator continues to push the work part with the pressing current at the stop time decided with the current limit value.
It is not the stop condition, so take the greatest care to deal with it.

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

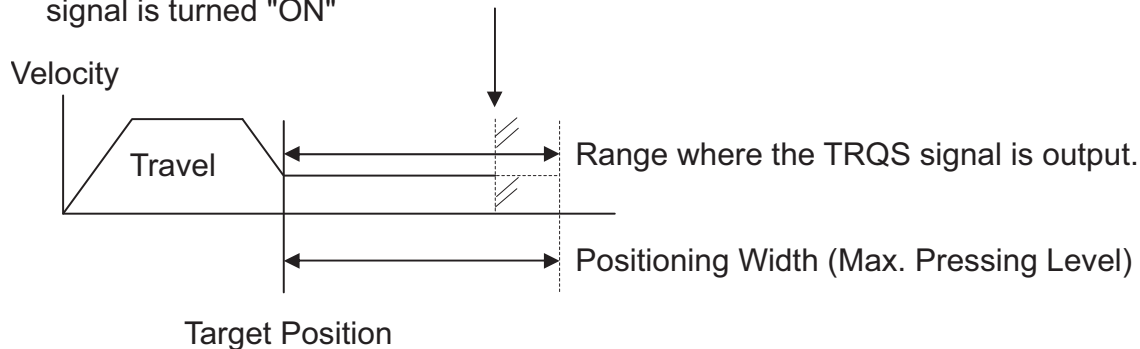
This signal is available only in the pressing operation.

When the motor current reaches the load threshold during the pressing operation (moving up to the positioning band), this signal is turned "ON".

Because the current level is monitored, when the current level is changed, this signal is turned "ON".

The velocity available for the pressing varies depends on the motor and leads, it is required to adjust the parameters.

Position where the actuator is pushed against the work and the pressing completion is judged so the positioning completion signal is turned "ON"



- Set the pressing velocity using the parameter No. 34 "Pressing Speed".
When the machine is delivered, it has been individually set depending on the actuator characteristics.
Set an appropriate speed considering the work part material and shape.
- Set the parameter No. 50 "Load Output Judgment Time Period".
- Set the parameter No. 51 "Torque Inspected Range" to "1" (disable).
- Set the threshold using the PLC's Load Current Threshold Register.
- Set the positioning band using the PLC's Positioning Band Register.
Set it a bit longer from the backmost position considering the mechanical dispersion of the work part.
Refer to the Operation Manual for the controller for more information.



- Caution:**
- If the actuator pushes against the work part before the target position, it is regarded as a servo-motor error.
Take care of the positional relationship between the target position and the work part position.
 - The actuator continues to push the work part with the pressing current at the stop time decided with the current limit value.
It is not the stop condition, so take the greatest care to deal with it.

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

One of the pulse motor general characteristics is that the holding current in the stop mode is larger than that for the AC servo-motor. Because of this, when the stop time is longer at the standby position, the measure to reduce the power consumption at the stop mode is taken as one of the energy saving measures.

SMOD=ON :Full Servo Control System is used in the standby condition.

SMOD=OFF: Standby condition

- Full-servo control mode

By means of servo control of the pulse motor, the holding current can be reduced.

The reduction level varies depending on the actuator type or load conditions. However, generally, the holding current will be 1/2 to 1/4.

The actual holding current can be confirmed in the current monitor window in the PC software.

(Note) Under the condition where any external force is given or depending on the stop position, slight vibration or abnormal noise might be caused.

After confirming that there would be no trouble in whole system, use this signal.

(29) Acceleration/deceleration mode (MOD1、MOD0)

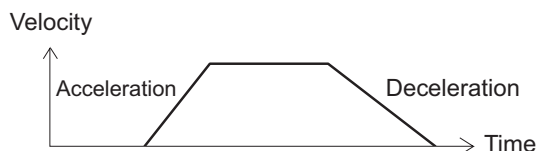
PLC output signal

Dedicated ACON function

This signal is used to select the acceleration/deceleration pattern characteristics. Select one of them before the actuator movement command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid Pattern	Factory setting
OFF	ON	S-shaped Motion	
ON	OFF	First-Order Lag Filter	
ON	ON	Unavailable	

Trapezoid Pattern



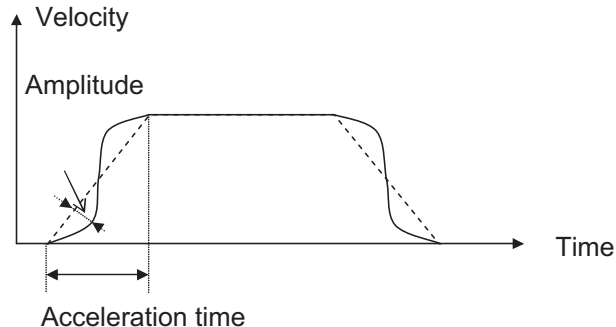
*The Acceleration and Deceleration are set in the "Acceleration" and "Deceleration" data boxes on the position data.

S-shaped Motion

When the value in the "Acceleration/deceleration mode" field in the position table is set to 1 (S-shaped motion), the S-shaped motion degree is defined by parameter No. 56.

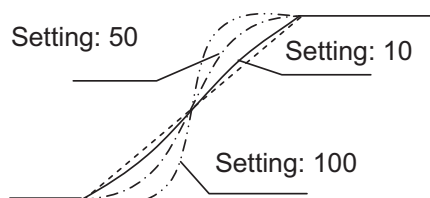
The setting unit is % and the setting range is from "0" to "100."

This is set to 0% (S-shaped motion disabled) in the factory setting.



An S-shaped motion becomes a sine waveform after one cycle of the acceleration time. Specify the degree of amplitude by parameter No. 56.

Parameter No. 56 setting [%]	Degree of amplitude
[Factory setting]	S-shaped motion disabled (Dotted line in the figure below)
100	Sine waveform amplitude x 1 (Chain double-dashed line in the figure below)
50	Sine waveform amplitude x 0.5 (Chain line in the figure below)
10	Sine waveform amplitude x 0.1 (Solid line in the figure below)

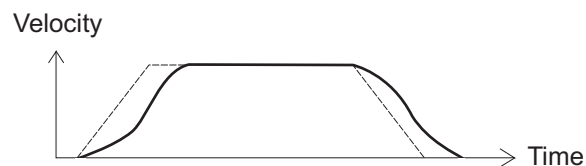


- ⚠ Caution:
- [1] Even if a position command or direct value command with S-shaped motion setting is issued when the actuator is running, S-shaped motion control will not be executed. Issue these commands when the actuator is stopped.
 - [2] When the index mode is set on the rotary actuator, S-shaped motion is not executed, and, instead, trapezoid control will be executed.
 - [3] Set the acceleration/deceleration speed so that the time for each will be within two seconds.
 - [4] An input to pause is not allowed during acceleration or deceleration. It may cause an excessive change in speed.
 - [5] If a large value is set, the speed will accelerate significantly at around the mid-point of the acceleration/deceleration time. Do not exceed the rated acceleration/deceleration time of the actuator.

First-Order Lag Filter

This describes much gentle acceleration/deceleration curve than that for the linear acceleration/deceleration (trapezoid pattern).

Use it when it is not desired to give any slight vibration to the work part in acceleration/deceleration operation.



- * The first-order lag degree is set using the parameter No. 55 "Position Command Primary Filter Time Constant". The minimum input unit is 0.1msec and setting range is from "0.0" to "100.0". When it is set to "0", the first-order lag filter is disabled. However, the setting is not reflected on the jog operation or inching operation performed using the teaching tools such as PC.

2.7 I/O Signal Timings

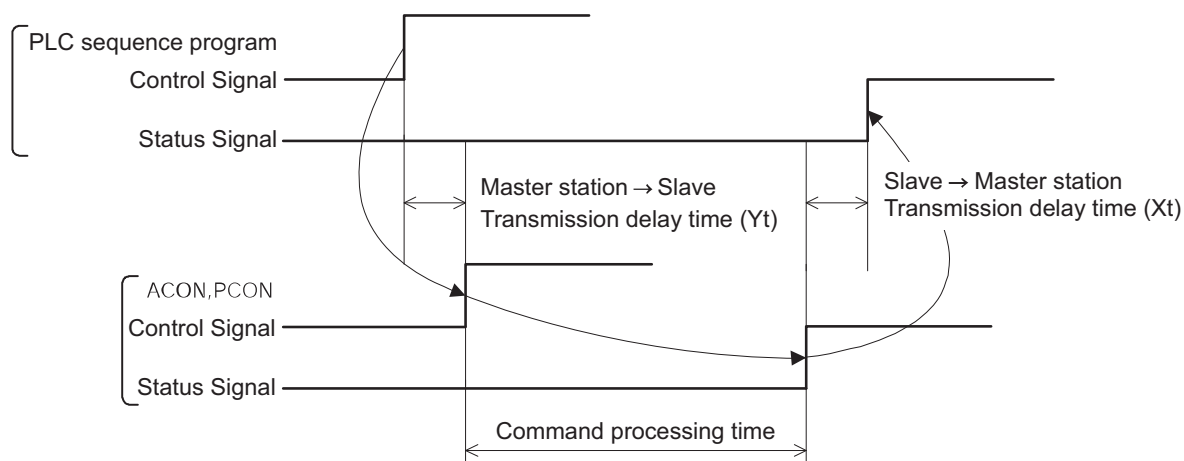
When any of the control signal is turned ON to perform the operation of the robot cylinder using the PLC's sequence program, the response (status) is returned to the PLC. The maximum response time is expressed using the following formula.

Maximum response time (msec) = $Y_t + x_t + 3 \times$ command processing time (operation time, etc.)

Y_t : Master Station → slave transmission delay time
 x_t : Slave → Master Station Transmission Delay Time

} Filed Network Transmission
 Delay Time

Master Station → For the master station → slave transmission delay (Y_t) and slave master station transmission delay (x_t), refer to the Operation Manuals for the EtherCAT(R) master unit and PLC installed in the master unit.



2.8 Operation

The timings for the basic operation examples in the Position/Simplified Direct Value Mode, Half Direct Value Mode and Full Direct Value Mode, are described.

For the Remote I/O Mode and Remote I/O Mode 2, refer to the Operation Manual for the controller main body.

(In remote I/O mode 2, read the current position and current speed from the respective byte of the PLC, as deemed appropriate.)

(1) Operation in the position/simple-direct mode

It is operated with the position data written in the PLC's register and the speed, acceleration /deceleration, positioning band and pressing current limit value, etc. set using the position table.

● Example of operation (normal positioning operation)

(Preparation) Set the position data items (speed, acceleration/deceleration, positioning band, etc) except for the target position item, in the position table.

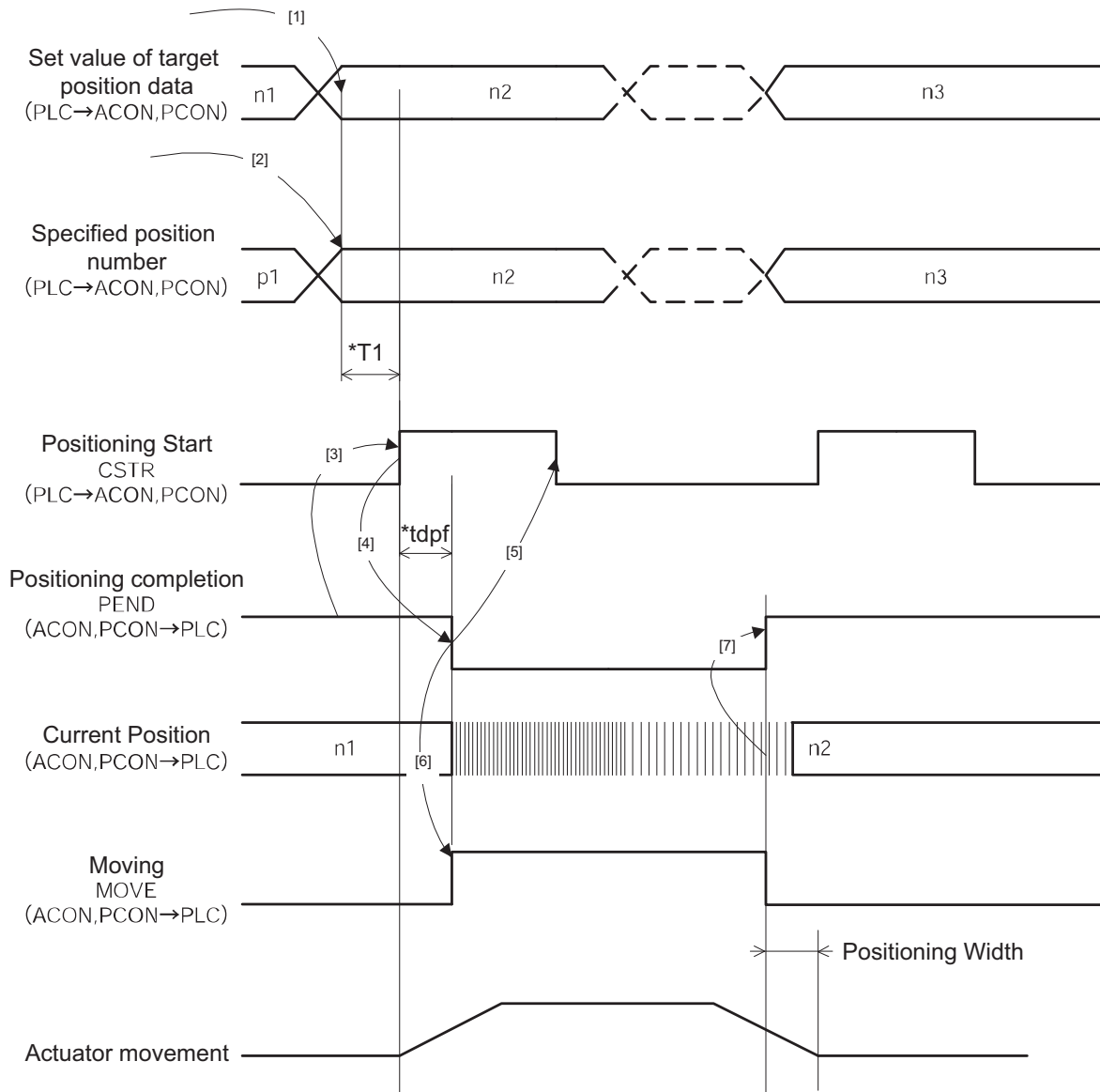
Turn on the Position/Simplified Direct Value Change-Over Signal (PMOD).

- [1] Set the target position data in the target position register.
- [2] Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
- [3] In the condition where the positioning completion (PEND) signal is turned "ON" or, Under Movement (MOVE) signal is turned "OFF", turn "ON" the Positioning Start (CSTR) signal. The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal. The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal.
- [4] After the CST signal is turned "ON", the PEND signal is turned OFF after tdpf.
- [5] After confirming that the PEND signal is turned "OFF" or MOVE signal is turned "ON", turn "OFF" the CSTR signal. Do not change the value in the target position register until the CSRT signal is turned "OFF".
- [6] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [7] The current position data is continuously updated. When the remaining travel distance becomes within the range of the positioning band set in the position data, and the CSTR signal is turned "OFF", the PEND signal is turned "ON". Then, the completed position No. is output to the completed position No. register.
Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned "ON".
The current position data might be changed slightly even when the system is stopped.
- [8] The target position data can be changed during the actuator movement.
In order to change the target position, change the target data and turn ON the CSTR signal after the time longer than the PLC scanning time has passed.
Change the value for the CSTR signal after the time longer than the PLC scanning time has passed.

● Example of operation (Pressing Operation)

For the pressing operation, the current limit value is set in the pressing data box on the position data at the preparation stage.

When the positioning is performed onto the position No. for which the value is set in the pressing data box, the pressing operation is performed.



*T1: Considering the scanning time of the host controller, set it so that " $T1 \geq 0ms$ ".

$*Yt+xt \leq tdpf \leq Yt+xt+3(msec)$

(2) Operation in the half direction mode

It is operated with the data set in the PLC's target position register, positioning band register, setup speed register, acceleration/deceleration register and pressing current limit setup register.

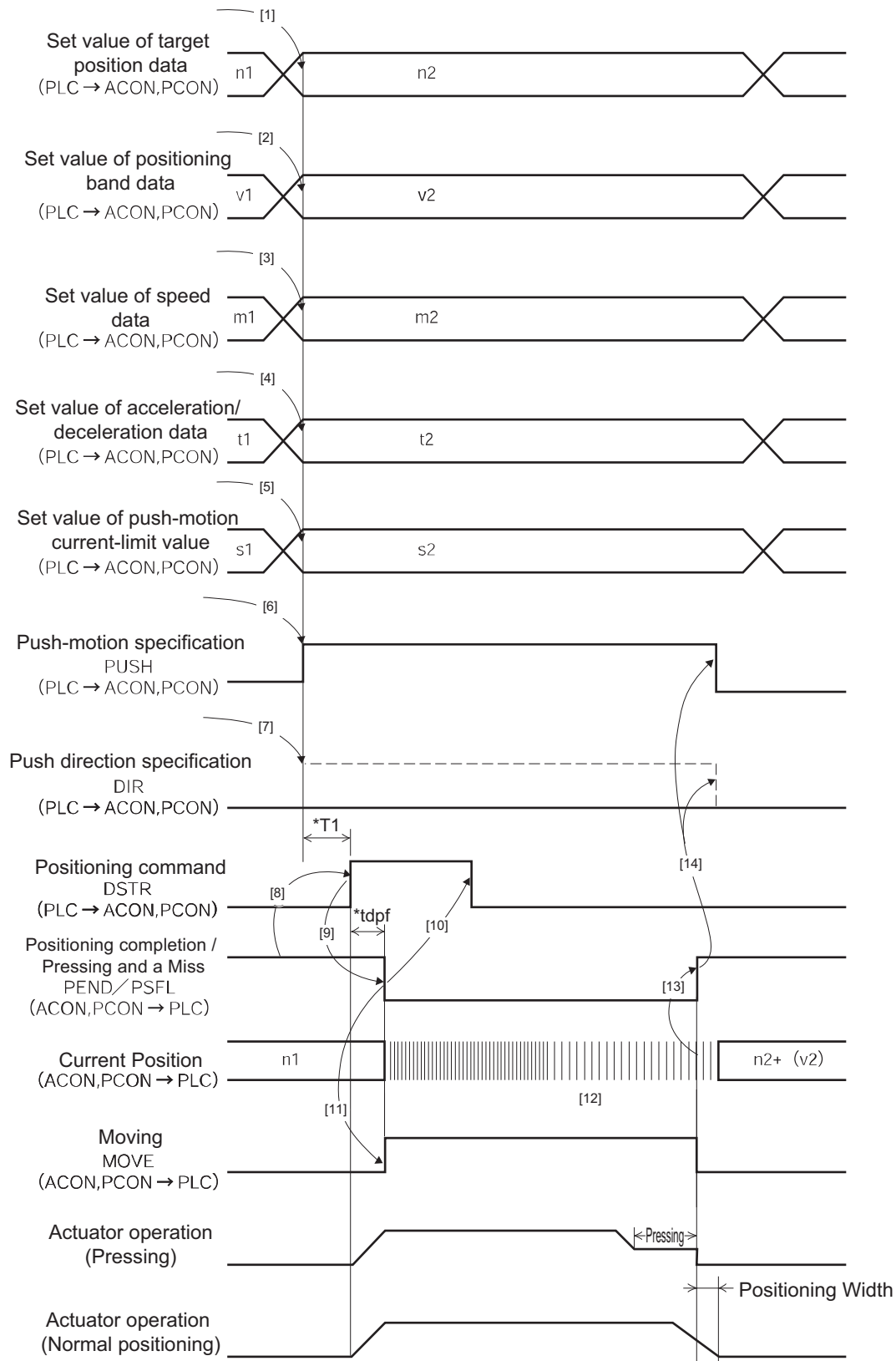
- Example of operation (Pressing Operation)

- [1] Set the target position data in the target position register.
- [2] Set the positioning band data in the positioning band register.
- [3] Set the speed data to the speed register.
- [4] Set the acceleration/deceleration data to the acceleration/deceleration register.
- [5] Set the pressing current limit data in the pressing current limit value register.
- [6] Turn "ON" the pressing setup (PUSH) signal.
- [7] Specify the pressing direction using the pressing direction setup (DIR) signal. (Refer to 2.6.7 (22))
- [8] In the condition where the positioning completion (PEND) signal is turned "ON" or under movement signal (MOVE) is turned "OFF", turn "ON" the positioning command (DSTR) signal.
The data items set in Steps 1) through 5) are read in the controller at the startup (ON edge) of the DSTR signal.
- [9] After the DSTR signal is turned "ON", the PEND signal is turned "OFF" after tdpf.
- [10] After confirming that the PEND signal is turned "OFF" or the MOVE signal is turned "ON", turn "OFF" the DSTR signal. Do not change any value in each register until the DSTR signal has been turned "OFF".
- [11] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [12] The current position data is continuously updated.
- [13] When the DSTR signal is turned "OFF" and the motor current reaches the current limit value set in Step 5, the PEND signal is turned "ON". (Completion of push-motion operation)
Even when the positioning band set in Step 2 is reached, in the case that the current does not reach the motor current limit value set in Step 5, the pressing and a miss (PSEL) signal is turned "ON". In this case, the PEND signal is not turned "ON" (Pressing and a Miss).
- [14] After the PEND signal or PSEL signal is turned "ON", turn "OFF" the PUSH signal.

- Example of operation (normal positioning operation)

For the general positioning operation, set the signal in Step 6 to "OFF".

When the remaining travel distance becomes within the range of the positioning band set in the position data, and the DSTR signal is turned "OFF", the PEND signal is turned "ON".



*T1: Considering the scanning time of the host controller, set it so that "T1 ≥ 0ms".

*Yt+xt ≤ tdpf ≤ Yt+xt+3(msec)

(3) Operation in the full direct mode

The actuator is operated by specifying all conditions required for positioning such as the target position register and positioning band register of the PLC.

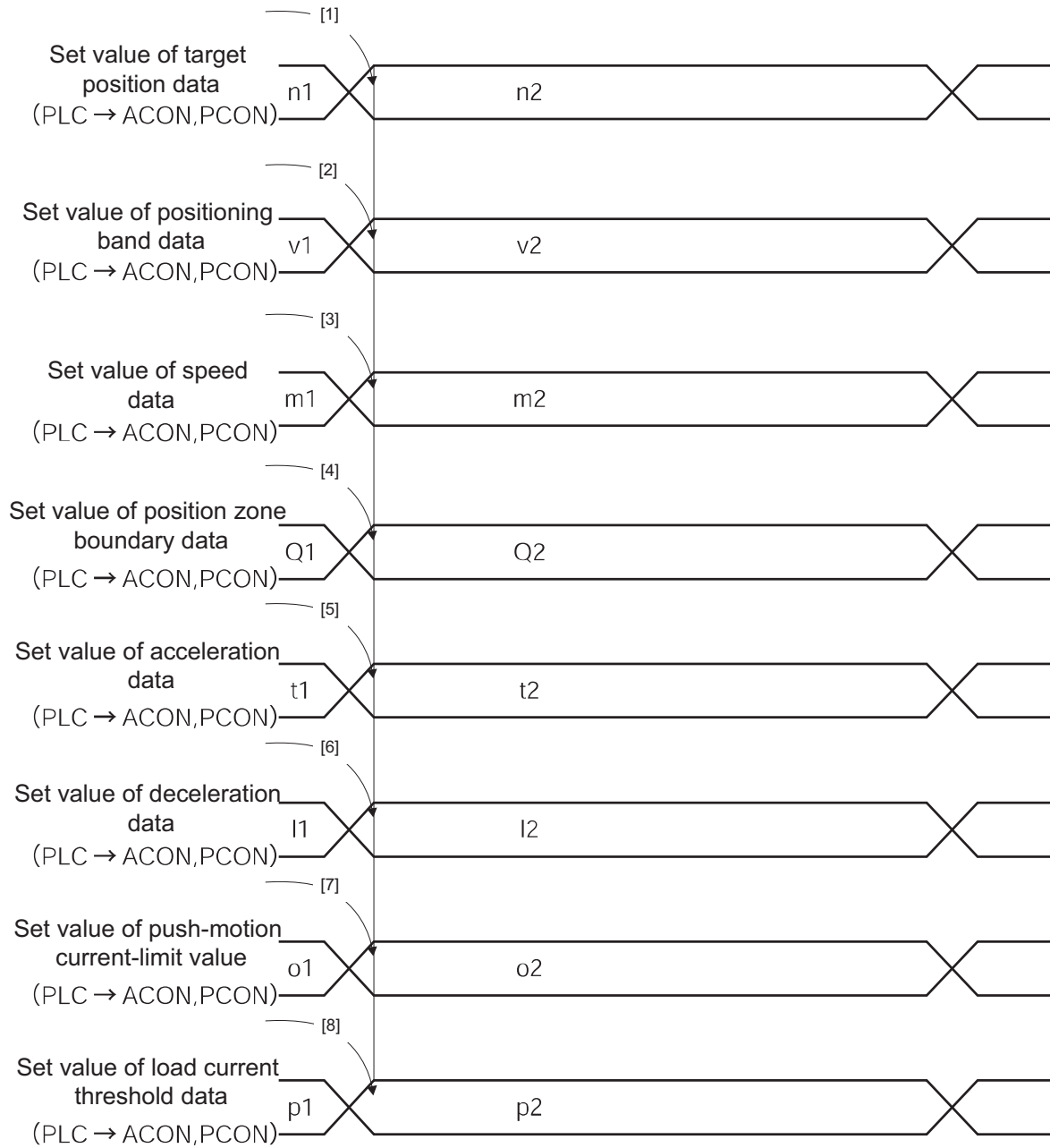
● Example of operation (Pressing Operation)

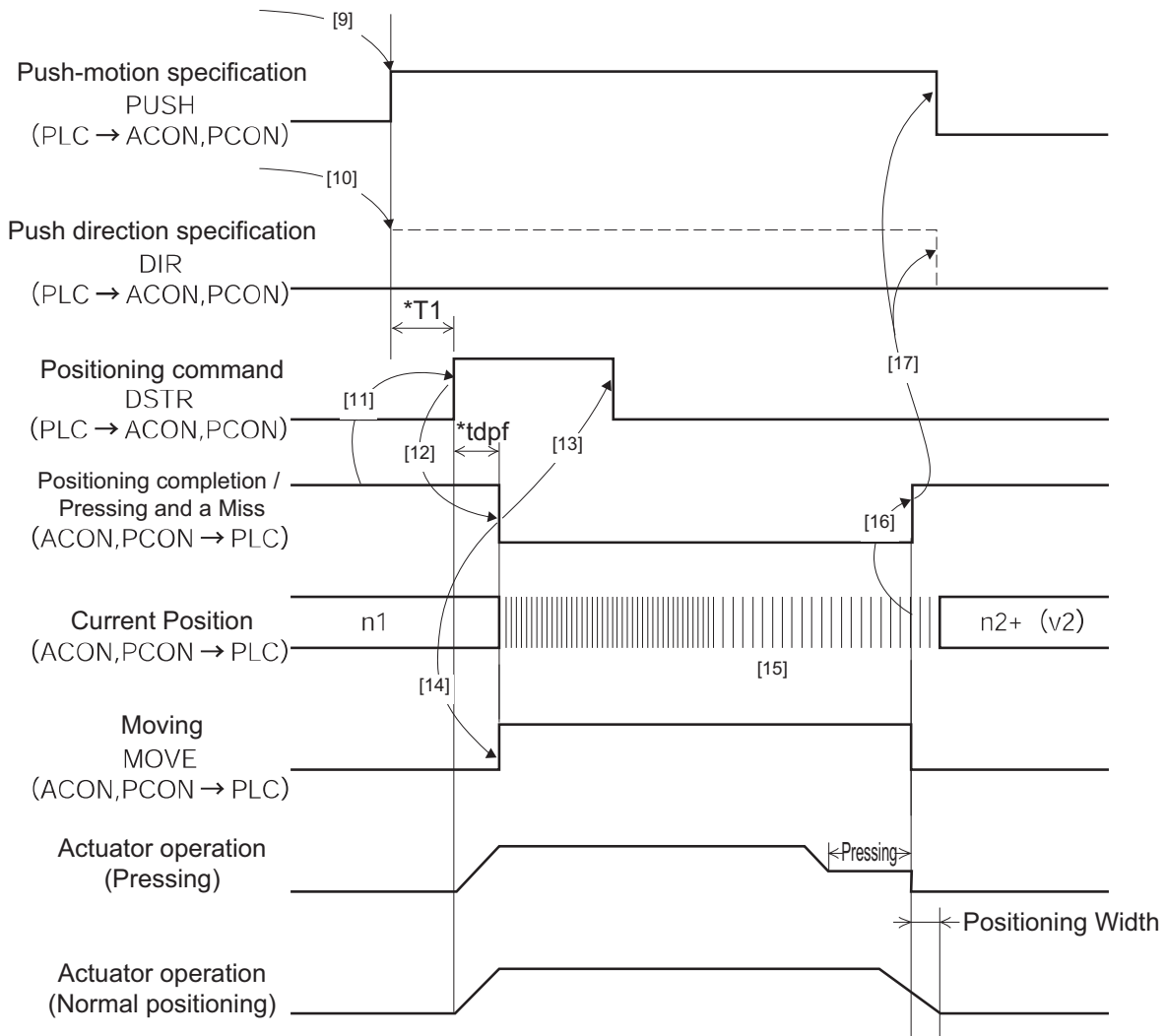
- [1] Set the target position data in the target position register.
- [2] Set the positioning band data in the positioning band register.
- [3] Set the speed data to the speed register.
- [4] Set the position zone output boundary data in the zone boundary + register or zone boundary - register.
- [5] Set the acceleration data in the acceleration register.
- [6] Set the deceleration data in the deceleration register.
- [7] Set the pressing current limit data in the pressing current limit value register.
- [8] Set the load current threshold data in the load current threshold setup register.
- [9] Turn "ON" the pressing setup (PUSH) signal.
- [10] Specify the pressing direction using the pressing direction setup (DIR) signal. (Refer to 2.6.7 (22))
- [11] In the condition where the positioning completion (PEND) signal is turned "ON" or under movement signal (MOVE) is turned "OFF", turn "ON" the positioning command (DSTR) signal.
The data items set in Steps 1) through 8) are read in the controller at the startup (ON edge) of the DSTR signal.
- [12] After the DSTR signal is turned "ON", the PEND signal is turned "OFF" after tpdf.
- [13] After confirming that the PEND signal is turned "OFF" or the MOVE signal is turned "ON", turn "OFF" the DSTR signal. Do not change any value in each register until the DSTR signal has been turned "OFF".
- [14] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [15] The current position data is continuously updated.
- [16] When the DSTR signal is turned "OFF" and the motor current reaches the current limit value set in Step 7, the PEND signal is turned "ON" (Completion of push-motion operation)
Even when the positioning band set in Step 2 is reached, in the case that the current does not reach the motor current limit value set in Step 7, the pressing and a miss (PSEL) signal is turned "ON". In this case, the PEND signal is not turned "ON" (Pressing and a Miss).
- [17] After the PEND signal or PSEL signal is turned "ON", turn "OFF" the PUSH signal.

● Example of operation (normal positioning operation)

For the general positioning operation, set the signal in Step 9 to "OFF".

When the remaining travel distance becomes within the range of the positioning band set in the position data, and the DSTR signal is turned "OFF", the PEND signal is turned "ON".





*T1: Considering the scanning time of the host controller, set it so that "T1 ≥ 0ms".

*Yt+xt ≤ tdpf ≤ Yt+xt+3(msec)

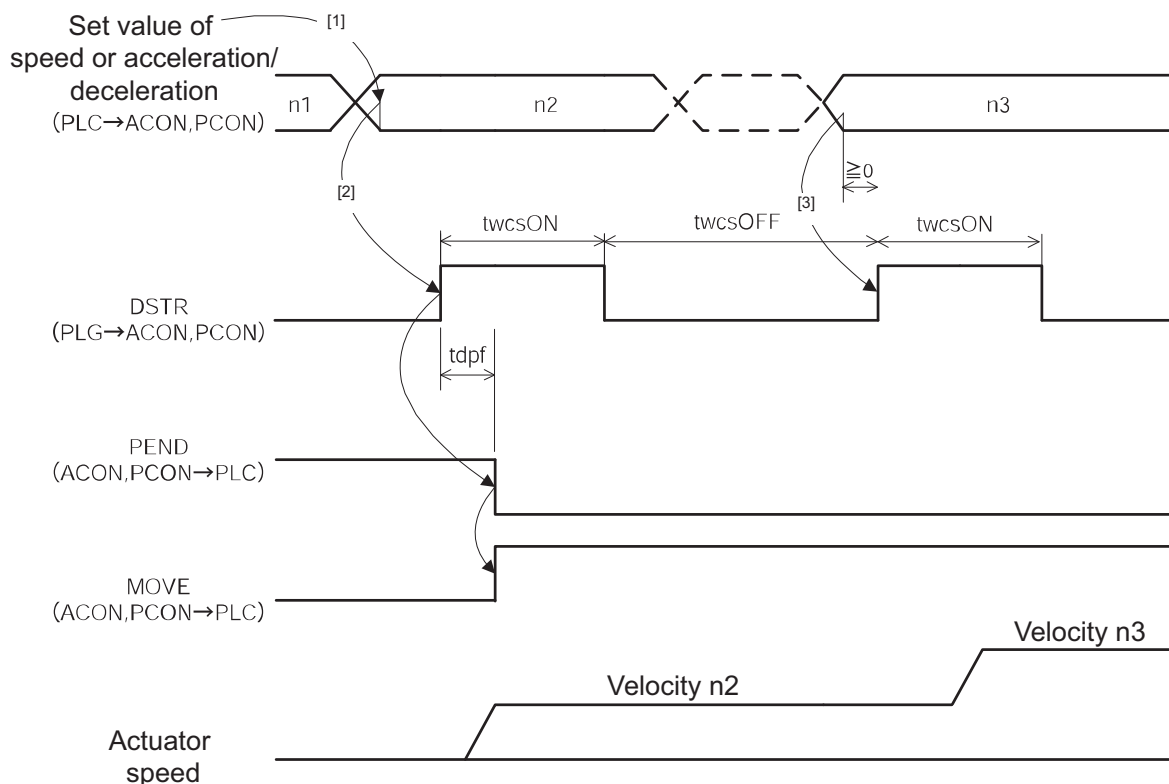
(4) Data change during movement

In the half direct mode or full direct mode, the value currently set to a given register among the registers for target position data, acceleration/deceleration data, speed data, positioning band and push-motion current-limiting value, can be changed while the actuator is moving.

After changing the data, turn "ON" the positioning command (DSTR) for more than t_{dpf} .

Also, after turning "OFF" the DSTR, set aside some time for " $t_{wcsON} + t_{wcsOFF}$ " or more, until the next DSTR is turned "ON".

The example is shown as follows, where the speed and acceleration/deceleration data items have been changed.



$$t_{wcsON} \geq Yt + xt + 3(\text{msec})$$

$$t_{wcsOFF} \geq Yt + xt + 3(\text{msec})$$

$$*Yt + xt \leq t_{pdf} \leq Yt + xt + 3(\text{msec})$$

Caution

1. When the speed has not been set or it is set to "0", the actuator is not moved, but an alarm is not issued.
2. When the speed setting is changed to "0" during the movement, the actuator is decelerated and stopped, but an alarm is not issued.
3. Even when the acceleration/deceleration data only is changed during the movement, the setting of the target position data is required.
4. Even when the target position data only is changed during the movement, the setting of the acceleration/deceleration data is required.

2.9 EtherCAT(R) Related Parameters

Parameters relating to EtherCAT(R) are No. 84 to No. 87 and No. 90.

Category: C :External interface parameter

No.	Category	Symbol	Name	Default Value set in the Factory before Delivery
1			Refer to Operation Manual for the controller for the parameters No. 1 through No. 83.	
2				
83				
84	C	FMOD	Field bus operation mode	0
85	C	NADR	Field bus node address	17
86	C	FBRs	Field bus baud rate	0
87	C	NTYP	Network type	6
90	C	FMIO	Field I/O format	3

- Field bus operation mode (No.84 FMOD)

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

Value set in parameter No. 84	Mode	Number of occupied bytes	Contents
0 (Factory setting)	Remote I/O Mode	2	Operation using PIOs (24 V I/Os) is performed via EtherCAT(R).
1	Position/simple direct mode	8	The target position can be set directly using the value or the operation can be performed using position data value. The other values required for the operation are set on the position data.
2	Half Direct Value Mode	16	In addition to the target position, the speed, acceleration/deceleration and pressing current value are set directly using the values to perform the operation.
3	Full Direct Value Mode	32	All the values related to the position control are set using the values to perform the operation.
4	Remote I/O Mode 2	12	The current position and current speed reading functions are added to the functions in the remote I/O mode.

- Field bus node address (No.85 NADR)

Specify the node address number in parameter No. 85.

Setting Range 0 to 127 (It is set to "17" when the machine is delivered from the factory.)



Caution : Selecting a value between 17 and 80 (EtherCAT (R) I/O device range) is recommended for node address if Omron's master is being used.
If a value between 0 and 16 is selected, the Full Direct Value mode cannot be used.

- Field bus baud rate (No.86 FBRs)

The baud rate is automatically set to the same value as the baud rate set in the master. Accordingly, you do not need to set the baud rate.

- Network type (No.87 NTYP)

The network module type is set for the parameter No. 87. Do not change the default value.

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

Addresses in the PLC are assigned in units of 16 points (2 bytes) based on the node address set in the controller and the occupied bytes in each operation mode.

By changing the setting of parameter No. 90, data elements can be swapped within a boundary of two words or less in units of bytes during communication using the I/O areas of the PLC.

Value set in parameter No. 90	Contents
0	Data exchange is not performed. The data is sent directly to the PLC. (Refer to "Example i".)
1	The host bytes are exchanged with slave bytes in the host words and slave words. (Refer to "Example ii".)
2	In the case of word register, the host words are exchanged with the slave words. (Refer to "Example iii".)
3 (Factory setting)	The host bytes are exchanged with slave bytes in the host words and slave words. In addition, the upper word and lower word are swapped for word registers. (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 CH	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			

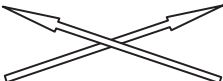
ACON, PCON Output register	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	1				2				3				4				A				B				C				D			

↓

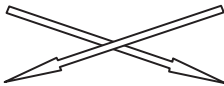
PLC : Input CH	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Hexadecimal data	1				2				3				4				A				B				C				D			

(Example ii) Set value = "1"

● indicates ON, while ○ indicates OFF.

ACON, PCON Input resister	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 CH	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 resister	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 CH	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.

ACON, PCON Input resister	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	A				B				C				D				1				2				3				4			
PLC : Output CH	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 resister	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	A				B				C				D				1				2				3				4				
PLC : Input CH	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 iv) Set value = "3"

● indicates ON, while ○ indicates OFF.

ACON, PCON Input resister	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	C				D				A				B				3				4				1				2			

PLC : Output CH	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 resister	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	C				D				A				B				3				4				1				2			

PLC : Input CH	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			

3. SCON-CA

3.1 Operation Modes and Functions

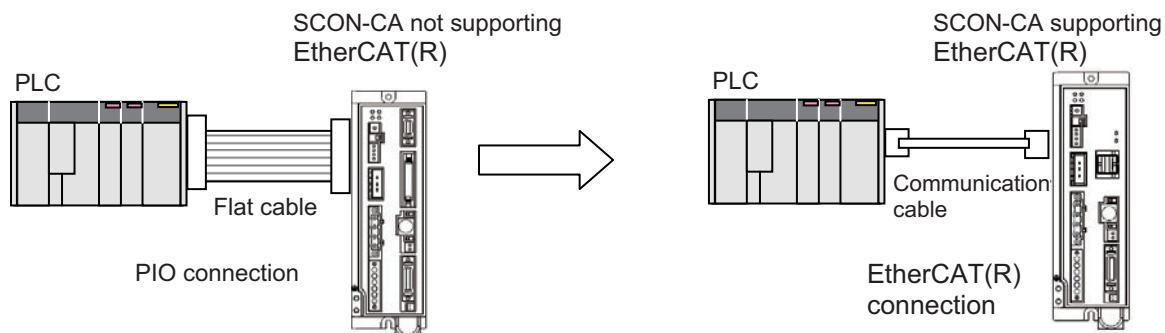
SCON-CA controllers supporting EtherCAT(R) can be operated in a desired operation mode selected from the following nine modes.

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	16
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)	○	○	△(*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.

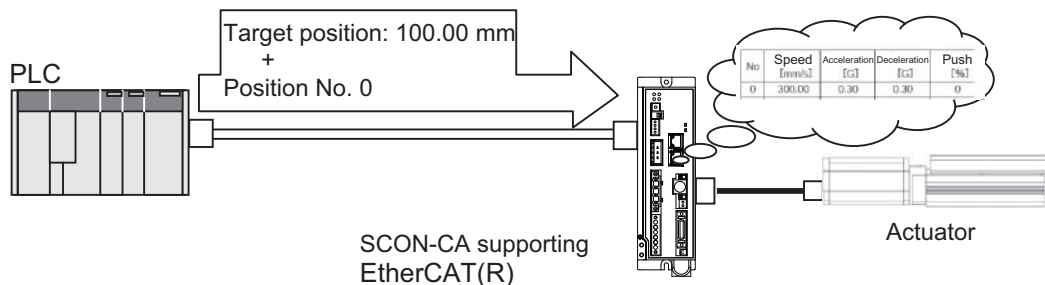
[1] Remote I/O mode: In this mode, the actuator is operated by PIOs (24-V I/Os) via EtherCAT(R) communication.
Number of occupied bytes: 2 bytes



[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.

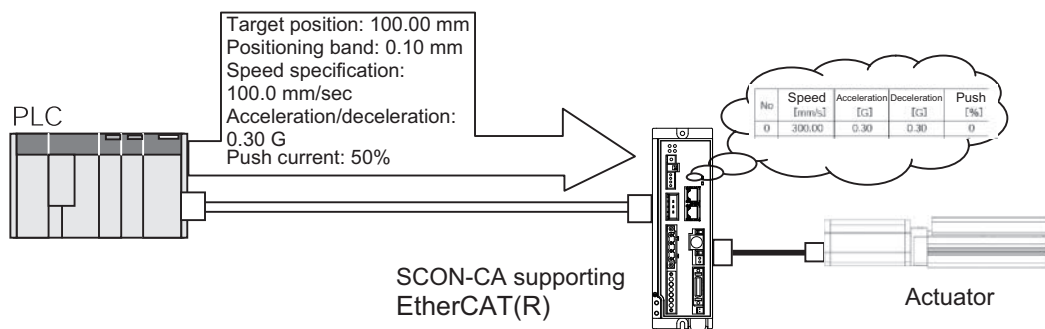
For the speed, acceleration/deceleration, positioning band, etc., values preregistered in the position data table are used. Up to 768 position data points can be set.

Number of occupied bytes: 8 bytes

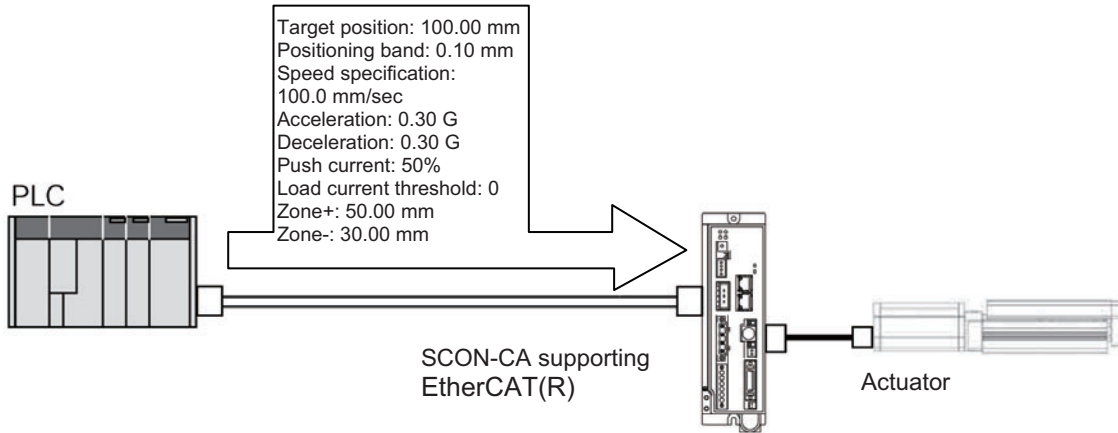


[3] Half direct mode: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.

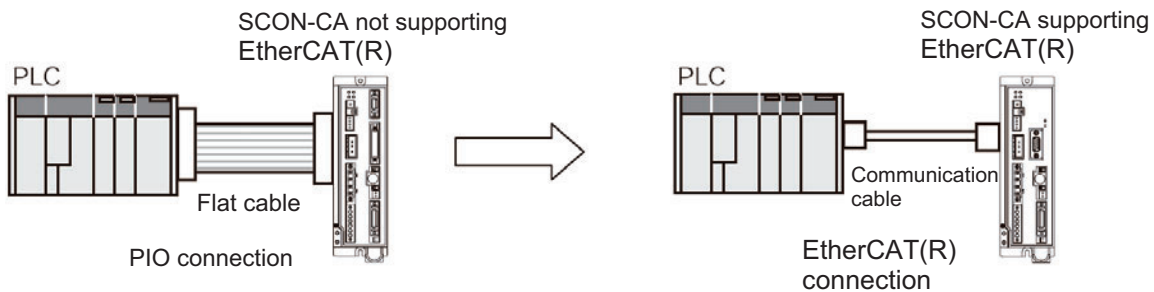
Number of occupied bytes: 16 bytes



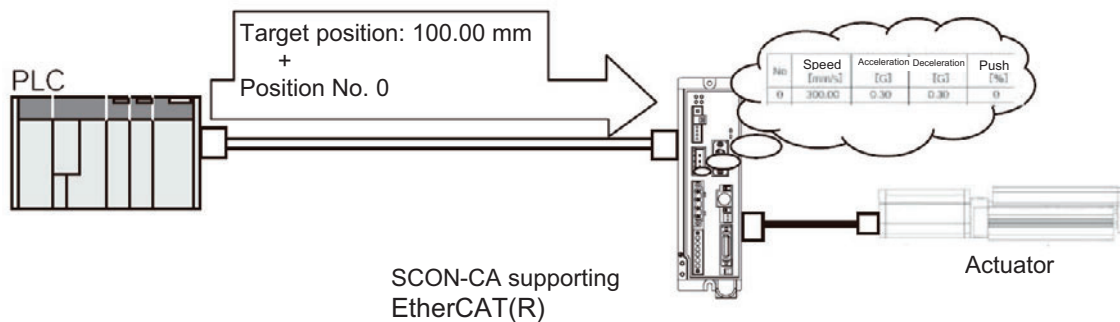
- [4] Full direct mode: In this mode, the actuator is operated by specifying all values relating to position control (target position, speed, acceleration/deceleration, etc.) directly as values. Number of occupied bytes: 32 bytes



- [5] Remote I/O mode 2: In this mode, the actuator is operated by PIOs (24-V I/Os) via EtherCAT(R) 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



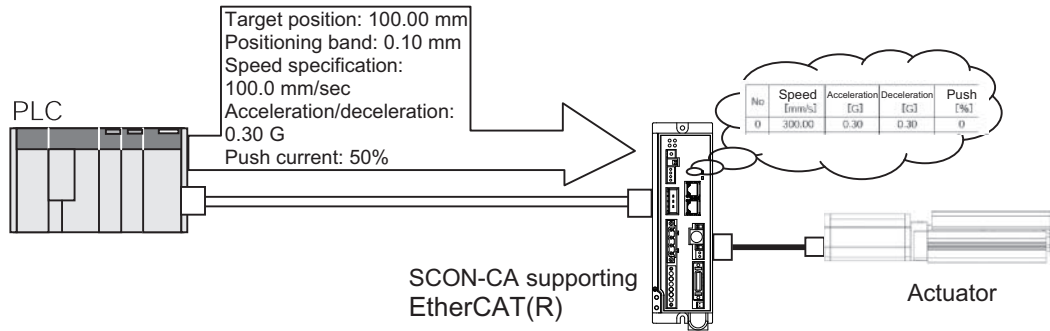
- [6] Position/simple direct mode 2: In this mode, the actuator is operated by specifying position numbers. In this mode, the force control function is available instead of the teaching function and zone function available in mode [2]. Number of occupied bytes: 8 bytes



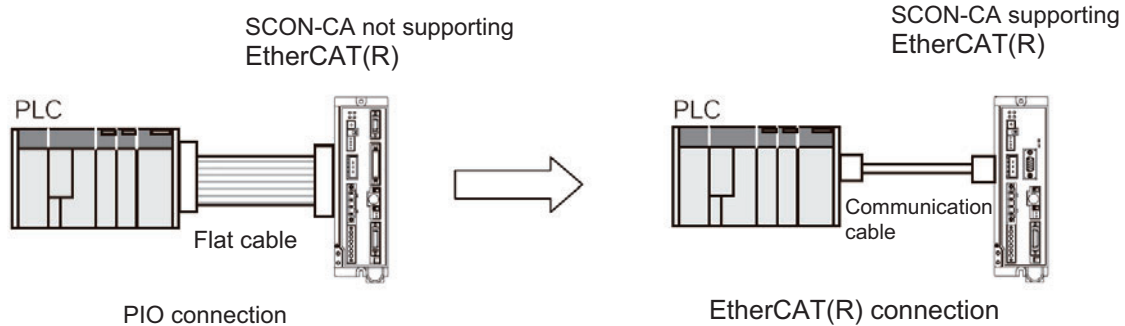
- [7] Half direct mode 2: In this mode, the actuator is operated by specifying the speed, acceleration/deceleration and push current, in addition to the target position, directly as values.

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



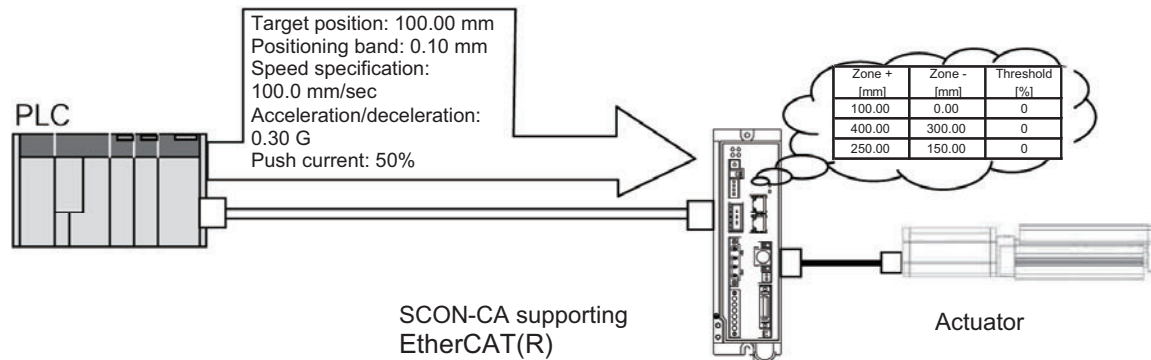
- [8] Remote I/O mode 3: In this mode, the actuator is operated by EtherCAT(R) instead of PIO (24 V I/O). Current position and command current function is added to the function [1].
- Number of occupied bytes: 12 bytes



[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].

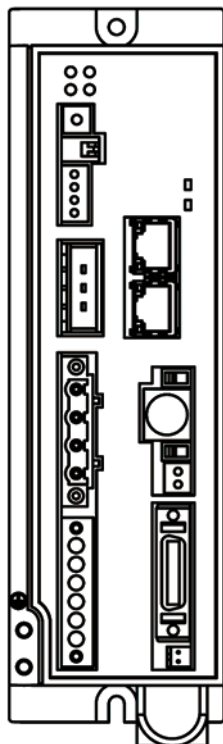
Number of occupied bytes: 16 bytes



3.2 Model Numbers

The model numbers of SCON-CA controller supporting EtherCAT(R) are indicated as follows, respectively:

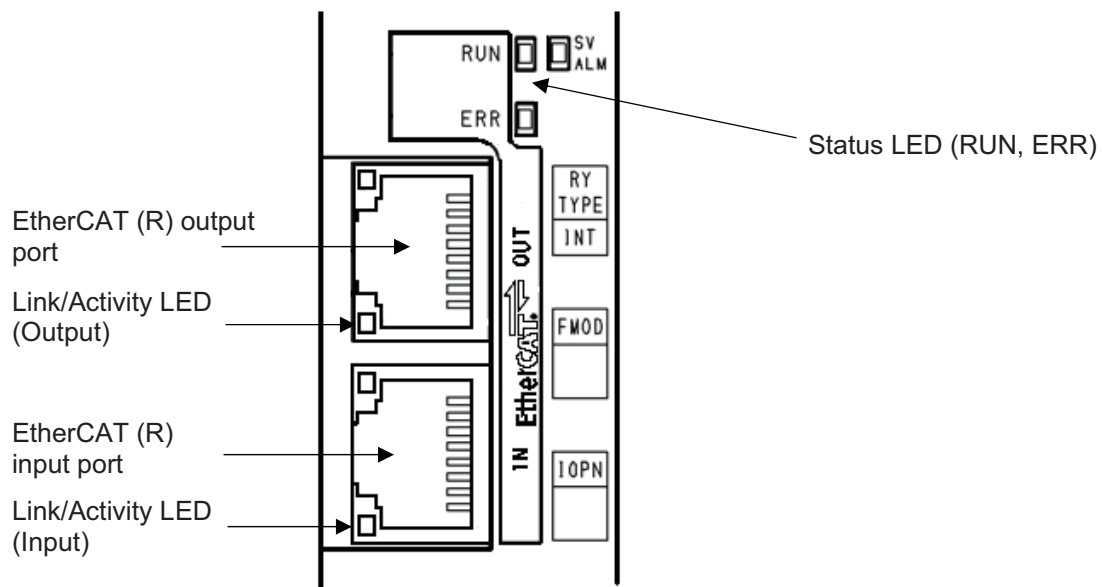
- SCON-CA-□-EC-□



3.3 EtherCAT(R) Interface

3.3.1 Names of the Parts

The names of each section related to EtherCAT(R) are described as follows.

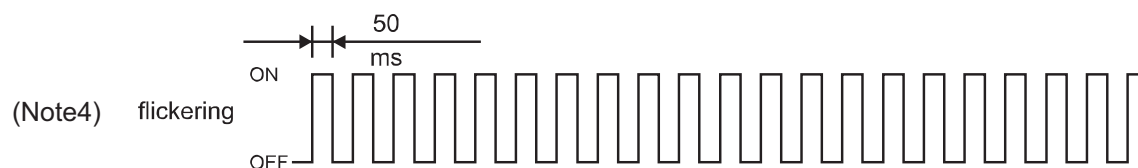
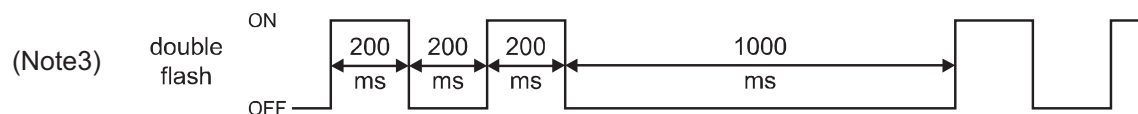
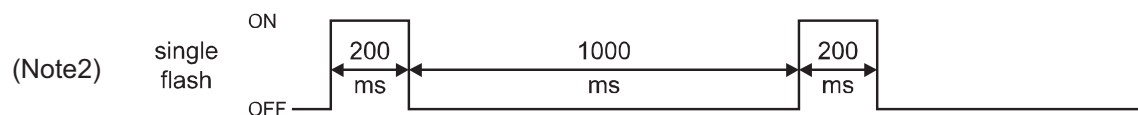
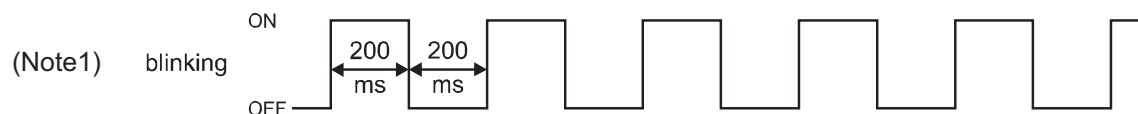


3.3.2 Monitor LED indications

The slave condition (each controller), as well as network condition, can be checked using the three LEDs, RUN, ERR and Link/Activity, provided on the front panel of the controller. The description of each is explained in the following table.

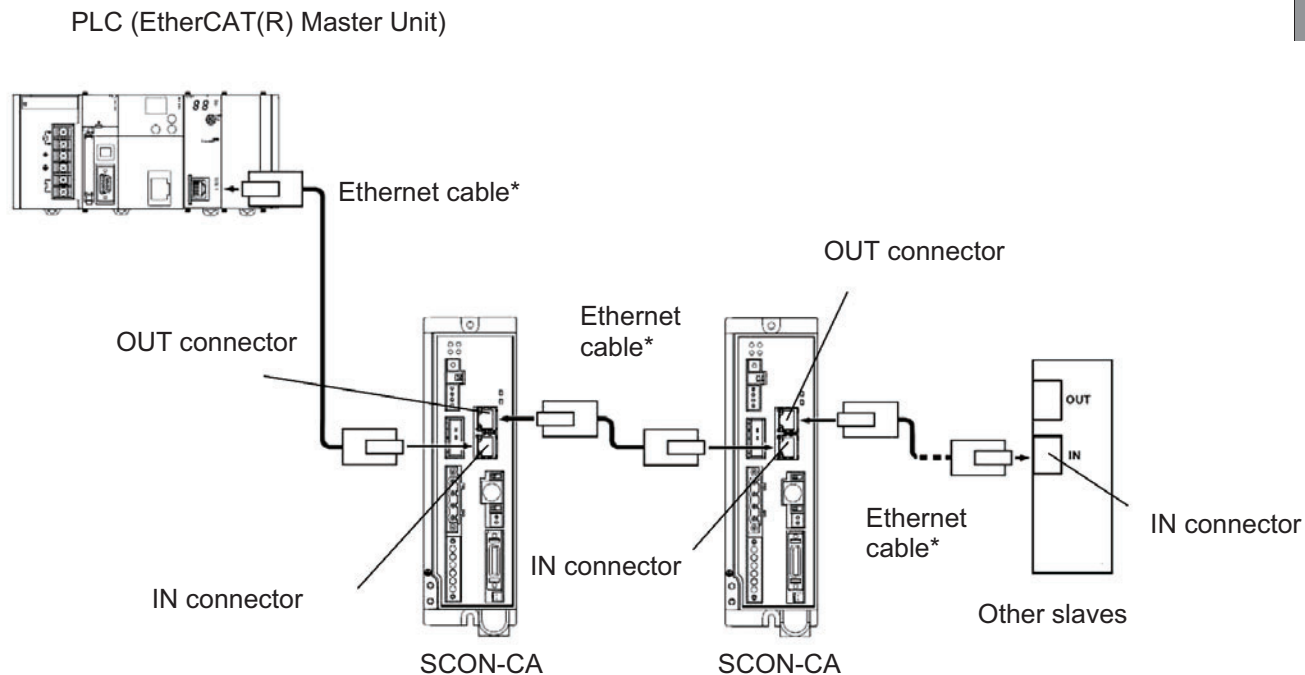
Name	Display color	Explanation
RUN	OFF	Initial status ("INIT" status of EtherCAT (R) communication), or the power is turned off
	GN (Illuminating)	Normal operation ("OPERATION" status of EtherCAT(R) communication)
	GN (Flashing) (ON: 200 ms/OFF: 200 ms) (Note1)	("PRE-OPERATION" status of EtherCAT(R) communication)
	GN (Flashing) (ON: 200 ms/OFF: 1000 ms) (Note2)	("SAFE-OPERATION" status of EtherCAT(R) communication)
	RD (Illuminating)	A communication part (module) error
ERR	OFF	No error, or the power is turned off.
	RD (Flashing) (ON: 200 ms/OFF: 200 ms) (Note1)	Configuration information (setting) error (Information received from the master cannot be configured.)
	RD (Flashing) (ON: 200 ms x twice /OFF: 1000 ms)(Note3)	Communication part circuit error (Watchdog timer timeout)
	RD (Illuminating)	Communication part (module) error
Link/ Activity	OFF	Link condition is not detected, or the power is turned off.
	GN (Illuminating)	Link established (No heavy traffic on the line)
	GN (Flashing) (ON: 50 ms/OFF: 50 ms) (Note4)	Link established (Heavy traffic on the line)

- LED Flash Timing



3.4 Wiring Example

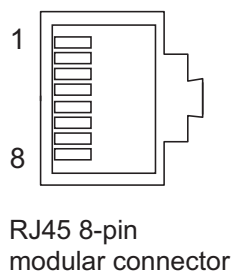
3.4.1 Connection Diagram



* Ethernet cable: Straight cable of category 5e or above, 100 m max
(Aluminum tape and braided double-shielded cable are recommended.)

(Note) Terminal processing is not required.

3.4.2 Connector Pin Layout



Pin number	Signal name	Signal abbreviation
1	Data transmitted +	TD+
2	Data transmitted -	TD-
3	Data received +	RD+
4	Not used	
5	Not used	
6	Data received -	RD-
7	Not used	
8	Not used	
Connector hood	Grounding pin for security	FG

3.5 Setting

Using the teaching tool, set controller parameters. Set the mode toggle switch on the front panel of the controller to “MANU” side. The versions of teaching tool compatible with EtherCAT(R) are as follows:

- RC PC-compatible software :V8.01.01.00 or later
- CON-T/TG :V1.10 (Planned)
- CON-PT/PD/PG :V1.20 (Planned)
- RCM-E/P :V2.20 (Planned)

3.5.1 Operation Mode Selecting

Set parameter No. 84 “FMODE: Field Bus Operation Mode.”
[Refer to 3.9 EtherCAT(R) Related Parameters.]

Set Value	Operation Mode	Number of occupied bytes
0 (Factory setting)	Remote I/O Mode	2
1	Position / Simplified Direct Value Mode	8
2	Half Direct Value Mode	16
3	Full Direct Value Mode	32
4	Remote I/O Mode	12
5	Position / Simplified Direct Value Mode2	8
6	Half Direct Value Mode 2	16
7	Remote I/O Mode 3	12
8	Half Direct Value Mode 3	16

* Entering any value except for the ones described above will cause an “Excessive Input Value Error”.

3.5.2 Station No. Setting

Set parameter No. 85 “NADR: Field Bus Node Address.”
[Refer to 3.9 EtherCAT(R) Related Parameters.]

Settable Range:0 to 127 (It is set to “17” when the machine is delivered from the factory.)



Caution: Selecting a value between 17 and 80 (EtherCAT (R) I/O device range) is recommended for node address if Omron's master is being used.
If a value between 0 and 16 are selected, the Full Direct Value mode cannot be used.

- (Note) Exercise caution to avoid node address duplication.
The nodes (controllers) are assigned in the order of their node address in the remote I/O memory areas of the PLC.
For details, refer to the Operation Manuals of the master unit and PLC in which in the master unit is installed.
- (Note) The setting for the communication speed is not required because it automatically follows the master's communication speed.
- (Note) After the parameter setting, turn on the power to the controller again and return the mode toggle switch on the front of the controller to “AUTO” side.
When the switch is set to “MANU”, the operation using PLC is not available.

3.6 Communicating with the Master Station

3.6.1 Operation Modes and Corresponding PLC I/O Areas

The channels allocated for each operation mode are described as follows.

- PLC Output → SCON-CA input (* “n” shows the node address of each axis.)

PLC output area (bytes)	DI on the SCON-CA side and Input Data Register					
	Remote I/O Mode	Position / Simplified Direct Value Mode	Half Direct Value Mode	Full Direct Value 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, n+1	Port No.0 to 15	Target Position	Target Position	Target Position	Port No.0 to 15	
n+2, n+3		Specified position number	Positioning Band	Positioning Band	Occupied area	
n+4, n+5						
n+6, n+7		Control Signal	Velocity	Speed Setup		
n+8, n+9						
n+10, n+11			Acceleration/Deceleration	Zone boundary+		
n+12, n+13			Pressing Current Limit Value			
n+14, n+15			Control Signal	Zone boundary-		
n+16, n+17				Acceleration		
n+18, n+19				Deceleration		
n+20, n+21				Pressing Current Limit Value		
n+22, n+23				ACON	Occupied area	
n+24, n+25				PCON	Load current threshold	
n+26, n+27		Control Signal 1				
n+28, n+29		Control Signal 2				
n+30, n+31						

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting. Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

- PLC output → SCON-CA Input Side (* “n” shows the node address of each axis.)

PLC input area (bytes)	DO on the SCON-CA side and Output Data Register			
	Position / Simplified Direct Value Mode 2	Half Direct Value Mode 2	Remote I/O Mode 3	Half Direct Value Mode 3
	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 12	Number of occupied bytes: 16
n+0, n+1 n+2, n+3	Target Position	Target Position	Port No.0 to 15	Target Position
n+4, n+5	Specified position number	Positioning Band	Occupied area	Positioning Band
n+6, n+7	Control Signal			
n+8, n+9		Velocity		Velocity
n+10, n+11		Acceleration/ Deceleration		Acceleration/ Deceleration
n+12, n+13		Pressing Current Limit Value		Pressing Current Limit Value
n+14, n+15		Control Signal		Control Signal
n+16, n+17				
n+18, n+19				
n+20, n+21				
n+22, n+23				
n+24, n+25				
n+26, n+27				
n+28, n+29				
n+30, n+31				

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting. Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

- SCON-CA output → PLC input (* “n” shows the node address of each axis.)

PLC output area (bytes)	DO on the SCON-CA side and Output Data Register				
	Remote I/O Mode	Position / Simplified Direct Value Mode	Half Direct Value Mode	Full Direct Value 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+0, n+1	Port No.0 to 15	Current Position	Current Position	Current Position	Port No.0 to 15
n+2, n+3					Occupied area
n+4, n+5		Completed Position No. (simple alarm ID)	Command Current	Command Current	Current position
n+6, n+7					
n+8, n+9		Status Signal	Current Speed	Current Speed	Command current
n+10, n+11					
n+12, n+13		Alarm Code	Alarm Code	Alarm Code	
n+14, n+15					
n+16, n+17		Status Signal	Force feedback data	Occupied area	
n+18, n+19					
n+20, n+21		Status signal 1	Status signal 2	Status signal 1	
n+22, n+23					
n+24, n+25		Status signal 2	Status signal 1	Status signal 2	
n+26, n+27					
n+28, n+29		Status signal 1	Status signal 2	Status signal 1	
n+30, n+31					

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting. Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

- SCON-CA output→PLC Input Side (* “n” shows the node address of each axis.)

PLC input area (bytes)	DO on the SCON-CA side and Output Data Register			
	Position / Simplified Direct Value Mode 2	Half Direct Value Mode 2	Remote I/O Mode 3	Half Direct Value Mode 3
	Number of occupied bytes: 8	Number of occupied bytes: 16	Number of occupied bytes: 12	Number of occupied bytes: 16
n+0, n+1	Current position	Current position	Port number 0 to 15	Current position
n+2, n+3			Occupied area	
n+4, n+5	Completed position number (simple alarm ID)	Force feedback data	Current position	Command current
n+6, n+7	Status signal			
n+8, n+9		Current speed	Force feedback data	Current speed
n+10, n+11		Alarm code		Alarm code
n+12, n+13		Status signal		Status signal
n+14, n+15				
n+16, n+17				
n+18, n+19				
n+20, n+21				
n+22, n+23				
n+24, n+25				
n+26, n+27				
n+28, n+29				
n+30, n+31				

(Note) The **Occupied area** shows the domain to be occupied with the operation mode setting. Therefore, this domain cannot be used for any other purpose. Also, exercise caution to avoid node address duplication.

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

This is the operation mode with the position No. set up as the same as using PIO (24V I/O).

Set the position data using the teaching tools such as PC software.

The number of operable positions varies depending on the parameter No. 25 “PIO Pattern” setting.

The I/O specifications for the PIO pattern are described as follows. (Refer to Operation Manual for the controller main body for more information.)

Value set in parameter No. 25	Operation Mode	I/O Specification
0	Positioning mode	64 positioning points and two zone output points are available.
1	Teaching mode	64 positioning points and one zone output point are available. Positioning operation and jog operation are supported. The current position can be written to a specified position.
2	256-point mode	256 positioning points and one zone output point are available.
3	512-point mode	512 positioning points are available. There are no zone outputs.
4	Electromagnetic valve mode 1	7 positioning points and two zone output points are available. The direct operation command is available for each position No. A position complete signal is output for each position number.
5	Electromagnetic valve mode 2	3 positioning points and two zone output points are available. The actuator is operated by specifying forward, backward and intermediate position commands. A position complete signal is output separately for the front end, rear end and intermediate position.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, one zone output point.
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, one zone output point. An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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	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) It is available when the parameter No. 27 “Movement Command Type” is set to “0”.
Turning “OFF” the “Movement Command” can stop the system temporarily.

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No.84	SCON-CA DI(Port No.)	PLC output address (bytes)	SCON-CA DO(Port No.)	PLC input address (bytes)
0	0 to 15	n+0, n+1	0 to 15	n+0, n+1

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input (1 word=2 bytes) and one output word (channel) in the I/O areas.

- Each address is controlled by ON/OFF bit signals.

PLC output (* “n” shows the node address of each axis.)

Address		1 word = 2 bytes = 16 bits															
n+0, n+1		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 (* “n” shows the node address of each axis.)

Address		1 word = 2 bytes = 16 bits															
n+0, n+1		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
Controller output port number		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

(3) I/O signal assignment

The controller's I/O port signal varies depending on the parameter No. 25 setting.

(Refer to Operation Manual for the controller main body for more information.)

		Parameter No. 25 setting					
		Positioning mode		Teaching mode		256-point mode	
		0		1		2	
Category	Port No.	Signal Name	Symbol	Signal Name	Symbol	Signal Name	Symbol
PLC Output → SCON-CA Input	0	Command position No.	PC1	Command position No.	PC1	Command position No.	PC1
	1		PC2		PC2		PC2
	2		PC4		PC4		PC4
	3		PC8		PC8		PC8
	4		PC16		PC16		PC16
	5		PC32		PC32		PC32
	6	Unavailable	-	Teaching Mode Command	MODE		PC64
	7		-	Jog/inching selector	JISL		PC128
	8		-	+Jog	JOG+	Unavailable	-
	9	Forced brake release	BKRL	-Jog	JOG-	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Home return	HOME
	12	Pause	*STP	Pause	*STP	Pause	*STP
	13	Positioning Start	CSTR	Positioning Start/ Position Data Import 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 No.	PM1	Completed Position No.	PM1	Completed Position No.	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		PM64
	7	Zone 1	ZONE1	Teaching mode Signal	MODES		PM128
	8	Position zone	PZONE	Position zone	PZONE	Position zone	PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal/ position-data read complete	PEND/ WEND	Positioning completion signal	PEND
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	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

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled. (ON/OFF is undefined.)

		Parameter No. 25 setting					
		512-point mode		Electromagnetic valve mode 1		Electromagnetic 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 No.	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	Unavailable	-
	4		PC16	Start position 4	ST4		-
	5		PC32	Start position 5	ST5		-
	6		PC64	Start position 6	ST6		-
	7		PC128	Unavailable	-		-
	8		PC256		-		-
	9	Forced brake release	BKRL	Forced brake release	BKRL	Forced brake release	BKRL
	10	Operating mode selector	RMOD	Operating mode selector	RMOD	Operating mode selector	RMOD
	11	Home return	HOME	Home return	HOME	Unavailable	-
	12	Pause	*STP	Pause	*STP		-
	13	Positioning Start	CSTR	Unavailable	-		-
	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 No.	PM1	Position 0 complete	PE0	Retracting end movement command 0	LS0
	1		PM2	Position 1 complete	PE1	Retracting end movement command 1	LS1
	2		PM4	Position 2 complete	PE2	Retracting end movement command 2	LS2
	3		PM8	Position 3 complete	PE3	Unavailable	-
	4		PM16	Position 4 complete	PE4		-
	5		PM32	Position 5 complete	PE5		-
	6		PM64	Position 6 complete	PE6		-
	7		PM128	Zone 1	ZONE1	Zone 1	ZONE1
	8		PM256	Position zone	PZONE	Position zone	PZONE
	9	Operation Mode Status	RMDS	Operation Mode Status	RMDS	Operation Mode Status	RMDS
	10	Home return completion	HEND	Home return completion	HEND	Home return completion	HEND
	11	Positioning completion signal	PEND	Positioning completion signal	PEND	Unavailable	-
	12	Operation preparation end	SV	Operation preparation end	SV	Operation preparation end	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

The symbol with a * mark shows the ON signal in normal condition.

The signal described as "Unavailable" is not controlled.(ON/OFF is undefined.)

		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	Cannot be used.	-
	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.)

3.6.3 Position/Simplified Direct Value Mode (Number of Occupied Bytes: 8)

This is the operation mode with the position No. set up. Whether the target position is set directly the control signals (PMOD signals), or the value registered on the position data is used can be selected.

For the speed, acceleration/deceleration and positioning band, etc., except for the target position, the values in the position table within the controller are used. Setup the position data referring the operation manual for the controller main body.

The settable No. of position data items is max 768 points.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	△	These items must be set in the position data table.
Pitch feed (inching)	△	
Pressing Operation	△	
Speed change during the movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using position data or parameters.
PIO pattern selection	x	

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No.84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
1	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Specified position number	n+4, n+5	Completed Position No. (Simple alarm code)	n+4, n+5
	Control Signal	n+6, n+7	Status Signal	n+6, n+7

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of four input words (4 words = 8 bytes) and four output words in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- The specified position No. and completed position No. are expressed using 1-word (16 bits) binary data. The figures from 0 to 767 can be set in PLC. However, set the position No. for which the operation conditions have been set in advance using the teaching tools such as PC software for RC.

PLC output

Address (* "n" shows the node address of each axis.)

		1 word = 2 bytes = 16 bits															
n+0, n+1		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position	(lower word)																

n+2, n+3		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position	(upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5		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+6, n+7		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" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

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

n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.							PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

n+6, n+7	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 assignment (* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details	
PLC Output	Target Position	32-bit data	-	32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between –999999 to +999999. (Example) When it is “+25.40mm”, set it as “2540”. If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (1)	
	Specified position number	16-bit data	PC1 to PC512	16-bit integer For the operation, the position data is required, for which the operation conditions have been set in advance using the teaching tools such as PC software. Set up the position No. for which the data has been input using this register. The settable range is 0 to 767. In the case that any value out of the range is set, or position No. that has not been set is specified, an alarm is output.	3.8 (1)	
	Control signal	b15	BKRL	Forced brake release: When it is turned ON, the brake is released.		3.6.11 (18)
		b14	RMOD	Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.		3.6.11 (19)
		b13	-	Unavailable		-
		b12				
		b11	PMOD	Position/simple-direct switching: The position mode is selected when this signal is OFF, and the simple direct mode is selected when the signal is ON.		3.6.11 (20)
		b10	MODE	Teaching Mode Command: The normal mode is selected when this signal is OFF, and the teaching mode is selected when the signal is ON.		3.6.11 (16)
		b9	PWRT	Position Data Import Command: Position data is read when this signal is ON.		3.6.11 (17)
		b8	JOG+	+Jog: “ON” for Movement in the Opposite Direction of Home		3.6.11 (13)
		b7	JOG-	-Jog: “ON” for Movement to the Home Direction		3.6.11 (13)
		b6	JVEL	Jog-speed/inch-distance switching: The values set in parameter No. 26, “Jog speed” and parameter No. 48, “Inch distance” are used when this signal is OFF, and the values set in parameter No. 47, “Jog speed 2” and parameter No. 49, “Inch distance 2” are used when the signal is ON.		3.6.11 (14)
		b5	JISL	Jog/inching selector: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.		3.6.11 (15)
		b4	SON	Servo ON Command: The servo turns ON when this signal turns ON.		3.6.11 (5)
		b3	RES	Reset: A reset is performed when this signal turns ON.		3.7.11 (4)
		b2	STP	Pause: A pause command is issued when this signal turns ON.		3.6.11 (11)
		b1	HOME	Home return: A home-return command is issued when this signal turns ON.		3.6.11 (6)
		b0	CSTR	Positioning Start: A move command is issued when this signal turns ON.		3.6.11 (7)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit	-	Current Position: 32-bit signed Integer. The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal)=10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (1)
	Completed Position No. (Simple alarm code)	16-bit	PM1 to PM512	16-bit integer It is moved to the target position and the positioning completed position No. within the positioning band is output. In the case that the position movement has not been performed at all, or during the movement, “0” is output. When an alarm is issued (in the case that the status signal ALM is “ON”), the simplified alarm code (Refer to the Operation Manual for the controller main body) is output.	3.8 (1)
	Status code	b15	EMGS	Emergency stop: An emergency stop is actuated when this signal turns ON.	3.6.11 (2)
		b14	PWR	Controller ready : This signal turns ON when the controller becomes ready.	3.6.11 (1)
		b13	ZONE2	Zone 2:“ON” for the current position within the zone set range	3.6.11 (12)
		b12	ZONE1	Zone 1:“ON” for the current position within the zone set range	3.6.11 (12)
		b11	PZONE	Position zone: This signal turns ON when the current position is inside the specified position zone.	3.6.11 (12)
		b10	MODES	Teaching mode Signal: This signal is ON while the teaching mode is selected.	3.6.11 (16)
		b9	WEND	Position-data read complete : This signal turns ON when reading is complete.	3.6.11 (17)
		b8	RMDS	Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
		b7	BALM	Absolute battery voltage low warning: This signal turns ON when the voltage drops.	3.6.11 (28)
		b6	-	Unavailable	-
		b5	PSEL	Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	3.6.11 (23)
		b4	SV	Operation preparation end: This signal turns ON when the servo turns ON.	3.6.11 (5)
		b3	ALM	Alarm: This signal turns ON when an alarm occurs.	3.6.11 (3)
		b2	MOVE	Moving Signal: This signal remains ON while the actuator is moving.	3.6.11 (9)
		b1	HEND	Home return completion: This signal turns ON when home return is completed.	3.6.11 (6)
		b0	PEND	Positioning completion signal: This signal turns ON when positioning is completed.	3.6.11 (10)

3.6.4 Half Direct Value Mode (Number of Occupied Bytes: 16)

This is the operation mode with the target position, positioning band, speed, acceleration/deceleration and pressing current value set up in the PLC. Set each value in the I/O areas. When the zone function is used, set it using the parameter Nos. 1, 2, 23 and 24.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remark
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	○	
Pitch feed (inching)	○	
Pressing Operation	○	
Speed change during the movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* “n” shows the node address of each axis.)

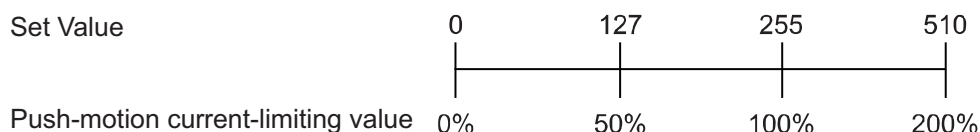
Parameter No.84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
2	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Positioning Band	n+4, n+5	Command Current	n+4, n+5
		n+6, n+7		n+6, n+7
	Velocity	n+8, n+9	Current Speed	n+8, n+9
	Acceleration/Deceleration	n+10, n+11		n+10, n+11
	Pressing Current Limit Value	n+12, n+13	Alarm Code	n+12, n+13
	Control signal	n+14, n+15	Status Signal	n+14, n+15

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (8 words = 16 bytes) and one output word in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 1-word (16 bits) binary data. The figures from 0 to +65535 (Unit: 1.0mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 510 (200%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC output

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	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+10, n+11	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+12, n+13	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+14, n+15	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" shows the node address of each axis.)

	1 word = 2 bytes =16 bits															
n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (lower word)																
n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (upper word)																

When the current speed is shown using the negative figure, it is expressed using the complement of 2.

n+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm code																
n+14, n+15	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 assignment (* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between -999999 to +999999. (Example) When it is "+25.41mm", set it as "2541". If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (2)
	Positioning Band	32-bit data	- 32-bit integer The unit is 0.01mm and settable range is between 1 to +999999. (Example) When it is "25.40mm", set it as "2540". This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position, that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the "PUSH" control signal setting.	3.8 (2)
	Velocity	16-bit data	- 16-bit integer Specify the speed at which to move the actuator. The unit is 1.0mm/sec and settable range is 0 to 65535. (Example) When it is "254.0mm/sec", set it as "254". When the movement command is set with the value bigger than the max. speed, an alarm is issued.	3.8 (2)
	Acceleration/Deceleration	16-bit data	- 16-bit integer Specify the acceleration / deceleration at which to move the actuator (the acceleration and deceleration will be the same value). The unit is 0.01G and settable range is 1 to 300. (Example) To set "0.30 G", specify "30". If a move command is issued by specifying "0" or any value exceeding the maximum acceleration or deceleration, an alarm will occur.	3.8 (2)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents			Details	
PLC Output	Pressing Current Limit Value	16-bit data	-	16-bit integer Specify the current-limiting value to be used during push-motion operation. The allowable specification range is 0 (0%) to 255 (100%). The actual settable range varies depending on each actuator.(Refer to the catalog or Operation Manual for the actuator.) If a move command is issued by specifying a value exceeding the maximum push-motion current, an alarm will occur.			3.8 (2)	
	Control Signal	b15	BKRL	Forced brake release: When it is turned ON, the brake is released.			3.6.11 (18)	
		b14	RMOD	Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.			3.6.11 (19)	
		b13	DIR	Push direction specification: “OFF” for the direction reducing the positioning band from the target position, “ON” for the direction adding the positioning band to the target position			3.6.11 (22)	
		b12	PUSH	Push-motion specification: Positioning operation is performed when this signal is OFF, and push-motion operation is performed when the signal is ON.			3.6.11 (21)	
		b11	GSL1	Servo gain parameter set selection 1	Select the servo gain parameter set to be used.		3.6.11 (33)	
		b10	GSL0	Servo gain parameter set selection 0	GSL1	GSL0		Function
					OFF	OFF		Select parameter set 0.
					OFF	ON		Select parameter set 1.
					ON	OFF		Select parameter set 2.
		ON	ON	Select parameter set 3.				
		b9	-	Cannot be used.			-	
		b8	JOG+	+ Jog: “ON” for Movement in the Opposite Direction of Home			3.6.11 (13)	
		b7	JOG-	-Jog: “ON” for Movement to the Home Direction			3.6.11 (13)	
		b6	JVEL	Jog-speed/inch-distance switching: The values set in parameter No. 26, “Jog speed” and parameter No. 48, “Inch distance” are used when this signal is OFF, and the values set in parameter No. 47, “Jog speed 2” and parameter No. 49, “Inch distance 2” are used when the signal is ON.			3.6.11 (14)	
		b5	JISL	Jog/inch switching: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.			3.6.11 (15)	
		b4	SON	Servo ON Command: The servo turns ON when this signal turns ON.			3.6.11 (5)	
		b3	RES	Reset: A reset is performed when this signal turns ON.			3.6.11 (4)	
		b2	STP	Pause: A pause command is issued when this signal turns ON.			3.6.11 (11)	
		b1	HOME	Home return: A home-return command is issued when this signal turns ON.			3.6.11 (6)	
	b0	DSTR	Positioning Command: A move command is issued when this signal turns ON.			3.6.11 (8)		

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	- 32-bit signed integer indicating the current position The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Command Current	32-bit data	- 32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. (Example) Reading:000003FF _H =1023 (decimal) =1023mA	3.8 (2)
	Current Speed	32-bit data	- 32-bit signed integer indicating the current position 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 setting unit is 0.01mm/sec. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm/sec * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Alarm Code	16-bit data	- 16-bit integer When an alarm is issued, the alarm code is output. When any alarm is not issued, it is "0 _H ". Refer to the Operation Manual for the controller main body for the details of the alarms.	3.8 (2)
	Status Signal	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	3.6.11 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	3.6.11 (1)
		b13	ZONE2 Zone 2:"ON" for the current position within the zone set range	3.6.11 (12)
		b12	ZONE1 Zone 1:"ON" for the current position within the zone set range	3.6.11 (12)
		b11	-	-
		b10		
		b9		
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	3.6.11 (28)
		b6	- Cannot be used.	-
		b5	PSEL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	3.6.11 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	3.6.11 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	3.6.11 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	3.6.11 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	3.6.11 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	3.6.11 (10)

3.6.5 Full Direct Value Mode (Number of Occupied Bytes: 32)

This is the operation mode with all the values (target position, speed, etc.) set up directly using values from PLC. Set each value in the I/O area.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	O:Direct control x:Disable
Home-return operation	<input type="radio"/>
Positioning operation	<input type="radio"/>
Speed and acceleration / deceleration setting	<input type="radio"/>
Pitch feed (inching)	<input type="radio"/>
Pressing Operation	<input type="radio"/>
Speed change during the movement	<input type="radio"/>
Operation at different acceleration and deceleration	<input type="radio"/>
Pause	<input type="radio"/>
Zone signal output	<input type="radio"/>
PIO pattern selection	x

(1) PLC address configuration (* "n" shows the node address of each axis.)

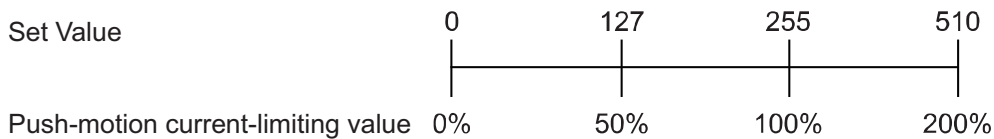
Parameter No. 84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
3	Target position	n+0, n+1	Current position	n+0, n+1
		n+2, n+3		n+2, n+3
	Positioning band	n+4, n+5	Command current	n+4, n+5
		n+6, n+7		n+6, n+7
	Speed	n+8, n+9	Current speed	n+8, n+9
		n+10, n+11		n+10, n+11
	Zone boundary+	n+12, n+13	Alarm code	n+12, n+13
		n+14, n+15	Occupied area	n+14, n+15
	Zone boundary-	n+16, n+17	Force feedback data	n+16, n+17
		n+18, n+19		n+18, n+19
	Acceleration	n+20, n+21	Occupied area	n+20, n+21
	Deceleration	n+22, n+23		n+22, n+23
	Push-current limiting value	n+24, n+25		n+24, n+25
	Load current threshold	n+26, n+27		n+26, n+27
	Control signal 1	n+28, n+29	Status signal 1	n+28, n+29
	Control signal 2	n+30, n+31	Status signal 2	n+30, n+31

(Note) The areas denoted by **Occupied area** cannot be used for any other purpose.
Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (16 words = 32 bytes) and one output word in the I/O areas.

- Control signals 1 and 2 and status signals are ON/OFF bit signals.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 2-word (32 bits) binary data. The figures from 0 to +999999 (Unit: 0.01mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 510 (200%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- Set the load current threshold. The load current threshold is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 510 (200%) can be set in PLC. (Refer to the graph of push-motion current-limiting value (above graph).)
- Zone Boundary “+” and Zone Boundary “-” are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 can be set in PLC. However make sure to set the smaller value for the Zone Boundary “-” than that for the Zone Boundary “+”.
- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.
- The force feedback data is 2-word (32-bit) binary data (unit: 0.01 N).

PLC output

Address (* "n" shows the node address of each axis.)

		1 word = 2 bytes =16 bits															
n+0, n+1		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																	
n+2, n+3		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																	

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (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+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Positioning Width (upper word)													524,288	262,144	131,072	65,536
n+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity (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+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Velocity (upper word)													524,288	262,144	131,072	65,536
n+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary + (lower word)																
n+14, n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary + (upper word)																

When the zone boundary is shown using the negative figure, it is expressed using the complement of 2.

Address (* "n" shows the node address of each axis.)

		1 word = 2 bytes = 16 bits															
n+16, n+17		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary – (lower word)																	
n+18, n+19		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Zone boundary – (upper word)																	

When the zone boundary is shown using the negative figure, it is expressed using the complement of 2.

n+20, n+21		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+22, n+23		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+24, n+25		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+26, n+27		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+28, n+29		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+30, n+31		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

Channel (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

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

n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (lower word)																

n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (upper word)																

When the current speed is shown using the negative figure, it is expressed using the complement of 2.

n+12, n+13	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm Code																

n+14, n+15	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used.																

n+16, n+17 b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

Force feedback data (lower word)																
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

n+18, n+19 b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

Force feedback data (upper word)																
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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

n+20 to n+27 b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

Cannot be used.																
--------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

n+28, n+29 b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0

Status signal 1															CEND	BALM
-----------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	------	------

n+30, n+31 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 assignment (* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed integer indicating the current position Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is -999999 to +999999. (Example) When it is “+25.41mm”, set it as “2541”. If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). * When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (3)
	Positioning Band	32-bit data	- 32-bit integer The unit is 0.01mm and settable range is 1 to +999999. (Example) When it is “25.40mm”, set it as “2540”. This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position, that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the “PUSH” control signal setting.	3.8 (3)
	Velocity	32-bit data	- 32-bit integer Specify the speed at which to move the actuator. The unit is 0.01 mm/sec and the settable range is 0 to 999999. (Example) When it is “25.41mm/sec”, set it as “2541”. When the movement command is set with the value bigger than the max. speed, an alarm is issued.	3.8 (3)
	Zone boundary+ /Zone boundary-	32-bit data	- 32-bit signed integer indicating the current position After completion of home return, an effective zone signal can be output separately from the zone boundaries specified by parameters. The status signal PZONE turns ON when the current position is inside these +/- boundaries. (Example) When it is “+25.40mm”, set it as “2540”. The unit is 0.01mm and the settable range is -999999 to 999999. Enter a value that satisfies the relationship of “Zone boundary + > Zone boundary -”. If this function is not used, enter the same value for both the positive and negative boundaries. *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (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.			3.8 (3)	
	Deceleration	16-bit data	-					
	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 510 (200%). If judgment is not performed, enter “0.”			3.8 (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.		3.6.11 (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.
		ON	ON	Select parameter set 3.				
		b11	-	Cannot be used.			-	
		b10						
		b9	ASO1	Stop mode 1	Select the stop mode during standby.		3.6.11 (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.
					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.				
		b7	MOD1	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.			3.6.11 (30)	
		b6	MOD0					
		b5	GSL1	Servo gain parameter set selection 1	Select the servo gain parameter set to be used.		3.6.11 (33)	
		b4	GSL0	Servo gain parameter set selection 0	GSL1	GSL0		Function
					OFF	OFF		Select parameter set 0.
					OFF	ON		Select parameter set 1.
					ON	OFF		Select parameter set 2.
		ON	ON	Select parameter set 3.				

Address		Bit	Symbol	Function	Details
PLC output	Control signal 1	b3	INC	Incremental specification: Absolute position command when the signal is OFF, or incremental position command when the signal is ON.	3.6.11 (24)
		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.	3.6.11 (22)
		b1	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.	3.6.11 (21)
		b0	-	Cannot be used.	-
	Control signal 2	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.	3.6.11 (18)
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	3.6.11 (19)
		b13	-	Cannot be used.	-
		b12			
		b11			
		b10			
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	3.6.11 (32)
		b8	JOG+	+Jog: The actuator moves in the direction opposite home when the signal is ON.	3.6.11 (13)
		b7	JOG-	-Jog: The actuator moves in the direction of home when the signal is ON.	3.6.11 (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.	3.6.11 (14)
		b5	JISL	Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	3.6.11 (15)
		b4	SON	Servo ON command: The servo is ON when the signal is ON.	3.6.11 (5)
		b3	RES	Reset: A reset is performed when the signal turns ON.	3.6.11 (4)
		b2	STP	Pause: A pause command is issued when the signal turns ON.	3.6.11 (11)
		b1	HOME	Home return: A home return command is issued when the signal turns ON.	3.6.11 (6)
		b0	DSTR	Positioning start: A move command is issued when the signal turns ON.	3.6.11 (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 complement of 2.	3.8 (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	3.8 (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 compliment of 2.	3.8 (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.	3.8 (3)
	Force feedback data	32-bit data	- 32-bit signed integer. The unit is 0.01 N. * If this data is read as a hexadecimal, a negative value is indicated by a compliment of 2.	3.8 (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.	3.6.11 (32)
		b1	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	3.6.11 (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	b15	EMGS	Emergency stop: An emergency stop is being executed when the signal is ON.	3.6.11 (2)
	b14	PWR	Controller ready: The signal turns ON when the controller becomes ready.	3.6.11 (1)
	b13	ZONE2	Zone 2: The signal is ON when the current position is inside the specified zone.	3.6.11 (12)
	b12	ZONE1	Zone 1: The signal is ON when the current position is inside the specified zone.	3.6.11 (12)
	b11	PZONE	Position zone: The signal is ON when the current position is inside the specified position zone.	3.6.11 (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.)	3.6.11 (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.)	3.6.11 (27)
	b8	RMDS	Operation mode: The signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
	b7	GHMS	Home return in progress: The signal is ON while the home return is in progress.	3.6.11 (6)
	b6	PUSHS	Push-motion operation in progress: The signal is ON while the push-motion operation is in progress.	3.6.11 (25)
	b5	PSFL	Missed work part during push-motion operation: The signal turns ON when the actuator missed the work part during push-motion operation.	3.6.11 (23)
	b4	SV	Ready: The signal is ON when the servo is ON.	3.6.11 (5)
	b3	ALM	Alarm: The signal turns ON when an alarm occurs.	3.6.11 (3)
	b2	MOVE	Moving signal: The signal is ON while the actuator is moving.	3.6.11 (9)
	b1	HEND	Home return complete: The signal turns ON when the home return is completed.	3.6.11 (6)
	b0	PEND	Positioning complete signal: The signal turns ON when the positioning is completed.	3.6.11 (10)

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

This is the operation mode with the position No. set up as the same as using PIO (24V I/O).

Set the position data using the teaching tools such as RC PC software.

The number of operable positions varies depending on the parameter No. 25 "PIO Pattern" setting.

This mode is the same as the remote I/O mode, but the current-position read function and command-current read function are also available.

The features of each PIO pattern are shown below. (Refer to Operation Manual for the controller main body for more information)

Value set in parameter No. 25	Operation Mode	I/O Specification
0	Positioning mode	64 positioning points and two zone output points are available.
1	Teaching mode	64 positioning points and one zone output point are available. Positioning operation and jog operation are supported. The current position can be written to a specified position.
2	256-point mode	256 positioning points and one zone output point are available.
3	512-point mode	512 positioning points are available. There are no zone outputs.
4	Electromagnetic valve mode 1	7 positioning points and two zone output points are available. The direct operation command is available for each position No. A position complete signal is output for each position number.
5	Electromagnetic valve mode 2	3 positioning points and two zone output points are available. The actuator is operated by specifying forward, backward and intermediate position commands. A position complete signal is output separately for the front end, rear end and intermediate position.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, one zone output point.
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, one zone output point. An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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	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) It is available when the parameter No. 27 "Movement Command Type" is set to "0".

Turning "OFF" the "Movement Command" can stop the system temporarily.

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No. 84	SCON-CA DI and input register	PLC output address (bytes)	SCON-CA DO and output register	PLC input address (bytes)
4	Port number 0 to 15	n+0, n+1	Port number 0 to 15	n+0, n+1
	Occupied area	n+2, n+3	Occupied area	n+2, n+3
		n+4, n+5	Current position	n+4, n+5
		n+6, n+7		n+6, n+7
		n+8, n+9	Command current	n+8, n+9
		n+10, n+11		n+10, n+11

(Note) The areas denoted by **Occupied area** cannot be used for any other purpose.
Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (6 words = 12 bytes) and one output word in the I/O areas.

- The areas controlled by port number are controlled using ON/OFF bit signals.
- The current position is a 2-word (32-bit) binary data (unit: 0.01 mm).
- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).

PLC output

Address (* “n” shows the node address of each axis.)

n+0, n+1	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" shows the node address of each axis.)

1 word = 2 bytes = 16 bits																
n+0, n+1	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+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Unavailable																

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																

n+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+8, n+9	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+10, n+11	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

(3) I/O signal assignment

For the signal assignments corresponding to each PIO pattern, refer to the I/O signal assignments for the remote I/O mode explained in 3.6.2 (3).

The signal allocation for the Command Current and Current Position, is shown in the following table.

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	-	-
	Command Current	32-bit data	-	-

3.6.7 Position/Simplified Direct Value Mode (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. Whether the target position is set directly the control signals (PMOD signals), or the value registered on the position data is used can be selected. For the speed, acceleration/deceleration and positioning band, etc., except for the target position, the values in the position table within the controller are used. Setup the position data referring the operation manual for the controller main body.

The settable No. of position data items is max 768 points.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remarks
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	△	These items must be set in the position data table.
Pitch feed (inching)	△	
Pressing Operation	△	
Speed change during the movement	△	
Operation at different acceleration and deceleration	△	
Pause	○	
Zone signal output	△	Zones are set using position data or parameters.
PIO pattern selection	x	

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No.84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
5	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Specified position number	n+4, n+5	Completed Position No. (Simple alarm code)	n+4, n+5
	Control Signal	n+6, n+7	Status Signal	n+6, n+7

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (4 words = 8 bytes) and one output word in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- The specified position No. and completed position No. are expressed using 1-word (16 bits) binary data. The figures from 0 to 767 can be set in PLC. However, set the position No. for which the operation conditions have been set in advance using the teaching tools such as PC software.

PLC output

Address (* "n" shows the node address of each axis.)

		1 word = 2 bytes = 16 bits															
n+0, n+1		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position	(lower word)																

n+2, n+3		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position	(upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5		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+6, n+7		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" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

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

n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Completed Position No.							PM512	PM256	PM128	PM64	PM32	PM16	PM8	PM4	PM2	PM1

n+6, n+7	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 compliment of 2.	3.8 (1)
	Specified position number	16-bit data	PC1 to PC512 16-bit integer. To operate the actuator, position data is needed for which operation conditions have already been entered using the teaching tools such as PC. 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.	3.8 (1)
	Control signal	b15	BKRL Forced brake release: The brake is released when the signal turns ON.	3.6.11 (18)
		b14	RMOD Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.	3.6.11 (19)
		b13	-	-
		b12		
		b11	PMOD Position/simple direct switching: Position mode when the signal is OFF, or simple direct mode when the signal is ON.	3.6.11 (20)
		b10	-	-
		b9	CLBR Load cell calibration command: Calibration is performed when this signal turns ON.	3.6.11 (32)
		b8	JOG+ +Jog: The actuator moves in the direction opposite home when the signal is ON.	3.6.11 (13)
		b7	JOG- -Jog: The actuator moves in the direction of home when the signal is ON.	3.6.11 (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.	3.6.11 (14)
		b5	JISL Jog/inching switching: Jog operation when the signal is OFF, or inching operation when the signal is ON.	3.6.11 (15)
		b4	SON Servo ON command: The servo is ON when the signal is ON.	3.6.11 (5)
		b3	RES Reset: A reset is performed when the signal turns ON.	3.6.11 (4)
		b2	STP Pause: A pause command is issued when the signal turns ON.	3.6.11 (11)
		b1	HOME Home return: A home return command is issued when the signal turns ON.	3.6.11 (6)
		b0	CSTR Positioning start: A move command is issued when the signal turns ON.	3.6.11 (7)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit	- Current Position: 32-bit signed Integer. The setting unit is 0.01mm. (Example) Reading: 000003FF _H = 1023 (decimal) = 10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (1)
	Completed Position No. (Simple alarm code)	16-bit	PM1 to PM512 16-bit integer It is moved to the target position and the positioning completed position No. within the positioning band is output. In the case that the position movement has not been performed at all, or during the movement, "0" is output. When an alarm is issued (in the case that the status signal ALM is "ON"), the simplified alarm code (Refer to the Operation Manual for the controller main body) is output.	3.8 (1)
	Status code	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	3.6.11 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	3.6.11 (1)
		b13	CEND Load cell calibration complete: This signal turns ON when the load cell calibration is complete.	3.6.11 (32)
		b12	ZONE1 Zone 1: "ON" for the current position within the zone set range	3.6.11 (12)
		b11	PZONE/ ZONE2 PZONE and ZONE2 can be switched in Parameter No.149. No.149 = 0 Position zone : This signal turns ON when the current position is inside the specified position zone. No.149 = 1 Zone2 : This signal turns ON when the current position is inside the specified zone.	3.6.11 (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.)	3.6.11 (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.)	3.6.11 (27)
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	3.6.11 (28)
		b6	PUSHS Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	3.6.11 (25)
		b5	PSFL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	3.6.11 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	3.6.11 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	3.6.11 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	3.6.11 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	3.6.11 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	3.6.11 (10)

3.6.8 Half Direct Value Mode (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 I/O areas. When the zone function is used, set it using the parameter Nos. 1, 2, 23 and 24.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remark
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	○	
Pitch feed (inching)	○	
Pressing Operation	○	
Speed change during the movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* "n" shows the node address of each axis.)

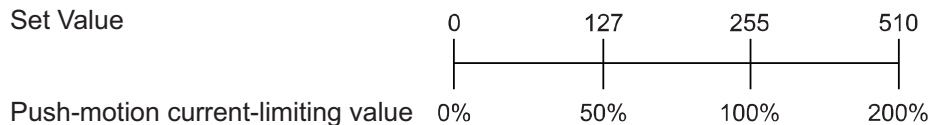
Parameter No.84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
6	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Positioning Band	n+4, n+5	Force feedback data	n+4, n+5
		n+6, n+7		n+6, n+7
	Velocity	n+8, n+9	Current Speed	n+8, n+9
	Acceleration/Deceleration	n+10, n+11		n+10, n+11
	Pressing Current Limit Value	n+12, n+13	Alarm Code	n+12, n+13
	Control signal	n+14, n+15	Status Signal	n+14, n+15

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (8 words = 16 bytes) and one output word in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 1-word (16 bits) binary data. The figures from 0 to +65535 (Unit: 1.0mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 510 (200%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- The force feedback data is 2-word (32-bit) binary data (unit: 0.01 N).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC output

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	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+10, n+11	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+12, n+13	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+14, n+15	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" shows the node address of each axis.)

		1 word = 2 bytes = 16 bits															
n+0, n+1		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																	
n+2, 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.

		1 Word = 2 bytes = 16 bits															
n+4, n+5		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (lower word)																	
n+6, n+7		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (upper word)																	

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

n+8, n+9		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current speed (lower word)																	
n+10, n+11		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+12, n+13		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm code																	
n+14 to n+15		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 assignment(* “ON” in the table shows the corresponding bit of “1” and “OFF” shows “0”.)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between -999999 to +999999. (Example) When it is “+25.41mm”, set it as “2541”. If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (2)
	Positioning Band	32-bit data	- 32-bit integer The unit is 0.01mm and settable range is between 1 to +999999. (Example) When it is “25.40mm”, set it as “2540”. This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the “PUSH” control signal setting.	3.8 (2)
	Velocity	16-bit data	- 16-bit integer Specify the speed at which to move the actuator. The unit is 1.0mm/sec and settable range is 0 to 65535. (Example) When it is “254.0mm/sec”, set it as “254”. When the movement command is set with the value bigger than the max. speed, an alarm is issued.	3.8 (2)
	Acceleration/Deceleration	16-bit data	- 16-bit integer Specify the acceleration / deceleration at which to move the actuator (the acceleration and deceleration will be the same value). The unit is 0.01G and settable range is 1 to 300. (Example) To set “0.30 G”, specify “30”. If a move command is issued by specifying “0” or any value exceeding the maximum acceleration or deceleration, an alarm will occur.	3.8 (2)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type		Bit	Symbol	Contents	Details
PLC Output	Pressing Current Limit Value	16-bit data	-	16-bit integer Specify the current-limiting value to be used during push-motion operation. The allowable specification range is 0 (0%) to 255 (100%). The actual settable range varies depending on each actuator.(Refer to the catalog or Operation Manual for the actuator.) If a move command is issued by specifying a value exceeding the maximum push-motion current, an alarm will occur.	3.8 (2)
	Control Signal	b15	BKRL	Forced brake release: When it is turned ON, the brake is released.	3.6.11 (18)
		b14	RMOD	Operating mode selector: The AUTO mode is selected when this signal is OFF, and the MANU mode is selected when the signal is ON.	3.6.11 (19)
		b13	DIR	Push direction specification: “OFF” for the direction reducing the positioning band from the target position, “ON” for the direction adding the positioning band to the target position	3.6.11 (22)
		b12	PUSH	Push-motion specification: Positioning operation is performed when this signal is OFF, and push-motion operation is performed when the signal is ON.	3.6.11 (21)
		b11	-	Unavailable	-
		b10			
		b9	CLBR	Load cell calibration command: Calibration is performed when this signal turns ON.	3.6.11 (32)
		b8	JOG+	+ Jog: “ON” for Movement in the Opposite Direction of Home	3.6.11 (13)
		b7	JOG-	-Jog: “ON” for Movement to the Home Direction	3.6.11 (13)
		b6	JVEL	Jog-speed/inch-distance switching: The values set in parameter No. 26, “Jog speed” and parameter No. 48, “Inch distance” are used when this signal is OFF, and the values set in parameter No. 47, “Jog speed 2” and parameter No. 49, “Inch distance 2” are used when the signal is ON.	3.6.11 (14)
		b5	JISL	Jog/inch switching: Jog operation is performed when this signal is OFF, and inch operation is performed when the signal is ON.	3.6.11 (15)
		b4	SON	Servo ON Command: The servo turns ON when this signal turns ON.	3.6.11 (5)
		b3	RES	Reset: A reset is performed when this signal turns ON.	3.6.11 (4)
		b2	STP	Pause: A pause command is issued when this signal turns ON.	3.6.11 (11)
		b1	HOME	Home return: A home-return command is issued when this signal turns ON.	3.6.11 (6)
		b0	DSTR	Positioning Command: A move command is issued when this signal turns ON.	3.6.11 (8)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	- 32-bit signed integer indicating the current position The setting unit is 0.01mm. (Example) Reading: 000003FF _H =1023 (decimal) =10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Command Current	32-bit data	- 32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. (Example) Reading: 000003FF _H =1023 (decimal) =1023mA	3.8 (2)
	Current Speed	32-bit data	- 32-bit signed integer indicating the current position 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 setting unit is 0.01mm/sec. (Example) Reading: 000003FF _H =1023 (decimal) =10.23mm/sec * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Alarm Code	16-bit data	- 16-bit integer When an alarm is issued, the alarm code is output. When any alarm is not issued, it is "0 _H ". Refer to the Operation Manual for the controller main body for the details of the alarms.	3.8 (2)
	Status Signal	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	3.6.11 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	3.6.11 (1)
		b13	ZONE2 Zone 2: "ON" for the current position within the zone set range	3.6.11 (12)
		b12	ZONE1 Zone 1: "ON" for the current position within the zone set range	3.6.11 (12)
		b11	-	-
		b10		
		b9	CEND Load cell calibration is complete: This signal turns ON when calibration is complete.	3.6.11 (32)
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops	3.6.11 (28)
		b6	PUSHS Push-motion operation in progress: The signal is ON when the Push-motion operation in progress.	3.6.11 (25)
		b5	PSEL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	3.6.11 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	3.6.11 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	3.6.11 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	3.6.11 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	3.6.11 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	3.6.11 (10)

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

In this mode, force control (feedback pressing of load cell values) is used in addition to the remote I/O mode 2 function for operation.

Set the position data using the teaching tools such as RC PC software.

The number of operable positions varies depending on the parameter No. 25 “PIO Pattern” setting.

This mode is the same as the remote I/O mode, but the current-position read function and command-current read function are also available.

The features of each PIO pattern are shown below. (Refer to Operation Manual for the controller main body for more information)

Value set in parameter No. 25	Operation Mode	I/O Specification
0	Positioning mode	64 positioning points and two zone output points are available.
1	Teaching mode	64 positioning points and one zone output point are available. Positioning operation and jog operation are supported. The current position can be written to a specified position.
2	256-point mode	256 positioning points and one zone output point are available.
3	512-point mode	512 positioning points are available. There are no zone outputs.
4	Electromagnetic valve mode 1	7 positioning points and two zone output points are available. The direct operation command is available for each position No. A position complete signal is output for each position number.
5	Electromagnetic valve mode 2	3 positioning points and two zone output points are available. The actuator is operated by specifying forward, backward and intermediate position commands. A position complete signal is output separately for the front end, rear end and intermediate position.
6	Force control mode 1 (when a dedicated load cell is used)	32 positioning points, one zone output point
7	Force control mode 2 (when a dedicated load cell is used)	5 positioning points, one zone output point An operation command can be specified directly for each position number. A positioning complete signal is output for each position number.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

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	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) It is available when the parameter No. 27 “Movement Command Type” is set to “0”.

Turning “OFF” the “Movement Command” can stop the system temporarily.

(1) PLC address configuration (* “n” shows the node address of each axis.)

Parameter No. 84	SCON-CA DI and input register	PLC output address (bytes)	SCON-CA DO and output register	PLC input address (bytes)
7	Port number 0 to 15	n+0, n+1	Port number 0 to 15	n+0, n+1
	Occupied area	n+2, n+3	Occupied area	n+2, n+3
		n+4, n+5	Current position	n+4, n+5
		n+6, n+7		n+6, n+7
		n+8, n+9	Force feedback data	n+8, n+9
		n+10, n+11		n+10, n+11

(Note) The areas denoted by Occupied area cannot be used for any other purpose.
Also, exercise caution to avoid node address duplication.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (6 words = 12 bytes) and one output word in the I/O areas.

- The areas controlled by port number are controlled using ON/OFF bit 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” shows the node address of each axis.)

		1 word = 2 bytes =16 bits															
n+0, n+1		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" shows the node address of each axis.)

1 word = 2 bytes =16 bits																
n+0, n+1	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+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Cannot be used																
n+4, n+5	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																
n+6, n+7	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (lower word)																
n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Force feedback data (upper word)																

When the current force feedback data is shown using the negative figure, it is expressed using the complement of 2.

(3) I/O signal assignment

For the signal assignments corresponding to each PIO pattern, refer to the I/O signal assignments for the remote I/O mode explained in 3.6.2 (3).

The signal allocation for the Command Current and Current Position, is shown in the following table.

Signal Type		Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	-	32-bit signed integer The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	-
	Force Feedback Data	32-bit data	-	32-bit signed integer The setting unit is 0.01N. * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	-

3.6.10 Half Direct Value 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 I/O areas. When the zone function is used, set it using the parameter Nos. 1, 2, 23 and 24.

The robot cylinder's effective main functions that can be controlled using this mode, are as shown in the following table.

ROBO cylinder function	○:Direct control △:Indirect control x:Disable	Remark
Home-return operation	○	
Positioning operation	○	
Speed and acceleration / deceleration setting	○	
Pitch feed (inching)	○	
Pressing Operation	○	
Speed change during the movement	○	
Operation at different acceleration and deceleration	x	
Pause	○	
Zone signal output	△	Parameters must be set.
PIO pattern selection	x	

(1) PLC address configuration (* "n" shows the node address of each axis.)

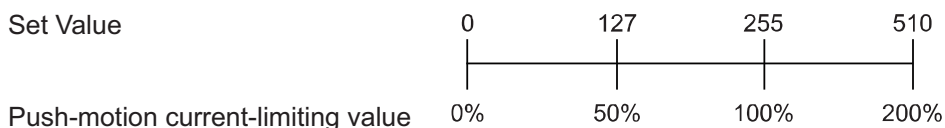
Parameter No.84	SCON-CA input register	PLC output address (bytes)	SCON-CA output register	PLC input address (bytes)
8	Target Position	n+0, n+1	Current Position	n+0, n+1
		n+2, n+3		n+2, n+3
	Positioning Band	n+4, n+5	Command Current	n+4, n+5
		n+6, n+7		n+6, n+7
	Velocity	n+8, n+9	Current Speed	n+8, n+9
	Acceleration/Deceleration	n+10, n+11		n+10, n+11
	Pressing Current Limit Value	n+12, n+13	Alarm Code	n+12, n+13
	Control signal	n+14, n+15	Status Signal	n+14, n+15

(Note) Be careful of using duplicated node addresses.

(2) I/O Signal Allocation for each Axis

The I/O signals of each axis consist of one input word (8 words = 16 bytes) and one output word in the I/O areas.

- The control signals and status signals are ON/OFF signals in units of bit.
- The target position and current position are expressed using 2-word (32 bits) binary data. The figures from -999999 to +999999 (Unit: 0.01mm) can be set in PLC. However, set the position data within the soft stroke range (0 to effective stroke length) for the actuator concerned.
- Set the positioning band. The positioning band is expressed using 2-word (32 bits) binary data. The figures from 1 to +999999 (Unit: 0.01mm) can be set in PLC.
- The specified speed is expressed using 1-word (16 bits) binary data. The figures from 0 to +65535 (Unit: 1.0mm/sec) can be set in PLC. Set the value that does not exceed the max. speed value for the actuator concerned.
- The Acceleration/Deceleration is expressed using 1-word (16 bits) binary data. The figures from 1 to 300 (Unit: 0.01G) can be set in PLC. However, set the value that does not exceed the max. acceleration/deceleration value for the actuator in question.
- The pressing current limit value is expressed using 1-word (16 bits) binary data. The figures from 0 (0%) to 510 (200%) can be set in PLC. However, set the value within the settable range for the pressing current limit value (Refer to the Catalog or Operation Manual for the actuator) for the actuator concerned.



- The command current is expressed using 2-word (32 bits) binary data (Unit: 1mA).
- The current speed is expressed using 2-word (32 bits) binary data (Unit: 0.01mm/sec).
- The alarm code is expressed using 1-word (16 bits) binary data.

PLC output

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Target Position (upper word)																

When the target position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	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+10, n+11	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+11, 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, n+14	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	—	—	—	SON	RES	STP	HOME	DSTR

PLC input

Address (* "n" shows the node address of each axis.)

1 word = 2 bytes = 16 bits

n+0, n+1	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (lower word)																
n+2, n+3	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Position (upper word)																

When the current position is shown using the negative figure, it is expressed using the complement of 2.

n+4, n+5	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+6, n+7	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+8, n+9	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (lower word)																
n+10, n+11	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Current Speed (upper word)																

When the current speed is shown using the negative figure, it is expressed using the complement of 2.

n+11, n+12	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Alarm code																
n+13, n+14	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 assignment(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Output	Target Position	32-bit data	- 32-bit signed Integer. Set the target position on the absolute coordinates. The unit is 0.01mm and settable range is between -999999 to +999999. (Example) When it is "+25.41mm", set it as "2541". If the value larger than the value (0.2mm) inside the soft limit for the parameter, the movement would be limited to the inside the soft limit (0.2mm). *When the input is performed in hexadecimal notation, input the negative value using a complement of 2.	3.8 (2)
	Positioning Band	32-bit data	- 32-bit integer The unit is 0.01mm and settable range is between 1 to +999999. (Example) When it is "25.40mm", set it as "2540". This register value has two meanings depending on the operation type. 1) In the case of positioning operation, it shows the allowable range from the target position, that is regarded as the positioning completion. 2) In the case of pressing operation, it shows the pressing width value. Specify the normal operation or pressing operation using the "PUSH" control signal setting.	3.8 (2)
	Velocity	16-bit data	- 16-bit integer Specify the speed at which to move the actuator. The unit is 1.0mm/sec and settable range is 0 to 65535. (Example) When it is "254.0mm/sec", set it as "254". When the movement command is set with the value bigger than the max. speed, an alarm is issued.	3.8 (2)
	Acceleration/Deceleration	16-bit data	- 16-bit integer Specify the acceleration / deceleration at which to move the actuator (the acceleration and deceleration will be the same value). The unit is 0.01G and settable range is 1 to 300. (Example) To set "0.30 G", specify "30". If a move command is issued by specifying "0" or any value exceeding the maximum acceleration or deceleration, an alarm will occur.	3.8 (2)

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "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.			3.8 (2)	
	Control signal	b15	BKRL	Forced brake release: The brake is released when the signal turns ON.			3.6.11 (18)	
		b14	RMOD	Operation mode: AUTO mode when the signal is OFF, or MANU mode when the signal is ON.			3.6.11 (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.			3.6.11 (22)	
		b12	PUSH	Push specification: Positioning operation when the signal is OFF, or push-motion operation when the signal is ON.			3.6.11 (21)	
		b11	GSL1	Servo gain parameter set selection 1	Select the servo gain parameter set to be used.		3.6.11 (33)	
		b10	GSL0	Servo gain parameter set selection 0	GSL1	GSL0		Function
					OFF	OFF		Select parameter set 0.
					OFF	ON		Select parameter set 1.
					ON	OFF	Select parameter set 2.	
		ON	ON	Select parameter set 3.				
		b9	NTC1	Vibration damping control mode selection 1	Select the vibration damping control parameter set to be used.		3.6.11 (29)	
		b8	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.	
		ON	ON	Select parameter set 3.				
		b7	-		Cannot be used.			-
		b6						
		b5						
b4	SON	Servo ON command: The servo is ON when the signal is ON.			3.6.11 (5)			
b3	RES	Reset: A reset is performed when the signal turns ON.			3.6.11 (4)			
b2	STP	Pause: A pause command is issued when the signal turns ON.			3.6.11 (11)			
b1	HOME	Home return: A home return command is issued when the signal turns ON.			3.6.11 (6)			
b0	DSTR	Positioning start command: A move command is issued when the signal turns ON.			3.6.11 (8)			

(* "ON" in the table shows the corresponding bit of "1" and "OFF" shows "0".)

Signal Type	Bit	Symbol	Contents	Details
PLC Input	Current Position	32-bit data	- 32-bit signed integer indicating the current position The setting unit is 0.01mm. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Command Current	32-bit data	- 32-bit integer The electrical current presently specified by a command is indicated. The setting unit is mA. (Example) Reading:000003FF _H =1023 (decimal) =1023mA	3.8 (2)
	Current Speed	32-bit data	- 32-bit signed integer indicating the current position 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 setting unit is 0.01mm/sec. (Example) Reading:000003FF _H =1023 (decimal) =10.23mm/sec * When the value is read in hexadecimal notation, the negative figure is expressed as a complement of 2.	3.8 (2)
	Alarm Code	16-bit data	- 16-bit integer When an alarm is issued, the alarm code is output. When any alarm is not issued, it is "0 _H ". Refer to the Operation Manual for the controller main body for the details of the alarms.	3.8 (2)
	Status Signal	b15	EMGS Emergency stop: An emergency stop is actuated when this signal turns ON.	3.6.11 (2)
		b14	PWR Controller ready : This signal turns ON when the controller becomes ready.	3.6.11 (1)
		b13	ZONE2 Zone 2:"ON" for the current position within the zone set range	3.6.11 (12)
		b12	ZONE1 Zone 1:"ON" for the current position within the zone set range	3.6.11 (12)
		b11	-	-
		b10		
		b9		
		b8	RMDS Operation Mode Status: This signal is OFF when the current mode is AUTO, or ON when the current mode is MANU.	3.6.11 (19)
		b7	BALM Absolute battery voltage low warning: This signal turns ON when the voltage drops.	3.6.11 (28)
		b6	- Unavailable	-
		b5	PSFL Pressing and a Miss: This signal turns ON when the actuator missed the work part in push-motion operation.	3.6.11 (23)
		b4	SV Operation preparation end: This signal turns ON when the servo turns ON.	3.6.11 (5)
		b3	ALM Alarm: This signal turns ON when an alarm occurs.	3.6.11 (3)
		b2	MOVE Moving Signal: This signal remains ON while the actuator is moving.	3.6.11 (9)
		b1	HEND Home return completion: This signal turns ON when home return is completed.	3.6.11 (6)
		b0	PEND Positioning completion signal: This signal turns ON when positioning is completed.	3.6.11 (10)

3.6.11 I/O Signal Controls and Function

- * ON indicates that the applicable bit signal is “1”, while OFF indicates that the bit signal is “0”.
The I/O control and functions used in the Position/Simplified Direct Value Modes 1 and 2, Half Direct Value Modes 1 to 3 and Full Direct Value Mode, are described as follows. For the I/O signals for the Remote I/O Modes 1 to 3, refer to the Operation Manual for the controller main body.

(1) Controller ready (PWR) PLC input signal

When the controller can control the system after the power injection, it is turned “ON”.

■Function

Regardless of the alarm or servo conditions, when the controller initialization is completed normally after the power injection and the controller can control the system, it is turned “ON”.

Even in the alarm condition, when the controller can control the system, it is turned “ON”.

(2) Emergency stop (EMGS) PLC input signal

When the controller is stopped in an emergency, it is turned “ON”.

■Function

When the controller is stopped in an emergency (motor driving power is cut off), it is turned “ON”. When the emergency stop status is cleared, it is turned “OFF”.

(3) Alarm (ALM) PLC input signal

When any error is detected using the controller protection circuit (function), it is turned “ON”.

■Function

When any error is detected and the protection circuit (function) is activated, this signal is turned “ON”.

When the cause of the alarm is eliminated and the reset signal is turned “ON”, the alarm is turned “OFF” in the case that it is the alarm with the operation cancellation level. (In the case of the alarm with the cold start level, re-injection of the power is required)

When the alarm is detected, the Status Indicator LED (Refer to 4, “EtherCAT(R) Interface”) on the front surface of the controller illuminates in red.

(4) Reset (RES) PLC output signal

This signal has two functions. It can reset the controller alarm and cancel the reminder for planned movements during pause conditions.

■Function

[1] When this signal is turned ON from OFF condition after eliminating the cause of the alarm during the alarm output, the alarm (ALM) signal can be reset. (In the case of the alarm with the cold start level, re-injection of the power is required)

[2] When this signal is turned ON from OFF condition during the pause condition, the reminder of the planned movement left can be cancelled.

- (5) Servo ON Command (SON) PLC output signal
 Operation preparation end (SV) PLC input signal

When the SON signal is turned ON, the servo will turn ON.

When "SON" signal is turned "ON", the servo-motor is turned "ON". When the servo-motor is turned ON, the Status Indicator LED (Refer to 3.3, "EtherCAT(R) Interface") on the front surface of the controller illuminates in green.

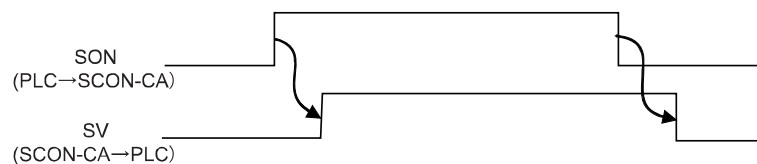
The "SV" signal is synchronized with this LED.

■Function

Using the "SON" signal, the turning ON/OFF of the controller is available.

While the "SV" signal is ON, the controller's servo-motor is turned "ON" and the operation becomes available.

The relationship between the "SON" signal and "SV" signal is as follows.



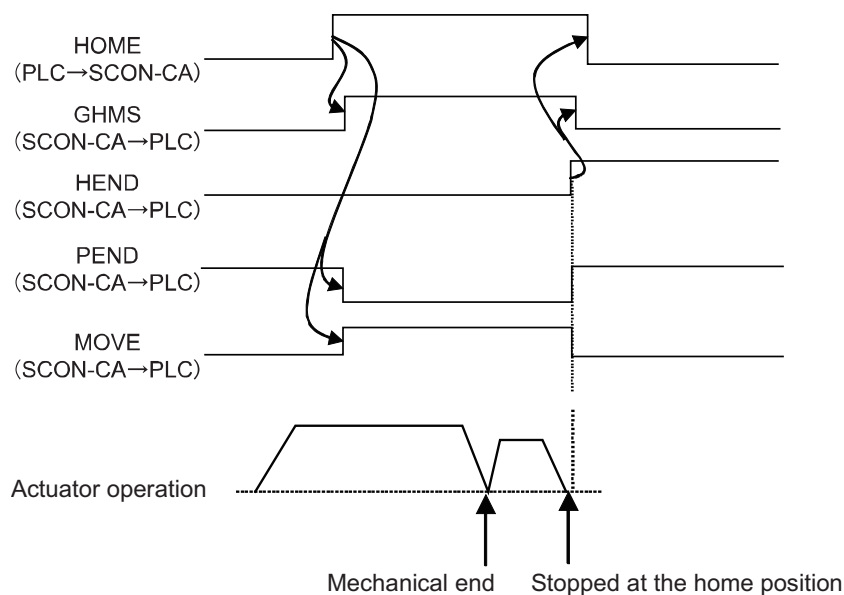
(6) Home return (HOME) PLC output signalHome return completion (HEND) PLC input signalUnder Home return Operation (GHMS) PLC input signal

When the "HOME" signal is turned "ON", this command is processed at the startup (ON edge), and the home return operation is performed automatically. During the home return operation, the "GHMS" signal is turned "ON".

When the "HEND" signal is turned "ON", turn "OFF" the "HOME" signal.

Once the "HEND" signal is turned "ON", it can not be turned "OFF" until the power is turned "OFF" or the "HOME" signal is input again. Once the HEND signal is turned ON, it can not be turned OFF until the power is turned OFF or the HOME signal is input again.

Even after the completion of the home return operation, when the "HOME" signal is turned "ON", the home return operation can be performed.



⚠ Caution: In the Remote I/O Modes 1 to 3 and Position/Simplified Direct Value Modes 1 and 2, when the positioning command is issued without performing the home return operation after the power injection, the positioning is performed after the automatic home return operation.

Exercise caution that in the Half Direct Modes 1 to 3 or Full Direct Mode, issuing a positioning command to a given position following the power on, without performing a home return first, will generate an alarm "Error Code 83: ALARM HOME ABS (absolute position move command when home return is not yet completed)" (operation-reset alarm).

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

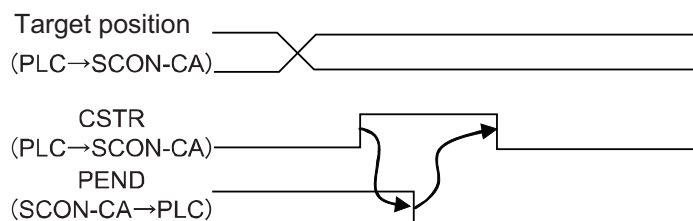
This signal is processed at the startup (ON edge) and the positioning is performed to the target position with the specified position No. or set using the PLC's target position register.

Whether if the target position with the specified position No. is used or the setting using the PLC's target position register is used, depends on the Control Signal b11: "Position/Simplified Direct Value Change-Over (PMOD) Signal".

- PMOD=OFF: Target position data for the specified position No. is used.
- PMOD=ON :Value for the target position set using the PLC's target position register is used.

When this signal is issued in the condition where the home return operation has not performed at all after the power injection (HEND signal OFF), the positioning to the target position is performed after the home return operation is performed automatically.

Turn "OFF" this signal after confirming that the Positioning Completion Signal (HEND) signal has been turned "OFF".

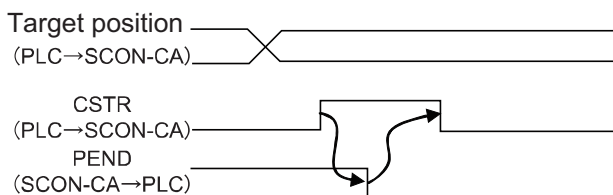


(8) Positioning Command (DSTR): Used in the half direct mode and full direct mode

PLC output signal

This signal is processed at the startup (ON edge) and the positioning to the target position input in the PLC's target position register is performed. When this signal is issued in the condition where the home return operation has not performed at all after the power injection (HEND signal OFF), an alarm is issued (Operation Cancellation Level).

Turn "OFF" this signal after confirming that the Positioning Completion Signal (PEND) signal has been turned "OFF".

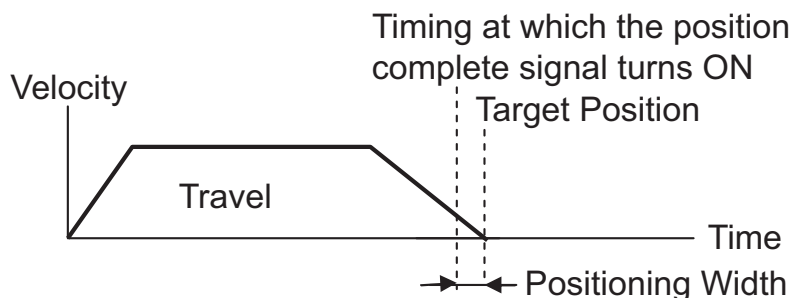
(9) Moving Signal (MOVE) PLC input signal

This signal is turned ON while the actuator's slider or rod is moving.(Including the pressing or jog operation after the home return operation)

After the completion of the positioning, home return or pressing operation, or during the pause condition, this signal is turned "ON".

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

This signal is turned "ON" when the actuator is moved to the target position and reaches the positioning band and the pressing is completed.



When the servo-motor is turned ON from OFF condition, the positioning is performed with the position set as the target position. Accordingly, this signal is turned "ON" and after that, when the positioning operation is started with the home return (HOME) signal, positioning start (CSTR) signal and positioning command (DSTR) signal, this signal is turned "OFF".



Caution: When the servo-motor is turned OFF or stopped in an emergency while the actuator is stopped at the target position, the PEND signal is turned "OFF" temporarily. Then, when the servo-motor is turned "ON" and the actuator is within the positioning band, the PEND signal is turned "ON" again.
When the positioning is completed with the CSTR signal or DSTR signal turned "ON", the PEND signal is not turned "ON".

(11) Pause (STP) PLC output signal

When this signal is turned "ON", the actuator movement is decelerated and stopped. When it is turned "OFF", the actuator movement is restarted.

The acceleration in the operation restart or the deceleration in stopping operation, is expressed as the value for the acceleration/deceleration for the position No. set using the specified position No. register in the Position/Simplified Direct Value Modes 1 and 2, and as the value set in the acceleration/deceleration register in the Half Direct Value Modes 1 to 3.

In the Full Direct Value Mode, the value is expressed as the value set in the acceleration register or deceleration register.

(12) Zone 1 (ZONE1)	PLC input signal
Zone 2 (ZONE2)	PLC input signal
Position zone (PZONE)	PLC input signal

These signals are turned ON when the current position of the actuator is within the set domain and turned OFF when the current position is out of the set domain.

[1] Zone 1, Zone 2

The zone is set using the user parameters.

The Zone 1 Signal is set using the parameter No. 1 “Zone Boundary 1 “+” Side” and No. 2 “Zone Boundary 1 “-” Side”.

The Zone 2 Signal is set using the parameter No. 23 “Zone Boundary 2 “+” Side” and No. 24 “Zone Boundary 2 “-” Side”.

The Zone 1 Signal and Zone 2 Signal become effective when the home return operation is completed. After that, even during the servo OFF, it is effective.

[2] Position zone

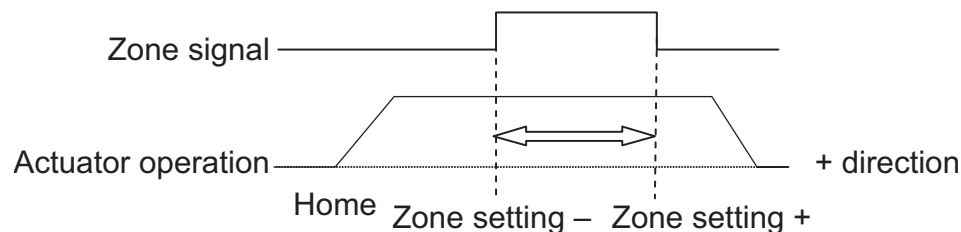
Each zone is set in the position table or using the zone boundary register.

In the case of the Position/Simplified Direct Value Modes 1 and 2, the PZONE signal is set using the position table.

In the case of the Full Direct Value Mode, the PZONE signal is set using the Zone Boundary Value Register.

(*)In the Half Direct Value Modes 1 to 3, there is no PZONE signal.

The PZONE signal becomes effective with the movement command after the home return operation. After that, even during the servo OFF, it is effective.



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

This signal is the command for the jog operation startup or inching operation startup.

If a + command is issued, the actuator will operate in the direction opposite home. When a – command is issued, the actuator will operate in the direction of home.

[1] Jog operation

Jog operation can be performed when the jog/inch switching (JISL) signal is OFF.

While the “JOG+” is turned “ON”, the movement direction is to the opposite of the home and when it is turned “OFF”, the actuator is decelerated and stopped.

While the JOG – is ON, the actuator will operate in the direction of home and when it is turned OFF, it is decelerated to a stop.

The operation is performed based on the set values of the following parameters.

- The velocity is based on the parameter value specified using the Jog Speed/Inching Distance Change-Over (JVEL) signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 26, “PIO jog speed”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 47, “PIO jog speed 2”.
- The acceleration/deceleration conforms to the rate acceleration/deceleration (the specific value varies depending on the actuator).
- When both the JOG+ and JOG- signals are turned “ON”, the actuator is decelerated and stopped.

[2] Inch operation

The inching operation is available while the IISI signal is turned “ON”.

Once it is turned “ON”, the actuator is moved as much as the inching distance.

When the JOG+ is turned “ON”, the movement is to the opposite of the home and when the JOG- is turned “ON”, the movement is to the home.

The operation is performed based on the set values of the following parameters.

- The speed conforms to the value of the parameter specified by the JVEL signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 26, “PIO jog speed”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 47, “PIO jog speed 2”.
- The travel conforms to the value of the parameter specified by the JVEL signal.
 If the JVEL signal is OFF, the actuator operates according to parameter No. 48, “PIO inch distance”.
 If the JVEL signal is ON, the actuator operates according to parameter No. 49, “PIO inch distance 2”.
- The Acceleration/Deceleration is based on the rated acceleration/deceleration (depending on the actuator).

During the normal operation, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the normal operation is continued. (The Jog signal is ignored)

In the pause condition, even when the “+” Jog Signal or “-” Jog Signal is turned “ON”, the actuator is not moved.

(Note) Because the software stroke limit is disabled before the home return operation, the actuator might run against the mechanism end. Take the greatest care.

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

This change-over signal is used for the parameters specifying the jog speed when the jog operation is selected or the inching distance when the inching operation is selected.

The relationship is as follows.

Controller ready	Jog operation: JISL=OFF	Inch operation: JISL=ON
OFF	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed" Parameter No. 48, "Inch distance"
ON	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2" Parameter No. 49, "Inch distance 2"

(15) Job/inch switching (JISL) PLC output signal

This signal changes over the jog operation and the inching operation.

JISL=OFF: Jog operation

JISL=ON :Inch operation

When the JISL signal is turned "ON" (for inching operation) during the jog operation, the actuator is decelerated and performs the inching operation.

When the JISL signal is turned OFF (jog) while the actuator is moving by inching, the actuator will complete the movement and then switch to the jog function.

The table below summarizes the relationship of the ON/OFF statuses of the JISL signal and jog speed/inch-distance switching (JVEL) signal.

		Jog operation	Inch operation
JISL		OFF	ON
JVEL=OFF	Velocity	Parameter No. 26, "Jog speed"	Parameter No. 26, "Jog speed"
	Travel	–	Parameter No. 48, "Inch 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	Velocity	Parameter No. 47, "Jog speed 2"	Parameter No. 47, "Jog speed 2"
	Travel	–	Parameter No. 48, "Inch distance"
	Acceleration/Deceleration	Rated value (The specific value varies depending on the actuator.)	Rated value (The specific value varies depending on the actuator.)
Operation		When the JOG +/-JOG – signal is ON.	Upon detection of the leading (ON) edge of the JOG +/-JOG – signal.

(16) Teaching Mode Command (MODE) PLC output signalTeaching mode Signal (MODES) PLC input signal

When the MODE signal is turned "ON", the normal operation mode is changed to the teaching mode.

When the mode for the controllers for each actuator is changed to the teaching mode, the MODES signal is turned ON.

After confirming that the MODES signal is turned "ON" on the PLC side, start the teaching operation.

(Note) In order to change the normal operation mode to the teaching mode, the following conditions are required.

- The actuator operation (motor) is stopped.
- The + JOG (JOG+) signal and – JOG (JOG-) signal are turned "OFF".
- The Position Data Import Command (PWRT) Signal and Positioning Start (CSTR) Signal are turned "OFF".

(Note) When the PWRT signal is not turned OFF, the mode is not returned to the normal operation mode.

(17) Position Data Import Command (PWRT) PLC output signalPosition data import complete (WEND) PLC input signal

The PWRT signal is available when the teaching mode signal (MODES) is turned "ON".

Turn the PWRT signal ON (*1), and the data of the current position will be written to the "Position" field under the position number set to the specified position number register of the PLC (*2).

When the data writing is completed, the WEND signal is turned "ON".

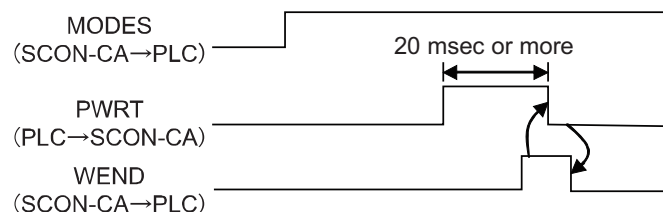
After the WEND signal is turned ON, turn OFF the PWRT signal in the host machine.

When the PWRT signal is turned ON before the WEND signal is turned "ON", the WEND signal is not turned "ON".

When the PWRT signal is turned "OFF" the WEND signal is also turned "OFF".

(*1) Turn it on for 20msec or more. If the time is shorter than 20msec, the writing is not completed.

(*2) When the data items except for the position have not been defined, the parameter initial values are written. (Refer to the Operation Manual for the controller main body)

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

Turning this signal "ON" can release the brake forcibly.

(19) Operating mode selector (RMOD) PLC output signalOperation Mode Status (RMDS) PLC input signal

The operation mode is selected with the RMOD signal and the MODE switch located on the front surface of the controller.

Also, which mode is currently set, AUTO or MANU, can be confirmed using the RMDS signal.

The operation modes with the combination of the RMOD signal and the MODE switch ON/OFF are described as follows.

	Controller MODE Switch = AUTO	Controller MODE Switch = MANU
RMOD signal = OFF (AUTO mode is specified)	AUTO mode (RMDS=OFF)	MANU mode (RMDS=ON)
RMOD signal = ON (MANU mode is specified)	MANU mode (RMDS=ON)	MANU mode (RMDS=ON)

(Note) In MANU mode, the startup of the operation from PLC is not available.

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

This signal changes over the use of the value registered in the controller position table for the target position in the movement and the use of the value specified in the PLC's target position register.

PMOD=OFF: Use the position table

PMOD=ON :Use the value of the target position register

(21) Push-motion specification (PUSH) PLC output signal

When the movement command signal is output after this signal is turned ON, the pressing operation is performed.

When this signal is set to "OFF", the normal positioning operation is performed.

(Refer to Item (2) Operation in Half Direct Value Mode in 3.8 "Operation" for the setting timing for this signal)

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

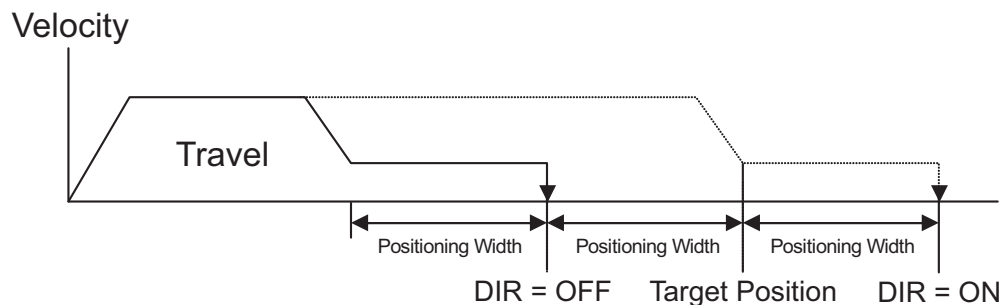
This signal specifies the pressing direction.

When this signal is turned "OFF", the pressing operation is performed to the position expressed using the value reducing the positioning band from the target position.

When this signal is turned "ON", the pressing operation is performed to the direction of the value determined by adding the positioning band to the target position.

In the case of the normal pressing operation, this signal is disabled.

Refer to Item (2) Operation in Half Direct Value Modes 1 to 3 in 3.8 "Operation" for the setting timing for this signal)



(23) Pressing and a Miss (PSFL) PLC input signal

In the case that the pressing operation was performed, and the actuator moved the travel distance set in the controller position table positioning band or set using the PLC's positioning band register, but it was not pushed against the work part, this signal is turned "ON".

Refer to Item (2) Operation in Half Direct Value Modes 1 to 3 in 3.8, "Operation" for the setting timing for this signal)

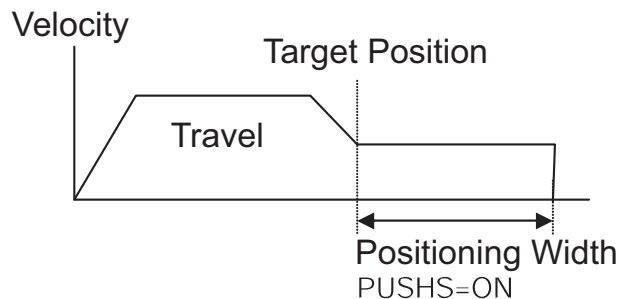
(24) Incremental Command (INC) PLC output signal

When the movement command is issued while this signal is turned "ON", the actuator is moved to the position expressed as the value input in the PLC's target position register based on the current position. (Incremental move)

When this signal is turned "OFF", the actuator is moved to the position expressed as the value set in the PLC's target position register.

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

This signal is turned "ON" during the pressing operation.



This signal is turned "OFF" when the pressing and a miss signal or the next movement command signal is output, or the servo-motor is turned "OFF".

Refer to Item (2) Operation in Half Direct Value Modes 1 to 3 in 3.8 "Operation" for the setting timing for this signal)

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

This signal is available only in the pressing operation.

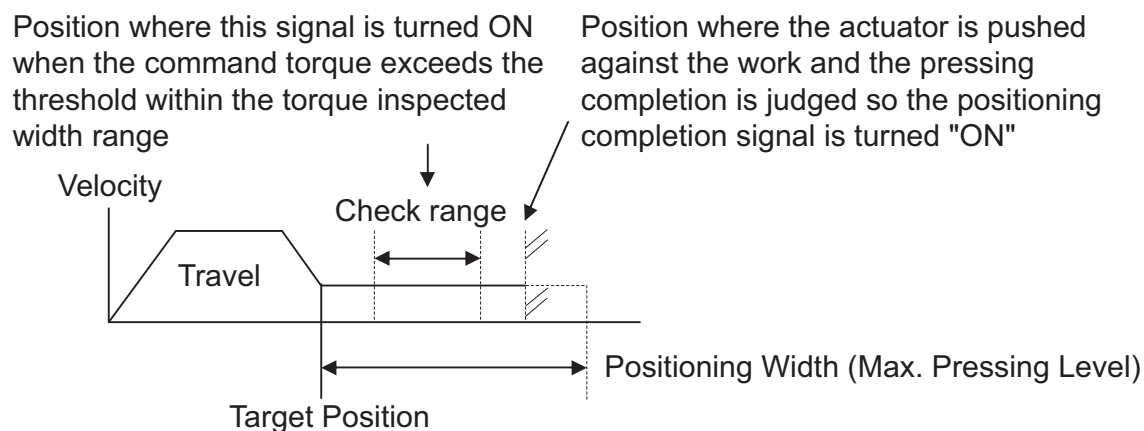
When this signal is used for pressing-in purpose, it should be known whether if the set load threshold is reached during the pressing operation.

The load threshold and check range are set by the PLC and the LOAD signal will turn ON when the command torque (motor current) exceeds the threshold inside the check range.

This signal judges the load output based on the fact that the command torque exceeds the threshold for the specified time period.

This processing procedure is the same as for the pressing judgment. The judgment time period can be changed freely using the parameter No. 50 "Load Output Judgment Time Period".

This signal is continued until the next movement command is received.



- Set the pressing speed using the parameter No. 34 "Pressing Speed".
When the machine is delivered, it has been individually set depending on the actuator characteristics.
Set an appropriate velocity considering the work part material and shape.
- Set the parameter No. 50 "Load Output Judgment Time Period".
- Set the threshold inspected width using the PLC's Zone Boundary + Register or Zone Boundary - Register.
- Set the threshold using the PLC's Load Current Threshold Register.
- Set the positioning band using the PLC's Positioning Band Register.
Set it a bit longer from the backmost position considering the mechanical dispersion of the work part.
Refer to the Operation Manual for the controller for more information.



Caution: The actuator continues to push the work part with the pressing current at the stop time decided with the current limit value.
It is not the stop condition, so take the greatest care to deal with it.

(27) Torque level (TRQS) PLC input signal

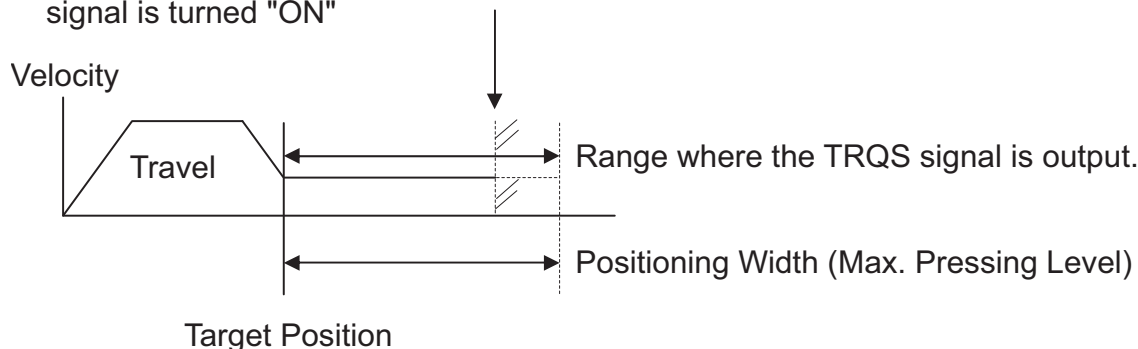
This signal is available only in the pressing operation.

When the motor current reaches the load threshold during the pressing operation (moving up to the positioning band), this signal is turned "ON".

Because the current level is monitored, when the current level is changed, this signal is turned "ON".

The velocity available for the pressing varies depends on the motor and leads, it is required to adjust the parameters.

Position where the actuator is pushed against the work and the pressing completion is judged so the positioning completion signal is turned "ON"



- Set the pressing velocity using the parameter No. 34 "Pressing Speed".
When the machine is delivered, it has been individually set depending on the actuator characteristics.
Set an appropriate speed considering the work part material and shape.
- Set the parameter No. 50 "Load Output Judgment Time Period".
- Set the threshold using the PLC's Load Current Threshold Register.
- Set the positioning band using the PLC's Positioning Band Register.
Set it a bit longer from the backmost position considering the mechanical dispersion of the work part.
Refer to the Operation Manual for the controller for more information.



Caution: The actuator continues to push the work part with the pressing current at the stop time decided with the current limit value.
It is not the stop condition, so take the greatest care to deal with it.

(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

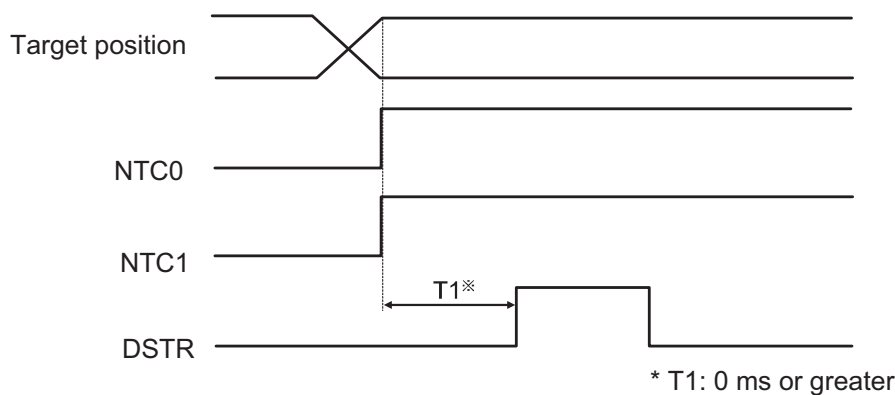
The vibration damping control function suppresses the load vibration induced by IAI's actuator. Measure the vibration frequency and set it in a parameter. In another parameter, select and set an appropriate option based on a combination of these signals.

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.



* $T1$: 0 ms or greater

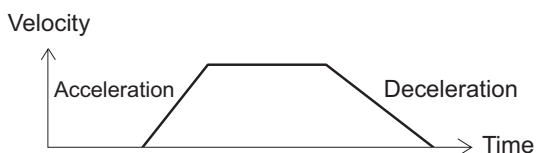


Caution: Since the statuses of NTC0/NTC1 signals are loaded when a movement command (DSTR) is recognized, nothing happens when the NTC0/NTC1 signals are turned ON/OFF while the actuator is moving.

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

This signal is used to select the acceleration/deceleration pattern characteristics. Select one of them before the actuator movement command.

MOD1	MOD0	Pattern name	Remarks
OFF	OFF	Trapezoid Pattern	Factory setting
OFF	ON	S-shaped Motion	
ON	OFF	First-Order Lag Filter	
ON	ON	Unavailable	

Trapezoid Pattern

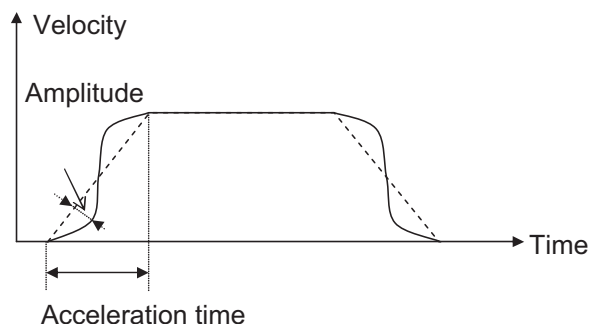
*The Acceleration and Deceleration are set in the "Acceleration" and "Deceleration" data boxes on the position data.

S-shaped Motion

When the value in the "Acceleration/deceleration mode" field in the position table is set to 1 (S-shaped motion), the S-shaped motion degree is defined by parameter No. 56.

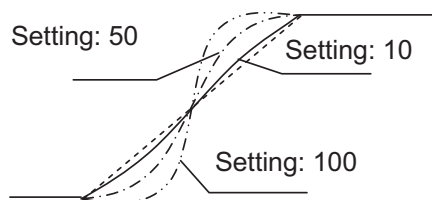
The setting unit is % and the setting range is from "0" to "100."

This is set to 0% (S-shaped motion disabled) in the factory setting.



An S-shaped motion becomes a sine waveform after one cycle of the acceleration time. Specify the degree of amplitude by parameter No. 56.

Parameter No. 56 setting [%]	Degree of amplitude
[Factory setting]	S-shaped motion disabled (Dotted line in the figure below)
100	Sine waveform amplitude x 1 (Chain double-dashed line in the figure below)
50	Sine waveform amplitude x 0.5 (Chain line in the figure below)
10	Sine waveform amplitude x 0.1 (Solid line in the figure below)



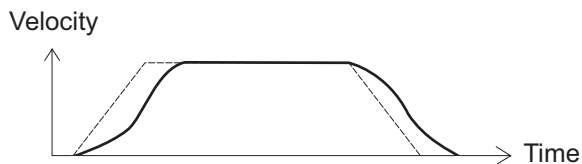


- Caution: [1] Even if a position command or direct value command with S-shaped motion setting is issued when the actuator is running, S-shaped motion control will not be executed. Issue these commands when the actuator is stopped.
- [2] When the index mode is set on the rotary actuator, S-shaped motion is not executed, and, instead, trapezoid control will be executed.
- [3] Set the acceleration/deceleration speed so that the time for each will be within two seconds.
- [4] An input to pause is not allowed during acceleration or deceleration. It may cause an excessive change in speed.
- [5] If a large value is set, the speed will accelerate significantly at around the mid-point of the acceleration/deceleration time. Do not exceed the rated acceleration/deceleration time of the actuator.

First-Order Lag Filter

This describes much gentle acceleration/deceleration curve than that for the linear acceleration/deceleration (trapezoid pattern).

Use it when it is not desired to give any slight vibration to the work part in acceleration/deceleration operation.



- * The first-order lag degree set using the parameter No. 55 "Position Command Primary Filter Time Constant". The minimum input unit is 0.1msec and setting range is from "0.0" to "100.0". When it is set to "0", the first-order lag filter is disabled. However, the setting is not reflected on the jog operation or inching operation performed using the teaching tools such as PC.

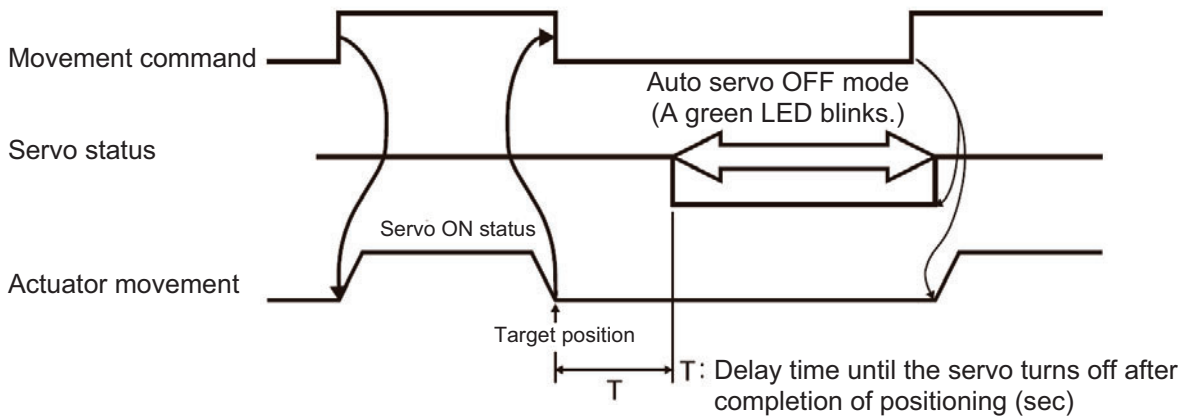
(31) Standstill Mode Selection (ASC0, ASC1) PLC Output Signals

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	Function	Remarks
OFF	OFF	Disabled	Factory setting
OFF	ON	Automatic servo OFF method Parameter No. 36 is enabled for T in the figure below.	
ON	OFF	Automatic servo OFF method Parameter No. 37 is enabled for T in the figure below.	
ON	ON	Automatic servo OFF method Parameter No. 38 is enabled for T in the figure below.	

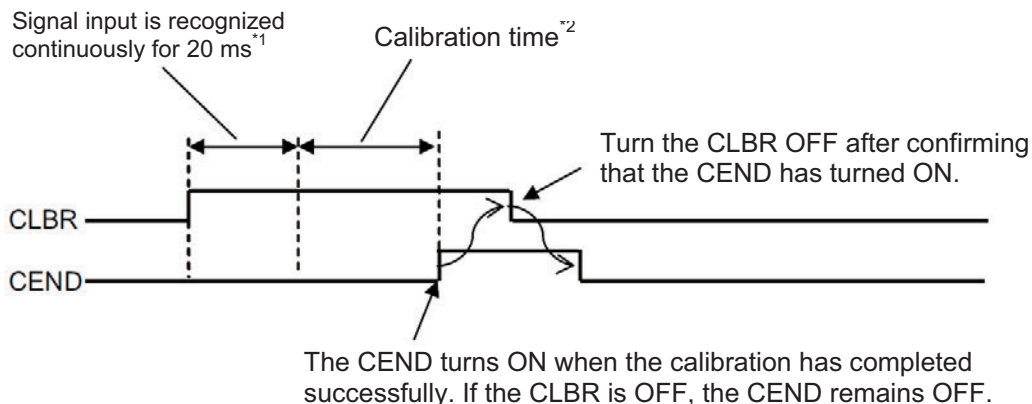


- (32) Load Cell Calibration Command (CLBR) PLC Output Signal
 Load Cell Calibration Complete (CEND) PLC Input Signal

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	

3.7 I/O Signal Timings

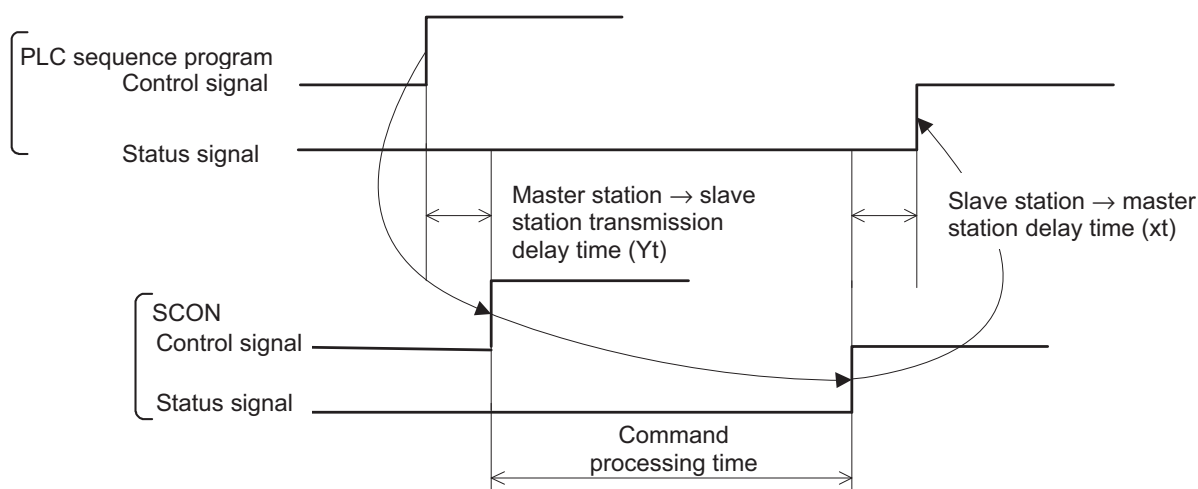
When any of the control signal is turned ON to perform the operation of the actuator using the PLC's sequence program, the response (status) is returned to the PLC. The maximum response time is expressed using the following formula.

Maximum response time (msec) = $Y_t + x_t + 3 \times$ command processing time (operation time, etc.)

Y_t : Master Station → slave transmission delay time
 x_t : Slave → Master Station Transmission Delay Time

} Filed Network Transmission
 Delay Time

Master Station → For the master station → slave transmission delay (Y_t) and slave → master station transmission delay (x_t), refer to the Operation Manuals for the EtherCAT(R) master unit and PLC installed in the master unit.



3.8 Operation

The timings for the basic operation examples in the Position/Simplified Direct Value Mode 1 and 2 , Half Direct Value Mode 1 to 3 and Full Direct Value Mode, are described.

For the Remote I/O Mode 1 to 3, refer to the Operation Manual for the controller main body.

(In remote I/O mode 2 and 3, read the current position and current speed from the respective byte of the PLC, as deemed appropriate.)

(1) Operation in the position/simple-direct mode 1 and 2

It is operated with the position data written in the PLC's register and the speed, acceleration /deceleration, positioning band and pressing current limit value, etc. set using the position table.

● Example of operation (normal positioning operation)

(Preparation) Set the position data items (speed, acceleration/deceleration, positioning band, etc) except for the target position item, in the position table.

Turn on the Position/Simplified Direct Value Change-Over Signal (PMOD).

- [1] Set the target position data in the target position register.
- [2] Set the position No. where the speed and acceleration/deceleration, etc., have been set, in the setup position No. register.
- [3] In the condition where the positioning completion (PEND) signal is turned "ON" or, Under Movement (MOVE) signal is turned "OFF", turn "ON" the Positioning Start (CSTR) signal. The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal.
The data items set in Steps 1) and 2) are read in the controller at the startup (ON edge) of the CSTR signal.
- [4] After the CST signal is turned "ON", the PEND signal is turned OFF after tdpf.
- [5] After confirming that the PEND signal is turned "OFF" or MOVE signal is turned "ON", turn "OFF" the CSTR signal. Do not change the value in the target position register until the CSRT signal is turned "OFF".
- [6] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [7] The current position data is continuously updated. When the remaining travel distance becomes within the range of the positioning band set in the position data, and the CSTR signal is turned "OFF", the PEND signal is turned "ON". Then, the completed position No. is output to the completed position No. register.

Accordingly, for the read of the completed position No. register when the positioning is completed, confirm it some time (Remaining Travel Distance Movement Time) after the PEND signal is turned "ON".

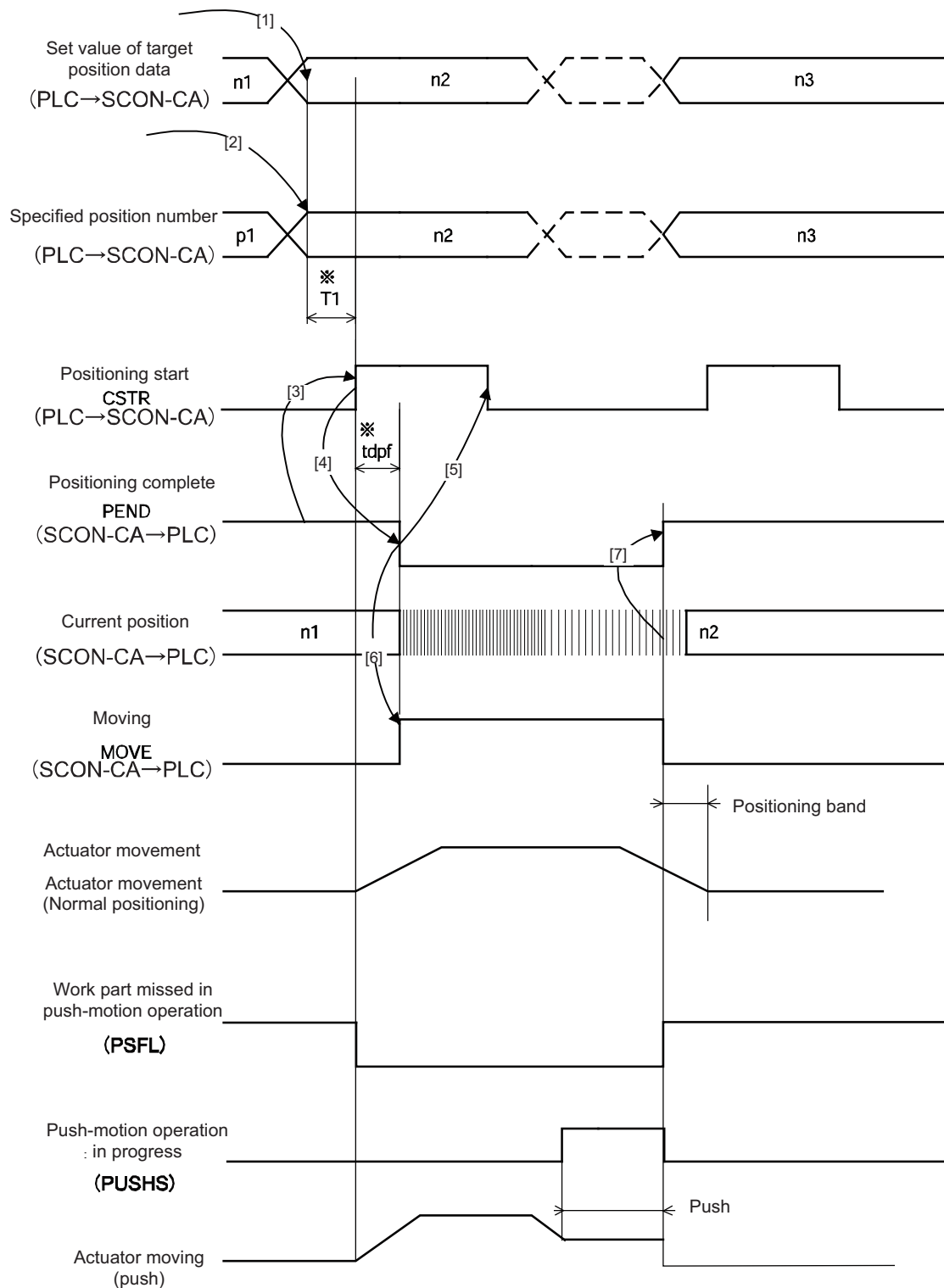
The current position data might be changed slightly even when the system is stopped.

- [8] The target position data can be changed during the actuator movement.
In order to change the target position, change the target data and turn ON the CSTR signal after the time longer than the PLC scanning time has passed.
Change the value for the CSTR signal after the time longer than the PLC scanning time has passed.

● Example of operation (Pressing Operation)

For the pressing operation, the current limit value is set in the pressing data box on the position data at the preparation stage.

When the positioning is performed onto the position No. for which the value is set in the pressing data box, the pressing operation is performed.



* $T1$: Considering the scanning time of the host controller, set it so that " $T1 \geq 0ms$ ".

* $Yt+xt \leq tdpf \leq Yt+xt+3(msec)$

(2) Operation in the half direction mode 1 to 3

It is operated with the data set in the PLC's target position register, positioning band register, setup speed register, acceleration/deceleration register and pressing current limit setup register.

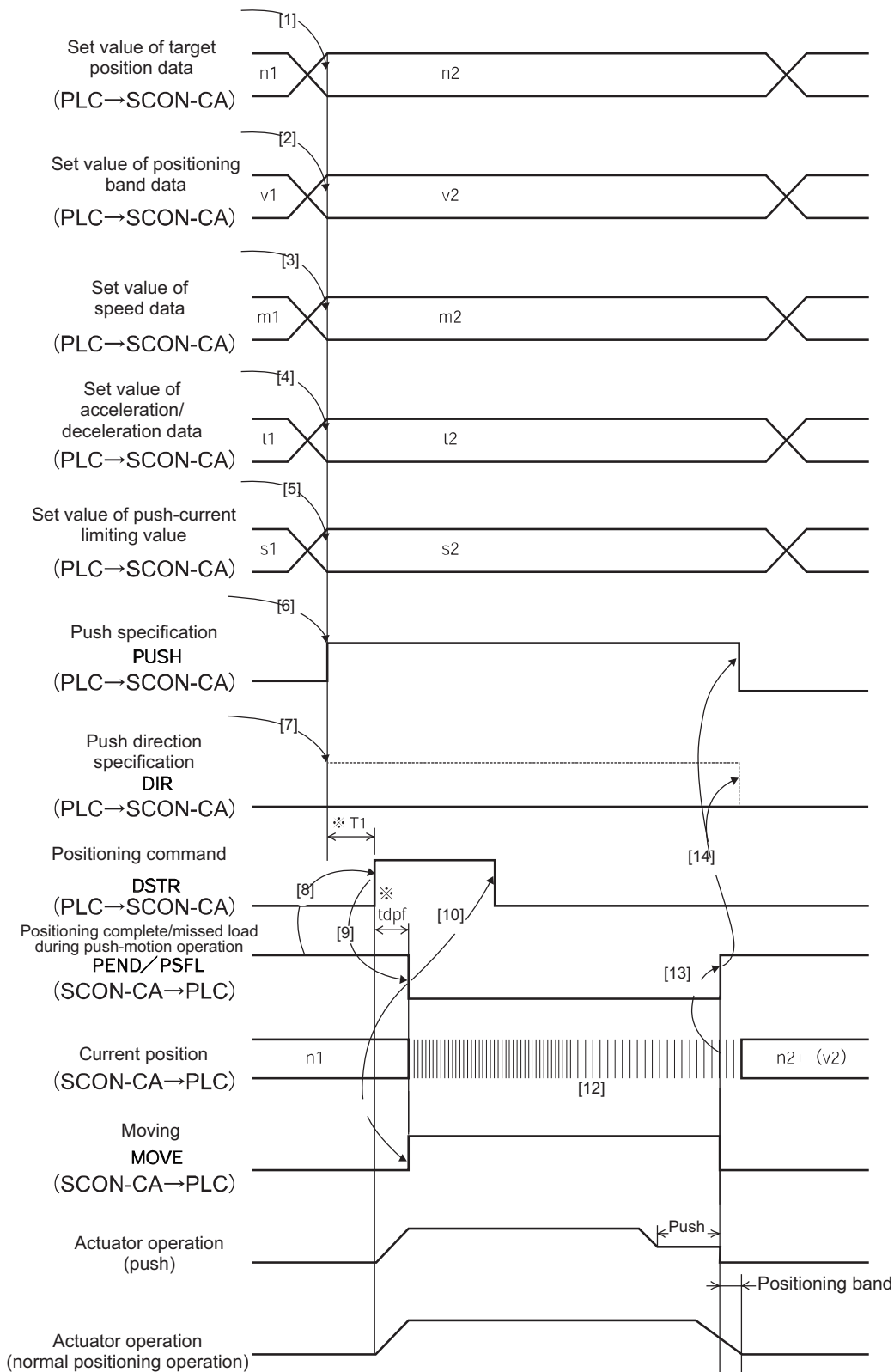
● Example of operation (Pressing Operation)

- [1] Set the target position data in the target position register.
- [2] Set the positioning band data in the positioning band register.
- [3] Set the speed data to the speed register.
- [4] Set the acceleration/deceleration data to the acceleration/deceleration register.
- [5] Set the pressing current limit data in the pressing current limit value register.
- [6] Turn "ON" the pressing setup (PUSH) signal.
- [7] Specify the pressing direction using the pressing direction setup (DIR) signal. (Refer to 3.6.11 (22))
- [8] In the condition where the positioning completion (PEND) signal is turned "ON" or under movement signal (MOVE) is turned "OFF", turn "ON" the positioning command (DSTR) signal.
The data items set in Steps 1) through 5) are read in the controller at the startup (ON edge) of the DSTR signal.
- [9] After the DSTR signal is turned "ON", the PEND signal is turned "OFF" after tdpf.
- [10] After confirming that the PEND signal is turned "OFF" or the MOVE signal is turned "ON", turn "OFF" the DSTR signal. Do not change any value in each register until the DSTR signal has been turned "OFF".
- [11] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [12] The current position data is continuously updated.
- [13] When the DSTR signal is turned "OFF" and the motor current reaches the current limit value set in Step 5, the PEND signal is turned "ON". (Completion of push-motion operation)
Even when the positioning band set in Step 2 is reached, in the case that the current does not reach the motor current limit value set in Step 5, the pressing and a miss (PSEL) signal is turned "ON". In this case, the PEND signal is not turned "ON" (Pressing and a Miss).
- [14] After the PEND signal or PSEL signal is turned "ON", turn "OFF" the PUSH signal.

● Example of operation (normal positioning operation)

For the general positioning operation, set the signal in Step 6 to "OFF".

When the remaining travel distance becomes within the range of the positioning band set in the position data, and the DSTR signal is turned "OFF", the PEND signal is turned "ON".



*T1: Considering the scanning time of the host controller, set it so that "T1 ≥ 0ms".

*Yt+xt ≤ tdpf ≤ Yt+xt+3(msec)

(3) Operation in the full direct mode

The actuator is operated by specifying all conditions required for positioning such as the target position register and positioning band register of the PLC.

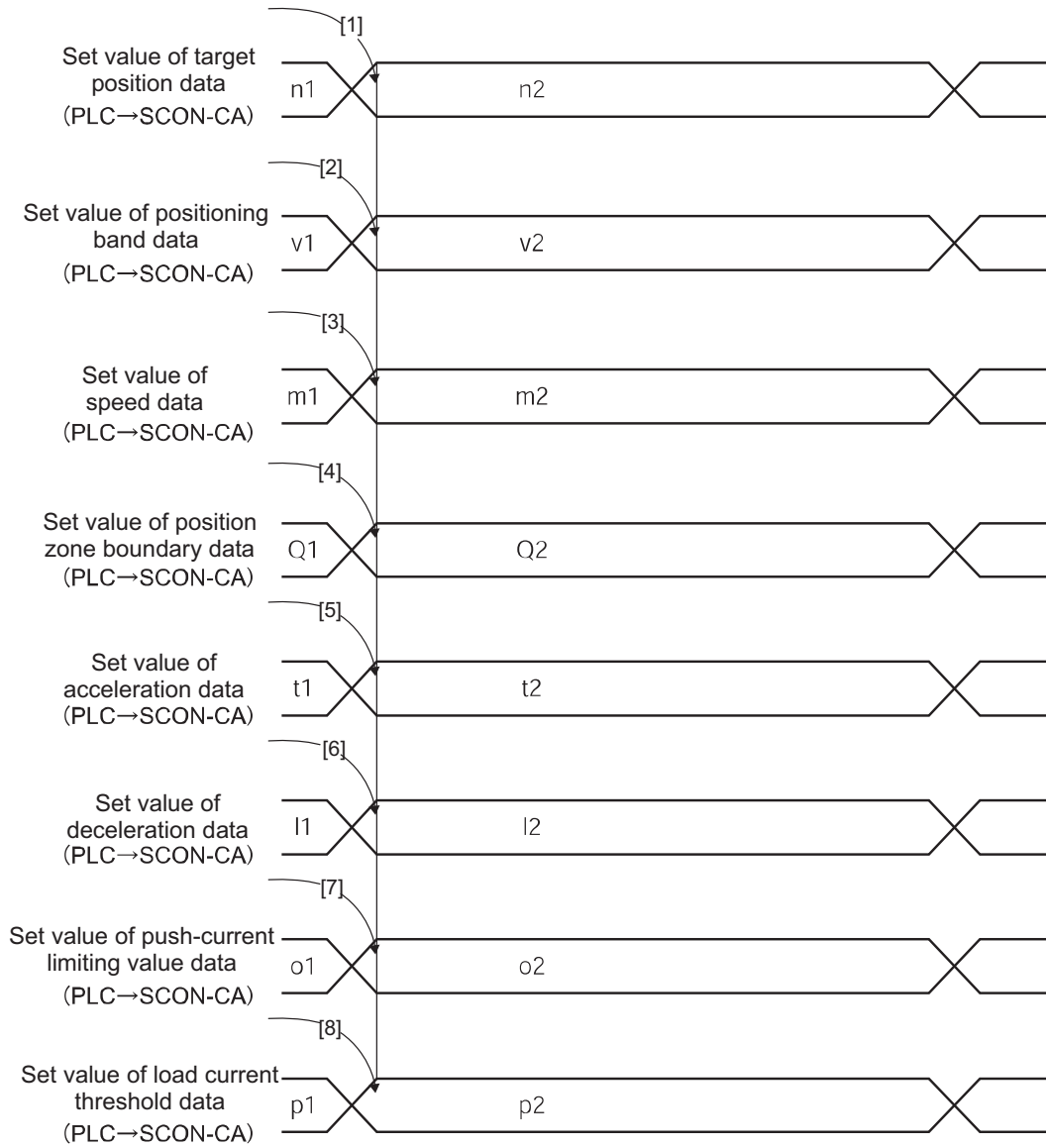
- Example of operation (Pressing Operation)

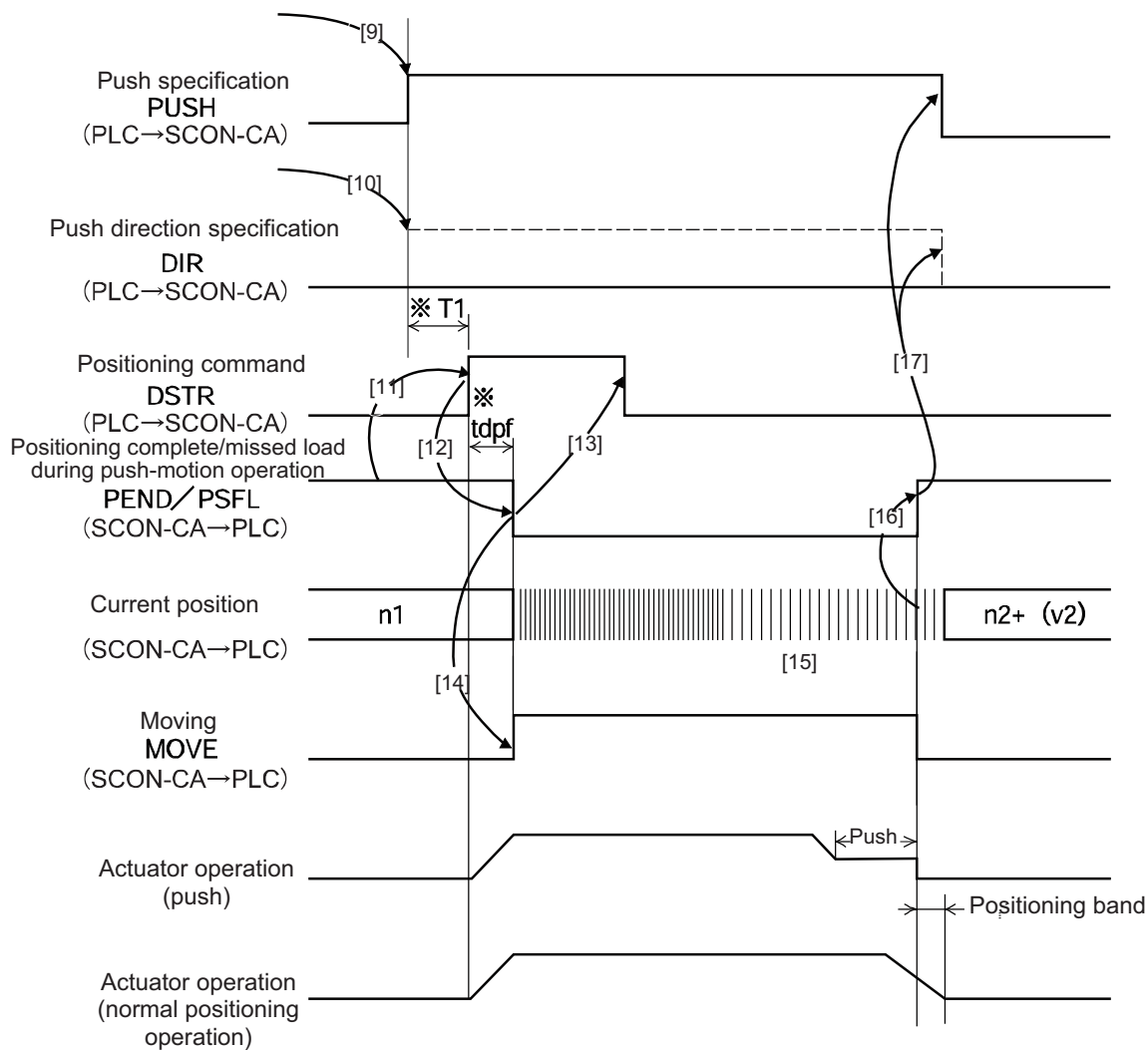
- [1] Set the target position data in the target position register.
- [2] Set the positioning band data in the positioning band register.
- [3] Set the speed data to the speed register.
- [4] Set the position zone output boundary data in the zone boundary + register or zone boundary - register.
- [5] Set the acceleration data in the acceleration register.
- [6] Set the deceleration data in the deceleration register.
- [7] Set the pressing current limit data in the pressing current limit value register.
- [8] Set the load current threshold data in the load current threshold setup register.
- [9] Turn "ON" the pressing setup (PUSH) signal.
- [10] Specify the pressing direction using the pressing direction setup (DIR) signal. (Refer to 3.6.11 (22))
- [11] In the condition where the positioning completion (PEND) signal is turned "ON" or under movement signal (MOVE) is turned "OFF", turn "ON" the positioning command (DSTR) signal.
The data items set in Steps 1) through 8) are read in the controller at the startup (ON edge) of the DSTR signal.
- [12] After the DSTR signal is turned "ON", the PEND signal is turned "OFF" after tpdf.
- [13] After confirming that the PEND signal is turned "OFF" or the MOVE signal is turned "ON", turn "OFF" the DSTR signal. Do not change any value in each register until the DSTR signal has been turned "OFF".
- [14] At the same time when the PEND signal is turned "OFF", the MOVE signal is turned "ON".
- [15] The current position data is continuously updated.
- [16] When the DSTR signal is turned "OFF" and the motor current reaches the current limit value set in Step 7, the PEND signal is turned "ON" (Completion of push-motion operation)
Even when the positioning band set in Step 2 is reached, in the case that the current does not reach the motor current limit value set in Step 7, the pressing and a miss (PSEL) signal is turned "ON". In this case, the PEND signal is not turned "ON" (Pressing and a Miss).
- [17] After the PEND signal or PSEL signal is turned "ON", turn "OFF" the PUSH signal.

- Example of operation (normal positioning operation)

For the general positioning operation, set the signal in Step 9 to "OFF".

When the remaining travel distance becomes within the range of the positioning band set in the position data, and the DSTR signal is turned "OFF", the PEND signal is turned "ON".





*T1: Considering the scanning time of the host controller, set it so that "T1 ≥ 0ms".

* $Yt + xt \leq tdpf \leq Yt + xt + 3(\text{msec})$

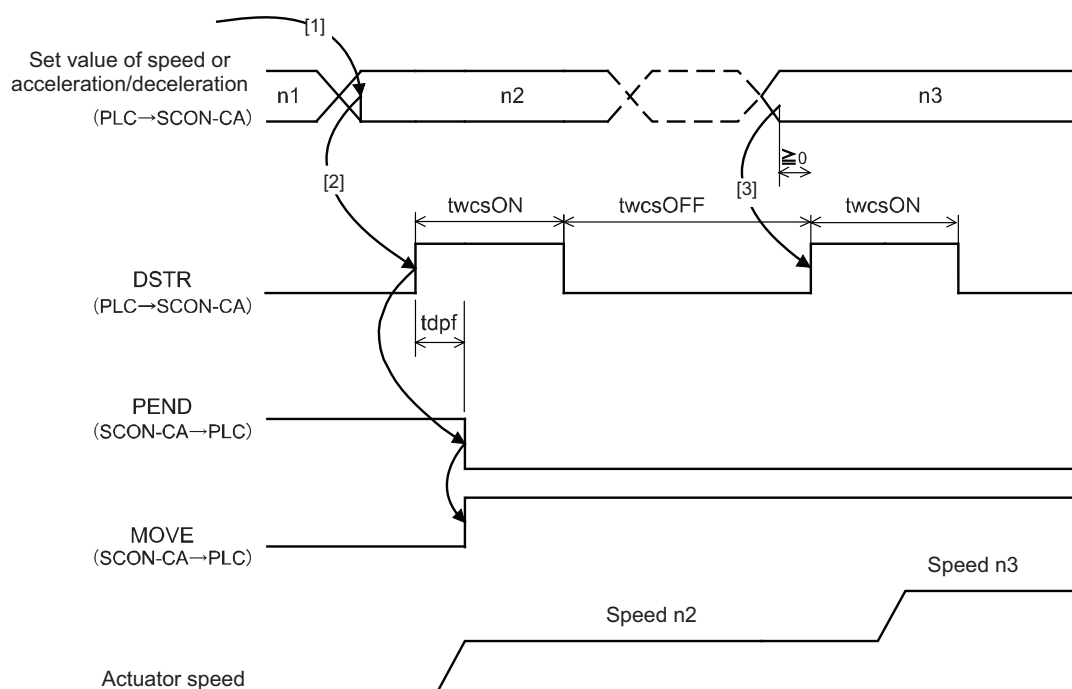
(4) Data change during movement

In the half direct mode or full direct mode 1 to 3, the value currently set to a given register among the registers for target position data, acceleration/deceleration data, speed data, positioning band and push-motion current-limiting value, can be changed while the actuator is moving.

After changing the data, turn "ON" the positioning command (DSTR) for more than $tdpf$.

Also, after turning "OFF" the DSTR, set aside some time for " $twcsON + twcsOFF$ " or more, until the next DSTR is turned "ON".

The example is shows as follows, where the speed and acceleration/deceleration data items have been changed.



$$twcsON \geq Yt + xt + 3 \text{ (msec)}$$

$$twcsOFF \geq Yt + xt + 3 \text{ (msec)}$$

$$*Yt + xt \leq tpdf \leq Yt + xt + 3 \text{ (msec)}$$

⚠ Caution

1. When the speed has not been set or it is set to "0", the actuator is not moved, but an alarm is not issued.
2. When the speed setting is changed to "0" during the movement, the actuator is decelerated and stopped, but an alarm is not issued.
3. Even when the acceleration/deceleration data only is changed during the movement, the setting of the target position data is required.
4. Even when the target position data only is changed during the movement, the setting of the acceleration/deceleration data is required.

3.9 EtherCAT(R) Related Parameters

Parameters relating to EtherCAT(R) are No. 84 to No. 85 and No. 90.

Category: C :External interface parameter

No.	Category	Symbol	Name	Default Value set in the Factory before Delivery
1			Refer to Operation Manual for the controller for the parameters No. 1 through No. 83.	
2				
83				
84	C	FMOD	Field bus operation mode	0
85	C	NADR	Field bus node address	17
86	C	FBRs	Field bus baud rate	0
87	C	NTYP	Network type	6
90	C	FMIO	Field I/O format	3

● Field bus operation mode (No.84 FMOD)

Specify the operation mode in parameter No. 84 using a value between 0 and 8.

Value set in parameter No. 84	Mode	Number of occupied bytes	Contents
0(Factory setting)	Remote I/O Mode	2	Operation using PIOs (24 V I/Os) is performed via EtherCAT(R).
1	Position/simple direct mode	8	The target position can be set directly using the value or the operation can be performed using position data value. The other values required for the operation are set on the position data.
2	Half Direct Value Mode	16	In addition to the target position, the speed, acceleration/deceleration and pressing current value are set directly using the values to perform the operation.
3	Full Direct Value Mode	32	All the values related to the position control are set using the values to perform the operation.
4	Remote I/O Mode 2	12	The current position and current speed reading functions are added to the functions 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.
8	Half direct mode 3	16	Set this value to switch servo gains or vibration damping control parameters in the half direct numerical mode.

● Field bus node address (No.85 NADR)

Specify the node address number in parameter No. 85.

Setting Range 0 to 127 (It is set to "17" when the machine is delivered from the factory.)

● Field bus baud rate (No.86 FBRs)

The baud rate is automatically set to the same value as the baud rate set in the master. Accordingly, you do not need to set the baud rate.

- Network type (No.87 NTYP)

The network module type is set for the parameter No. 87. Do not change the default value.

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

Addresses in the PLC are assigned in units of 16 points (2 bytes) based on the node address set in the controller and the occupied bytes in each operation mode.

By changing the setting of parameter No. 90, data elements can be swapped within a boundary of two words or less in units of bytes during communication using the I/O areas of the PLC.

Value set in parameter No. 90	Contents
0	Data exchange is not performed. The data is sent directly to the PLC. (Refer to "Example i".)
1	The host bytes are exchanged with slave bytes in the host words and slave words. (Refer to "Example ii".)
2	In the case of word register, the host words are exchanged with the slave words. (Refer to "Example iii".)
3 (Factory setting)	The host bytes are exchanged with slave bytes in the host words and slave words. In addition, the upper word and lower word are swapped for word registers. (Refer to "Example iv".)

(Example i) Set value = "0"

● indicates ON, while ○ indicates OFF.

SCON Input resister	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 CH	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 resister	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 CH	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.

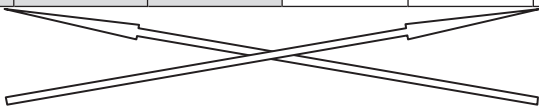
SCON Input resister	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
ON/OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	●	●	○	○	○	○	○	○	○
Hexadecimal data	3				4				1				2				C				D				A				B			
PLC : Output CH	1F	1E	1D	1C	1B	1A	19	18	17	16	15	14	13	12	11	10	F	E	D	C	B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

SCON	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
Output resister																																
ON / OFF	○	○	●	●	○	●	○	○	○	○	○	●	○	○	●	○	●	●	○	○	●	●	○	○	●	○	○	●	○	●	●	
Hexadecimal data	3				4				1				2				C				D				A				B			

PLC : Input CH	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.

SCON Input resister	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	A				B				C				D				1				2				3				4				
																																	
PLC : Output CH	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 resister	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	A				B				C				D				1				2				3				4				

<

(Example iv) Set value = "3"

● indicates ON, while ○ indicates OFF.

SCON Input resister	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	C				D				A				B				3				4				1				2			

PLC : Output CH	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 resister	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	C				D				A				B				3				4				1				2			

PLC : Input CH	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			

4. Troubleshooting

● Alarm Description and Cause/Treatment

- [1] When an alarm is issued, the completed position No. (4 bits for PM1 to PM8) shows the simplified alarm code in the Remote I/O Mode 1 to 3.

In the position/simple direct mode 1 and 2, this simple alarm code is output to the (n+4, n+5) bytes.

In the half direct mode 1 to 3 and full direct mode, this simple alarm code is output to the (n+12, n+13) bytes.

- 1) Confirm the alarm code using the PLC's monitor function, etc., or using the status monitor, connecting the teaching tools such as RC PC software.
 - 2) Based on the read alarm code, search the alarm description list in the operation manual for the controller.
 - 3) Deal with it based on the description for the alarm code in question.
- For the following alarm code, deal with it according to the following table.

Code	Error name	ID (*1)	RES (*2)	Cause/Treatment
0F2	Field bus module error	05	x	Cause: The field bus module error is detected Treatment: Confirm the parameter.
0F3	Field bus module not detected	04	x	Cause: The module can not be detected. Treatment: Turn ON the power again. If the error is not removed, contact our company.

(*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. Appendix

5.1 Setup of Connection with Omron's Master Unit

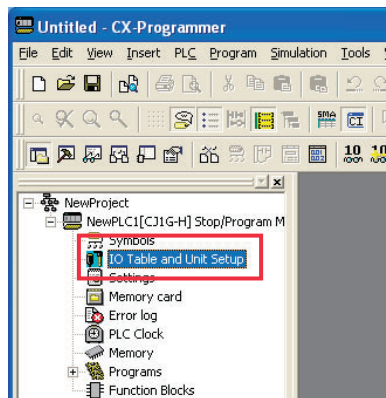
The following devices and software are required to connect to an Omron master.

- | | |
|--|---|
| [1] PLC CPU unit: | (Ex) CJ1G-CPU43H |
| [2] EtherCAT(R) master unit (Position control unit): | (Ex) NC-882 |
| [3] Setting software: | CX-One V4.0 or later CX-Programmer V9.11 or later |
| [4] IAI controller designed for EtherCAT(R) | |

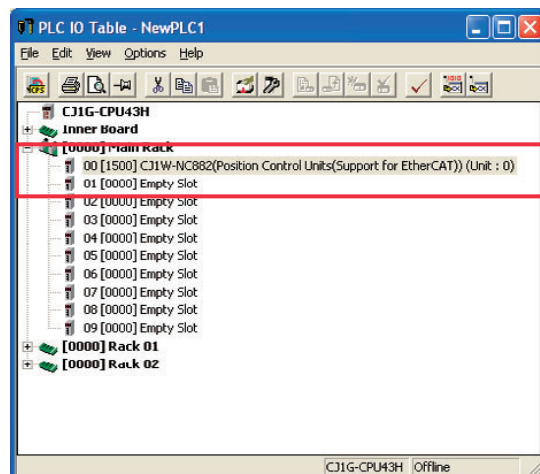
5.2 Automatic Network Setup

The setup procedure is as follows:

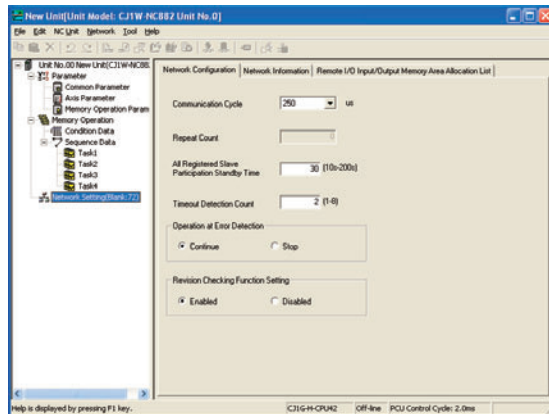
- [1] Open CX-Programmer. Double-click I/O Table/Unit setting listed on the project tree, and open the I/O table.



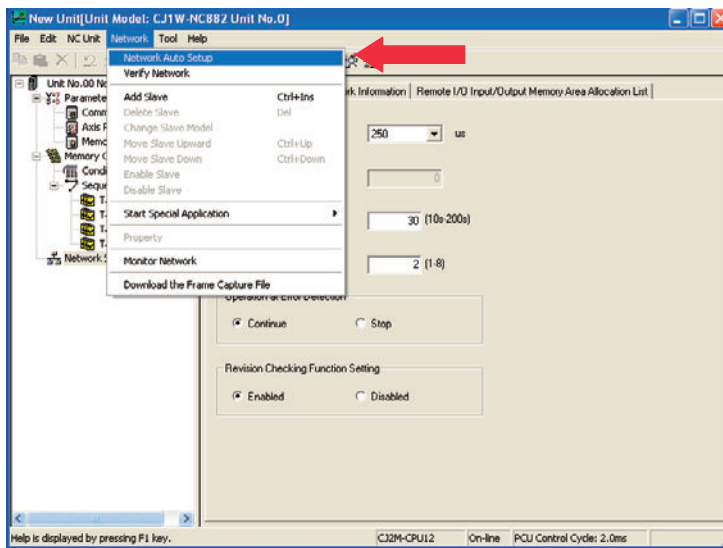
- [2] Double-click the field for CJ1W-NC882 position control unit (EtherCAT(R) communication type) on the CPU rack tree and launch the position control unit setting tool (hereinafter referred to as the "NCF tool").



After the double-click, the following screen will appear.



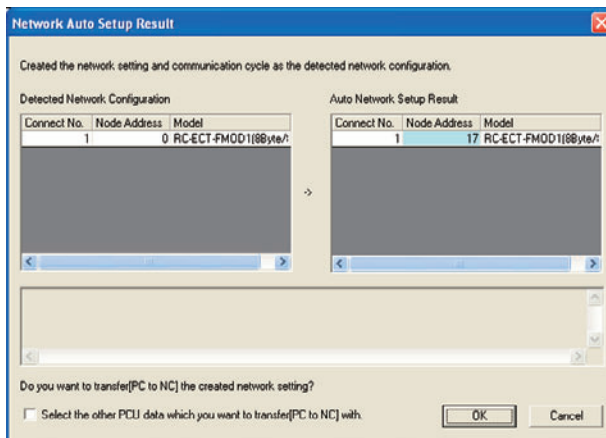
- [3] From the NCF tool menu bar, select Network, and then Automatic Network Setup.



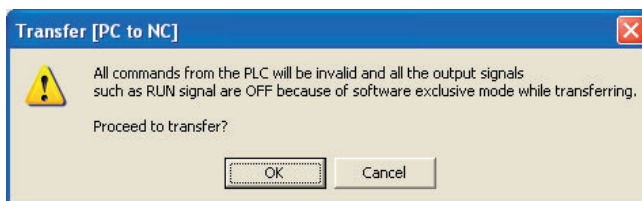
- [4] Select OK to begin the automatic network setup.



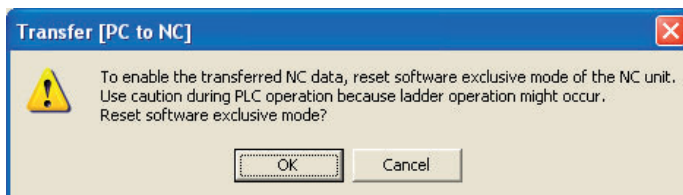
- [5] A search for EtherCAT(R) slaves on the network will be executed, and the list of the slaves found will be displayed.
Find the field where the node address* with the ACON, PCON or SCON-CA setting in the list displayed.
Check to make sure that the format (RC-ECT-FMODx) displayed in "Detected network configuration" and "Automatic network setup result" are the same. Upon checking, select OK.
* x represents the setting of parameter No. 84 Field Bus Operation Mode. [Refer to 2.5.1 or 3.5.1, "Operation Mode Selection."]



- [6] Select OK to transfer the setup result to the PLC.



- [7] When the transfer is completed, the following screen will appear. Select OK.



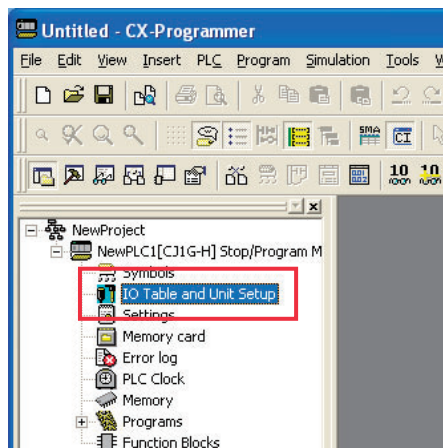
- [8] Lastly, a confirmation message will appear. Select OK.
Check to make sure that the RUN LED of ACON, PCON or SCON-CA is lit, and ERR LED is not lit.

This completes the automatic setup.

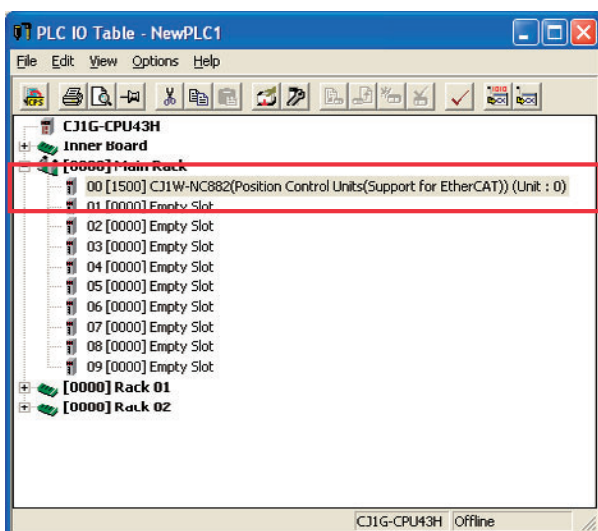
5.3 Manual Network Setup

The setup procedure is as follows:

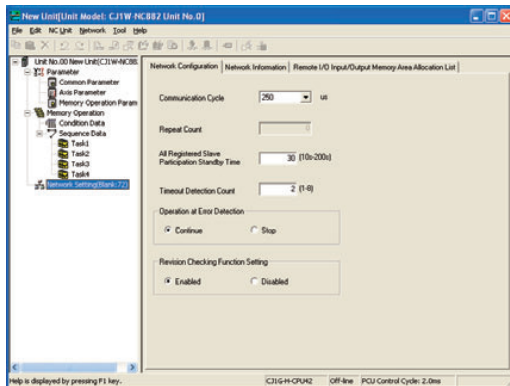
- [1] Open CX-Programmer. Double-click I/O Table/Unit setting on the project tree, and open the I/O table.



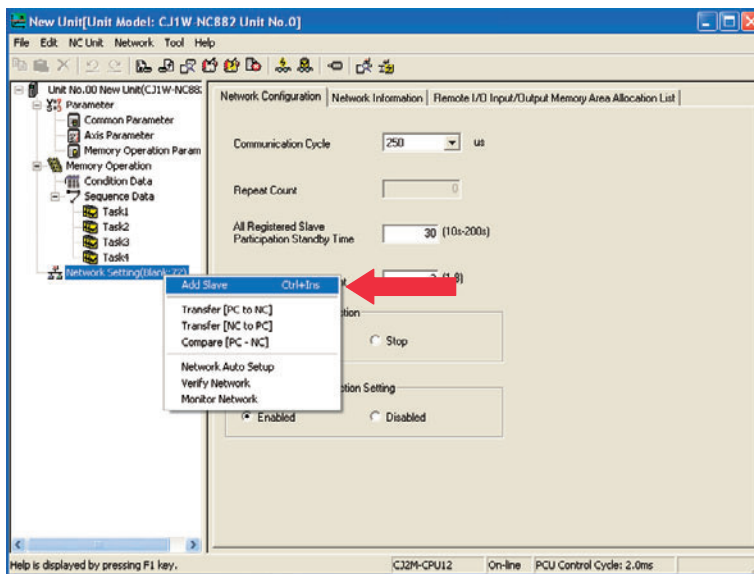
- [2] Double-click the field for CJ1W-NC882 position control unit (EtherCAT(R) communication type) on the CPU rack tree and launch the position control unit setting tool (hereinafter referred to as the "NCF tool").



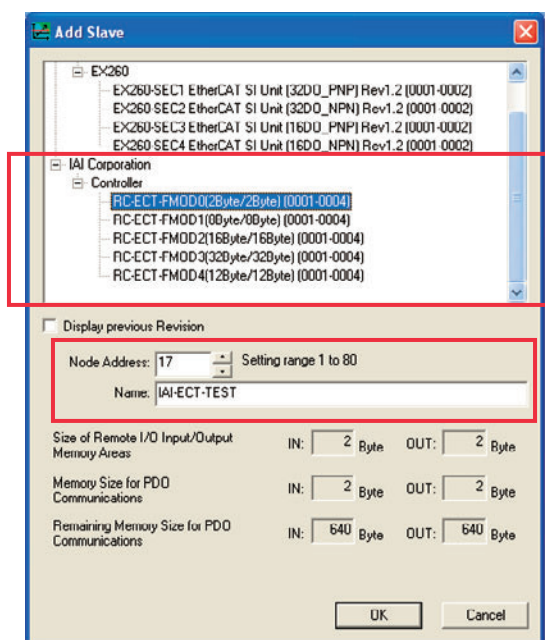
After the double-click, the following screen will appear.



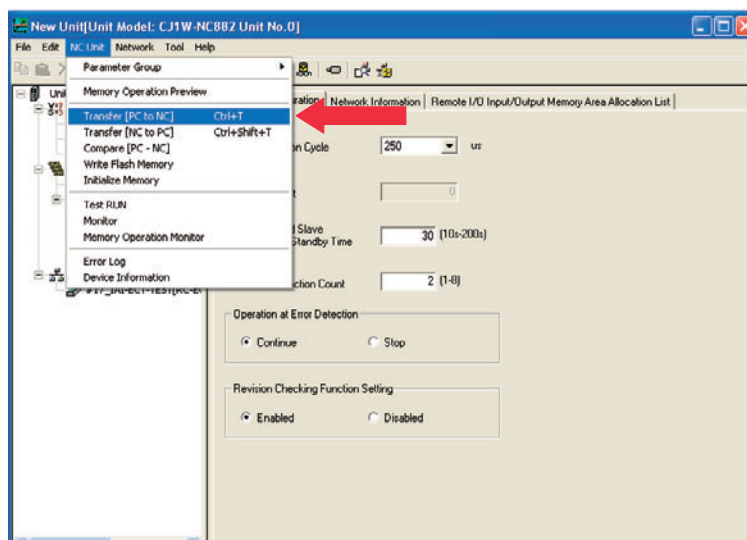
- [3] In the tree view on the left-hand side of the NCF tool screen, right-click Network setting and select Add slaves.



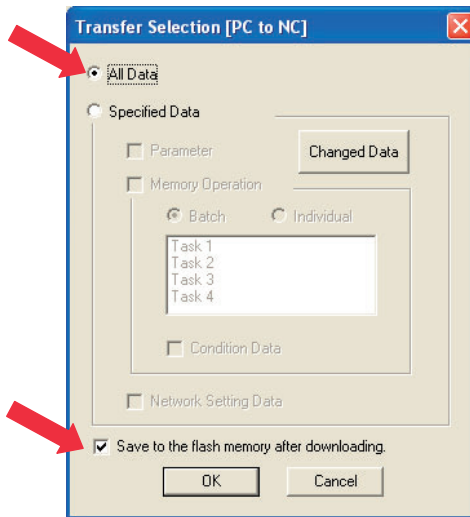
- [4] A list of slaves will be displayed in which five items, RC-ECT-FMOD [0 ~ 4], are registered to Controller under IAI. The ending number represents the Field Bus Operation mode setting ^(Note 1). Select the item ending with the same number as the current setting.
Set the node address (Note 2).
Set the slave name (any) and select OK.
(Note 1) Parameter No. 84 setting [Refer to 2.5.1 or 3.5.1 Operating Mode Selecting.]
(Note 2) Set this to the same value as parameter No. 85 of ACON, PCON or SCON-CA.
[Refer to 2.5.2 or 3.5.2 Station No. Setting.]



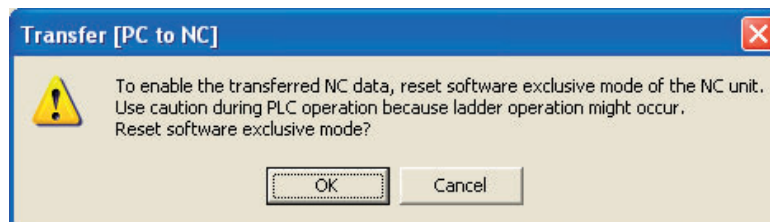
- [5] Repeat step [4] to set all slaves.
From the menu of the NCF tool, select NC unit and then Transfer [PC → NC].



- [6] Select the checkboxes for “All data” and “Save to flash memory after transfer” and select OK.



- [7] When the transfer is completed, the following screen will appear. Select OK.



- [8] Lastly, a confirmation message will appear. Select OK.
Check to make sure that the RUN LED of ACON, PCON or SCON-CA is lit, and ERR LED is not lit.

This completes the automatic setup.

Change History

Revision Date	Description of Revision
October 2010	First edition
November 2011	Second edition Contents changed in Safety Guide Caution notes added for when working with two or more persons “3. SCON-CA” added



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